# ST JOSEPH’S COLLEGE OF ENGINEERING

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION**

**ENGINEERING**

# SMART WASTE MANAGEMENT SYSTEM FOR METROPOLITAN CITIES

**NALAIYA THIRAN PROJECT REPORT 2022**

***Submitted by***

|  |  |
| --- | --- |
| **SANJAY KUMAR T** | **312319106137** |
| **VINO JOSELIN** | **312319106308** |
| **NARESH KUMAR** | **312319106108** |
| **THANGAPRAKASAM** | **312319106307** |

**Team ID:** PNT2022TMID00354

**NOVEMBER 2022**

**TABLE OF CONTENTS**

**CHAPTER TITLE PAGE NO**

**NO.**

1. **INTRODUCTION** 4
   1. Project Overview 4
   2. Purpose 5
2. **LITERATURE SURVEY** 5
   1. Existing problem 6
   2. References 8
   3. Problem Statement Definition 9
3. **IDEATION & PROPOSED SOLUTION** 10
   1. Empathy Map Canvas 10
   2. Ideation & Brainstorming 11
   3. Proposed Solution 12
   4. Problem Solution fit 13
4. **REQUIREMENT ANALYSIS** 14
   1. Functional requirement 14
   2. Non-Functional requirements 15
5. **PROJECT DESIGN** 16
   1. Data Flow Diagrams 16
   2. Solution & Technical Architecture 17
   3. User Stories 18

1. **PROJECT PLANNING & SCHEDULING**

* 1. Sprint Planning & Estimation 19
  2. Sprint Delivery Schedule 20
  3. Reports from JIRA 21

1. **CODING & SOLUTIONING 23** 
   1. Feature 1 23
   2. Feature 2 24
   3. Database Schema 24

1. **TESTING 25** 
   1. Test Cases 25
   2. User Acceptance Testing 25
2. **RESULTS 25** 
   1. Performance Metrics 25
3. **ADVANTAGES & DISADVANTAGES 26**
4. **CONCLUSION 27**
5. **FUTURE SCOPE 27**
6. **APPENDIX 28**  Source Code 28

GitHub & Project Demo Link 29

## 1. INTRODUCTION

**1.1 PROJECT OVERVIEW:**

The term "Internet of Things" refers to items that are connected to the internet and occasionally allow users to operate these gadgets remotely. The Internet of Things (IoT) is a theory in which remote items connect to one another automatically across wired and wireless networks. To offer users cutting-edge intelligent services, IoT objects share information and communicate with one another. The IoT has piqued significant academic interest as a result of recent developments in mobile devices outfitted with various sensors and communication modules, as well as communication network technologies like Wi-Fi and LTE. Waste management has grown to be a big problem in academics, industry, and government as important IoT application domains as a result of the features and benefits of IoT services. Therefore, it's essential to have a good waste management system to stop the spread of some fatal diseases. Monitoring the condition of the smart bins and making decisions based on that information. Municipal entities then collect up this rubbish and put it in landfills and disposal sites. However, some rubbish is not collected owing to a lack of resources or inadequate groundwork, posing a major health risk to the neighbourhood. Cleaning at the appropriate intervals could solve this issue. However, manually monitoring the status of the bin is a very challenging task. In the city or on the campus, there are several trash cans. The Smart trash cans in our system are linked to the internet to obtain real-time.

**1.2. PURPOSE :**

* The term "Internet of Things" (IoT) refers to the existing global network of internet-connected gadgets that is constantly growing.
* Through real-time monitoring and administration of city processes, IoT is essential to improving smart city applications.
* Solid waste management is one of the main issues with smart city applications because it affects both the environment and society's health
* Global trash is predicted to exceed 3.40 billion tonnes by 2050, more than double the rate of population growth during that time.
* By recovering materials and energy from solid waste, as shown, solid waste management aims to limit the amount of waste that is dumped on land.

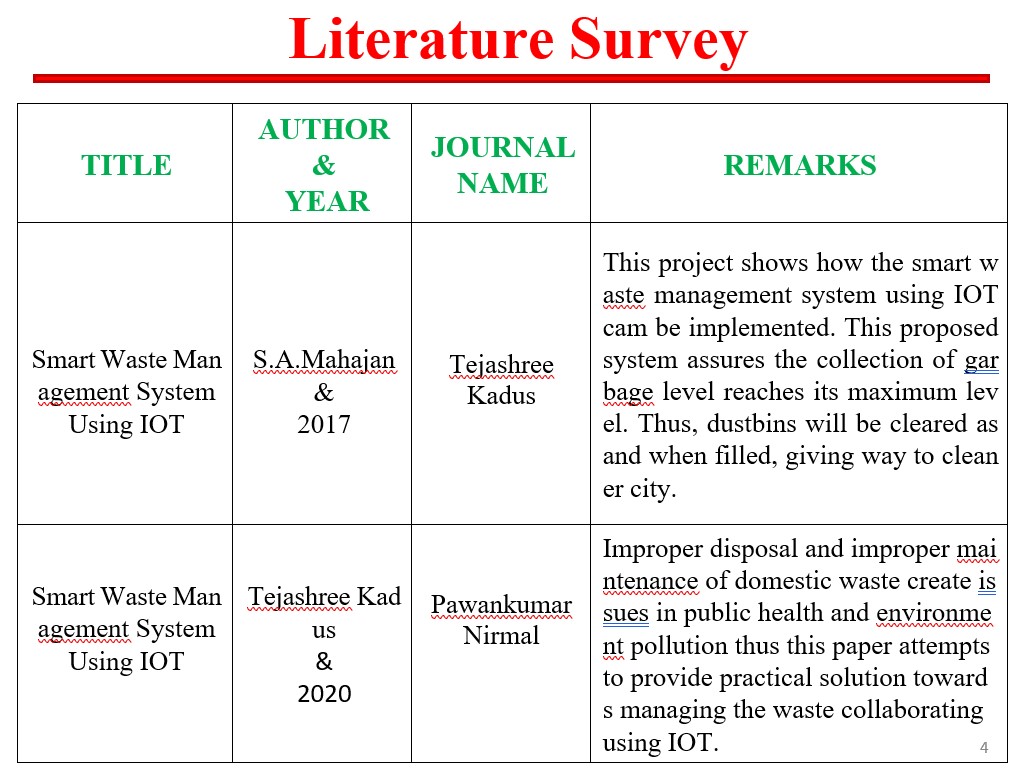
1. **LITERATURE SURVEY**

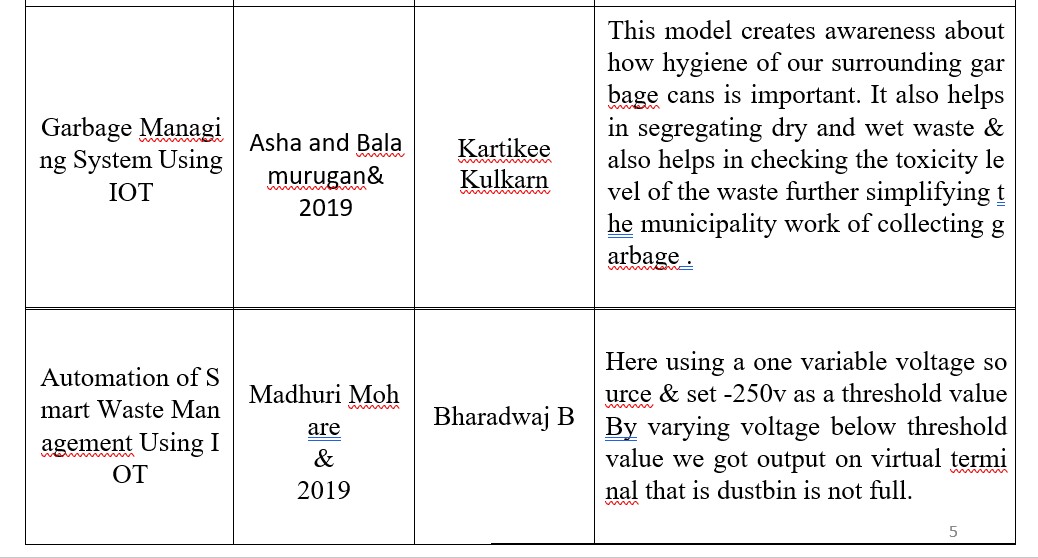
Waste production is a natural result of growth and industrial advancement. Because of this, effective waste management is a global priority, and nations have established strong regulatory waste management regimes to balance the goals of development and environmental sustainability. The national environment policy for India from 2006 suggested steps for waste collection and secure disposal of residues.

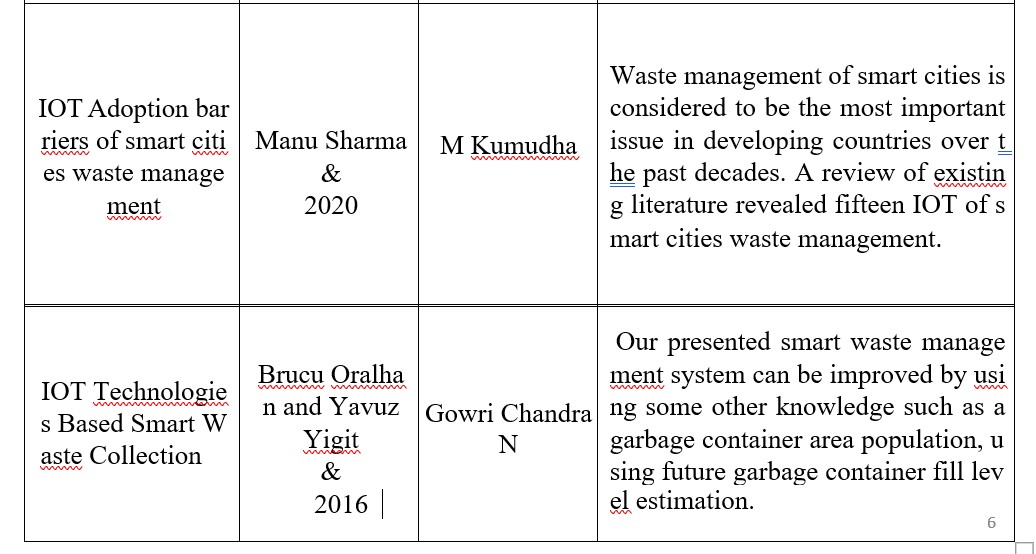
The largest amount of waste is produced in metro areas and significant economic centres, but a review of 20 smaller cities chosen for development as smart cities reveals that the majority are having difficulty managing waste.

Therefore, waste management methods ought to be improved.

* 1. **EXISTING PROBLEM :**







* 1. **REFERENCES :** 
     1. Tarandeep Singh , Rita Mahajan , Deepak Bagai, “Smart Waste

Management using Wireless Sensor Network”, in IJRCCE Volume 4 , Issue 6 , June 2016.

* + 1. Narayan Sharma, “Smart Bin Implemented for Smart City”, International

Journal of Scientific & Engineering Research, Volume 6, Is sue 9, September2015

* + 1. Issac, R;Akshai,M. “An effective solid waste management system for

Thiruvalla Municipality in Android OS” IEEE Conference Publications , 2013.

4.Longhi,S ; Marzioni,D ; Alidori, E ; Di Buo,G.; Pris,M. ; Grisostomi, M. ; Pirro,M. “Solid Waste Management Architecture Using Wireless Sensor

Network Technology”, New Technology, Mobility and Security (NTMS), 2012 5th International Conference.

5.MANGESH, N., SWAPNIL, K., AVINASH, P. & AVINASH,G. 2017. Iot Based Waste Management for Smart City. International Journal of Advance Research, Ideas and Innovations in Technology, 3, 247-250.

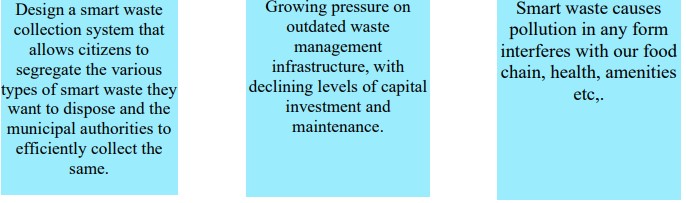
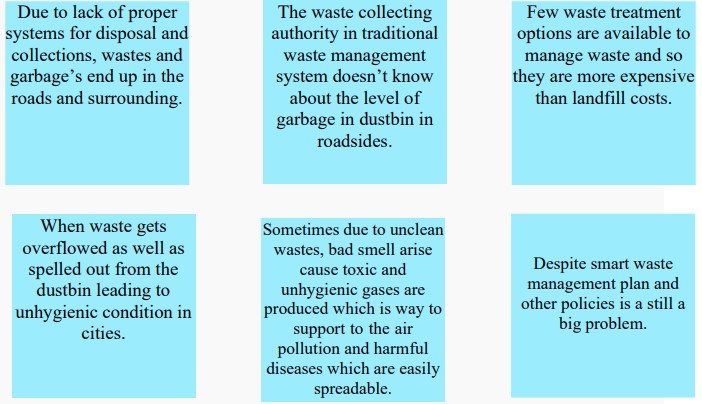
6.BANDAL, A., MANKAR, R., NATE, P., POWAR, R. & S.A.J ADHAV, P. 2017. Smart Wi-Fi Dustbin System. International Journal of Advance Engineering and Research Development, 4, 33 6-339.

7. BOROZDUKHIN, A., DOLININA, O. & PECHENKIN, V. App roach to

the garbage collection in the “Smart Clean City” project. Information Science and Technology (CiSt), 2016 4th IEEE International Colloquium on, 2016.

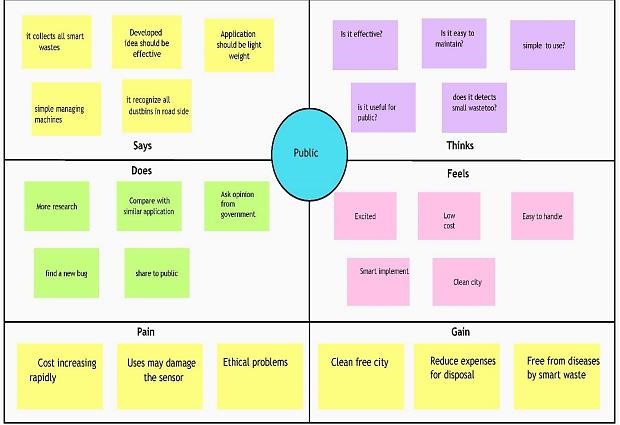
IEEE, 918-922.

**2.2 PROBLEM STATEMENT DEFINITION :**

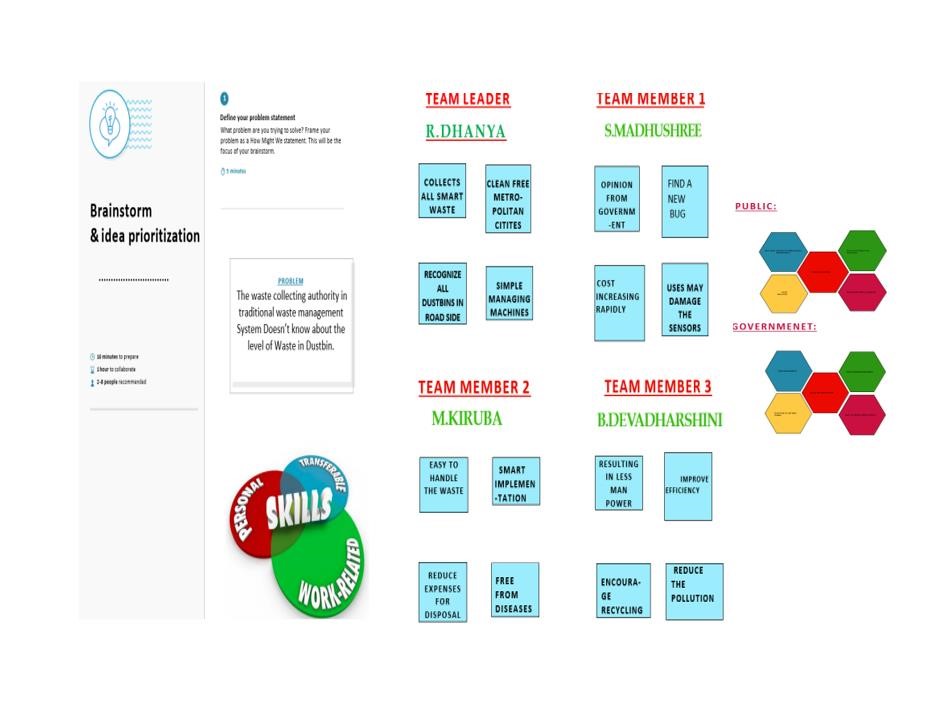


1. **IDEATION & PROPOSED SOLUTION**

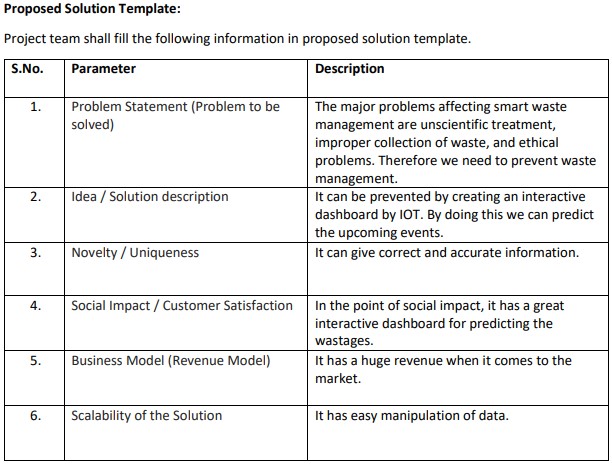
**3.1 Empathy Map Canvas :**



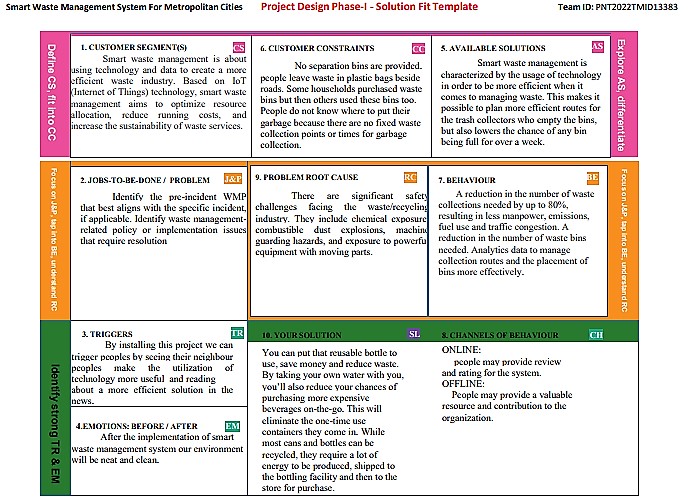
## 3.2 Ideation & Brainstorming



**3.3 Proposed Solution:**

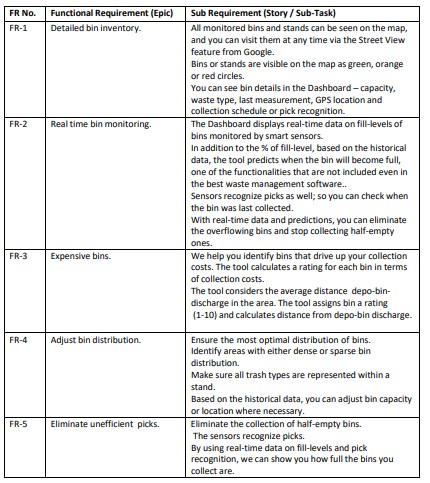


## 3.4 Problem Solution fit

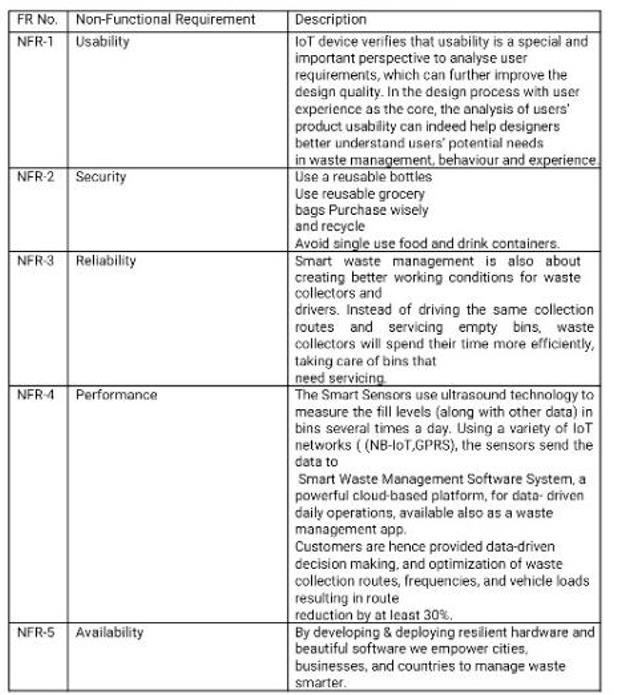


## 4. REQUIREMENT ANALYSIS

**4.1 Functional requirement:**

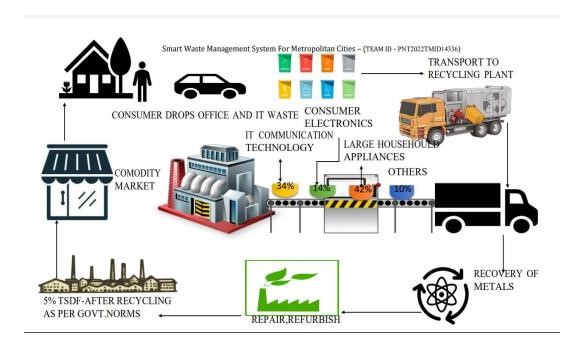


**4.1 Non-Functional requirement:**

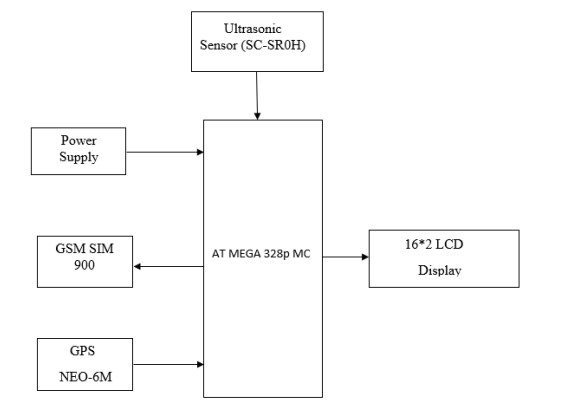


## 5. PROJECT DESIGN

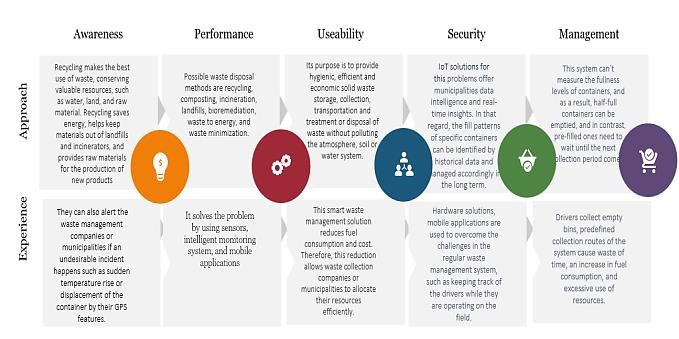
**5.1 Data Flow Diagram:**



**5.2 Solution & Technical Architecture:**

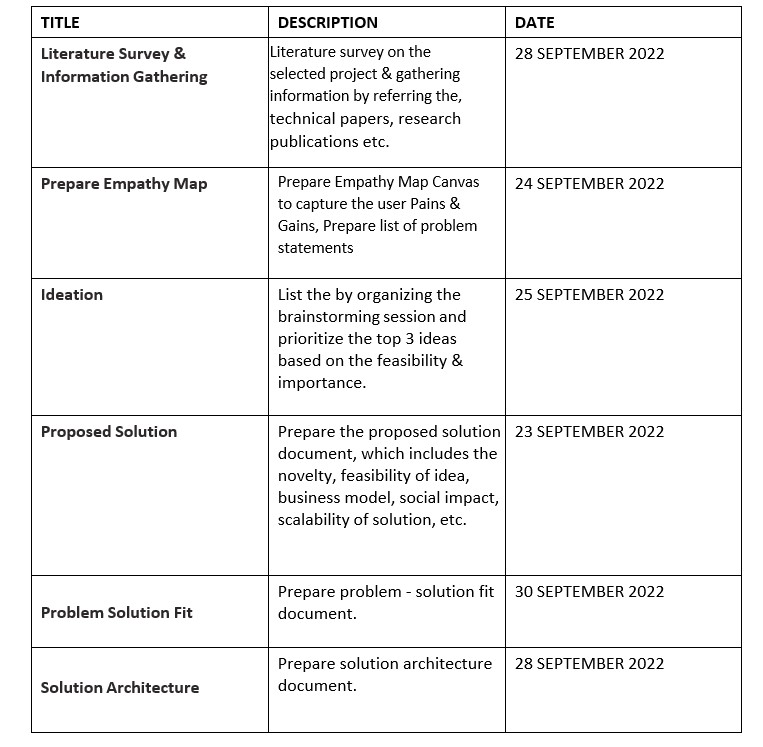


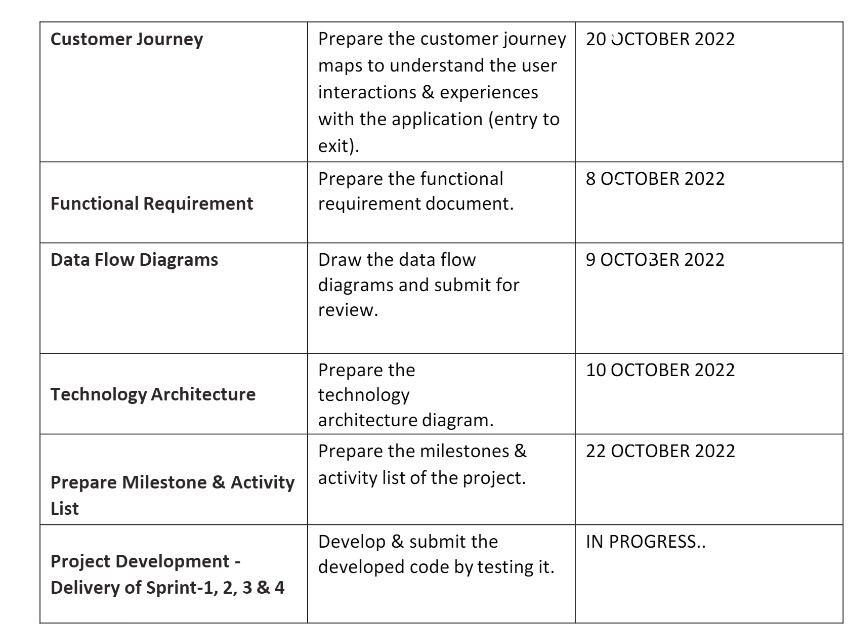
## 5.2: User Stories



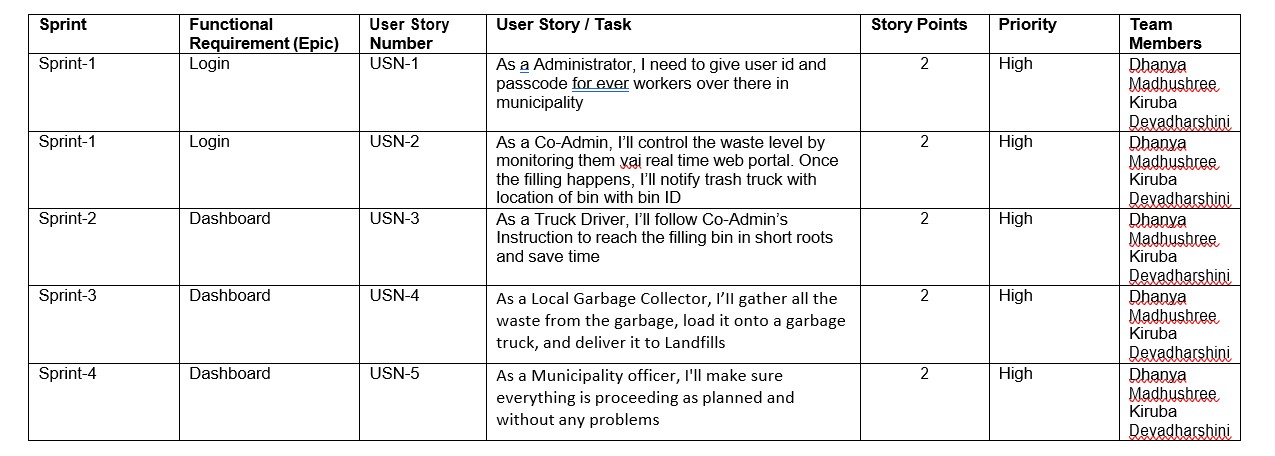
## 6. PROJECT PLANNING & SCHEDULING

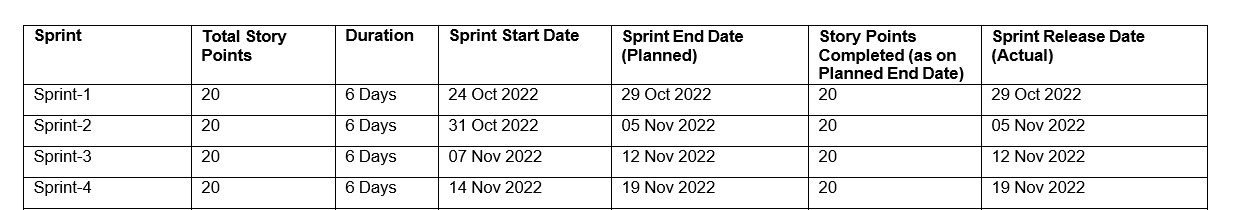
### 6.1 Sprint Planning & Estimation



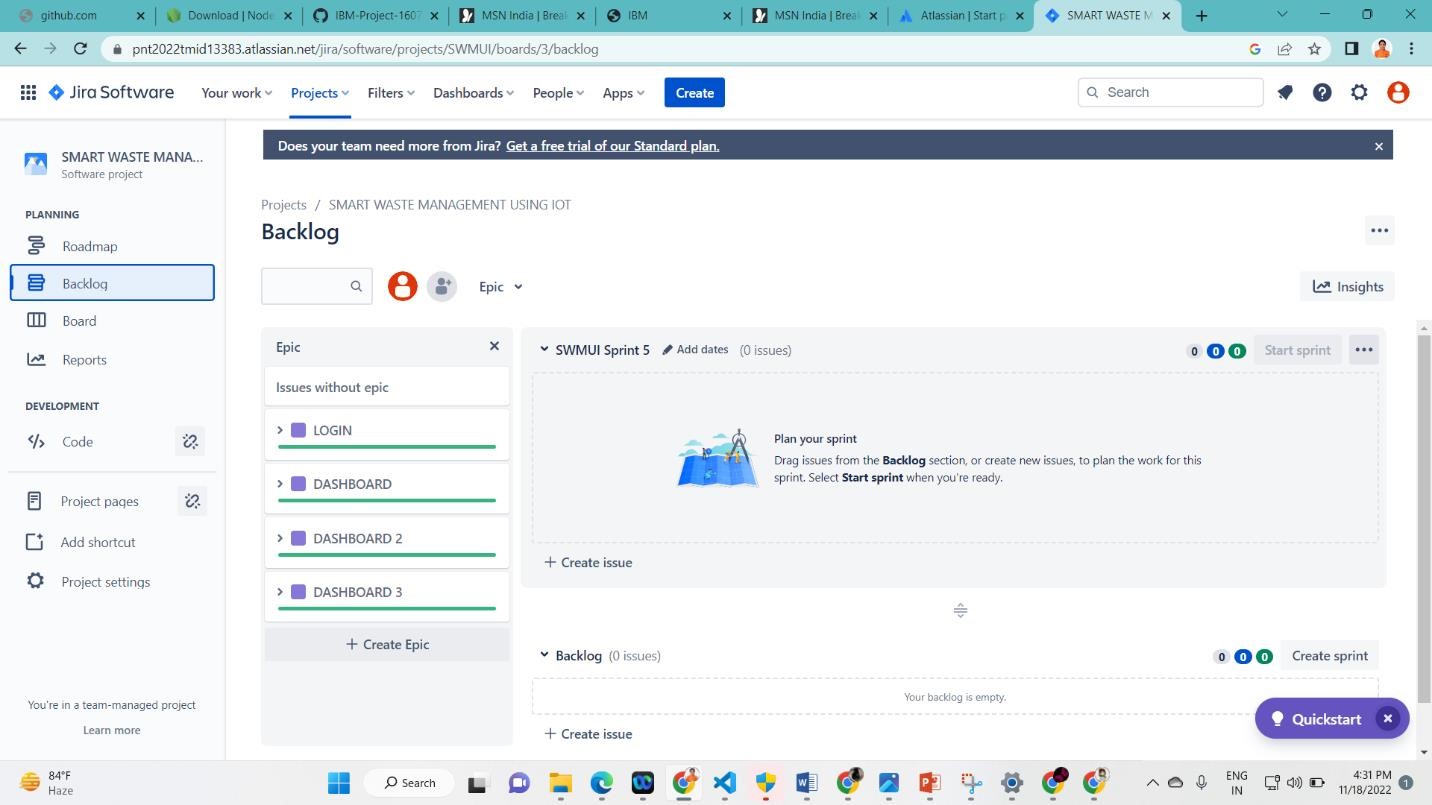


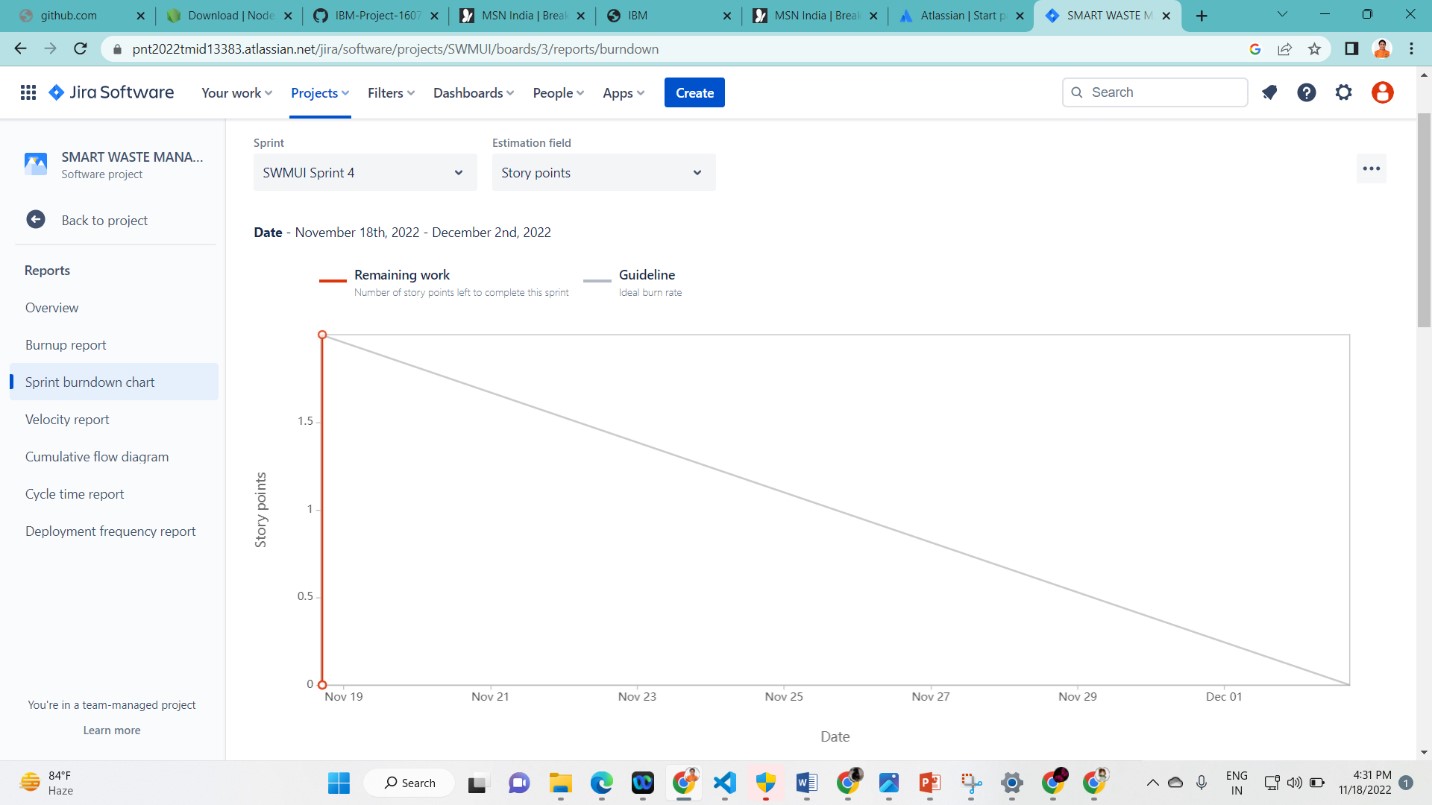
### 6.2 Sprint Delivery Schedule

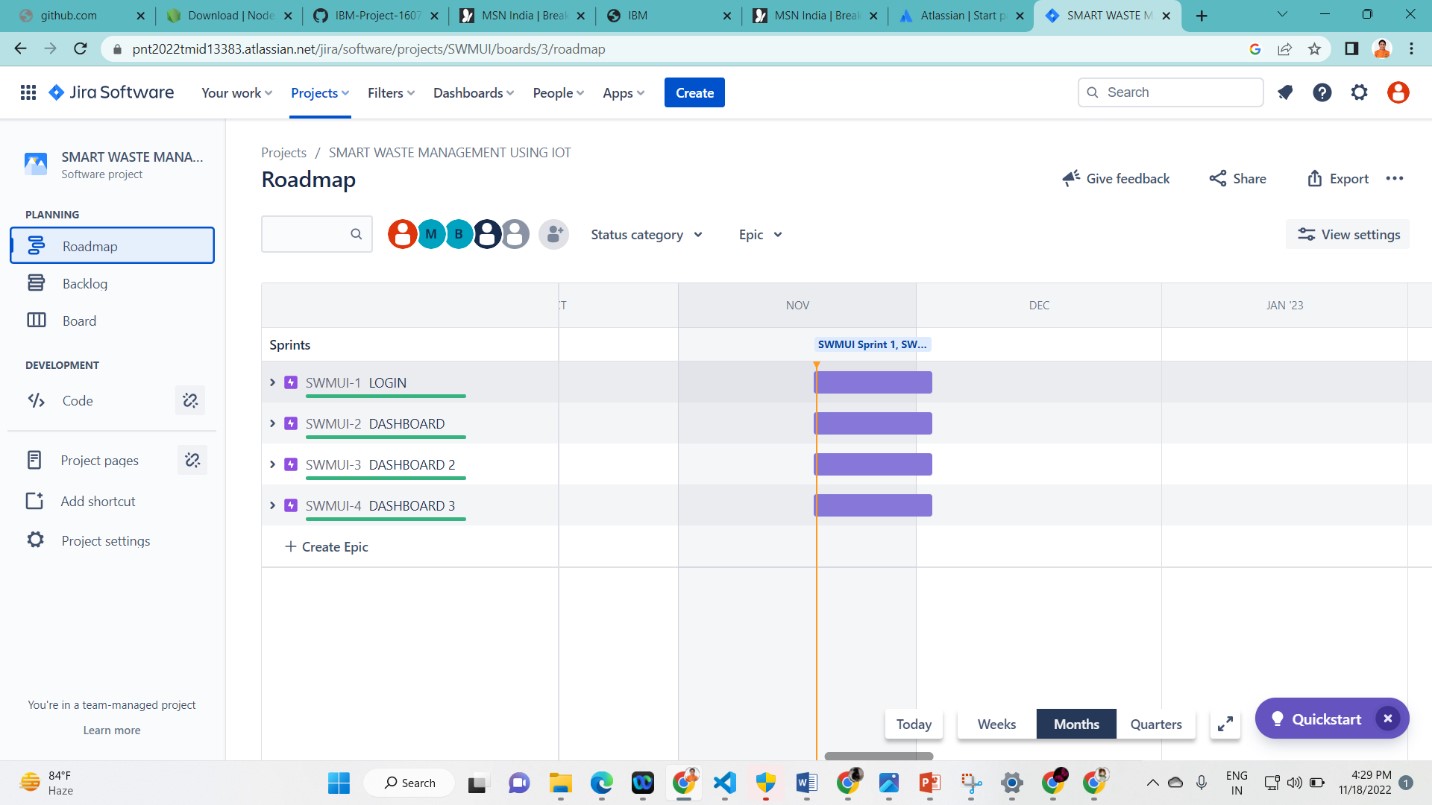




### 6.3 Reports from JIRA

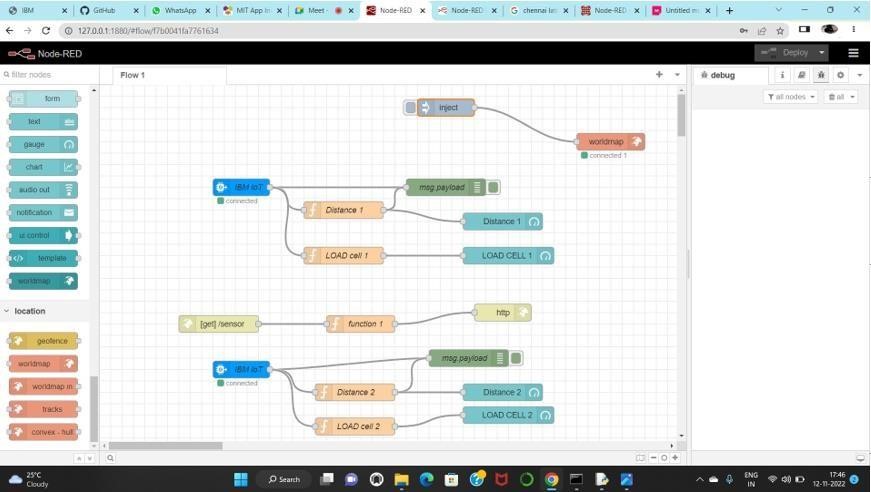




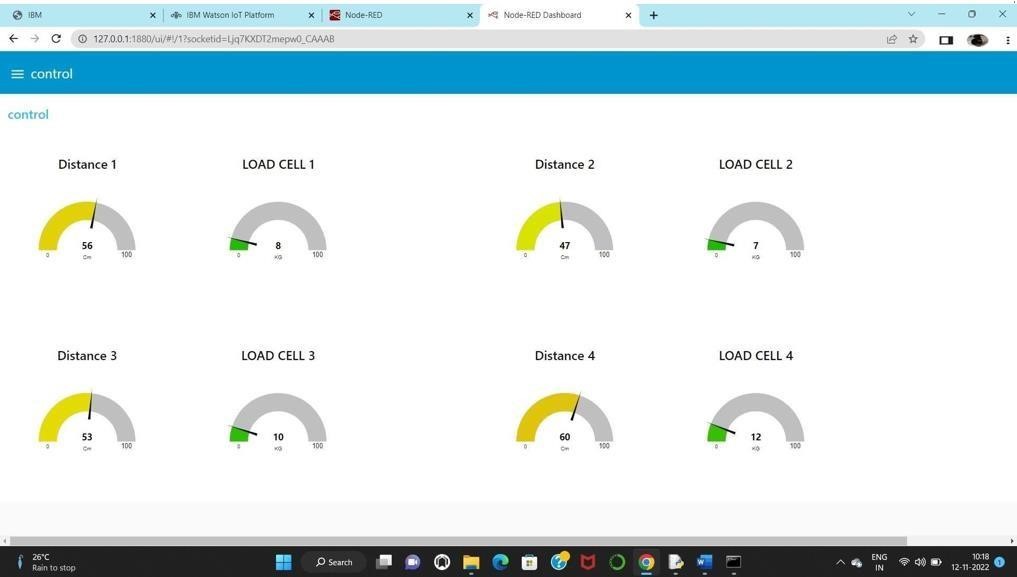


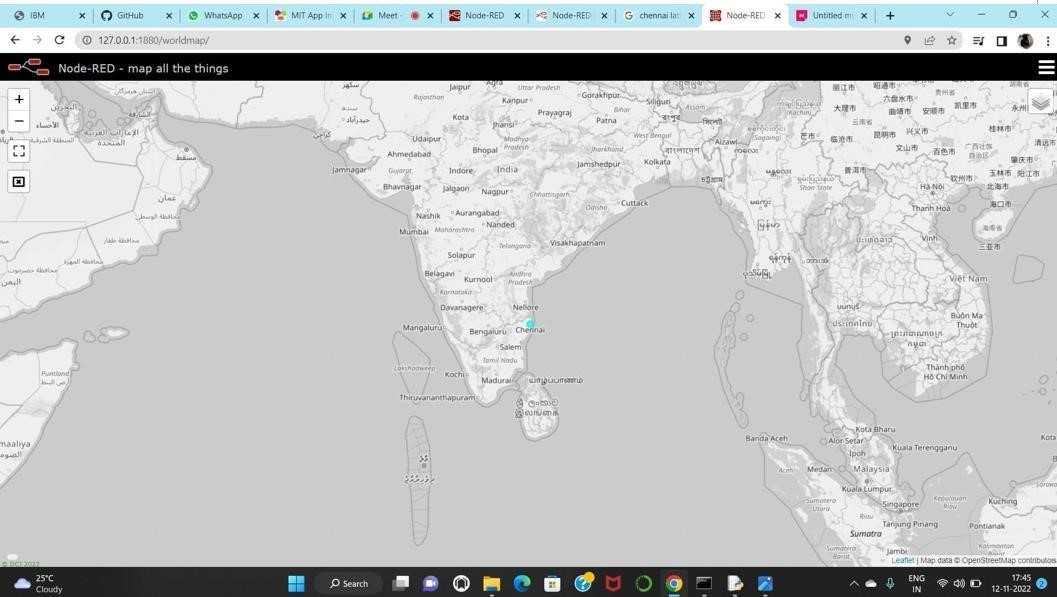
## 7.CODING & SOLUTIONING

### 7.1 Feature 1



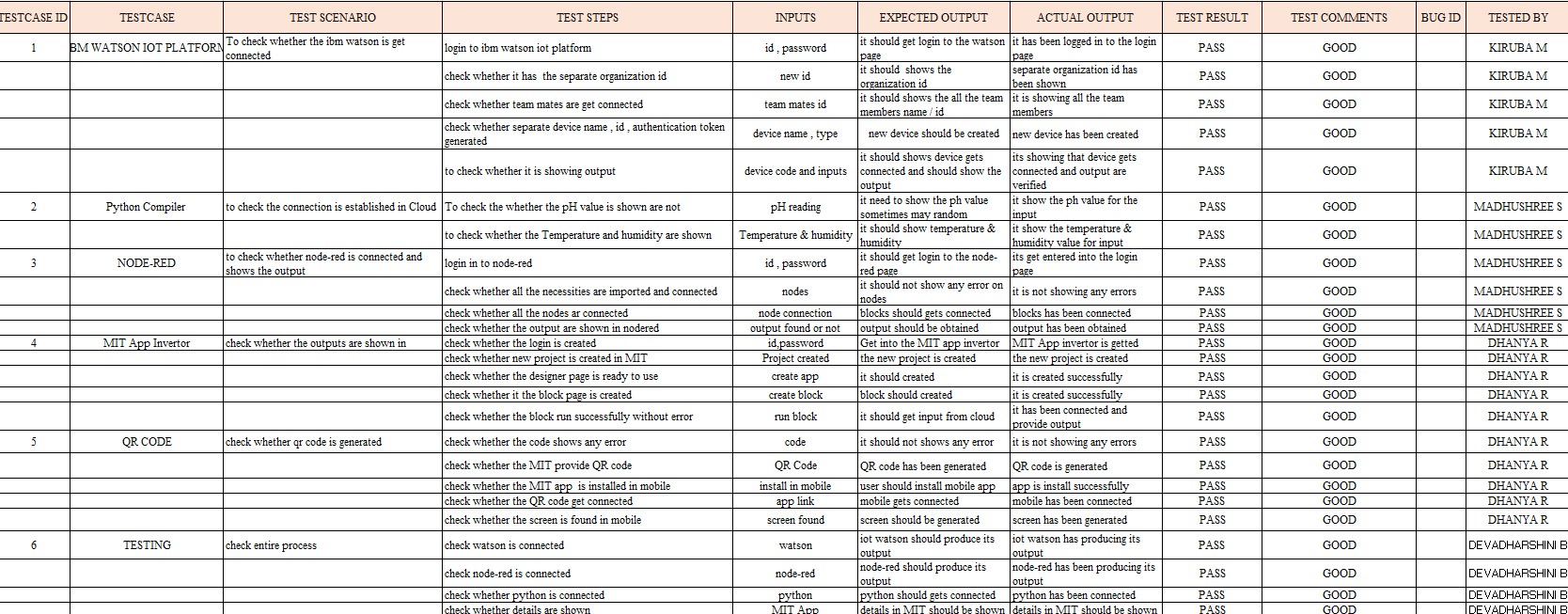
### 7.2 Feature 2





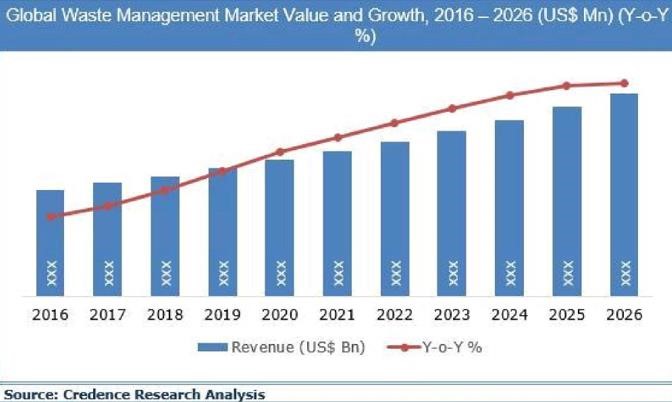
## 8.TESTING

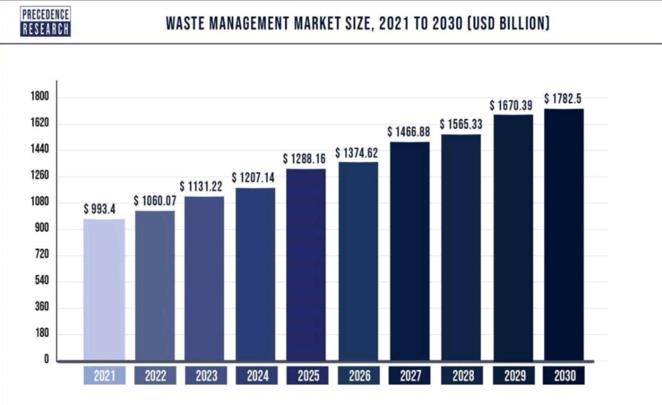
### 8.1 Test Cases



## 9.RESULTS

### 9.1 Performance Metrics





1. **ADVANTAGES & DISADVANTAGES:**

**ADVANTAGES:**

* + - Trucks only travel to filled containers, saving time and fuel; fewer trucks on the road means less noise, less traffic, and less air pollution.
    - Our sophisticated operating system enables two-way communication between the service provider and the trash cans placed across the city. As a result, the collection of the containers' fill levels based on the route is the only area of concentration.
    - Both service providers and citizens benefit from an efficient system that results in significant cost savings and less urban pollution. This is made possible by the sensors put in the containers, which offer real-time information on the fill level.

**DISADVANTAGES:**

* + - System requires a greater number of waste bins for separated waste collection as population in the city.
    - This results in high initial cost due to expensive smart dustbins compare to other methods.
    - Sensor node use in the dustbin have limited memory size.

1. **CONCLUSION:**

The genesis, characteristics, collection, and transportation of have all been reviewed in an honest and thorough manner. The suggested system would be able to handle and monitor the entire collecting process for solid waste. This method would enable timely solid trash collection while also overcoming all of its drawbacks, including the need for a short route, minimal fuel use, a clean, green environment, and a vehicle that is readily available. The technologies that are incorporated into the proposed system are sufficient to guarantee that it is perfect for managing and monitoring the solid waste collection procedure in a green environment.

**FUTURE SCOPE:**

There are several future works and improvements for the proposed system, including the following:

* + Change the system of user authentication and atomic lock of bins, which would aid in protecting the bin from damage or theft.
  + The concept of green points would encourage the involvement of residents or end users, making the idea successful and aiding in the achievement of collaborative waste management efforts, thus fulfilling the idea of Swachh Bharath.
  + Having case study or data analytics on the type and times waste is collected on different days or seasons, making bin filling predictable and removing the reliance on electronic components, and fixing the coordinates.
  + Improving the Server’s and Android’s graphical interfaces.

**APPENDIX:**

**SOURCE CODE:**

import time import sys import ibmiotf.application import ibmiotf.device import random

#Provide your IBM Watson Device Credentials organization = "pdgqan" deviceType = "12345" deviceId = "MCU" authMethod = "use-token-auth"

authToken = "vwkMUUgR5IEdOl9(8W"

# Initialize GPIO

def myCommandCallback(cmd): print("Command received: %s" % cmd.data['command']) status=cmd.data['command'] if status=="alarmon":

print ("DUST BIN IS FULL") else:

print ("Alarm is off")

#print(cmd)

try:

deviceOptions = {"org": organization, "type": deviceType, "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 "hello" with value "world" into the cloud as an event of type"greeting"

10 times deviceCli.connect() while True:

#Get Sensor Data from DHT11

latidude=random.randint(0,100)

logditude=random.randint(0,100)

data = { 'latidude' : latitude, 'logditude': logditude }

#print data def myOnPublishCallback():

print ("Published latitude = %s C" % latidude, "logditude = %s %%" % logditude, "to IBM Watson") success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,

on\_publish=myOnPublishCallback) if not success: print("Not connected to IoTF") time.sleep(10)

deviceCli.commandCallback = myCommandCallback # Disconnect the device and application from the cloud deviceCli.disconnect()

**GITHUB LINK:**

https://github.com/IBM-EPBL/IBM-Project-12808-1659493970