

# PROJECT REPORT

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Project Name	Smart Waste Management System For Metropolitan Cities
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# 1. INTRODUCTION

## 1.1 Project Overview

The amount of waste produced everyday by the industries and the households is increasing at an appalling rate, and the major reason for this is soaring use of packaged items, textiles, paper, food, plastics, metals, glass etc, thus management of this refuse becomes a crucial part in our everyday life. In most of the developed countries there are many efficient techniques which are used for the proper management of this waste, but in some countries especially the developing ones the careless attitude of people towards maintaining clean surroundings, along with this many issues such as no stringent laws for using the biodegradable materials, no proper environmental policies, no laws for sustainable development are the seed for the fatal results of waste management. Due to the increasing waste, the public bins which are used for collecting this waste are overflowing, the locality is jumbled of trash, causing not only malodorous streets but also a negative impact on the health and environment. We segregate the waste at our homes for ease at processing and recycling. We observed trash vans come irregular to homes creating a despoliation of households. Due to this many civilians empty their overloaded dustbins in open spaces. This in turn increases environmental pollution. The waste is a great hassle for our health and the environment it has many effects which are dreadful.

Trash is breeding ground for bacteria, insects, flies these flies are the same that roam around the eatable and drop the off springs. Thus they increase the risk with food poisoning, typhoid, gastroenteritis, salmonella, the insects cause malaria dengue etc. Here a waste management system is introduced in which each dumpster is embedded in a monitoring system which will notify the corresponding person if the dumpster is full. In this system, it is also possible to separate wet and dry waste into two separate containers. This system provides an effective solution to waste management problem.

## 1.2 Purpose

1. To ensure the protection of the environment through effective waste management.
2. Ensure separation at source in all metropolitan and local municipalities.
3. Preventing pollution and ecological degradation.
4. To protect the health and wellbeing of people by providing an affordable waste collection service.

## 2.LITERATURE SURVEY:

S. N O	TITLE OF THE PAPER	AUTHOR NAME	YEAR OF PUBLICATION	REMARKS	OUTPUT
1	IOT based smart waste in monitoring and municipal solid waste management system for smart cities	Muhammed irfan, Abdullah saeed, Al wadie , adam	4-June/2020	Environmental Pollution. Improper collector and disposal mechanism	Collect the waste effectively. Detection of fire in waste material. Wirelessly connected th he central hub Of ransmit the info about the bins filling level with existing collection. Avoid the overflow of bins.

2	Smart garbage segregator and IOT based waste collector system	Mrigank goel, Amogh harsh goyal, Preeti dhiman, Vikas deep, Purshottam sharma	05-March/2021	All wet waste are not used for urban agriculture, organic farming.	It segregates the metallic dry and wet waste. It also convert that it can be further used in urban agriculture, organic farming.  It alert the waste management Center through IOT system
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					whenever any of the metallic or dry garbage Bins is full to avoid serious environment hazards
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3	<p>A novel strategy for waste prediction using machine Learning algorithm with IOT based intelligent waste management system</p>	<p>G.Uganya, D.Rajalakshmi, Arun Radhakrishnan Ramya , Yuvaraja teeka, -raman</p>	<p>10-Feb/2022</p>	<p>Low cost Method High accuracy Complicated method Because of using machine learning algorithm</p>	<p>Automatic method, predicting the possibility of waste things. The waste capacity ,gas level, metal level monitored continuously Using IOT based dustbins. Tested by random forest algorithm gives the accuracy of 92.15% and give time consumptions of 0.2 ms.</p>
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4	System waste management	Arafat ali khan Farhana shetu Saimum bari Lawshik shikder	7-Jan/2021	Good enough to prevent the garbage overflow and ensures the partial  is perfect waste management and monitoring system	Microcontroll er, sensor, GSM are used in the system. This proposed system would have an automated waste level detection process and also a smart monitoring and  overall management process.
5	Real time smart garbage bin mechanism	Dominic Abuga N.S.Ragava	23-Oct/2021	Fuzzy logic is applied Hence real	This mechanism proposed

	for solid waste management in smart cities			time decision making avoid real time monitoring	accesses   real time information of any smart garbage   bin deployed across the city and helps to resolve   the problem of waste overflow from garbage  bins and keeps cities clean
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6	Smart waste management system using IOT	V.Pavan sankeeth V.Bhavana V.Santhosh Markandeya	3-Nov/2019	Easy process but garbage truck driven must have cell phones	The server monitors garbage bins that are spread across the city at multiple location sever sends SMS to assigned mobile number which provide route to the driver based on all the data collected from bins
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7	Automated waste garbage monitoring system with optimal route generation for collection	Aarati medehal Aniruddha Annaiuru Shalini T.S.Chander	1-Oct/2020	Using of machine learning algorithm improve the redundant inefficient	This purpose of this system is use powerful tools of IOT for completely automated the process of garbage monitoring using ultrasonic sensor and node MCU And provide an optimal route for garbage
---	--	---	------------	---	---

					collection using cluster first route several ml algorithm
--	--	--	--	--	---

8	An IOT based garbage monitoring a disposal support system.	T.M.N Vamsi G.Kalyan chakravathi B.Divakar Protibha	10- April/2021	Consumption of fuel  in garbage truck is reduced but clean personal must  have smart phone to active  this process	This system monitors garbage bins located at different locations and notifies about the level of garbage accumulated in garbage bins through android application to cleaning personnel and provides shortest path to the garbage bin location
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9	<p>IOT based solar powered smart waste management system</p> <p>with real time monitoring an advancement for smart city planning</p>	<p>Md.humaun Kabir,sujit roy, Md.tofail ahmed, Mahmudul alam</p>	21-Oct/2020	<p>Project costs complicated but this can be suitable for any kind of cities or town and ensures proper collection and disposal of garbage</p>	<p>It enables real time monitoring of solar powered several smart bins located in different point in the city which are connected to control system through long range (LDRA) Communicati on device and also supervises the waste collection and disposal time using automated</p>
					<p>vehicles locating system</p>

10	Intelligent sensor based waste disposal system for smart cities	Chinmai shetty B.Dhenanya ya Deepa N.Rashmi	1-Nov/2020	Intelligent sensor makes a person to through garbage the bins	Sensor helps is identify the quality of garbage and real collected information the info is send to the drivers and the garbage collected information is updated on the web page this system also ensure that there is no waste thrown around the trash bin the intelligent sender should make beeping sound if any person through around the
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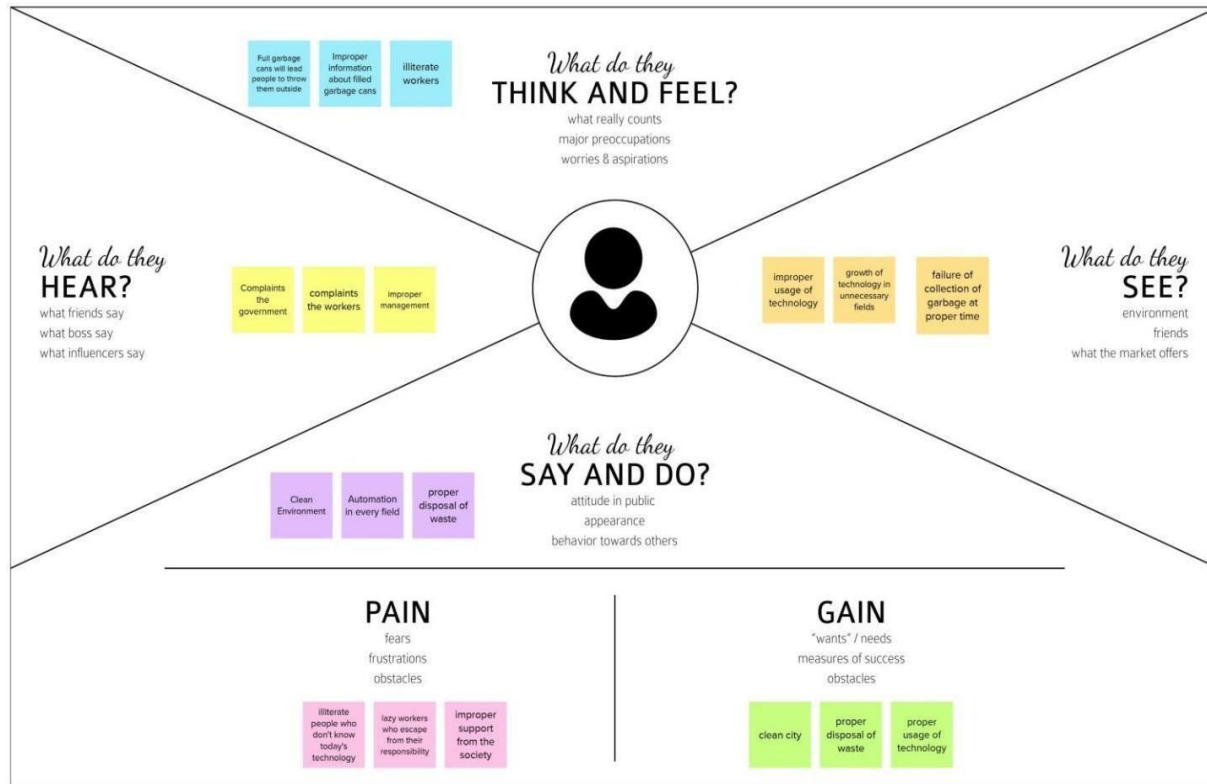
					trash bin and not into the trash bin
--	--	--	--	--	--

## 2.3 PROBLEM STATEMENTS



### 3. IDEATION & PROPOSED SOLUTION

#### 3.1 Empathy Map Canvas



#### 3.2 Ideation&Brainstorming:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	<ul style="list-style-type: none"> <li>❖ Rubbish and waste can cause air and water pollution.</li> <li>❖ Rotting garbage is also known to produce harmful gases mix with the air and cause breathing problem in people.</li> <li>❖ Due to improper waste disposal, we may face several problems like unpleasant odour and health problems</li> </ul>



2.	Idea / Solution description	<ul style="list-style-type: none"> <li>❖ To solve this problem of waste management for disposal using a smart refuse bin built with technologies like Sensors, Arduino Yun.</li> <li>❖ Garbage truck Weighing Mechanisms.</li> <li>❖ AI Recycling Robots</li> </ul>
3.	Novelty / Uniqueness	<ul style="list-style-type: none"> <li>❖ Identify potential wastestreams.</li> <li>❖ Create a waste management-focused community outreach plane</li> </ul>
4.	Social Impact / Customer Satisfaction	<ul style="list-style-type: none"> <li>❖ Neighbourhood of landfills to communities, breeding of pests and loss in property values.</li> <li>❖ The IOT solution uses the data and selects optimum routes for waste collection trucks</li> </ul>
5.	Business Model (Revenue Model)	<ul style="list-style-type: none"> <li>❖ It generates revenue through the provision of various waste management and disposal services.</li> <li>❖ Recycling solutions to residential, commercial, industrial and municipal clients</li> </ul>

6.	Scalability of the Solution	<ul style="list-style-type: none"> <li>❖ Installing more bins firecollecting recyclables like paper, glass,plastic.</li> <li>❖ Recycling not only save energy but also prevent the material from going to landfills &amp; Incineration and provides raw materials for new products.</li> </ul>
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## 4. REQUIREMENT ANALYSIS:

### 4.1 Functional Requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Detailed bin inventory	<p>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.</p> <p>Bins or stands are visible on the map as green, orange or red circles.</p> <p>You can see bin details in the Dashboard – capacity, waste type, last measurement, GPS location and collection schedule or pick recognition</p>

FR-2	Real time bin monitoring	<p>The Dashboard displays real-time data on fill-levels of bins monitored by smart sensors.</p> <p>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..</p> <p>Sensors recognize picks as well; so you can check when the bin was last collected.</p> <p>With real-time data and predictions, you can eliminate the overflowing bins and stop collecting half-empty</p>
FR-3	Expensive bins.	<p>We help you identify bins that drive up your collection costs. The tool calculates a rating for each bin in terms of collection costs.</p> <p>The tool considers the average distance depo-bin-discharge in the area. The tool assigns bin a rating (1-10) and calculates distance from depo-bin discharge.</p>
FR-4	Adjust bin distribution.	<p>Ensure the most optimal distribution of bins.</p> <p>Identify areas with either dense or sparse bin distribution.</p> <p>Make sure all trash types are represented within a stand.</p> <p>Based on the historical data, you can adjust bin capacity or location where necessary</p>

FR5	Eliminate unefficient picks	<p>Eliminate the collection of half-empty bins. The sensors recognize picks.</p> <p>By using real-time data on fill-levels and pick recognition, we can show you how full the bins you collect are.</p> <p>The report shows how full the bin was when picked. You immediately see any inefficient picks below 80% full.</p>
FR6	Plan waste collection routes.	<p>The tool semi-automates waste collection route planning. Based on current bin fill-levels and predictions of reaching full capacity, you are ready to respond and schedule waste collection.</p> <p>You can compare planned vs. executed routes to identify any inconsistencies</p>

## 4.2 Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
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NFR-1	<b>Usability</b>	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	<b>Security</b>	Use a reusable bottles Use reusable grocery bags Purchase wisely and recycle Avoid single use food and drink containers
NFR-3	<b>Reliability</b>	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.

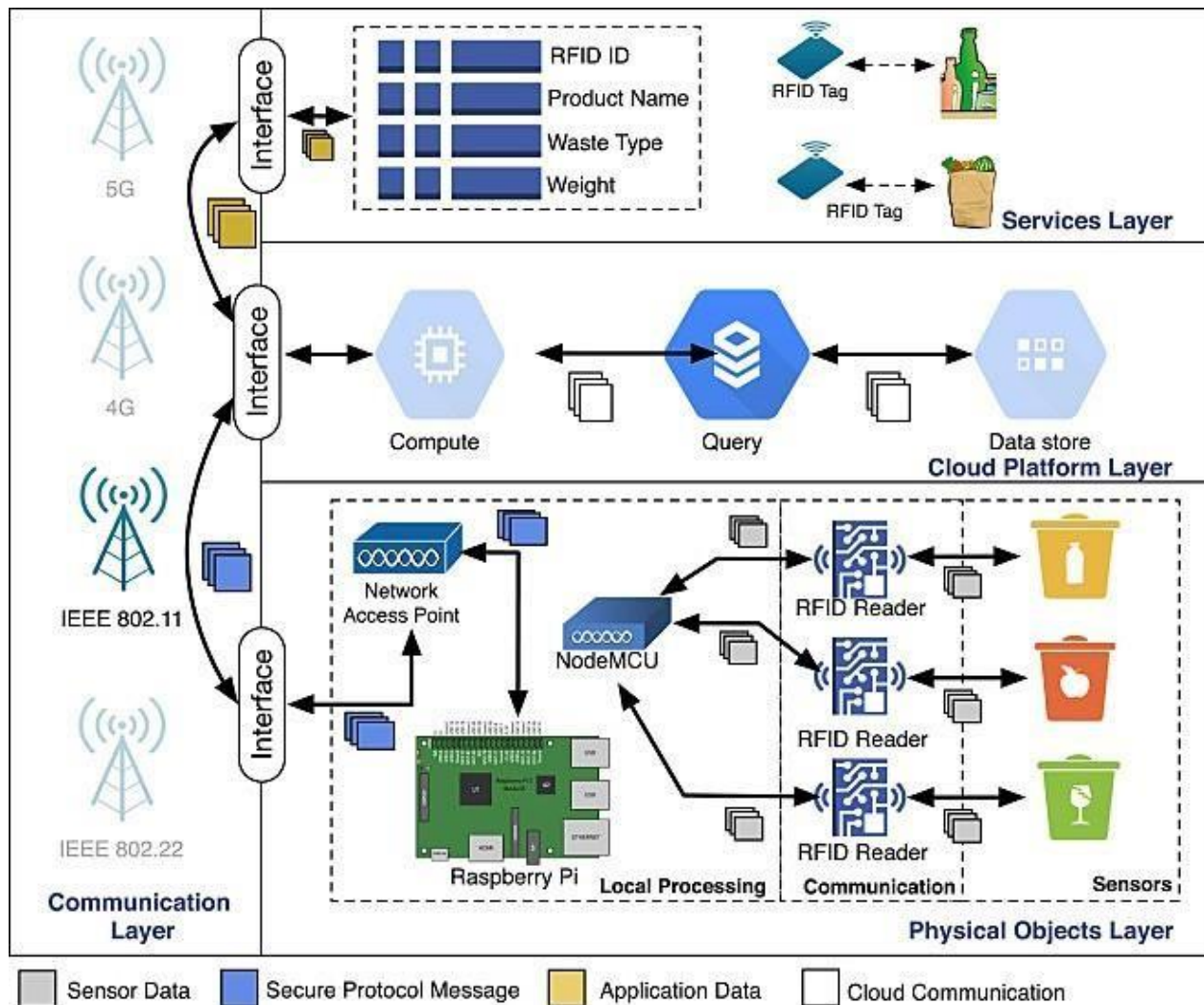
NFR-4	<b>Performance</b>	The Smart Sensors useultrasound technology to measure the fill levels (along with other data) in bins several times a day. Using a variety of IoT networks ( (NB-IoT,GPRS), the sensors send the data to Sensoneo’s Smart Waste Management Software System, a powerful cloud-based platform, for data-driven 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	<b>Availability</b>	By developing & deploying resilient hardware and beautiful software we empower cities, businesses, and countries to manage waste smarter
NFR-6	<b>Scalability</b>	Using smart waste bins reduce the number of bins inside town , cities coz we able to monitor the garbage 24/7 more cost effect and scalability when we moves to smarter.

## 5.PROJECT DESIGN

### 5.1 DATA FLOW DIAGRAMS:



## 5.2 SOLUTION&TECHNICAL ARCHITECTURE:



S.No	Component	Description	Technology
1.	User Interface	Web User	HTML, CSS, JavaScript / Angular Js / React Js etc.
2.	Application Logic-1	To calculate the distance of dreck and show the real time level in web portal , information getting via ultra sonic sensor and the alert message activate with python script to web portal.	Java / Python
3.	Application Logic-2	To calculate the weight of the garbage and show the real time weight in web portal, this info getting via load cell and the alert	Load cell/Python.



		message activate with python to	
4.	Application Logic-3	Getting location of the Garbage.	GSM / GPS.
5.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration:localhost Cloud Server Configuration:localhost,Firebase	Localhost,Web portal.
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	Ultrasonic sensor	To throw alert message when garbage is getting full.	Distance Recognition model

**Table-2: Application Characteristics:**

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks		Technology of Opensource framework
2.	Security Implementations	Raspberry Pi is connected to the internet and for example used to broadcast live data, further security measures are recommended and use the UFW(uncomplicated	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.
3.	Scalable Architecture		Technology used
4.	Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Technology used

5.	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	Technology used
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### 5.3 User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Web server	Login	USN-1	As a user, I give a user id and password for every workers and manage them.	I can manage web account	High	Sprint-1
Co admin	Login	USN-2	As a co admin, I monitor how wastes are filtering if garbage full, i give id to truck driver.	I monitor the garbage.	High	Sprint-1
Truck driver	Login	USN-3	As a truck driver, i follow the route send by co admin to collect the garbage.	I go to garbage filled place.	Low	Sprint-2

Local garbage collector	Login	USN-4	As a garbage collector, i collect trash from garbage and load into truck and get them into landfill.	I collect wastes and send off to landfill.	Medium	Sprint-1
Municipality	Login	USN-5	As a municipality, i enquire te process are done properly.	I will manage all these process are going correctly.	High	Sprint-1

## 6. PROJECT PLANNING AND SCHEDULING:

### Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Login	USN-1	As a user, I give a user id and password for every workers and manage them.	20	High	Rajkumar S
Sprint-1	Login	USN-2	As a co admin, I monitor how wastes are filtering if garbage full, i give id to truck driver.	10	High	Rajkumar S

Sprint-2	Login	USN-3	As a truck driver, i follow te route send by co admin to collect the garbage.	10	Low	Rajkumar K
Sprint-3	Login	USN-4	As a garbage collector, i collect trash from garbage and load into truck and get them into landfill.	20	Medium	Ragulraj M
Sprint-4	Login	USN-5	As a municipality, i enquire te process are done properly.	20	High	Pukazhenth B

## 7. CODING&SOLUTIONING:

PROGRAM CODE:

```
#set GPIO direction (IN / OUT)
GPIO.setup(GPIO_TRIGGER, GPIO.OUT)
GPIO.setup(GPIO_ECHO, GPIO.IN)
def distance():
# set Trigger to HIGH
GPIO.output(GPIO_TRIGGER, True)
# set Trigger after 0.01ms to LOW
time.sleep(0.00001)
GPIO.output(GPIO_TRIGGER, False)
StartTime = time.time()
StopTime = time.time()
# save StartTime
while GPIO.input(GPIO_ECHO) == 0:
```

```

StartTime = time.time()
# save time of arrival
while GPIO.input(GPIO_ECHO) == 1:
    StopTime = time.time()
# time difference between start and arrival
TimeElapsed = StopTime - StartTime
# multiply with the sonic speed (34300 cm/s)
# and divide by 2, because there and back
distance = (TimeElapsed * 34300) / 2
return distance
23
if __name__ == '__main__':
    try:
        while True:
            dist = distance()
            print ("Measured Distance = %.1f cm" % dist)
            percent = (100.0 - (dist * 100 / 40.0))
            url =
            "http://localhost:80/demoaddbin.php?bin_id=1&percent_filled="+str(percent)x=
            urllib.urlopen(url)
            print(x.read)
            time.sleep(5)
        # Reset by pressing CTRL + C
    except KeyboardInterrupt:
        print("Measurement stopped by User")
        GPIO.cleanup()
PROGRAM CODE FOR ACCESS DATABASE:
package com.bin;
import android.app.NotificationManager;
import android.app.PendingIntent;
import android.app.Service;
import android.content.Context;
import android.content.Intent;
import android.content.SharedPreferences;
import android.media.RingtoneManager;
import android.net.Uri;
import android.os.AsyncTask;
import android.os.Handler;
import android.os.IBinder;
import android.support.annotation.Nullable;
import android.support.v4.app.NotificationCompat;

```

```

import android.util.Log;
import android.widget.Toast;
import org.json.JSONArray;
import org.json.JSONException;
import org.json.JSONObject;
import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStream;
import java.io.InputStreamReader;
import java.net.HttpURLConnection;
import java.net.URL;
27
public class GetData extends Service {
String BASE_URL = "http:// dustbin.000webhostapp.com/";
String POPMOVIES_BASE_URL = BASE_URL + "getresponsefrombin.php";
SharedPreferences preferences;
SharedPreferences.Editor editor;
@Override
public void onCreate() {
Toast.makeText(this, "Service Called", Toast.LENGTH_SHORT).show();Log.d("Create:","called");
/ addNotification();
super.onCreate();
}
@Override
public int onStartCommand(Intent intent, int flags, int startId) {
Log.d("onStartCommand:","called");
preferences = getSharedPreferences("DustBin",MODE_PRIVATE);
final Handler handler = new Handler();
Runnable runnable = new Runnable() {
@Override
public void run() {
Log.d("handler","run()");
new DustbinTask().execute();
handler.postDelayed(this, 5000);
}};
/ Start
handler.postDelayed(runnable, 1000);
return START_STICKY;
}
@Override

```

```

public void onDestroy() {
    Log.d("Destroy:", "called");
    28
    super.onDestroy();
}
@Nullable
@Override
public IBinder onBind(Intent intent) {
    Log.d("Bind:", "called");
    return null;
}
public class DustbinTask extends AsyncTask<Void, Void, Void>{
    @Override
    protected void onPreExecute() {
        Log.d("onPreExecute", "initiate");
        try {
            if (!new Network(GetData.this).isConnected()) {
                Log.d("onPreExecute", "No Internet Available!!");
                cancel(true);
            }
        } catch (InterruptedException | IOException e) {
            e.printStackTrace();
        }
        @Override
        protected Void doInBackground(Void... params) {
            HttpURLConnection urlConnection = null;
            BufferedReader reader = null;
            URL url;
            String MoviesJsonStr;
            try {
                url = new URL(POPMOVIES_BASE_URL);
                urlConnection = (HttpURLConnection) url.openConnection();
                urlConnection.setRequestMethod("GET");
                urlConnection.connect();
                InputStream inputStream = urlConnection.getInputStream();29
                StringBuilder buffer = new StringBuilder()
                reader = new BufferedReader(new InputStreamReader(inputStream));
                String line;
                while ((line = reader.readLine()) != null) {
                    buffer.append(line).append("\n");
                }
            } catch (IOException e) {
                e.printStackTrace();
            }
        }
    }
}

```

```

}
MoviesJsonStr = buffer.toString();
getMovieNames(MoviesJsonStr);
} catch (IOException | JSONException e1) {
e1.printStackTrace();
} finally {
if (urlConnection != null) {
urlConnection.disconnect();
} if (
reader != null) {
try {
reader.close();
} catch (final IOException ignored) {}
}} return null;
}}

private void getMovieNames(String MovieJsonStr) throws JSONException {
JSONObject MovieJson = new JSONObject(MovieJsonStr);
JSONArray movieLists = MovieJson.getJSONArray("bin_info");for
(int i = 0; i < movieLists.length(); i++) {
JSONObject jMovieDetails = movieLists.getJSONObject(i);
String name = jMovieDetails.getString("bin_id");
int id = jMovieDetails.getInt("percent_filled");
Log.d("DATA", name + " " + id);
MainActivity.percent = id;
if(id>=80){
30
addNotification(id);
}} / Log.v("Length: ", String.valueOf(movieLists.length()));
}

/ Show a notification
private void addNotification(int id) {
int min, max;
int percentage = preferences.getInt("last_percent",0);min
= percentage - 5;
max = percentage + 5;
if (min > id || id > max) {
Intent intent = new Intent(this, MainActivity.class
intent.setFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP);
editor = preferences.edit();
editor.putInt("last_percent",id);
editor.apply();

```



```

PendingIntent pendingIntent = PendingIntent.getActivity(this, 0/*Request code*/,intent,
PendingIntent.FLAG_ONE_SHOT);
/ Set sound of notification
Uri notificationSound =
RingtoneManager.getDefaultUri(RingtoneManager.TYPE_NOTIFICATION);
NotificationCompat.Builder notiBuilder = new NotificationCompat.Builder(this)
.setSmallIcon(R.mipmap.ic_launcher
.setContentTitle(id + "% Dustbin Full")
.setContentText("Please clear your trash")
.setAutoCancel(true)
.setSound(notificationSound)
.setContentIntent(pendingIntent);
NotificationManager notificationManager = (NotificationManager)
getSystemService(Context.NOTIFICATION_SERVICE);
notificationManager.notify(999 /*ID of notification*/, notiBuilder.build());
/ stopSelf()
PROGRAM FOR CONNECTING APPLICATION TO INTERNET:
package com.bin;
import android.content.Context;
import android.net.ConnectivityManager;
import android.util.Log;
import java.io.IOException;
/**
 * Created by Sylvester on 03-Mar-17.
 */
class Network {
private Context mContext;
Network(Context mContext) {
this.mContext = mContext;
}
private boolean isNetworkAvailable() {
final ConnectivityManager connectivityManager = ((ConnectivityManager)
mContext.getSystemService(Context.CONNECTIVITY_SERVICE));
return connectivityManager.getActiveNetworkInfo() != null &&
connectivityManager.getActiveNetworkInfo().isConnected();
}
boolean isConnected() throws InterruptedException, IOException
{ if (
isNetworkAvailable()) {
String command = "ping -c 1 google.com";
return (Runtime.getRuntime().exec (command).waitFor() == 0

```

## 8. TESTING:

### 8.1 TEST CASES:

TEST CASE ID	FEATURE TYPE	COMPONENT	TEST SCENARIO	PREREQUISITE	STEPS TO EXECUTE	TEST DATA	EXPECTED RESULT	ACTUAL RESULT	STATUS	COMMENTS
LOGIN PAGE_TC_001	FUNCTIONAL	HOME PAGE	VERIFY THE USER IS ABLE TO SEE THE LOGIN/SIGN UP WHEN USER CLICK ON MY ACCOUNT BUTTON		1. ENTER URL AND CLICK GO 2. VERIFY LOGIN/SIGN UP	https://169.51.204.219.30106	Login page is visible	Working as expected	PASS	Successful
LOGIN PAGE_TC_002	UI	HOME PAGE	VERIFY THE USER IS ABLE TO SEE THE LOGIN/SIGN UP WHEN USER CLICK ON MY ACCOUNT BUTTON		1. ENTER URL AND CLICK GO 2. VERIFY LOGIN/SIGN UP Elements a. ID text box B. password text box c. login button D. new user E. already have an account	https://169.51.204.219.30106	Application should show below UI element	Working as expected	PASS	Successful
LOGIN PAGE_TC_003	FUNCTIONAL	LOGIN PAGE	VERIFY THE USER IS ABLE TO SEE THE LOGIN/SIGN UP WHEN USER CLICK ON MY ACCOUNT BUTTON		1. enter url and click go 2. click on my account 3. Enter valid ID 4. Enter valid password 5. click on login button	Id:1111 password:5678	User should navigate your home page.	Working as expected	PASS	Successful
LOGIN PAGE_TC_004	FUNCTIONAL	LOGIN PAGE	VERIFY THE USER IS ABLE TO SEE THE LOGIN/SIGN UP WHEN USER CLICK ON MY ACCOUNT BUTTON		1. enter url and click go 2. click on my account 3. Enter valid ID 4. Enter valid password 5. click on login button	Id:1111 password:5678	Confirmation message sent	Working as expected	PASS	Successful

LOGIN PAGE_TC_ 005	UI	LOGIN PAGE	VERIFY THE USER IS ABLE TO SEE THE LOGIN/SIGN UP WEN USER CLICK ON MY ACCOUNT BUTTON		1.enter url and click go 2.click on my account 3.Enter valid ID 4.Enter valid password 5.click on login button	Id:1111 password:5678	Confirmation message sent	Working as expected	PASS	Successful
LOGIN PAGE_TC_ 006	FUNCTI ONAL	LOGIN PAGE FOR ADMIN	VERIFY THE USER IS ABLE TO SEE THE LOGIN/SIGN UP WEN USER CLICK ON MY ACCOUNT BUTTON		1.enter url and click go 2.click on my account 3.Enter valid ID 4.Enter valid password 5.click on login button	Id:1111 password:5678	Customer database is visible	Working as expected	PASS	Successful

8.2 USER ACCEPTANCE TESTING:

**1.Purpose of Document**The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT).

**2.Defect Analysis**

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

Resoluti on	Severi ty 1	Severi ty 2	Severi ty 3	Severi ty 4	Subtot al
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1

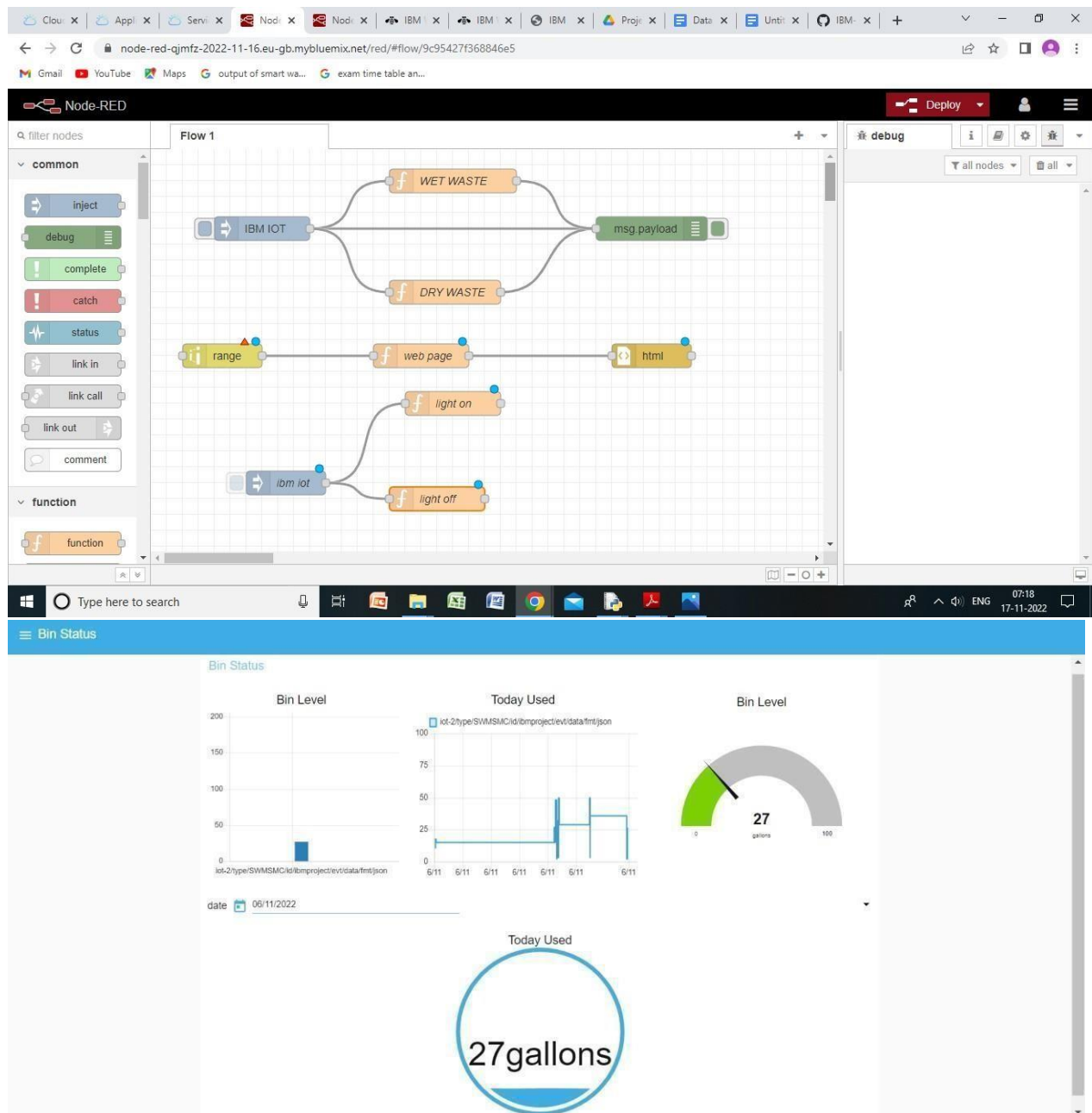
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	7

### 3. Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

## 9. RESULTS:



## 10. ADVANTAGES:

1. It saves time and money by using smart waste collection bins and systems equipped with fill level sensors. As smart transport vehicles go only to the filled containers or bins. It reduces infrastructure, operating and maintenance costs by upto 30%.
2. It decreases traffic flow and consecutively noise due to less air pollution as result of less waste collection vehicles on the roads. This has become possible

due to two way communication between smart dustbins and service operators.

- 3.It keeps our surroundings clean and green and free from bad odour of wastes, emphasizes on healthy environment and keep cities more beautiful.
- 4.It further reduces manpower requirements to handle the garbage collection process.
- 5.Applying smart waste management process to the city optimizes management, resources and costs which makes it a "smart city".

#### **DISADVANTAGES:**

- 1.System requires more 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.
- 2.Sensor nodes used in the dustbins have limited memory size.
- 3.Wireless technologies used in the system such as zigbee and wifi have shorter range and lower data speed. In RFID based systems, RFID tags are affected by surrounding metal objects (if any).
- 4.It reduces man power requirements which results into increase in unemployments for unskilled people.
- 5.The training has to be provided to the people involved in the smart waste management system.

## **11. Conclusion:**

The smart waste management system using IoT is successfully built. This proposed method aims at building a prototype model which is able to provide a technical solution to the waste management problem which will effectively separate dry and wet wastes. This model,

Smart Waste Management System (SWM) effectively employs IR sensor to identify dry waste items, and capacitive soil moisture sensor along with IR sensor to differentiate between dry and wet wastes. This system is integrated with ESP8266 Wi-Fi module for IoT applications so as to access information through internet to help higher authorities in better 45th Series Student Project Programme (SPP) – 2021-22 4 monitoring. This system can be effectively deployed at source in all metropolitan and local municipalities.

## **12. Scope for future work:**

1. More numbers of separations can be done like metals, plastics, glass etc., with appropriate technology. GSM contraption to intimate to the nearest industry to use the metals collected.
2. Further, plastic can be segregated from the collected dry waste and can be processed based on their types, grades and colors.
3. Solar panels can be fixed to the body of the dustbin for power requirement.
4. By using this proposed scheme will be helpful to easily achieve our mission clean India.
5. Provisions can be made for on spot decomposition of wet wastes.

## **13. APPENDIX:**

### **Source code:**

<https://github.com/IBM-EPBL/IBM-Project-34953-1660279999>