**Project Report**

|  |  |
| --- | --- |
| **Team id** | **PNT2022TMID13652** |
| **Project Name** | **Smart Waste Management System For Metropolitan Cities** |

1. **INTRODUCTION**
   1. Project Overview

With the increasing population and industrialization of nations throughout the globe, waste has become a great concern for all of us. Over years, researchers figured that only waste management is not enough for its proper treatment and disposal techniques to preserve our environment and keeping it clean in this era of globalization. With the help of technology researchers have, introduced IoT based Smart Waste Management solutions and initiatives that ensures reduced amount of time and energy required to provide waste management services and reduce the amount of waste generated. Unfortunately, developing countries are not being able to implement those existing solutions due to many factors like socio-economic environment. Therefore, in this research we have concentrated our thought on developing a smart IoT based waste management system for developing countries like INDIA that will ensure proper disposal, collection, transportation and recycling of household waste with the minimum amount of resources being available.

* 1. Purpose

We amalgamate technology along with waste management in order to effectively create a safe and a hygienic environment. Smart waste management is about using technology and data to create a more efficient waste industry. Based on IoT (Internet of Things) technology, smart waste management aims to optimize resource allocation, reduce running costs, and increase the sustainability of waste services. This makes it possible to plan more efficient routes for the trash collectors who empty the bins, but also lowers the chance of any bin being full for over a week. A good level of coordination exists between the garbage collectors and the information supplied via technology. This makes them well aware of the existing garbage level and instigate them whenever the bins reach the threshold level. They are sent with alert messages so that they can collect the garbage on time without littering the surrounding area. The fill patterns of specific containers can be identified by historical data and managed accordingly in the long term. In addition to hardware solutions, mobile applications are used to overcome the challenges in the regular waste management system, such as keeping track of the drivers while they are operating on the field. Thus, smart waste management provides us with the most optimal way of managing the waste in an efficient manner using technology

1. **LITERATURE SURVEY**
   1. Existing problem

Waste management has become an alarming challenge in local towns and cities across the world. Often the local area bins are overflowing and the municipalities are not aware of it. This affects the residents of that particular area in numerous ways starting from bad odour to unhygienic and unsafe surroundings. Poor waste management - ranging from non-existing collection systems to ineffective disposal -causes air pollution, water and soil contamination. Open and unsanitary areas contribute to contamination of drinking water and can cause infection and transmit diseases. Toxic components such as Persistent Organic Pollutants (POPs) pose particularly significant risks to human health and the environment as they accumulate through the food chain. Animals eating contaminated plants have higher doses of contaminants than if they were directly exposed. Precipitation or surface water seeping through waste will absorb hazardous components from landfills, agricultural areas, feedlots, etc. and carry them into surface and groundwater. Contaminated groundwater also poses a great health risk, as it is often used for drinking, bathing and recreation, as well as in agricultural and industrial activities. Landfills and waste transfer stations can attract various pests (insects, rodents, gulls, etc.) that look for food from waste. These pests can spread diseases through viruses and bacteria (i.e., salmonella and e-coli), which are a risk to human health

* 1. References

**PAPER TITLE:** Smartwaste management using IOT

**AUTHOR:** 1.Gopal Krishnan Shyam 2.S.Mani

A smart city is nothing but a vision to integrate several information and communication technology(ICT) along with Internet-of -things(IOT) in a way so as to manage a city’s assetsinclude, among others , the local departments ,information systems, libraries , schools, hospitals, waste management system, transportation system etc.Currently, Indian cities accommodate nearly 31% of current population and contributes to 63% of GDP(Census 2014)[2]. Urban areas are expected to house 40% of Indians population and contribute 75% of Indians GDP by 2030.This requires comprehensive development of infrastructure pertaining to social, economic, physical, and institutions fields [3].All are important in improving the quality of life and attracting people and investment.

**PAPER TITLE:** Arduino Microcontroller Based Smart Dustbins for Smart Cities

**AUTHOR:** 1.K. Suresh 2.S.Bhuvanesh 3.B. Krishna Devan

In this paper, a method is presented to make our surrounding's and environment to be clean. Recently the Government of India has launched a smart city project and for these smart cities to be smarter, it is necessary that the garbage collection and disposal system has to be smarter than the existing systems. The idea of Self-Monitoring Automated Route Trash (SMART) dustbin is for the smart buildings, Colleges, Hospitals and bus stands, etc. In this paper, we have used the Ultrasonic sensor and PIR sensor to sense the human presence, Servomotor to open the dustbin top, Ultrasonic sensor to sense the garbage level. A communication module is used to communicate signals between two dustbins and GSM module to send the message to operator. As soon as the dustbin is full it moves in the predefined path to reach the unnoticed place with the help of the Line follower robot using Arduino Microcontroller. We have designed a simple model to test the effectiveness of the proposed method. This paper gives an idea to be implemented in Swach Bharat dustbin in a real time model of various loads like full load, half load and empty load and for different weights.

**PAPER TITLE:** Design and Development of Smart Waste Management System: A Mobile App for Connecting and Monitoring Dustbin Using IoT

**AUTHOR:** 1.Na Jong Shen 2.Azham Hussain 3.Yuhanis Yusof

The Smart Waste Management System is a very innovative system which will contribute to the path towards Smart City. In our city, we usually observe that the trash bins put at open spots are always over-burden. It forms unsanitary conditions to the city and it is not optimize to solve the problem by currently existing waste management in Malaysia. Also, the traditional way of manually monitoring the wastes in dustbins is a complicated process and excessive more human effort with expenses. To avoid all such situations, a project called Smart Waste Management System is implemented. This system is developed to perform the connectivity of mobile application with Internet of Things (IoT) based dustbins. These dustbins are developed using IoT. IoT is the system of physical devices implanted with software, sensors and network connectivity which empowers these items to gather and trade information. The status of dustbins will be determined using ultrasonic sensor and collected data send through network to the database. The mobile application is used to monitor dustbins and perform route direction to the dustbins. The methodology which applies in developing this project is Adaptive Software Development (ASD). The benefits of this scheme are to reduce used of human resources and efforts together with the enhancement of Smart City. The prototype of this project is evaluated by some users before published to ensure the system can be enhanced in future works.

**PAPER TITLE:** IoT-Enabled Solid Waste Management in Smart Cities

**AUTHOR:** 1.S.Vishnu 2.S.R.Jino Ramson 3.Samson 4. Adnan M. Abu-Mahfouz 5.S.Srinivasan 6. Theodoros Anagnostopoulos 7.Xiaozhe Fan 8.A.Alfred

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. Municipalities and waste management companies fail to keep up with outdoor containers, making it impossible to determine when to clean them or when they are full. 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. The PBLMUs and HBLMUs measure the unfilled level of the trash bin and its location data, process it, and transmit it to a central monitoring station for storage and analysis. An intelligent Graphical User Interface (GUI) enables the waste collection authority to view and evaluate the unfilled status of each trash bin.

**PAPER TITLE:** Smart City Waste Management System using IoT and Cloud Computing.

**AUTHOR:** 1.Aderemi A.Atayero 2.Segun I. Popoola 3.Rotimi Williams 4.Joke A.Badejo 5.Sanjay Misra

Indiscriminate disposal of solid waste is a major issue in urban centers of most developing countries and it poses a serious threat to healthy living of the citizens. Access to reliable data on the state of solid waste at different locations within the city will help both the local

authorities and the citizens to effectively manage the menace. In this paper, an intelligent solid waste monitoring system is developed using Internet of Things (IoT) and cloud computing technologies. The fill level of solid waste in each of the containers, which are strategically situated across the communities, is detected using ultrasonic sensors. A Wireless Fidelity (Wi-Fi) communication link is used to transmit the sensor data to an IoT cloud platform known as Thing Speak. Depending on the fill level, the system sends appropriate notification message (in form of tweet) to alert relevant authorities and concerned citizen(s) for necessary action. Also, the fill level is monitored on ThingSpeak in real-time. The system performance shows that the proposed solution may be found useful for efficient waste management in smart and connected communitie

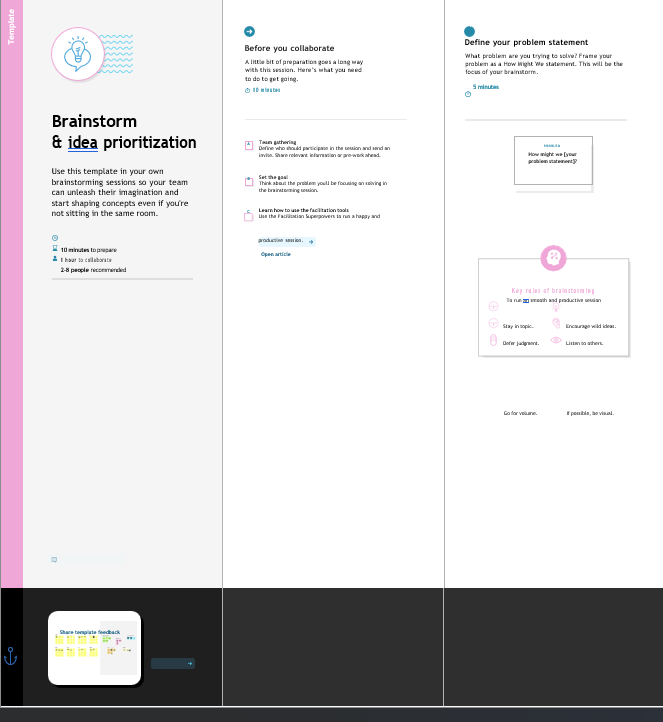
* 1. Problem Statement Definition

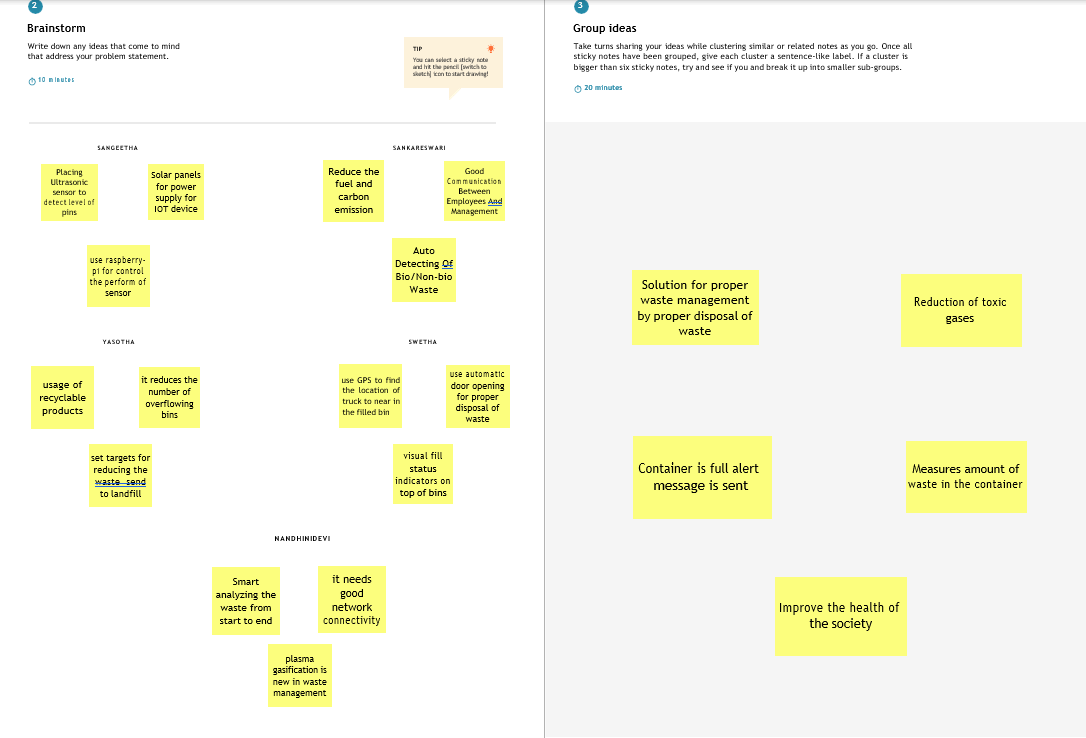
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **PROBLEM STATEMENT** | **I AM (Customer)** | **I’m TRYING TO** | **BUT** | **BECAUSE** | **WHICH MAKES ME FEEL** |
| PS -1 | People of metropolitan cities | Dispose my bio-degradable and non-bio-degradable waste in the garbage bins near my house | There is no separate bins for disposing both the types of waste and sometimes the dustbins were overflowed | Lack of awareness and also the municipal workers didn’t aware about the overflow of waste in the dustbin. | frustrated. |
| PS -2 | Sanitary worker | Collect waste from public and try to know where the bins are overflowed | I can’t able to find the overflowed bin among all the bins at everytime. | There is no proper system to intimate the overflowed dustbins. | Tired |

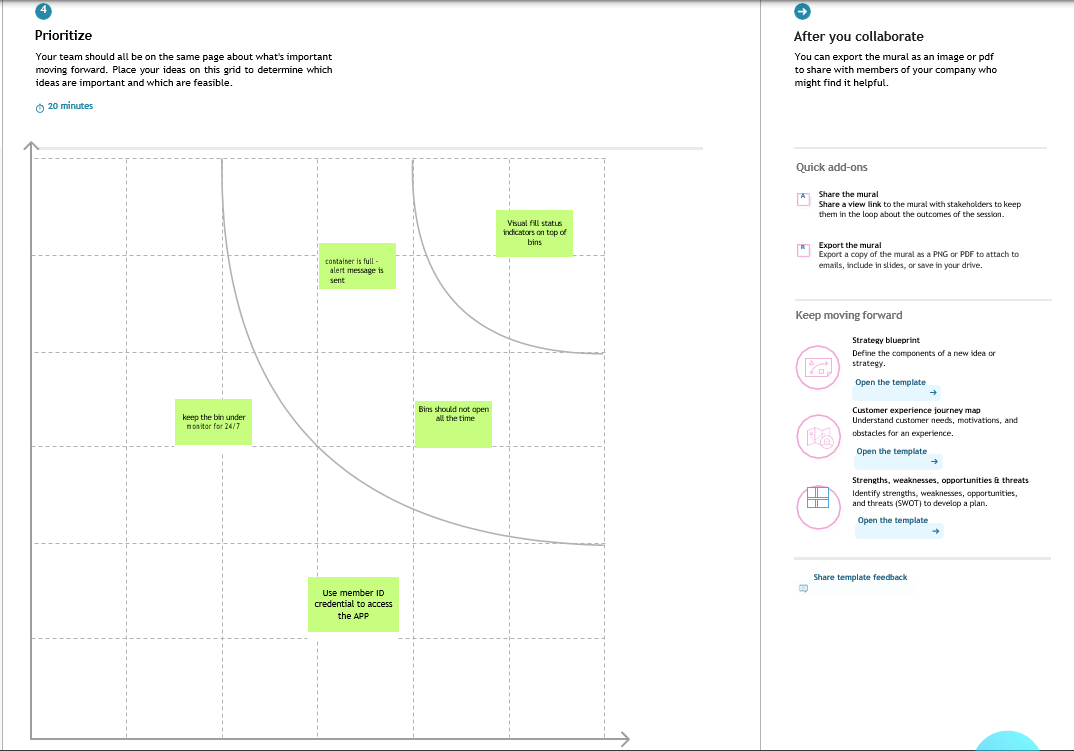
1. **IDEATION & PROPOSED SOLUTION**
   1. Empathy Map Canvas



* 1. Ideation & Brainstorming







* 1. Proposed Solution

|  |  |  |
| --- | --- | --- |
| **S.NO** | **Parameter** | **Description** |
| 1. | Problem Statement (Problem to  be solved) | * Smart Waste Management System for Metropolitan Cities * The problem is identified as lack of proper waste management system leads to various problems including unhygienic environment which leads to spread of many diseases. |
| 2. | Idea/Solution Description | * Creating smart dustbin by using IOT with help of sensors * The sensors embedded will help to find out the thrash level in the bin which help to make immediate intimation like alert message to the sanitary worker to collect the trash. * The sensor will help to identify the obstacles like human beings with the help of the actuators it will make lid of the bin open and close automatically. * GPS module to identify the location of the bin |
| 4. | Social Impact/Customer Satisfaction | * Reduces unhygienic environment and also environmental pollution because of proper waste management which improve street sanitization * With the help of the sensor, automation is possible which helps to reduce man power therefore less time consuming. * No overflow in bins because of proper alert intimation to the municipality. * Administrator can get real time data about the bin across the cities |
| 5. | Business Model (Revenue Model) | * This smart waste management system provided to the public which creates awareness about waste management to the public * It was cost effective * It ensures public health and environmental safety |
| 6. | Scalability of the Solution | * Access to reliable and real time data of various bins in different location of the cities about status of the bin * Keep the environment clean and fresh * Real time monitoring makes effiecient solution for waste management. |

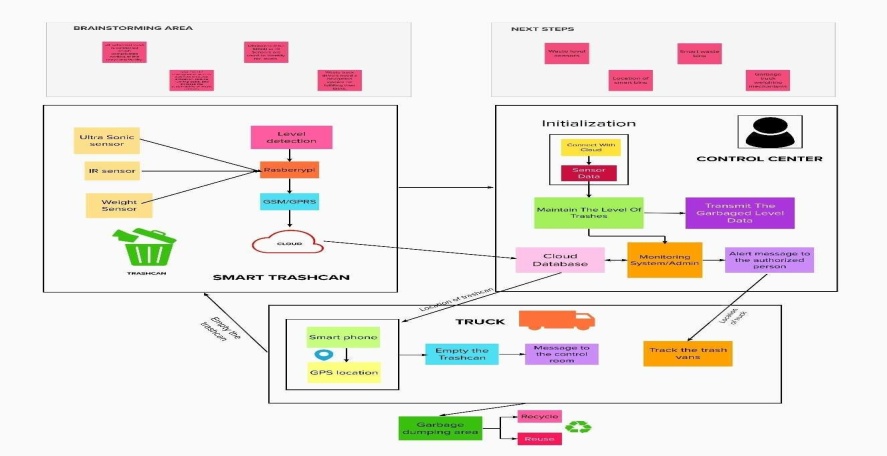
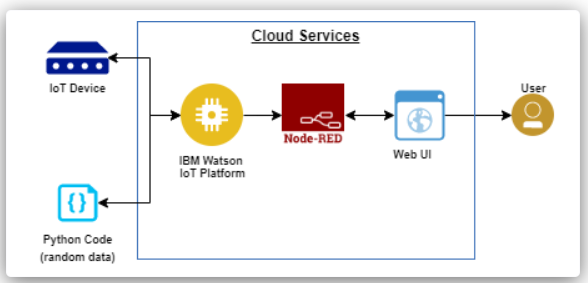
1. **REQUIREMENT ANALYSIS**
   1. Functional requirement

|  |  |  |
| --- | --- | --- |
| **FR No.** | **Functional Requirement (Epic)** | **Sub Requirement (Story / Sub-Task)** |
| FR-1 | Detailed bin inventory. | All monitored bins and stands can be seen on the map, and you can visit them at any time via the Street View feature from Google.  You can see bin details in the Dashboard – capacity, waste type, last measurement, GPS location and collection schedule or pick recognition. |
| FR-2 | Real time bin monitoring. | The Dashboard displays real-time data on fill-levels of bins monitored by smart sensors.  In addition to the % of fill-level, based on the historical data, the tool predicts when the bin will become full, one of the functionalities that are not included even in the best waste management software..  Sensors recognize picks as well; so you can check when the bin was last collected.  With real-time data and 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 for each bin in terms of collection costs.  The tool considers the average distance bin discharge in the area. The tool assigns bin a rating (1-10) and calculates distance from bin discharge. |
| FR-4 | Adjust bin distribution. | Ensure the most optimal distribution of bins. Identify areas with either dense or sparse bin distribution.  Make sure all trash types are represented within a stand.  Based on the historical data, you can adjust bin capacity or location where necessary. |
| FR-5 | Eliminate unefficient picks. | Eliminate the collection of half-empty bins.  The sensors recognize picks. Raspberry Pi camera with 12 MP and high resolution of upto 1080p is used. By using real-time data on fill-levels and pick recognition, we can show you how full the bins you collect are. |

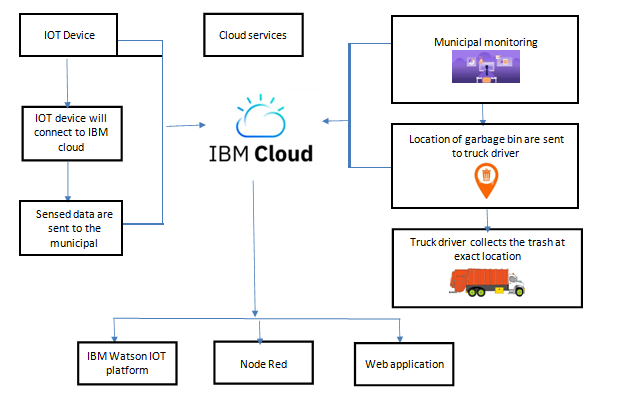
# Non-functional Requirements:

|  |  |  |
| --- | --- | --- |
| **NFR 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 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 bottles Use reusable grocery bags Compost it  Purchase wisely and recycle  Avoid using use and throw 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 more efficiently, taking care of bins that need servicing. |
| NFR-4 | **Performance** | The Smart Sensors use ultrasound technology to measure the 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 datadriven daily operations, available also as a waste management app.  Customers are hence provided data-driven decision making, and optimization of waste collection routes, frequencies, and vehicle loads resulting in route reduction by at least 30%. |
| NFR-5 | **Availability** | By developing & deploying resilient hardware and beautiful software we empower cities, businesses, and countries to manage waste smarter. |
| NFR-6 | **Scalability** | Using smart waste bins reduce the number of bins inside town and cities because we are able to monitor  the garbage 24/7 more cost effectively and scalability is high |

1. **PROJECT DESIGN**
   1. Data Flow Diagrams



* 1. Solution & Technical Architecture



* 1. User Stories

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **User Type** | **Functional**  **Requirement (Epic)** | **User Story Number** | **User Story / Task** | **Acceptance criteria** | **Priority** | **Release** |
| Admin | Registration | USN-1 | As an admin, I can give the credentials to the login page for every sanitary worker to monitor real time data | I can monitor the system. | High | Sprint-4 |
|  |  | USN-2 | As an admin, I will inform the authorized person to empty the trashcan. | I can inform the  authorised person. | High | Sprint-2 |
|  |  | USN-3 | As an admin, I can notice the trash level of every dustbin every particular period of time | I can notice the trash level. | Low | Sprint-2 |
| Co-Admin | Login | USN-4 | As a Co-Admin, I can send an alert message to the truck drivers about the location of the dustbin to collect the trash | I can alert the truck driver. | Medium | Sprint-1 |
| Driver | Login | USN-5 | As a trash van driver, I will follow the route to the dustbin using location given by the admin team with the help of the global positioning system(GPS) to collect the garbage. | I can reach the  filled trashcans. | High | Sprint-2 |
| Sanitary worker | Dashboard | USN-6 | As a sanitary worker, I will collect all the trash from the bin which has overflowed for every particular period of time. | I can empty the  Trash cans. | Low | Sprint-2 |
| Municipality of kficer |  | USN-7 | As a municipality officer, I can  supervise the process and ensure the cleanliness of the city. | I can manage all  processes in an efficient manner. | Medium | Sprint-1 |
|  | Login | USN-8 | As a municipality officer, I can initialize  new bins in different location of the cities wherever it required. | I can register new  smart trashcans. | High | Sprint-3 |
|  |  | USN-9 | As a municipality officer, I can check the quality of IOT device’s quality ensure about its working condition and durability. | I can check the IOT device. | Medium | Sprint-3 |

1. **PROJECT PLANNING & SCHEDULING**
   1. Sprint Delivery Schedule

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sprint** | **Functional Requirement (Epic)** | **User Story Number** | **User Story / Task** | **Story Points** | **Priority** | **Team Members** |
| Sprint-1 | Registration form | USN-1 | As an administrator need to give credentials to every sanitary workers over the cities to make them accessible to the APP to get real time data. | 20 | High | S.Sangeetha  P.Sankareswari  S.Nandhini devi  P.Swetha  M.Yasotha |
| Sprint-1 | Sign-up & sign-in form | USN-2 | As a user, I able to create account and I can login to the app by using credentials given and also I can able to sign-in the form once I had created the account. | 20 | High | S.Sangeetha  P.Sankareswari  S.Nandhini devi  P.Swetha  M.Yasotha |
| Sprint-2 | Technology | USN-3 | Design the circuit with processor, sensors, actuators which is to be integrated with the dustbin. | 5 | Low | S.Sangeetha  P.Sankareswari  S.Nandhini devi  P.Swetha  M.Yasotha |
| Sprint-2 | Cloud | USN-4 | Cloud web server is created using IBM cloud that connects the bin with the administrator to fetch real time data produced by the sensor embedded in that which helps in real time monitoring of trash in the dustbins. | 10 | Medium | S.Sangeetha  P.Sankareswari  S.Nandhini devi  P.Swetha  M.Yasotha |
| Sprint-2 | Cloud & GPS | USN-5 | The location of the bin was fetch using GPS connected to it. | 10 | Medium | S.Sangeetha  P.Sankareswari  S.Nandhini devi  P.Swetha  M.Yasotha |
| Sprint-3 | Sensor & technology | USN-6 | The level of the trash in the dustbin were monitored by the ultrasonic sensor embedded in that which will helps us to identify the overflowing of the dustbins. | 20 | High | S.Sangeetha  P.Sankareswari  S.Nandhini devi  P.Swetha  M.Yasotha |
| Sprint-4 | Alert notification | USN-7 | Once the dustbin were over-flown, immediate alert message including location of the bin were sent to the municipal officer regarding collection of wastes. | 15 | High | S.Sangeetha  P.Sankareswari  S.Nandhini devi  P.Swetha  M.Yasotha |
| Sprint-4 | Acknowledgement | USN-8 | After collecting the trash the sanitary worker intimates that the garbage has collected to the municipal officer using app | 5 | Low | S.Sangeetha  P.Sankareswari  S.Nandhini devi  P.Swetha  M.Yasotha |

**Project Tracker, Velocity & Burn down Chart: (4 Marks)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sprint** | **Total Story Points** | **Duration** | **Sprint Start Date** | **Sprint End Date (Planned)** | **Story Points**  **Completed (as on Planned End Date)** | **Sprint Release Date (Actual)** |
| Sprint-1 | 20 | 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 |

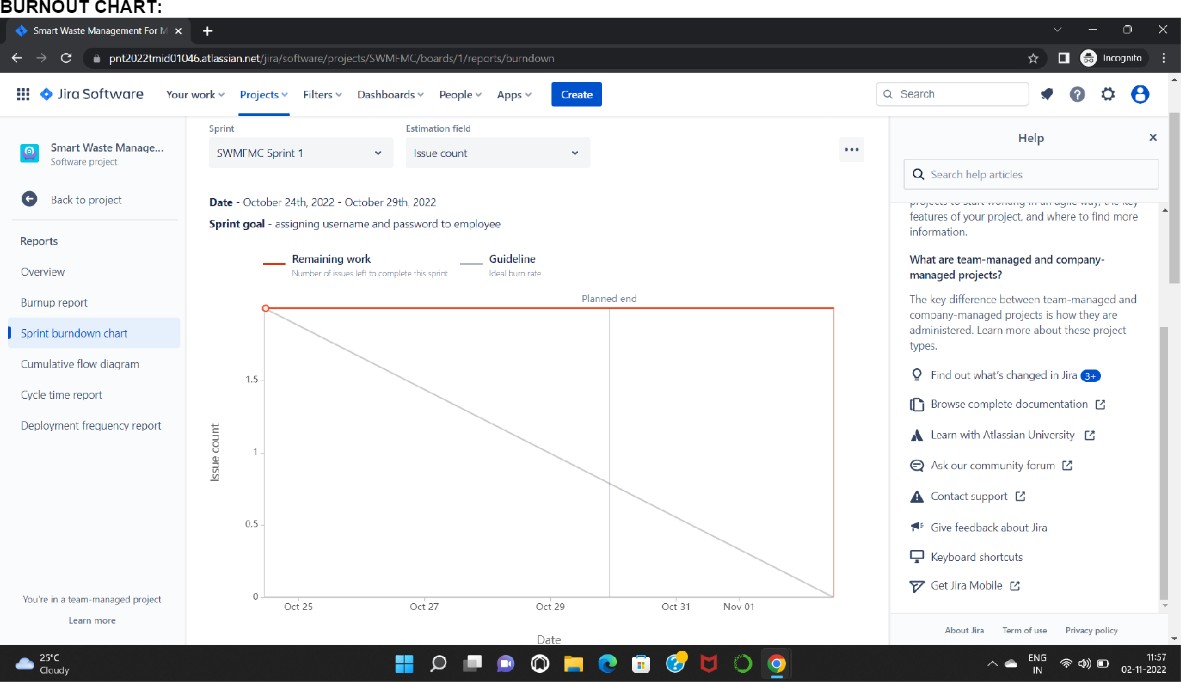
Velocity:

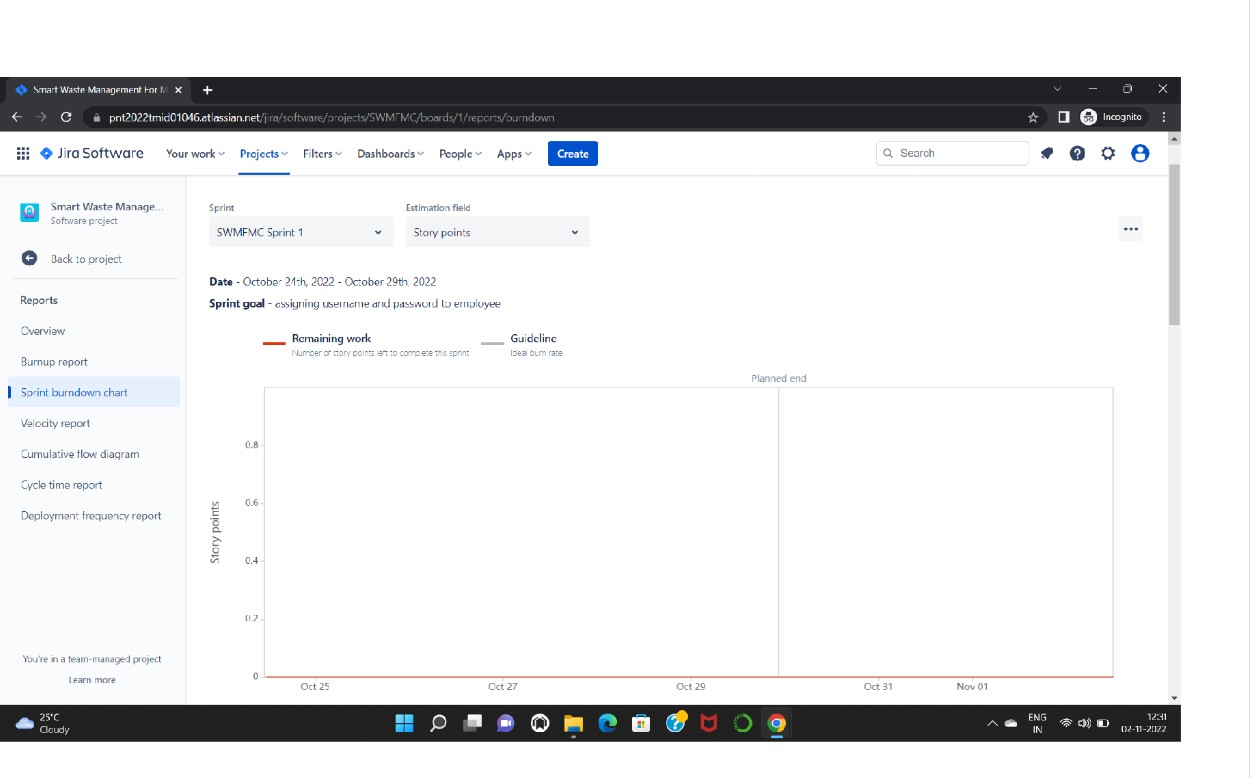
Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let’s calculate the team’s average velocity (AV) per iteration unit (story points per day)

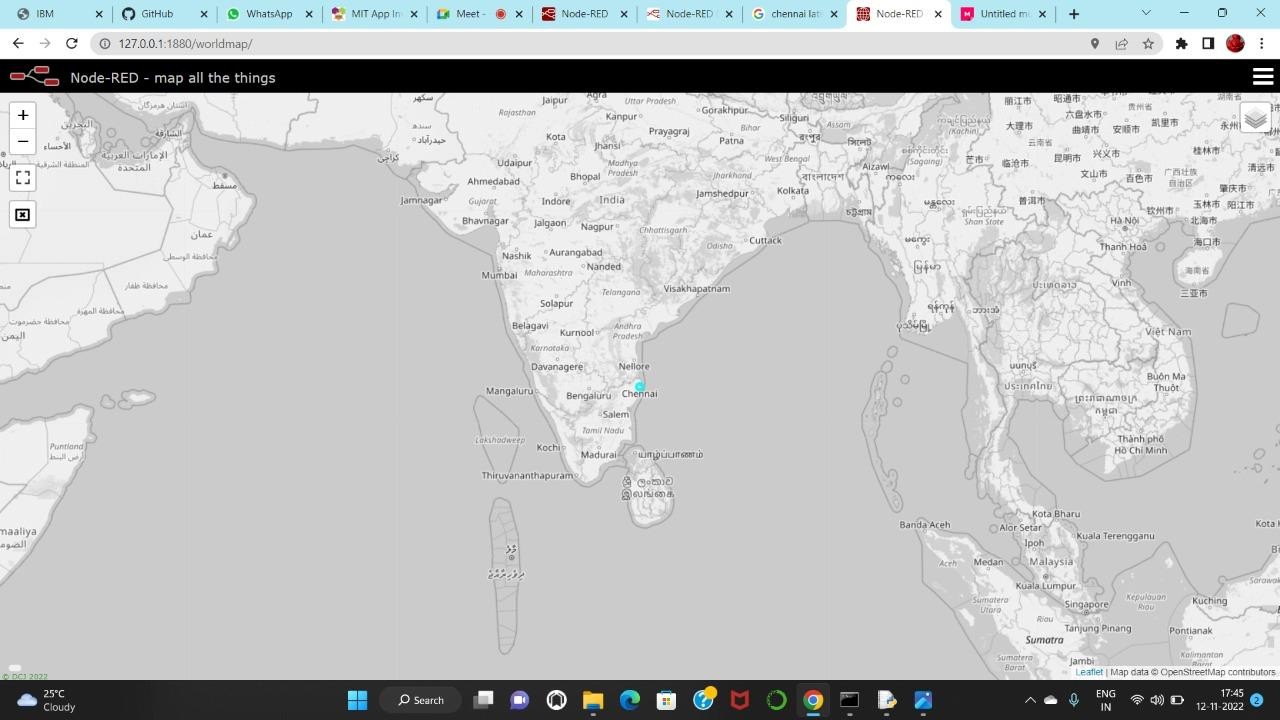


AV = 20/6 = 3.3

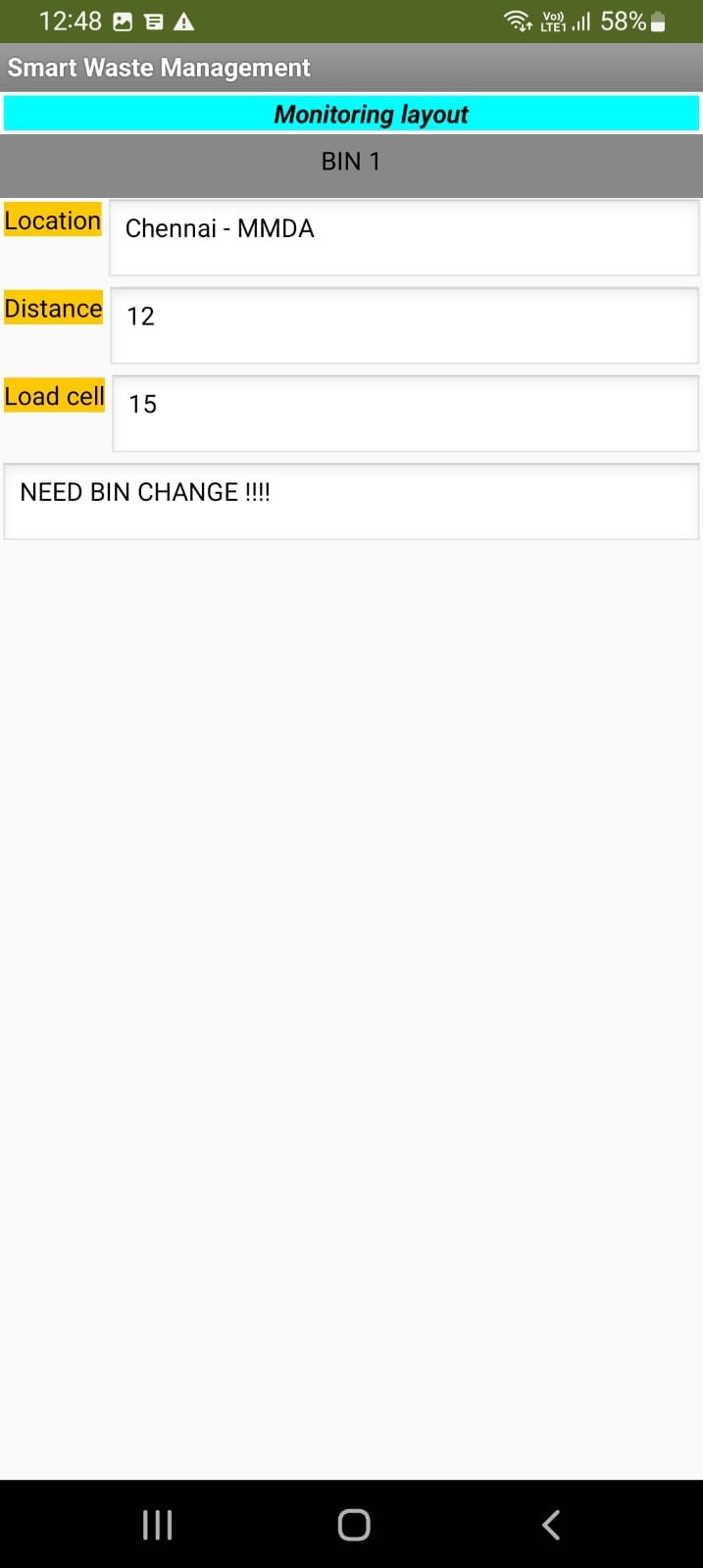
1. Reports from JIRA

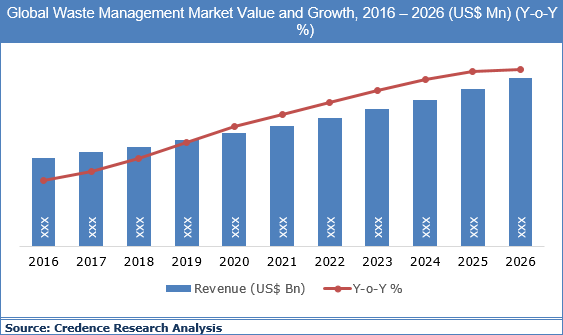


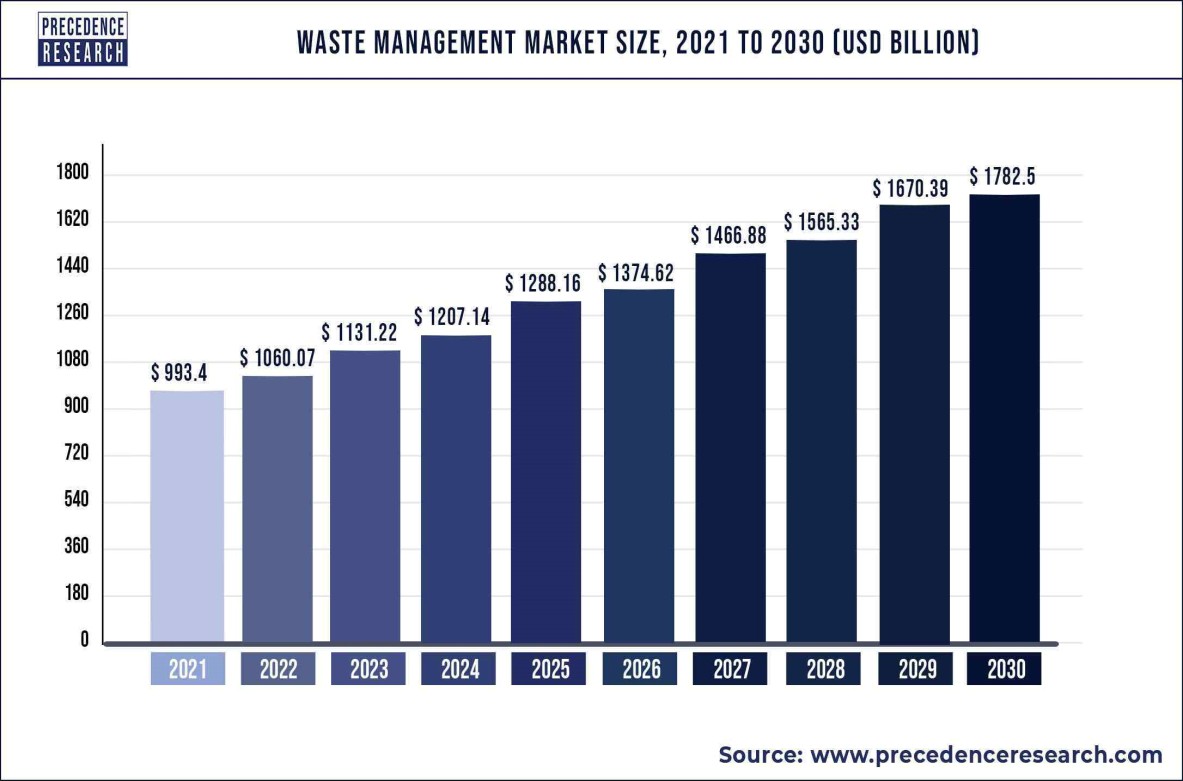


1. **CODING & SOLUTIONING (Explain the features added in the project along with code)**
   1. Feature 1

Feature 2



1. **RESULTS**
   1. Performance Metrics



Test Cases

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test case ID | Feature Type- Bin Level | Component | Test Case Scenario | Pre- Requisite | Availability | Test Condition | Expected Result | Actual Result | Access By |
| Test case 1 | Empty | Ultrasonic Sensor | When Bin is empty | Ultrasoncic sensor PIR Motion | Sensor Garbage Bins | Bin Level  == 0 | Displays Bin level and space left | Working as expected | User |
| Test case 2 | Accessible | Ultrasonic Sensor | When bin level is below50  % | Ultrasonic sensor , PIR Motion Sensor , ,  Garbage Bins | ,bin is accessible to user | Bin Level  < 50 | Displays Bin level and space left | Working as expected | User |
| Test case 3 | Accessible | Ultrasonic Sensor | When bin level is above 50 | Ultrasonic sensor , PIR Motion Sensor , , Garbage Bins | Bin is accessible to users and the admin gets warning about the  bin level | Bin level  >50 | Displays bin level space left | Working as expected | User |
| Test case4 | Accessible | Ultra sonic sensor | When bin level is below75% | Ultrasonic sensor , PIR Motion Sensor , , Garbage Bins | Bin is accessible to users and the admin gets warning about the  bin level | Bin level<75 | Displays bin level space left | Working as expected | User |
| Test case  5 | Accessible | Limit exceedUltrasonic  sensor | When bin level is  above | Ultrasoncic sensor ,  PIR Motion | Bin is not accessible  To the | Bin level>75 | Display bin level  And | Working as expected | User |

**User Acceptance Testing**

# Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the Smart Fashion Recommender Application project at the time of the release to User Acceptance Testing (UAT).

# Defect Analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Section** | **Total Cases** | **Not Tested** | **Fail** | **Pass** |
| Print Engine | 5 | 0 | 1 | 4 |
| Client Application | 47 | 0 | 2 | 46 |
| Security | 3 | 0 | 0 | 3 |

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Resolution** | **Severity 1** | **Severity 2** | **Severity 3** | **Severity 4** | **Subtotal** |
| By Design | 10 | 4 | 2 | 2 | 19 |
| Duplicate | 1 | 1 | 2 | 0 | 4 |
| External | 2 | 4 | 0 | 1 | 6 |
| Fixed | 10 | 2 | 3 | 20 | 37 |
| Not Reproduced | 0 | 0 | 2 | 0 | 2 |
| Skipped | 0 | 0 | 2 | 1 | 3 |
| Won't Fix | 0 | 5 | 2 | 1 | 8 |
| Totals | 23 | 16 | 13 | 25 | 79 |

# Test Case Analysis

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outsource Shipping | 2 | 0 | 0 | 2 |
| Exception Reporting | 11 | 0 | 2 | 9 |
| Final Report Output | 5 | 0 | 0 | 5 |
| Version Control | 3 | 0 | 1 | 2 |

1. **ADVANTAGES**

• Reduction in Collection Cost

• No Missed Pickups

• Reduced Overflows

• Waste Generation Analysis

• CO2 Emission Reduction

**DISADVANTAGES**

• System requires a greater number of waste bins for separate waste collection as per population in the city.

• This results into high initial cost due to expensive smart dustbins compare to other methods.

• Sensor nodes used in the dustbins have limited memory size.

1. **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.

1. **FUTURE SCOPE**

There are several future works and improvements for the proposed system, including the following: 1. Change the system of user authentication and atomic lock of bins, which would aid in protecting the bin from damage or theft. 2. The concept of green points would encourage the involvement of residents or end users, making the idea successful and aiding in the achievement of collaborative waste management efforts, thus fulfilling the idea of Swachh Bharath. 3. Having case study or data analytics on the type and times waste is collected on different days or seasons, making bin filling predictable and removing the reliance on electronic components, and fixing the coordinates. 4. Improving the Server's and Android's graphical interfaces

1. **APPENDIX**

Source Code

import requests

importjson importibmiotf.application import ibmiotf.device import time

import random

import sys

# watson device

details organization "4yi0vc"

devicType = "BIN1"

deviceId = "BIN1ID"

authMethod= "token"

authToken= "123456789"

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

def myCommandCallback(cmd):

global a

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

control=cmd.data['command']

print(control) try:

deviceOptions={"org": organization, "type": devicType,"id": deviceId,"auth-

method":authMethod,"authtoken":authToken} deviceCli = ibmiotf.device.Client(deviceOptions) except Exception as e: print("caught exception connecting device %s" %str(e)) sys.exit()

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

distance= random.randint(10,70)

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

{'dist':distance,'load':loadcell}

if loadcell < 13 and loadcell

> 15:

load = "90 %" elif loadcell < 8 and loadcell > 12: load = "60 %"

elif loadcell < 4 and loadcell > 7: load = "40 %"

else: load = "0 %"

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

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

and distance > 41: dist = 'Risk warning:' '40 %' else: dist = 'Risk warning:' '17 %'

if

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

warn = 'alert :' ' 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 '

def myOnPublishCallback(lat=10.678991,long=78.177731):

print("Gandigramam, Karur") print("published distance = %s " %distance,"loadcell:%s "

%loadcell,"lon = %s " %long,"lat = %s" %lat) print(load) print(dist) print(warn)

time.sleep(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(30)

deviceCli.commandCallback=myCommandCallback

#disconnect the device deviceCli.disconnect

GitHub & Project Demo Link

https://github.com/IBM-EPBL/IBM-Project-36527-1660295833