Project ReportFormat

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Project Report

Team ID	**PNT2022TMID20345**
Project Name	**Smart waste management system for metropolitan cities**

1. INTRODUCTION

1.1 PROJECT OVERVIEW :

During the last century,the major world population has been quadrupled,and there has been major relocations from rural to urban areas. Today 50% of the world’s population inhabit cities and this number is expected to reach 70% by 2050.About 2.1 billion tonnes of municipal solid waste is generated annually around the globe. Population growth and rapid urbanization lead to a huge increase in waste generation,so the traditional methods of waste collection have become inefficient and costly.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.The Internet of Things (IoT) is a concept in which surrounding objects are connected through wired and wireless networks without user intervention. In the field of IoT, the objects communicate and exchange information to provide advanced intelligent services for users.This project enables the organizations to meet their needs of smart garbage management systems. This system allows the user to know the fill level of each garbage bin in a locality or city at all times, to give a cost-effective and time-saving route to the truck drivers.

1.2 Purpose :

The proposed system would be able to automate the solid waste monitoring process and management of the overall collection process using IOT (Internet of Things).The Proposed system consists of main subsystems namely Smart Trash System (STS) and Smart Monitoring and Controlling Hut (SMCH).In the proposed system, whenever the waste bin gets filled this is acknowledged by placing the circuit at the waste bin, which transmits it to the receiver at the desired place in the area or spot. In the proposed system, the received signal indicates the waste bin status at the monitoring and controlling system.The most efficient way this exraordinary amount of waste can be solved is through smart waste management with obsolete methods of waste collection.Challenges of traditional waste collection and management system Inefficient way to identify the waste collection. Fixed routine for waste collection Wastage of resources (Labor,Fuel etc,.)Missed pick – ups,causing unclean environment.

2. LITERATURE SURVEY:

2.1Existing problem:

Waste management has becomean alarming challenge in local townsand cities across the world. Often the local area bins are overflowing and the municipalities are not aware of it. This affectsthe residents of that particular area in numerousways 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 throughwaste will absorbhazardous 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 SMART SOLID WASTE MANAGEMENT SYSTEM

AUTHOR NAME: NOR AZMAN ISMAIL,SHAKUR ABU HASSAN

PUBLICATION YEAR: 2019 DESCRIPTION:

With the increasing number of world population and the rapidly expanding globalization of the world, waste is one of the main issues that concerns many parties. The World Bank estimates that in 2025, the population of the world's urban population will reach 4.3 billion and the rate of waste production is about 1.42 kg per day for every resident.Today a smart solid waste management system uses Internet-of-Things (IoT) technology in order to automate several traditional waste management processes. In this paper, a systematic literature review methods is used to collect and analyze related works on smart solid waste management systems .Literature has been compiled based on five major databases including, IEEE Xplore, Google Scholar, Springer,Web of Science (WOS) and ACM Digital Library.Literatures were searched based on several relevant keywords and the ones selected were the ones that satisfy selection criteria defined. A total of 25 literature met the requirements se t, and 12 of them are reviewed in this paper. Research gaps from an existing works have been concluded, based on the results of the study .

PAPER 2:

TITLE: SMART GARBAGE MONITORING SYSTEM

AUTHOR NAME: SARMILA SS, SIVA KUMAR V, VASANTH KUMAR U

PUBLICATI ON YEAR: 2018

DESCRIPTION:

The Smart bin system that identifies hazardous gases and fullness of bins. The system is designed to collect data and to deliver the data through wireless mesh network. To collect data and to obtain bin utilization and bin daily information, With such information, wastage bin providers and cleaning contractors are able to make better decision. In our system, the Smart dustbins are connected to the internet to get the real time information of the smart dustbins. In the recent years, there was a rapid growth in population which leads to more waste disposal. So a proper waste management system is necessary to avoid spreading some deadly diseases. The aim of the mission is to cover all the rural and urban areas of the country to present this country as an ideal country before the world. With the proliferation of Mobile network devices such as smart phones, sensors, cameras. It is possible to collect massive amount of garbage .

PAPER 3:

TITLE:SMART WASTE MANAGEMENT SYSTEM USING IOT

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

PUBLICATION ON YEAR :2019

DESCRIPTION:

With rapid increase in population, the issues related to sanitation with respect to garbage management are degrading immensely. It creates unhygienic conditions for the citizens in the nearby surrounding, leading to the spread of infectious diseases and illness. To avoid this problem, IoT based “Smart Waste Management” is the best and trending solution. In the proposed system, public dustbins will be provided with embedded device which helps in real time monitoring of level of garbage in garbage bins. The data regarding the garbage levels will be used to provide optimized route for garbage collecting vans, which will reduce cost associated with fuel. The load sensors will increase efficiency of data related to garbage level and moisture sensors will be used to provide data of waste segregation in a dust bin.

PAPER 4:

AUTHONAME: SAMSONZENITH,THEODOROS AANAGNOSTOPOULOS

PUBLICATION YEAR: 2022

DESCRIPTION:

The Internet of Things (IoT) paradigm plays a vital role for improving smart city applications by tracking and managing city processes in real-time. One of the most significant issues associated with smart city applications is solid waste management, which has a negative impact on our society’s health and the environment. The traditional waste management process begins with waste created by city residents and disposed of in garbage bins at the source. Municipal department trucks collect garbage and move it to recycling centers on a fixed schedule.This work proposes an IoT-enabled solid waste management system for smart cities to overcome the limitations of the traditional waste management systems. The proposed architecture consists of two types of end sensor nodes: PBLMU (Public Bin Level Monitoring Unit) and HBLMU (Home Bin Level Monitoring Unit), which are used to track bins in public and residential areas, respectively.

PAPER 5:

TITLE: GARBAGE MANAGEMENT FOR SMART CITIES USING IOT

AUTHORNAME:ANKITAKEDIKAR,NIKITAMAHADULE,MONIKA KHOBRAGADE

PUBLICATION YEAR: 2015

DESCRIPTION:

Internet and its applications have become an integral part of today’s human lifestyle. It has become an essential tool in every aspect.These researches led to the birth of an Internet of Things (IoT). Things (Physical Devices) that are connected to Internet and sometimes these devices can be controlled from the internet is commonly called as Internet of Things. Now a days, there are a number of technique which are purposefully used and are being build up for well management of garbage or solid waste. Sensors and IOT module i.e. Wi-Fi are the latest trends and are one of the best combination to be used in the project. Hence a combination of both of these technologies issued in the project. Here we are using raspberry pi. A threshold value is set in the IOT. In these we use ultrasonic sensor . The same thing is displayed on the LCD, which is connected to the output port of the controller. IOT through data available on web portal about all area dustbin.

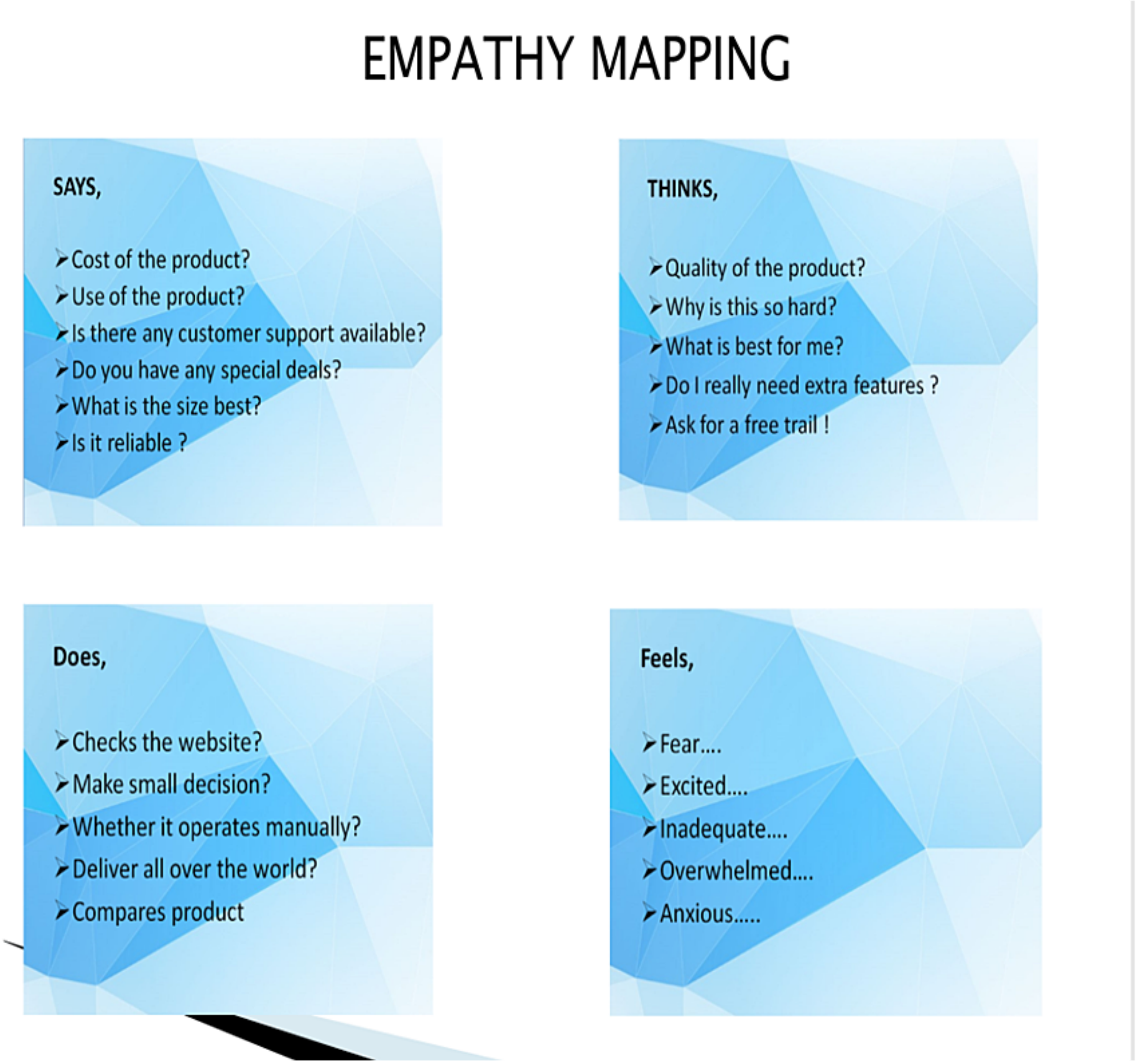
i. ProblemStatement Definition:

Problem Statement(PS)	**I am (Customer)**	**I’m trying to**	**But**	**Because**	**Which makes mefeel**
PS-1	Municipal corporation authority	Get notifiedwhen the trash cans are full and be made aware of wherethe	Don't havethe facilities atthemoment	There is no toolavailable to determine the level of bins.	Frustrated

		full cans are located.			
PS-2	Individual working for a private limited corporation	Get rid of the example of asurplus of waste	The trash cans are always filled	I occupy a metropolitan where there is acity is invariably crowd.	Worried

IDEATION &PROPOSED SOLUTION

Empathy Map Canvas :



EMPATHY MAPPING

SAYS,

- Cost of the product?
- Use of the product?
- Is there any customer support available?
- Do you have any special deals?
- What is the size best?
- Is it reliable ?

THINKS,

- Quality of the product?
- Why is this so hard?
- What is best for me?
- Do I really need extra features ?
- Ask for a free trail !

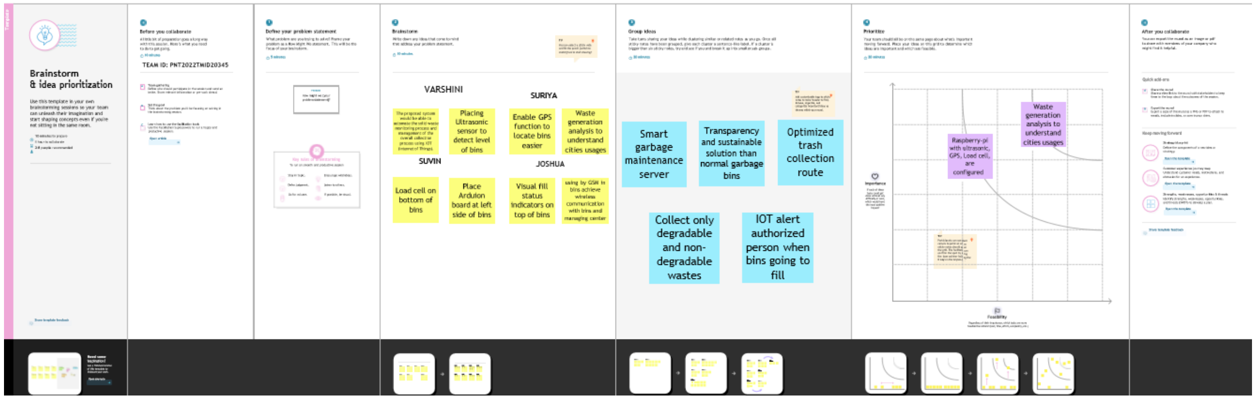
Does,

- Checks the website?
- Make small decision?
- Whether it operates manually?
- Deliver all over the world?
- Compares product

Feels,

- Fear….
- Excited….
- Inadequate….
- Overwhelmed….
- Anxious…..

IDEATION AND BRAIN STROM:



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.

Brainstorm
& idea prioritization
Before you collaborate
TEAM ID: PNT2022TMID20345
Define your problem statement
Brainstorm
VARSHINI
SURIYA
SUVIN
JOSHUA
Placing Ultrasonic sensor to detect level of bins
Enable GPS function to locate bins easier
Waste generation analysis to understand cities usages
Load cell on bottom of bins
Place Arduion board at left side of bins
Visual fill status indicators on top of bins
using by GSM in bins achieve wireless communication with bins and managing center
Group Ideas
Smart garbage maintenance server
Transparency and sustainable solution than normal garbage bins
Optimized trash collection route
Collect only degradable and non-degradable wastes
IOT alert authorized person when bins going to fill
Prioritize
Importance
Feasibility
Raspberry-pi with ultrasonic, GPS, Load cell, are configured
Waste generation analysis to understand cities usages
After you collaborate

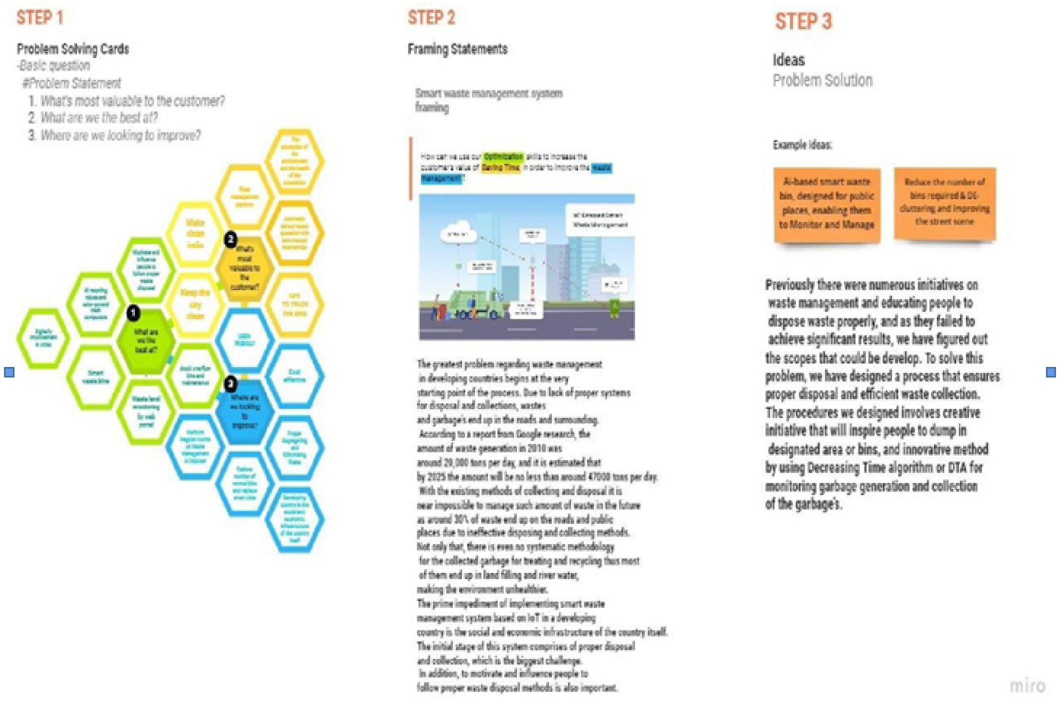
Proposed Solution

S. No	Parameter	Description
1.	Problem Statement (Problem to be solved)	1. The manual monitoring of wastes in trash cans is a laborious operation that requires additional time, money, and human labor 2. Unsafe trash disposal is generatingproblems for people. 3. Bad odor all around the place from uncollected trashor rubbish.

2.	Idea/ Solution description	1. This procedure uses a cloud connection and non-bio degradable wastes and an ultrasonic sensor to determine the level of a rubbish container 2. By developing an app, thecompany of a certain neighborhood inside a large metropolis will be able to check thetrash cansto see if they are full or not.
3.	Novelty / Uniqueness	1. In contrast to the traditional ways for collecting trash cans, this strategy instructs us to utilizethe transportation onlywhen necessary. 2. Keeping an eye on thetrash cans easierand less labor-intensive for humans.
4.	SocialImpact / Customer Satisfaction	1. People can experience a cleanatmosphere. 2. Reduces the amount of labor required from humans for waste disposal. 3. For a municipal corporation to monitorthecleanliness of different areas of the

		city, this proposal will be quitehelpful.
5.	Business Model (Revenue Model)	1. By cutting back on unneeded transportation costs to pointless locations, this lowers a significantamount of fuel costs for city businesses. 2. This initiative intends to assistmunicipal corporation. 3. Provide a sanitary atmosphere.

Problem Solution fit



What are we the best at?
What's most valuable to the customer?
Where are we looking to improve?
1
2
3
Make clean India
Keep the city clean
Smart waste bins
Waste level monitoring by web portal
Cost effective
miro

STEP 1

Problem Solving Cards

-Basic question

#Problem Statement

1. What's most valuable to the customer?
2. What are we the best at?
3. Where are we looking to improve?

STEP 2

Framing Statements

Smart waste management system framing

How can we use our Optimization skills to increase the customer's value of Saving Time in order to improve the waste management?

The greatest problem regarding waste management in developing countries begins at the very starting point of the process. Due to lack of proper systems for disposal and collections, wastes and garbage's end up in the roads and surrounding. According to a report from Google research, the amount of waste generation in 2010 was around 20,000 tons per day, and it is estimated that by 2025 the amount will be no less than around 47000 tons per day. With the existing methods of collecting and disposal it is near impossible to manage such amount of waste in the future as around 30% of waste end up on the roads and public places due to ineffective disposing and collecting methods. Not only that, there is even no systematic methodology for the collected garbage for treating and recycling thus most of them end up in land filling and river water, making the environment unhealthier. The prime impediment of implementing smart waste management system based on IoT in a developing country is the social and economic infrastructure of the country itself. The initial stage of this system comprises of proper disposal and collection, which is the biggest challenge. In addition, to motivate and influence people to follow proper waste disposal methods is also important.

STEP 3

Ideas

Problem Solution

Example Ideas:

AI-based smart waste bin, designed for public places, enabling them to Monitor and Manage

Reduce the number of bins required & DE-cluttering and improving the street scene

Previously there were numerous initiatives on waste management and educating people to dispose waste properly, and as they failed to achieve significant results, we have figured out the scopes that could be develop. To solve this problem, we have designed a process that ensures proper disposal and efficient waste collection. The procedures we designed involves creative initiative that will inspire people to dump in designated area or bins, and innovative method by using Decreasing Time algorithm or DTA for monitoring garbage generation and collection of the garbage's.

REQUIREMENT ANALYSIS

Functional Requirements:

Followingarethe functional requirements of the proposedsolution.

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

FR-1	Detailed bin inventory.	All monitored bins and standscan be seenon the map,and you can visit them at any time via the Street Viewfeature from Google. Bins or stands are visible on the map as green, orangeor red circles. You can see bindetails in the Dashboard – capacity, wastetype, last measurement, GPS location andcollection schedule or pick recognition.
FR-2	Real time binmonitoring.	The Dashboard displays real-time dataon fill-levels ofbins monitored by smart sensors. In addition to the % of fill-level, based on the historicaldata, the tool predicts when the bin will become full, one of the functionalities that are not included even inthe best wastemanagement software.. Sensorsrecognize picks as well; so you can check whenthe bin was last collected. With real-time dataand predictions, you can eliminate the overflowing bins and stop collecting half-empty ones.
FR-3	Expensive bins.	We help you identify bins that drive up your collection costs. The tool calculates a rating foreach bin in termsofcollection costs. The toolconsiders the average distance depo-bin-discharge in the area. The toolassigns bin a rating (1-10) and calculates distance from depo-bin discharge.

FR-4	Adjust bin distribution.	Ensure the most optimal distribution of bins. Identify areas with either dense or sparse bindistribution. Make sure all trash types are represented within astand. Based on the historical data,you can adjustbin capacityorlocation where necessary.
FR-5	Eliminate unefficient picks.	Eliminate the collection of half-empty bins.The sensors recognize picks. By using real-time data on fill-levels and pick recognition, we can showyou how full the binsyou collect are. The report showshow full the bin was whenpicked. You immediately seeany inefficient picksbelow 80% full.
FR-6	Plan waste collection routes.	The tool semi-automates waste collection route planning. Based on current bin fill-levels andpredictionsof reaching full capacity, you are ready to respond andschedule waste collection. You can compareplanned vs. executed routes toidentify any inconsistencies.

Non-functional Requirements:

Following are the non-functional requirements of the proposedsolution.

FR No.	Non-Functional Requirement	Description

NFR-1	**Usability**	IoT device verifies that usability is a special and important perspective to analyze user requirements,which can further improve the design quality. In thedesign process with user experience as the core, theanalysis of users’ product usability can indeed help designers betterunderstand users’ potential needsin wastemanagement, behavior and experience.
NFR-2	**Security**	Use a reusable bottlesUse reusable grocerybags Purchase wisely and recycle Avoid singleuse food and drink containers.
NFR-3	**Reliability**	Smart waste management is also about creating better working conditions for waste collectors and drivers. Instead of driving the same collection routes and servicing empty bins, waste collectors will spend their time moreefficiently, taking careof bins thatneed servicing.

NFR-4	**Performance**	The Smart Sensors use ultrasound technology to measurethe fill levels(along with other data)in bins several times a day. 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. Customers are hence provideddata-driven decision making, and optimization of waste collection routes, frequencies, and vehicle loads resulting in route reduction by at least30%.
NFR-5	**Availability**	By developing & deploying resilient hardware and beautiful software we empower cities,businesses, and countries to manage wastesmarter.
NFR-6	**Scalability**	Using smart wastebins reduce the number of binsinside town, cities coz we able to monitorthe

PROJECT DESIGN

Data Flow Diagrams

A Data FlowDiagram (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 requirementgraphically.

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

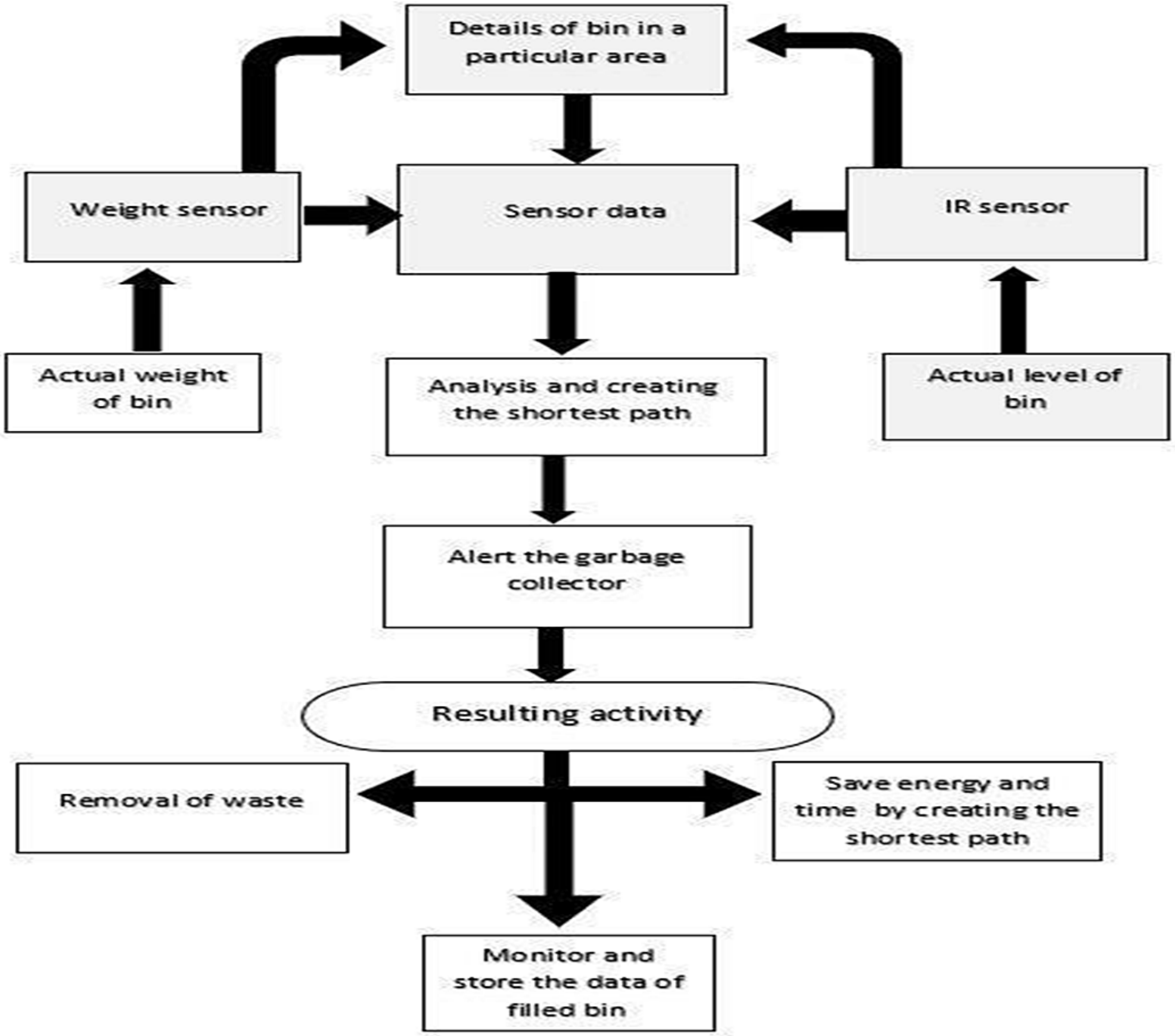
A smart waste management platform uses analytics to translate the data gather in your

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

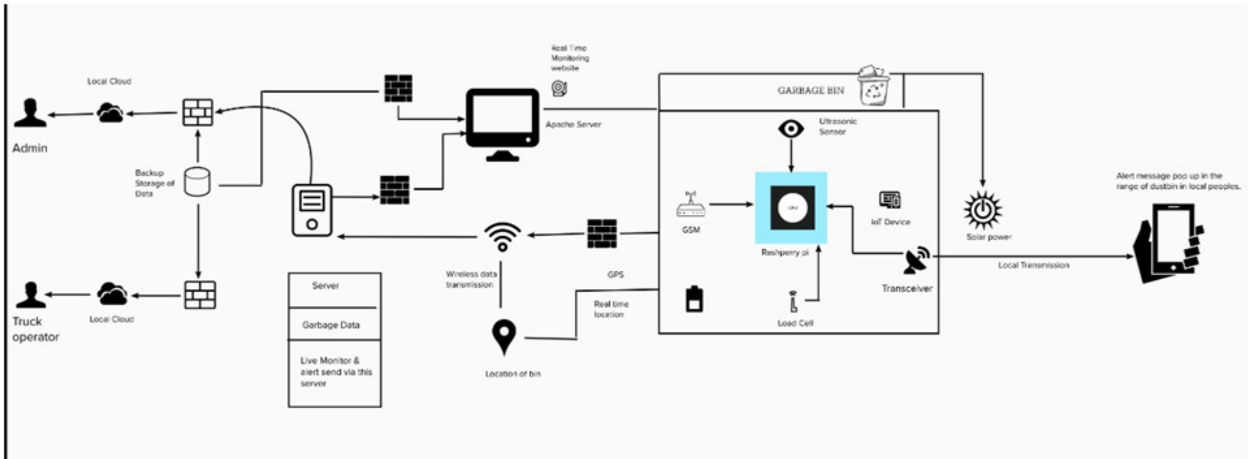
You can receive data on metric such as:

1. The first test conducted is the situationwhere the garbagebin is empty or its garbage levelis very low
2. Then, the bin is filledwith more garbageuntil its level has surpassedthe first threshold **value, which is set to 80% then the first warningSMS is being sent, as depicted**
3. The first notification SMS sent by the system,once the waste reaches the level of 85% full
4. The second notification SMS sent by the system,indicating that bin is at least 95% full and **the garbage needs to be collected immediately**
5. Locations prone to overflow
6. The number of bins needed to avoid overflowing waste
7. The number of collection servicesthat could be saved
8. The amount of fuel that could be saved
9. The driving distance that could be saved.

Data flow diagram:


Details of bin in a particular area
Weight sensor
Sensor data
IR sensor
Actual weight of bin
Analysis and creating the shortest path
Actual level of bin
Alert the garbage collector
Resulting activity
Removal of waste
Save energy and time by creating the shortest path
Monitor and store the data of filled bin

Solution & TechnicalArchitecture:



TECHNOLOGY ARCHITECTURE FOR SMART WASTE MANAGEMENT SYSTEM.

Table-1: Components & Technologies:

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

6.	Infrastructure (Server /Cloud)	Application Deployment onCloudLocal Server Configurati on	Local and CloudFoundry

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 expansion more databaseof smart bins added additionally can be updated.	Cloud storage
4.	Availability	As the system controlis connected to web server itisavailable 24*7 and can be accessed whenever needed.	Server, Appleixe, reple
5.	Performance	Performanceis high it uses 5mb caches	Wireless Sensor Network

User Stories

Use the below templateto list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Admin	Login	USN-1	As an administrator, I assigned user namesand passwords to each employee and managedthem.	I can control myonline account and dashboard.	Medium	Sprint-1
Co-Admin	Login	USN-2	As a Co-Admin, I'll control the waste level monitor. If a garbagefilling alert occurs, I will notify the trash truckof the location and rubbish ID.	I can handlethe waste collectio n.	High	Sprint-1
Truck Driver	Login	USN-3	As a Truck Driver, I'll follow Co Admin'sinstructi on toreach the filled garbage.	I can take the shortest pathtoreach the waste filled routespecified.	Medium	Sprint-2
Local Garbage Collector	Login	USN-4	As a Local Garbage Collector, I’IIgather allthe waste from the garbage, load it onto a garbage truck, and deliver it to Landfills	I can collect the trach, pullit to thetruck, and send itout.	Medium	Sprint-3

Municipalityofficer	Login	USN-5	As a Municipalityofficer, I'll make sure everything is proceeding as planned andwithout any problems.	All of these processes areundermy control.	High	Sprint-4

PROJECT PLANNING& SCHEDULING

Sprint Planning & Estimation

TITLE	DESCRIPTION	DATE
Literature Survey & Information Gathering	Literature survey on the selected project & gatheringinformation by referring the,technical papers,research publications etc.	18 SEPTEMBER 2022
Prepare Empathy Map	Prepare Empathy Map Canvasto capture the user Pains & Gains, Prepare list of problemstatements	18 SEPTEMBER 2022

Ideation	List the by organizing the brainstorming session andprioritize the top 3 ideas based on the feasibility & importance.	18 SEPTEMBER 2022
Proposed Solution	Prepare the proposed solutiondocument, which includes thenovelty, feasibility of idea, business model, social impact, scalability of solution, etc.	23 SEPTEMBER 2022
Problem Solution Fit	Prepare problem - solution fitdocument.	19 OCTOBER 2022
Solution Architecture	Prepare solution architecturedocument.	19 OCTOBER 2022
Customer Journey	Prepare the customer journeymaps to understand the user interactions & experiences with the application (entry to exit).	19 OCTOBER 2022

Functional Requirement	Prepare the functional requirement document.	28 OCTOBER 2022
Data FlowDiagrams	Draw the data flow diagrams and submit forreview.	29 OCTOBER 2022
Technology Architecture	Prepare the technology architecture diagram.	10 NOVEMBER 2022
Prepare Milestone & ActivityList	Prepare the milestones &activity list of the project.	17 NOVEMBER 2022
Project Development - Delivery of Sprint-1, 2, 3 &4	Develop & submit the developed codeby testing it.	IN PROGRESS..

Product Backlog, SprintSchedule, and Estimation (4 Marks)

Use the below templateto create productbacklog and sprintschedule

Sprint	FunctionalRequirement (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 workersover there in municipality	20	High	JOSHUA VIMAL RAJ
Sprint-1	login	USN-2	As a Co-Admin, I’ll control the waste level by monitoring themvai real timeweb portal. Oncethe filling happens, I’ll notify trashtruck with location of bin with binID	20	High	SRI VARSHINI
Sprint-2	dashboard	USN-3	As a Truck Driver, I’ll follow Co-Admin’s Instructionto reachthe filling bin in shortroots and savetime	10	Medium	SURIYA PONSELVI ,SRI VARSHINI

Sprint-3	dashboard	USN-4	As a LocalGarbage Collector, I’IIgather all thewaste from the garbage, load it onto a garbage truck, and deliver it to Landfills	20	High	SURIYA PONSELVI
Sprint-4	dashboard	USN-5	As a Municipality officer, I'll make sure everything is proceeding as planned and without any problems	20	High	SUVIN RAJ

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

Sprint	Total Story Points	Duration	Sprint StartDate	Sprint End Date(Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022

Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

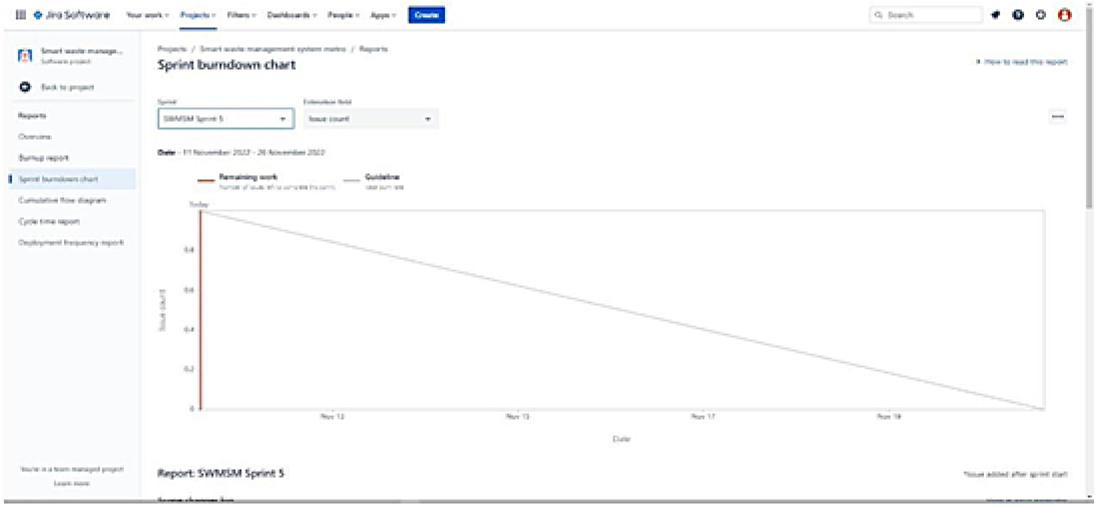
Velocity:

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

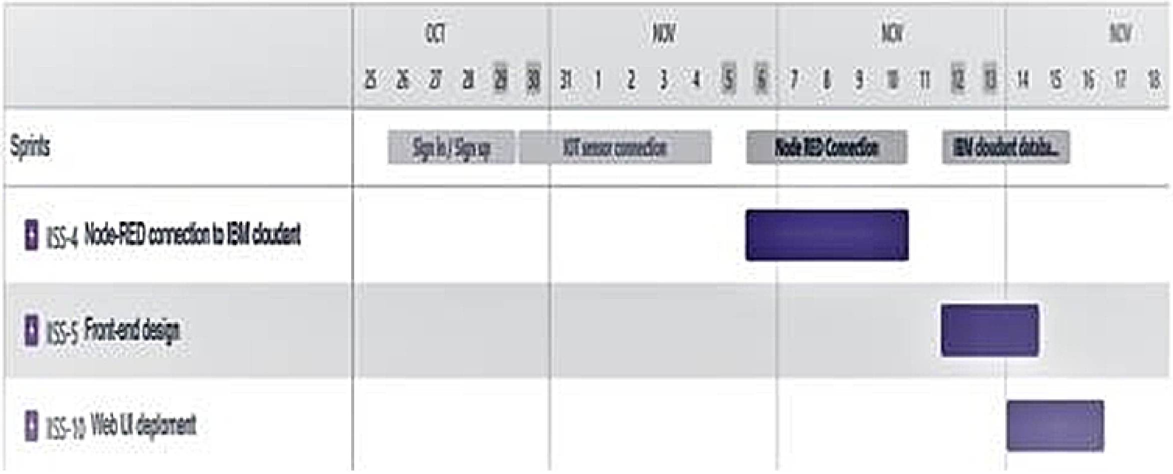
$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

Reports from JIRA

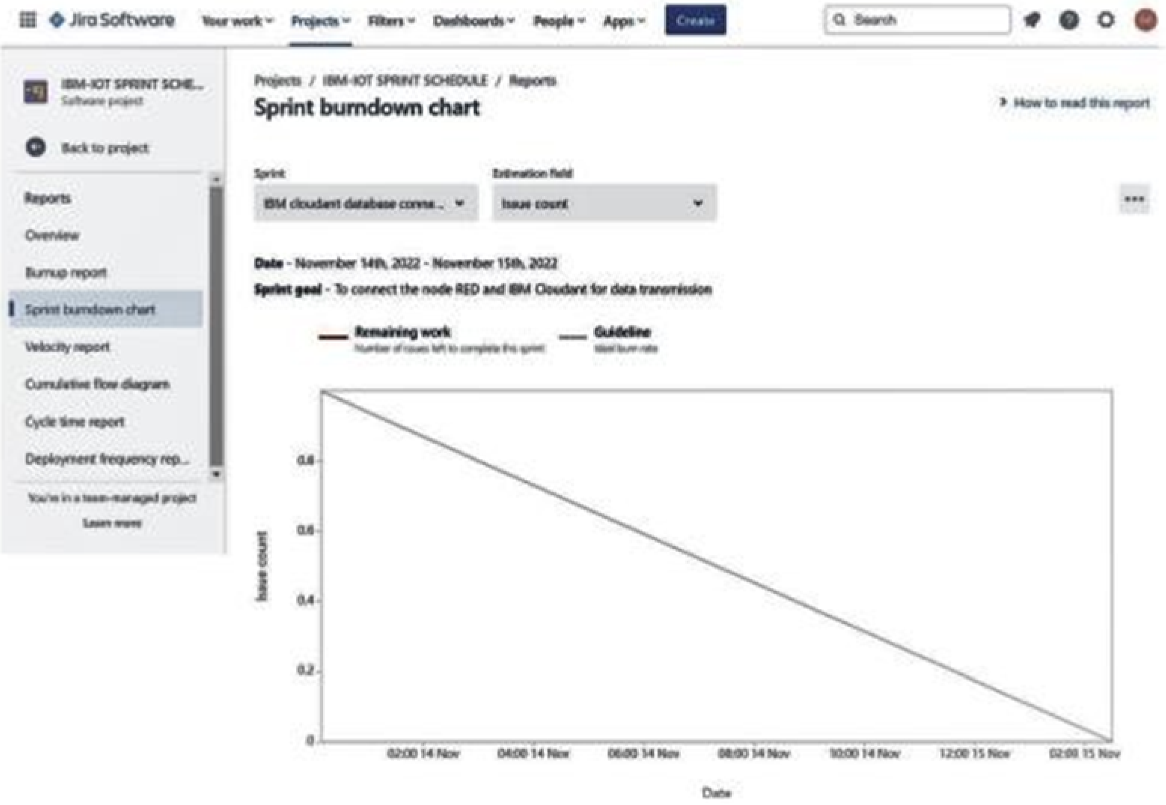
BURNDOWN CHART



ROADMAP


OCT
NOV
NOV
NOV
25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Sprints
Sign In / Sign up
IOT sensor connection
Node RED Connection
IBM cloudant databa...
ISS-4 Node-RED connection to IBM cloudant
ISS-5 Front-end design
ISS-10 Web UI deployment

SPRINT BURNDOWN CHART



Sprint burndown chart

Sprint: IBM cloudant database conne...

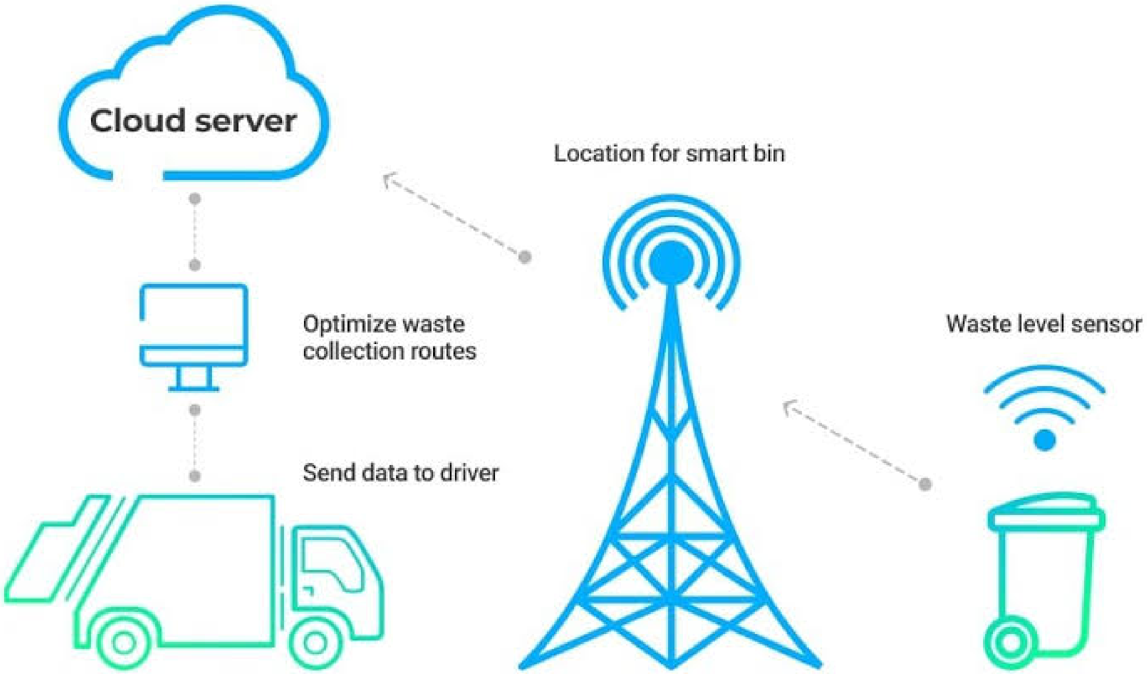
Estimation field: Issue count

Date - November 14th, 2022 - November 15th, 2022

Sprint goal - To connect the node RED and IBM Cloudant for data transmission

CODING & SOLUTIONING (Explainthe features added in the projectalongwith code)

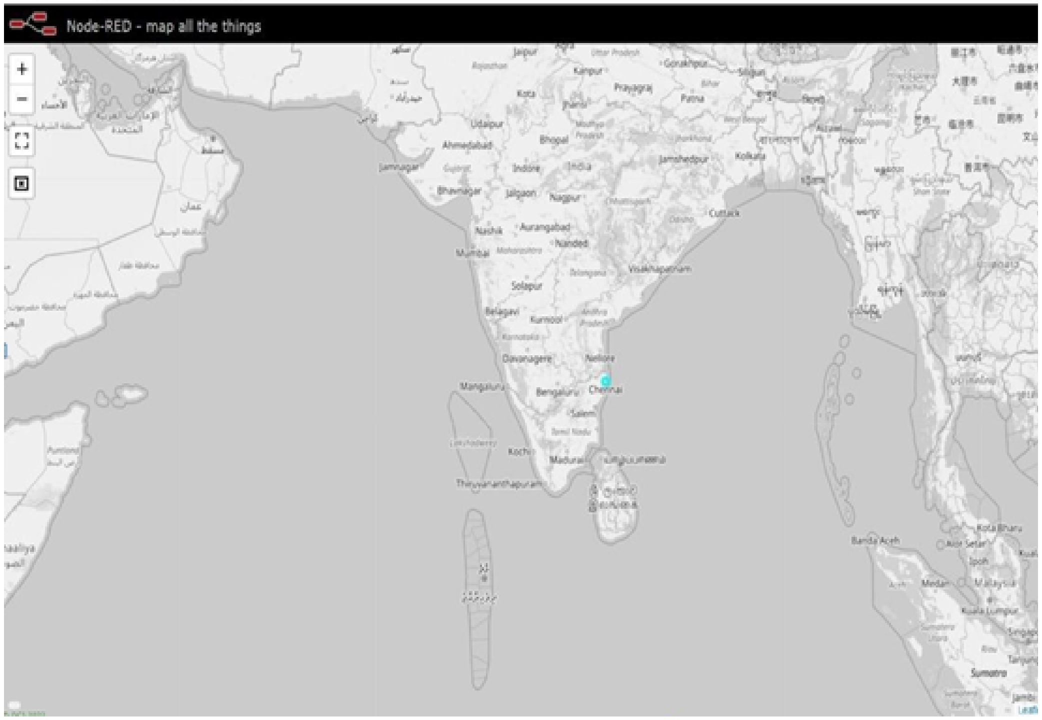
i. Feature 1- LOCATION TRACKER



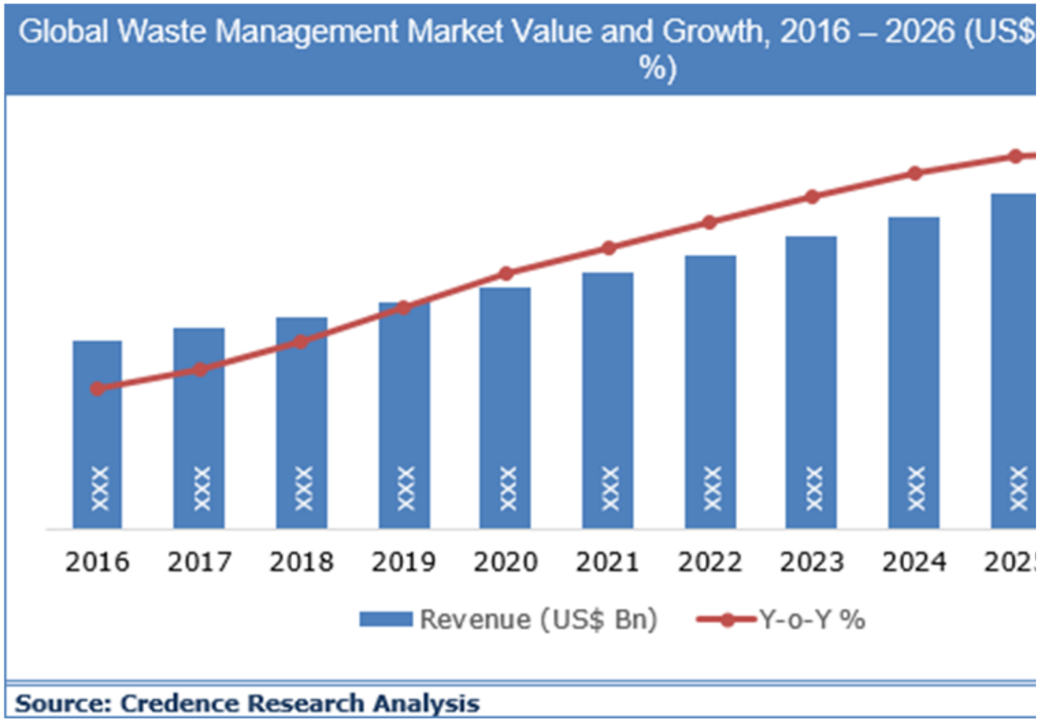
CODING & SOLUIĬIONING (Explainthe featuíes a(

the píoject along with code)7.1Ïeatuíe 1- LOCAIĬI

IĬRACKER

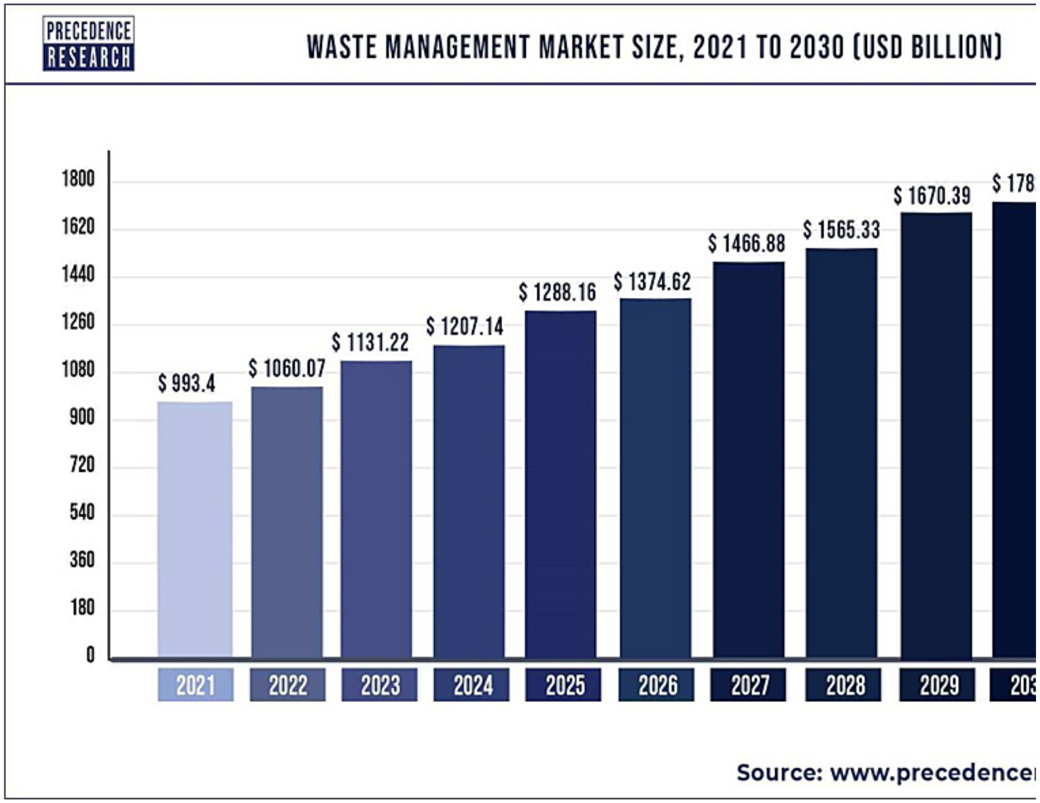


RESULTS & PERFORMANCE MATRICS:



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

Source: Credence Research Analysis


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

Source: www.precedence

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

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

DISADVANTAGES:

- Systemrequires a greaternumber of wastebins for separatewaste collection as per population in the city.
- This results into high initialcost due to expensive s dustbins compare to other methods.
- Sensor nodes used in the dustbins have limited m size.

CONCLUSION

A Smart WasteManagement system that is mo effective than the one in use now is achievable using sensors to monitor the filling of bins. C conception of a "smart waste management syste focuses on monitoring waste manageme offeringintelligent technology for wa systems,eliminating human interventi minimizing human time and effort,and produci a healthy and trash- free environment. T suggested approach can be implemented in sm cities where residents have busy schedules t provide little time for garbage management. desired, the bins might be put into place in metropolis where a sizable container would able to hold enough solid trash for a single u The price might be high.

a. 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 ortheft.

2. The conceptof green pointswould encourage the involvement of residents or end users,makingthe 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 graphicalinte

12) APPENDIX

Source Code

```
# Project : Smart Waste
Management# Team ID :
PNT2022TMID48488
MAIN.py
  c= 1
                import time
                for i in range(1,2):
```

```
while True:
ifc == 1:
import distance
d=distance.distancesensor()
c = 2
elif c == 2:
import load
w = int(load.loop())
c = 3
else:
import database as db
ifw < 5000 and w > 4000:
load = "90 %"
elif w < 4000 and w > 3000:
load = "60 %"
elif w < 3000 and w > 100:
load = "40 %"
else:
load = "0 %"
if d > 30:
distance = "90 %"
elif d < 30 and d >20:
distance = "60 %"
elif d < 20 and d > 5:
distance = "40 %"
else:
```

```
distance = "7 %"
if load == "90 %" or distance == "90 %":
m = "Risk Warning: Dumpster poundage getting high, Time to cc
elif load == "60 %" or distance == "60 %":
m ="dumpster is above 60%"
else :
m = "          "
db.database(d,w,m,load,distance)


print("data pushed")
c= 1
break
```

LOAD.py

```
import

time
         import sys



         EMULATE_HX711=False


         referenceUnit = 1


         ifnot EMULATE_HX711:
         import RPi.GPIO as GPIO
```

```
from hx711 import HX711
else:
from emulated_hx711 import HX711


defcleanAndExit():
print("Cleaning...")


ifnot EMULATE_HX711:
GPIO.cleanup()
print("Bye!")
sys.exit()


hx= HX711(5, 6)

# I've found out that, for some reason, the order of the bytes is not
between versions of python,numpy and the hx711 itself.
# Still need to figure out why doesit change.
# If you're experiencing super random values, change these valuest
morestable values.
# There is some code below to debug and log the order of the bitsa
# The first parameter is the orderin which the bytesare used to buil
# The second paramter is the order of the bits inside eachbyte.
```

```
 # According to the HX711Datasheet, the secondparameter is MS
                                                need to modify it.
hx.set_reading_format("MSB", "MSB")


# HOWTO CALCULATE THE REFFERENCE UNIT
#To set the reference unit to 1. Put 1kg on your sensor or anythi
exactlyhow much it
weights.
# In this case, 92 is 1 gram because, with 1 as a reference unit I go
any weight
# and I got numbers around 184000 when I added 2kg.So, accordi
# If 2000grams is 184000then 1000 gramsis 184000 / 2000 =92.
hx.set_reference_unit(113)
#hx.set_reference_unit(referenceUnit)



hx.reset()


hx.tare()


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


# to use both channels, you'll need to tarethem both
#hx.tare_A()
```

```
#hx.tare_B()



defloop():
try:
# These three linesare usefull to debugwether to use MSB or LSB
# for thefirst parameter of "hx.set_reading_format("LSB", "MSB"
# Comment the two lines "val = hx.get_weight(5)" and "print val"
three lines to see what
it prints.
# np_arr8_string = hx.get_np_arr8_string()
# binary_string = hx.get_binary_string()
# print binary_string + " "+ np_arr8_string
# Prints the weight. Comment if you're debbuging the MSB andLS
val = hx.get_weight(5)
print(val)
return val



#To get weightfrom both channels (if you haveload cells hookedup
# to both channel A and B), do something likethis
#val_A = hx.get_weight_A(5)
#val_B = hx.get_weight_B(5)
#print "A: %s  B: %s" % ( val_A,val_B )
```

```
hx.power_down()
hx.power_up()
time.sleep(0.1)


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

DISTANCE.py

```
import RPi.GPIO as GPIO
import time


defdistancesensor():
try:


GPIO.setmode(GPIO.BOAR
GPIO.setwarnings(False)
PIN_TRIGGER = 23
PIN_ECHO = 33
GPIO.setup(PIN_TRIGGER
GPIO.setup(PIN_ECHO, G
GPIO.output(PIN_TRIGGE
time.sleep(2)
 GPIO.output(PIN_TRIGGE
 time.sleep(0.00001)
 GPIO.output(PIN_TRIGGE
 while GPIO.input(PIN_ECH
 pulse_start_time = time.time
 while GPIO.input(PIN_ECH
 pulse_end_time = time.time
 pulse_duration = pulse_end_
 pulse_start_time
      global
    distance
 distance = round(pulse_dura
 print(distanc
         e)
      return
    distance



finally:
 GPIO.cleanup()
```

HX711.py

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

```
import time
import threading
class HX711:



def __init_(self, dout, pd_sc
self.PD_SCK = pd_sck



self.DOUT = dout

# Mutex for readingfrom th
multiplethreads inclient
# software try to access get v
same time.
self.readLock = threading.L
GPIO.setmode(GPIO.BCM
GPIO.setwarnings(False)
GPIO.setup(self.PD_SCK, 
GPIO.setup(self.DOUT, GP



self.GAIN = 0
```

```
# The value returned by  the
corresponds to yourreferenc
# unit AFTER dividing by th
self.REFERENCE_UNIT =
self.REFERENCE_UNIT_B


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


self.DEBUG_PRINTING =


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


self.set_gain(gain)



# Thinkabout whether this is
```

```
time.sleep(1)


def convertFromTwosComp
inputValue):
return -(inputValue & 0x800
&0x7fffff)


defis_ready(self):
return GPIO.input(self.DOU


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


GPIO.output(self.PD_SCK,


# Read out a set of raw bytes
```

```
self.readRawBytes()


defget_gain(self):
if self.GAIN == 1:
return 128
if self.GAIN == 3:
return 64
if self.GAIN == 2:
return 32


# Shouldn't get here.
return 0


defreadNextBit(self):
# Clock HX711 Digital Seri
DOUT will be
# ready 1us afterPD_SCK ri
after
# lowering PD_SCL, when v
stable.


GPIO.output(self.PD_SCK,
GPIO.output(self.PD_SCK,
value = GPIO.input(self.DO


#Convert Boolean to int and
return int(value)




defreadNextByte(self):
byteValue = 0


#Read bits and build the byt
depending
# on whether we are in MSB
for x in range(8):
if self.bit_format == 'MSB':
byteValue <<= 1
byteValue |= self.readNextB
else:
byteValue >>= 1
byteValue |= self.readNextB


#Return the packedbyte.
```

```
return byteValue


defreadRawBytes(self):
# Wait for andget the Read I
threadis already
# driving the HX711 serial i
self.readLock.acquire()


# Wait until HX711 is ready
while not self.is_ready():
pass


# Read three bytes of data fr
firstByte  = self.readNextBy
secondByte = self.readNextl
thirdByte  = self.readNextBy


# HX711 Channel and gain f
bits read
# after 24 data bits.
for i in range(self.GAIN):
```

```
# Clock a bit out of the HX7
self.readNextBit()


# Release the Read Lock, no
driving theHX711
# serial interface.
self.readLock.release()


# Depending on how we'reco
orderd listof rawbyte
# values.
if self.byte_format == 'LSB'
return [thirdByte, secondBy
else:
return [firstByte, secondByt
def read_long(self):
# Get a sample from the HX
bytes.
dataBytes = self.readRawBy
if self.DEBUG_PRINTING:
print(dataBytes,)
# Join the raw bytes into asi
value.
twosComplementValue = ((
(dataBytes[1] << 8) |
dataBytes[2])


if self.DEBUG_PRINTING:
print("Twos: 0x%06x" % tw
# Convert from24bit twos-c
value.
signedIntValue
=
self.convertFromTwosComp
entValue)


# Record the latest sampleva
self.lastVal = signedIntValu


# Return the sample value w
return int(signedIntValue)
def read_average(self, times


# Make sure we've been aske
of samples.
iftimes <= 0:
raise ValueError("HX711()::
>= 1!!")
```

```
#If we're only average acros
return it.
if times == 1:
return self.read_long()


# If we're averaging across
take the
# median.
if times <5:
return self.read_median(tim


# If we're takinga lot of sa
in a list,remove
# the outliers, then take the
valueList = []


forx in range(times):
valueList += [self.read_long


valueList.sort()
```

```
# We'll be trimming 20% of
and bottomof collected set.
trimAmount = int(len(value


#Trim the edgecase values.
valueList = valueList[trimA


# Return the mean of remain
return sum(valueList) / len(v
# A median-based read meth
gettingrandom
value spikes
# for unknown or CPU-relat
def read_median(self, times=
if times <= 0:


raise ValueError("HX711::r
be greater
than zero!")
# If times == 1, justreturn a
if times == 1:
return self.read_long()
```

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

#If times is odd we can just
if(times & 0x1) == 0x1:
return valueList[len(valueLi
else:
# If times is even we have to
of
# the two middlevalues.
midpoint = len(valueList) / 2
return sum(valueList[midpo
# Compatibility function, us
def get_value(self, times=3)
return self.get_value_A(tim
def get_value_A(self, times=
return self.read_median(tim
def get_value_B(self, times=
# for channel B, we need tos
g = self.get_gain()
self.set_gain(32)
value = self.read_median(tin
self.set_gain(g)
return value
```

```
# Compatibility function, us
def get_weight(self, times=3
return self.get_weight_A(tim
def get_weight_A(self, time
value = self.get_value_A(tim
value = value/ self.REFERE
return value
def get_weight_B(self, times
value = self.get_value_B(tim
value = value/ self.REFERE
return value
# Sets tare for channel A for
def tare(self, times=15):
return self.tare_A(times)
def tare_A(self, times=15):
# Backup REFERENCE_U

backupReferenceUnit = self
self.set_reference_unit_A(1)
value = self.read_average(ti

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

```
# Restore the reference unit,
offset.
self.set_reference_unit_A(ba
return value
def tare_B(self, times=15):
# Backup REFERENCE_UI
backupReferenceUnit = self
self.set_reference_unit_B(1)


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


value = self.read_average(ti
if self.DEBUG_PRINTING:
print("Tare B value:", value)
self.set_offset_B(value)
# Restore gain/channel/refer
self.set_gain(backupGain)
self.set_reference_unit_B(ba
return value
def          set_reading_for
byte_format="LSB",

bit_format="MSB"):
if byte_format == "LSB":
self.byte_format = byte_forr
elif byte_format == "MSB":
self.byte_format = byte_forr
else:
raise     ValueError("Unreco
\"%s\""     %

byte_format)
if bit_format == "LSB":
self.bit_format = bit_format
elif bit_format == "MSB":
self.bit_format = bit_format
else:


raise ValueError("Unrecogn
bit_format)
# sets offset for channel A fo
def set_offset(self, offset):
self.set_offset_A(offset)



defset_offset_A(self, offset)
self.OFFSET = offset
def set_offset_B(self, offset)
```

```
self.OFFSET_B = offset


defget_offset(self):
return self.get_offset_A()


defget_offset_A(self):
return self.OFFSET


defget_offset_B(self):
return self.OFFSET_B
def set_reference_unit(self,
self.set_reference_unit_A(re
def set_reference_unit_A(se
# Make sure we aren't asked
unit.
if reference_unit == 0:
raise ValueError("HX711::s
can'taccept 0
as a reference unit!")
return


self.REFERENCE_UNIT =
defset_reference_unit_B(sel
# Make sure we aren'tasked
unit.
if reference_unit == 0:
raise ValueError("HX711::s
can'taccept 0
as a reference unit!")
return
self.REFERENCE_UNIT_E
def get_reference_unit(self):
return get_reference_unit_A
def get_reference_unit_A(se
return self.REFERENCE_U
def get_reference_unit_B(se
return self.REFERENCE_U


def power_down(self):
# Wait for and getthe Read I
is already
# driving the HX711 serial i
self.readLock.acquire()


# Causea rising edgeon HX7
(PD_SCK).We then
```

```
# leave it held up and wait 1
HX711 should

be

# powered down.

GPIO.output(self.PD_SCK,

GPIO.output(self.PD_SCK,



time.sleep(0.0001)


# Release the Read Lock, nc

driving theHX711

# serial interface.

self.readLock.release()

def power_up(self):

# Wait for and get the ReadI
is already

# driving the HX711 serial i

self.readLock.acquire()

# Lower the HX711 Digital
line.

GPIO.output(self.PD_SCK,

# Wait 100 us for the HX71

time.sleep(0.0001)
```

```
# Release the Read Lock, nc
driving the HX711
# serial interface.
self.readLock.release()
# HX711 will nowbe default
of 128.  If
this
# isn't what client softwareh
a sample
and
# throw it away,so that next
be from
the
# correct channel/gain.
if self.get_gain() != 128:
self.readRawBytes()
def reset(self):


self.power_down
()
self.power_up()
```

```
<html>
```

WEBSITE CODING

Index.html

```
<!DOCTYPE html>


<head>
  <link rel="stylesheet"
href="https://cdn.jsdelivr.net/npm/bootstrap@4.3.1/dist/css/bootstrap.min.css"
integrity="sha384-
ggOyR0iXCbMQv3Xipma34MD+dH/1fQ784/j6cY/iJTQUOhcWr7x9JvoRxT2
crossorigin="anonymous">
        <meta charset="utf-8">
        <meta name="viewport" content="width=device-width">
        <title>Garbage Management System</title>
        <link rel="icon" type="image/x-icon" href="/Images/DUMPSTER.png"
        <link href="style.css" rel="stylesheet" type="text/css" />
        <script src="https://www.gstatic.com/firebasejs/8.10.1/firebase-app.js">
        <script src="https://www.gstatic.com/firebasejs/8.10.1/firebase-
        database.js"></script>

        <script>
                var firebaseConfig =
                {
```

```
                apiKey:
                "AIzaSyB9ysbnaWc3IyeCioh-
                aJQT_UCMd5CBFeU",
                authDomain: "fir-test-
                923b4.firebaseapp.com",
                databaseURL: "https://fir-test-
                923b4-default-
                rtdb.firebaseio.com", projectId:
                "fir-test-923b4",
                storageBucket: "fir-
                test-
                923b4.appspot.com
                ",
                messagingSenderI
                d:
                "943542145393",
                appId:
                "1:943542145393:web:9b5ec7
                593e6a3cbd7966d0",
                measurementId: "G-
                BN7JNX1Q7B"
        };



</head>
```

```
        firebase.initializeApp(firebaseConfig)
</script>
<script defer src="database.js"></script>


 <body style="background-color:#1F1B24;">
         <script src="map.js"></script>



   </div>
         </div>

 <div id="map_container">
         <h1 id="live_location_heading" >LIVELOCATION</h1>
         <div id="map"></div>
         <div id="alert_msg">ALERT MESSAGE!</div>

 <center><a
  href="https://goo.gl/maps/G9XET5mzS
  w1ynHQ18" type="button" class="btn
  btn-dark">DUMPSTER</a></center>
```

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


</html>
```

Database.js

```
const cap_status =
document.getElementById('cap
_status');const alert_msg=
document.getElementById('ale
rt_msg');

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


ref.on("value", function(snapshot)
 {
   snapshot.forEach(f
      unction
      (childSnapshot)
      {var value =
        childSnapshot.va
        l();

                    const alert_msg_val = value.alert;
                    const cap_status_val = value.distance_status;


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

Map.js

```
const database = firebase.database();

function myMap()
{
            var ref1 = firebase.database().ref();

                        ref1.on("value", function(snapshot)
                         {
                           snapshot.forE
                              ach(function
                              (childSnaps
                              hot) { var
                              value =
childSnapsh
ot.val();
             const
             latitu
             de =
             value.
             latitud
             e;
             const
             longit
             ude=
             value.
             longit
             ude;

             var latlong =
             { lat:
             latitude, lng:
             longitude}
             var
             mapProp=
             {
                     center: new
                     google.map
                     s.LatLng(lat
                     long),zoom:
                     10,
             };
                          var map = new
              google.maps.Map(document.getElementB
                       yId("map"), mapProp);



                                  });
```

```
                                                    }, function (error) {

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

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

}

html, body
```

Style.css

```
{
height: 100%;
     ma
     rgi
     n:
     0p
     x;
     pad
     din
     g:0
     px;

 #container
 {
  }

}

display: flex;
flex-direction: row;
height: 100%;
width: 100%;
position:relative;
```

```
#logo_container
{







}
.logo
{

height: 100%;
width: 12%;
backgroun
d-color:
#C5C6D0;
display:
flex;
flex-
directio
n:
column;
vertical-
align:
text-
bottom;



width:70%;
```

```
        margin: 5% 15%;

/*        border-radius: 50%; */


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

}
#data_container
{
        height: 100%;
        width: 20%;
        margin-left: 1%;
        ma
        rgi
        n-
        rig
        ht:
        1
        %;
        dis
        pla
        y:
        fle
        x;
        flex-direction: column;
}
#data_status
{
        hei
        ght
```

```
:60%;width:8%;margin:7%;background-color:#691F6E;display
```

```
        :
        fl
        e
        x
        ;
        fle
        x-
        dir
        ecti
        on:
        col
        um
        n;
        bor
        de
        r-
        rad
        ius:
        20p
        x;
}
#load_status
{
        background-
        image:
        url("/Images/
        KG.png");
        background-
        repeat: no-
        repeat;
         bac
        kgro
        und-
        size:
        170
        px;
        back
        grou
        nd-
        posi
        tion:
        left
        cent
        er;
}
#cap_status
{






}
.status
{

background-image:
url("/Images/dust.png"
);background-repeat:
no-repeat;
 background-
size: 150px;
background-
position: left
center;



width: 80%;
height: 40%;
margin:
5% 10%;
backgrou
```

```
nd-
color:#18
5adc;
border-
radius:20
px;
display:fl
ex;
justif
y-
conte
nt:
cente
r;
alig
n-
item
s:
cente
r;
colo
r:
whit
e;
font-size: 60px;




}
.datas
{
```

```
width
:86
%;
margi
n:2.
5%
7%;
heigh
t:10
%;

  backgr
   ound:
   url(wa
   ter.png
   );
   backgr
   ound-
   repeat:
   repea
   t-x;
   animat
   ion:
   datas1
   0s
   linear
   infinit
   e;

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

}
#map_container
{
            height: 100%;
            wid
            th:
```

```
        100
        %;
        dis
        pla
        y:
        fle
        x;
        flex-direction: column;
}



#live_location_heading
{
        ma
        rgi
        n-
        top
        :10
        %;
        tex
        t-
        alig
        n:
        cen
        ter;
 color:  GREY;
}



#map
{
}
#alert_msg
{
```

```
}
.lat
{

}
```

```
height: 70%;
width: 90%;
ma
rgi
```

```
n-
lef
t:
4
%;
ma
rgi
n-
rig
ht:
4
%;
border:
10px
solid
white;
border-
radius:
25px;



width:9
2%;
height:
20%;
margin:
4%;
backgro
und-
color:gr
ey;
border-
radius:
20px;
display:
flex;
justify-
```

```
conten
:
center;
align-
items:
center;
color:
#41af7
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```

```
font-size:0px;

@keyframes datas{

0
```

```
  %

  {
    background-position: -500px 100px;
  }
  40%
  {
    background-position: 1000px -10px;
  }

  80% {
    background-position: 2000px 40px;
  }
  10
  0%
  {
    background-position: 2700px95px;
  }

}
```

For simulator pythoncode

BIN1.PY

imp

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req

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```
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```
# watsondevice details

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```
d=
"to
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n=
"12
345
678
9"

#generate randomvalues for randomovariables (temperature&humidity)




def myCommandCallback(cmd):
    global a
    print("command recieved:%s"
    %cmd.data['command'])
    control=cmd.data['command']
    print(control)

try:
        deviceOptions={"org": organization, "type": devicType,"id": deviceId,"auth-
        method":authMethod,"auth-
token":authToken}
        deviceCli =
ibmiotf.device.Client(deviceO
ptions)except Exception as e:
        print("caught exception
        connecting device %s" %str(e))
        sys.exit()

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

while True:


    distance=
    random.randi
    nt(10,70)
    loadcell=
    random.randi
    nt(5,15)data=
    {'dist':distanc
    e,'load':loadce
    ll}


    if loadcell
        < 13
        and
        loadcell
        > 15:
        load =
        "90 %"
    elif loadce
          ll < 8
          and
          loadce
          ll > 12:
          load =
          "60
          %"

    elif
          loadce
          ll < 4
          and
          loadce
          ll > 7:
          load =
          "40
          %"
    else:
          load = "0 %"

    if distance< 15:
          dist = 'alert :' ' Dumpster poundage getting high, Time to collect:) ' '90 %'


    elif distance< 40 and distance >16:
          dist = 'alert :' 'dumpster is above '' 60%'

    elif distance < 60 and distance > 41:
          dist = 'alert :'
```

```
'dumpster is above
''40 %'else:
    dist ='alert :' 'No need to collectright now ''17 %'



if load == "90 %" or
    distance == "90 %":
    warn  = 'alert
    pushedto ibm
    sucessfully :'

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

    warn = 'alert
pushed to ibm
sucessfully :'else :
    warn = 'alertpushed to ibm sucessfully :'
def myOnPublishCallback(lat=10.678991,long=78.177731):
  print("Gandigramam, Karur")
  print("publisheddistance = %s " %distance,"loadcell:%s "%loadcell,"lon = %s "
  %long,"lat = %s" %lat)print(load)
  pri
  nt(
  dis
  t)
  pri
  nt(
  war
```

```
        n)

    time.sleep(4)
    success=deviceCli.publishEvent ("IoTSensor","json",warn,qos=0,on_publish= myOnPul

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