PROJECT REPORT

SMART WASTE MANAGEMENT SYSTEM FOR METROPOLITAN CITIES

Team ID	PNT2022TMID17661
Project Name	Smart Waste Management System For Metropolitan Cities
Date	18.11.2022

INTRODUCTION

1.1 PROJECT OVERVIEW

Project Name : **Smart Waste Management System For Metropolitan Cities.**

Category **: Internet Of Things.**

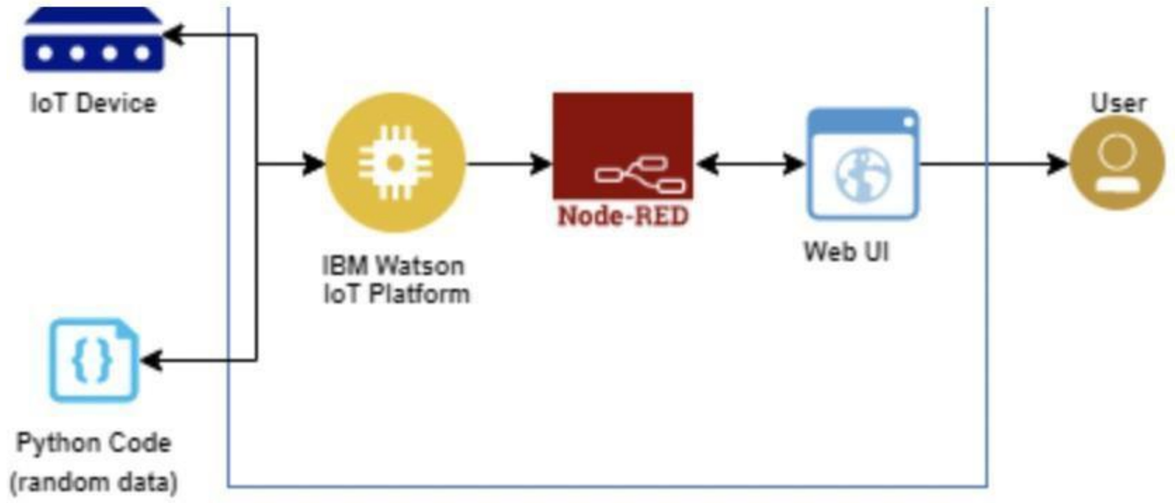
Project Description:

- Garbage level detection in bins.
- Getting the weight of the garbage in the bin.
- Alerts the authorized person to empty the bin whenever the bins are full.
- Garbage level of the bins can be monitored through a web App.
- We can view the location of every bin in the web application by sending GPS location from the device.

Skills Required:

Python, IoT Cloud Platform, IBM Cloud, Node-RED, IBM IoT Platform, IBM Node-red, IBM Cloudant DB

Technical Architecture :



1.2 PROJECT PURPOSE

The main aim of the project is to automate the waste managing process, smartly, using the Internet of Things. In the proposed system, we aim to measure the fill level of dry and wet dustbin and send a notification to the garbage collector if the fill level exceeds 75% mark.

Smart waste management is an idea where we can control lots of problems which disturbs the society in pollution and diseases. The waste management has to be done instantly else it leads to irregular management which will have adverse effects on nature. Smart waste management is compatible mainly with the concept of smart cities.

Main objectives:

1. Monitoring waste management.
2. Providing smart technology for waste systems.
3. Avoiding human intervention.
4. Reducing human time and effort
5. Resulting in a healthy waste-ridden environment.

LITERATURE SURVEY

2.1 EXISTING PROBLEM

The waste collection process is a critical aspect for the service providers. The traditional way of manually monitoring the wastes in waste bins is a complex, cumbersome process and utilizes more human effort, time and cost which is not compatible with the present-day technologies. Irregular management of waste typically domestic waste, industrial waste and environmental waste is a root cause of many of human problems such as pollution, diseases and has adverse effects on the hygiene of living beings. In order to overcome all these problems, we are proposing the idea of a smart waste management system which helps in the auto-management of waste without human interaction in order to maintain a clean environment.

2.2 REFEREN

CES Paper 1:

A Survey on Garbage Collection and Monitoring System for Smart cities using IOT

Publisher: Dept of Computer Engineering, Terna Engineering College,Nerul,Navi

Mumbai **Reference**: https://www.irjet.net/archives/V5/i2/IRJET-V5I2118.pdf

Paper 2:

IOT enabled solid waste management in smart cities

Publisher: S. Vishnu 1 , S. R. Jino Ramson 1,2,3,* , Samson Senith 4 , Theodoros Anagnostopoulos 5 , Adnan M. Abu-Mahfouz 6 , Xiaozhe Fan 2 , S. Srinivasan 3 and A. Alfred Kirubaraj 4

Reference: https://www.mdpi.com/2624-6511/4/3/53/pdf

Paper 3:

IOT enabled intelligent solid waste management system for smart city

Publisher:
https://www.semanticscholar.org/paper/IoT-Enabled-Intelligent-Solid-Waste-Management
-f or-De wangan/6fbe2679732dbcff5132ed75114137e00dcc53beisher

Reference: https://www.irjet.net/archives/V5/i2/IRJET-V5I2118.pdf

2.3 PROBLEM STATEMENT DEFINITION

Garbage Management and Collection in Cities, Town and Villages is a major concern and emerging problem in the Smart City paradigm. Also lack of proper resource distribution in the process of Garbage collection is a great risk to sanitation, cleanliness and health. Theme: Internet of Things

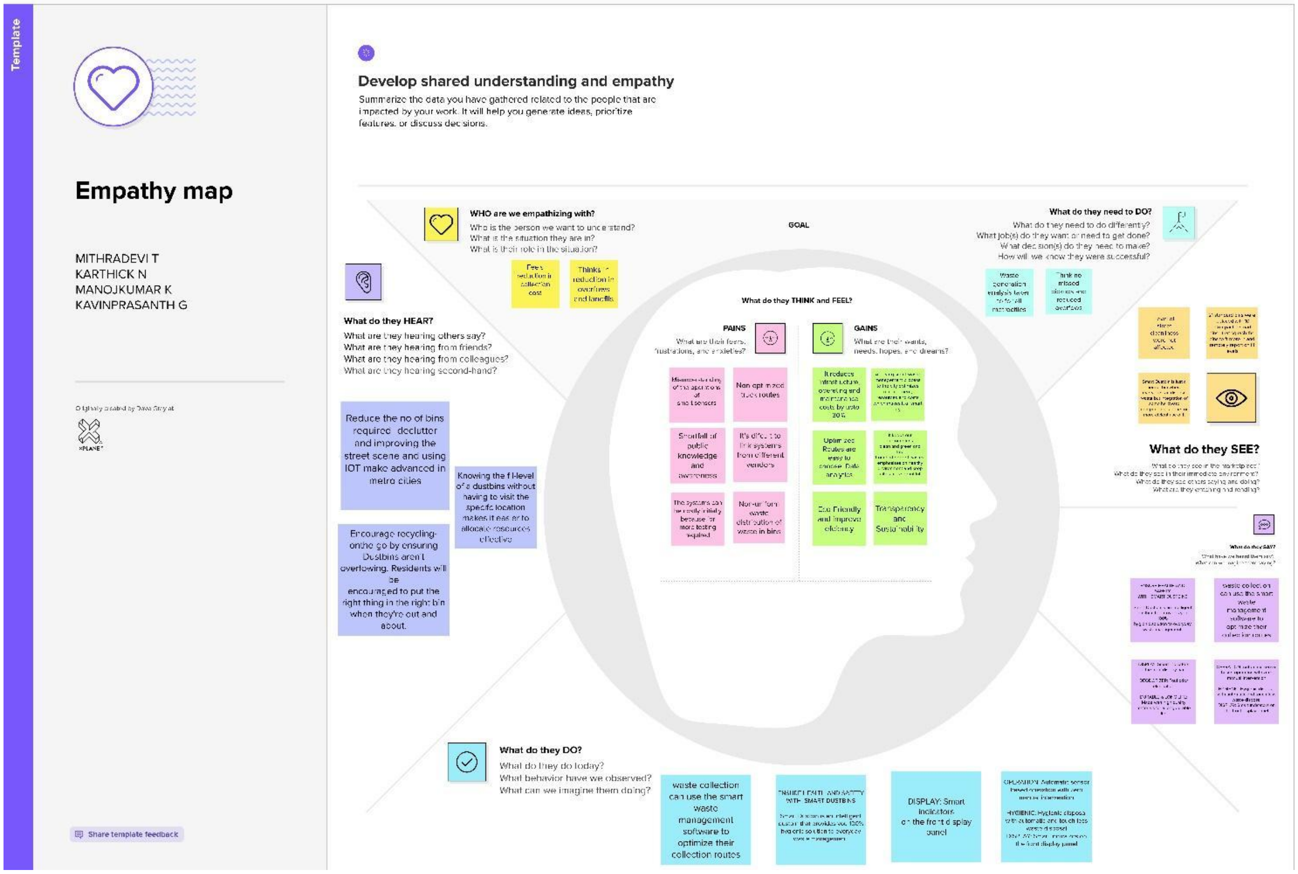
Technologies: LoRa, Smart Mesh, RF, WiFi

IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

3.2 IDEATION AND BRAINSTORMING

IDEA 1:



Template

Empathy map

MITHRADEVI T
KARTHICK N
MANOJKUMAR K
KAVINPRASANTH G

Develop shared understanding and empathy

Summarize the data you have gathered related to the people that are impacted by your work. It will help you generate ideas, prioritize features, or discuss decisions.

WHO are we empathizing with?
Who is the person we want to understand?
What is the situation they are in?
What is their role in the situation?

Feels reduction in collection cost

Thinks in reduction in overflows and landfills

GOAL

What do they need to DO?
What do they need to do differently?
What job(s) do they want or need to get done?
What decision(s) do they need to make?
How will we know they were successful?

Waste generation analysis taken for all metrocities

Think no missed pickups and reduced overflows

What do they HEAR?
What are they hearing others say?
What are they hearing from friends?
What are they hearing from colleagues?
What are they hearing second-hand?

Reduce the no of bins required declutter and improving the street scene and using IOT make advanced in metro cities

Knowing the fill-level of a dustbins without having to visit the specific location makes it easier to allocate resources effective

Encourage recycling-onthe go by ensuring Dustbins aren't overlowing. Residents will be encouraged to put the right thing in the right bin when they're out and about.

What do they THINK and FEEL?

PAINS
What are their fears, frustrations, and anxieties?

Misunderstanding of the operations of smart sensors

Non optimized truck routes

Shortfall of public knowledge and awareness

It's difficult to link systems from different vendors

The systems can be costly initially because for more testing required

Non-uniform waste distribution of waste in bins

GAINS
What are their wants, needs, hopes, and dreams?

It reduces infrastructure, operating and maintenance costs by upto 30%

Optimized Routes are easy to choose. Data analytics

Eco Friendly and improve eficiency

Transparency and Sustainability

What do they SEE?
What do they see in the marketplace?
What do they see in their immediate environment?
What do they see others saying and doing?
What are they watching and reading?

What do they SAY?
What have we heard them say?
What can we imagine them saying?

waste collection can use the smart waste management software to optimize their collection routes

What do they DO?
What do they do today?
What behavior have we observed?
What can we imagine them doing?

waste collection can use the smart waste management software to optimize their collection routes

ENABLE HEALTH AND SAFETY WITH SMART DUSTBINS

DISPLAY: Smart indicators on the front display panel

OPERATION: Automatic sensor based operation with zero manual intervention

HYGIENIC: Hygienic disposal with automatic and touch less waste disposal

DISPLAY: Smart indicators on the front display panel

Share template feedback

The idea is to produce a stable equipment of weighing sensors and other communication- IoT devices to create a best and efficient Smart-Waste Management System. The idea include, initially-building a stable and durable stand to which the weighing and communication sensors/devices are added and are used to update and send the information to the nearest waste collector. The normal dustbins are inserted into the stand and removed as needed. The communication sensor consists of applications including giving notification to the waste collectors about the weight and capacity of the dustbin that is filled.

IDEA 2:

The smart net bin is an ideology put forward which is a combination of hardware and software technologies i.e. connecting a Wi-Fi system to the normal dustbin in order to provide free internet facilities to the user for a particular period of time. The technology awards the user for keeping the surrounding clean and thus work hand in hand with the proper waste management in a locality. Smartnet bin uses multiple technologies firstly the technology for measuring the amount of trash dumped secondly the movement of the waste and lastly sending necessary signals and connecting the user tothe Wi-Fi system. The proposed system will function on a client-server model, a cause that will assure a clean environment, good health, and a pollution-free society.

IDEA 3:

The idea presents smart waste management using an IoT-based waste bin for collection and monitoring the level of waste inside the bin. The system is implemented using two ultrasonic sensors which are controlled by Node MCU. One of the ultrasonic sensors detects the level of the waste in the bin and another detects the person approaching the bin to dispose of the waste. This detection helps in the automatic opening and closing of the lid. The Servo motor is connected to the lid which serves the action of closing and opening of the lid. In this system, the level of waste in the bin will be sent to the concerned authorities. The IoT data is stored and monitored using the Blynk app.The proposed system is reliable, cost-effective and can be easily implemented.

IDEA 4:

A smart garbage monitoring system monitors the garbage bins and informs about the level of garbage in the garbage bins via an Android application. For this, the system uses ultrasonic sensors placed over the bins to detect the garbage level and compare it with the garbage bin's depth. The system makes use of GPS and Node MCU Esp8266(wi-fi) for sending data to the cloud. An

Android Application is used to view the level of waste in the bins. The Application gives the location of garbage bins and highlights the marker when the bins are full.

3.3 PROPOSED SOLUTION

S.NO	PARAMETER	DESCRIPTION
1.	Problem statement	A growing population and economy, means increased volumes ofwaste are generated. This puts pressure on waste management facilities, which are already in short supply.Hence IOT Based smart net bins can be used to overcome this problem.
2.	Idea / Solution description	The idea is to produce stable equipment of weighing sensors and other communication IoT devices to create the best and most efficient Smart-Waste Management System. The idea includes initially-building a stable and durable stand to which the weighing and communication sensors/devices are added and are used to update and send the information to the nearest waste collector. The normal dustbins are inserted into the stand and removed as needed. The communication sensor consists of applications including giving notification to the waste collectors about the weight and capacity of the dustbin that is filled.
3.	Novelty / Uniqueness	The existing system makes use of IoT devices and sensors for communication. But in our model, we have used IBM Cloud services data storage. IBM Watson IoT platform is used as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform.
4.	Social Impact / Customer Satisfaction	The main impact of this smart bin is people don't have to wait for the waste collector. The app takes the information to the waste collector directly. This saves the time of the customer. The cost of the product is also less so this will help all kinds of people to manage their waste properly.
5.	Business Model (Revenue Model)	This business model is to target all the residentials of the city to dispose of the waste properly. The total cost for producing the model using the is around 7000 - 8500. This smart bin is very efficient for day today use.
6.	Scalability of the Solution	Traditional means of waste management do more harm than good to the environment and human life. For a country like India where the huge population is already exerting tremendous pressure on the resources, sustainable waste management to reduce environmental impact is

		desperately needed.

3.4 PROBLEM SOLUTION FIT

1. CUSTOMER SEGMENT(S):

This product is for trash collectors in metropolitan cities and also for people who like to create a cleaner, safer, and more hygienic environment. It is ideal for busy locations such as campuses, themeparks, airports, railway stations and shopping malls.

2. JOBS-TO-BE-DONE / PROBLEMS:

Avoids unnecessary lumping of wastes on the side as it alerts the authorized person to empty the bin whenever the bins are full. With less manpower, I can view the location of every bin using a web application.

3. TRIGGERS:

Due to overflowing bins, if there is an odour, trash collectors think of a solution and buy it in busylocations such as campuses, theme parks, airports, railway stations and shopping malls, for all metropolitan cities.

4. EMOTIONS: BEFORE AFTER:

At first, trash collectors found it difficult to empty the bin because they didn’t know when the bin got full. After an improvement in the monitoring system as it alerts the authorized person to empty thebin and is able to get the weight of the garbage in the bin, it becomes an easy task for them.

5. AVAILABLE SOLUTIONS:

With the help of smart bins, we can improve efficiency using the resources available to us in a more focused and targeted way. Reduce the number of bins required- decluttering and improving the street scene.

6. CUSTOMER CONSTRAINTS:

- May have confusion about emptying the bins
- Insufficient data collection.

7. BEHAVIOR:

Improper waste management can lead to adverse health outcomes so buying and using the product is more beneficial.

8. CHANNELS OF BEHAVIOR:

- ONLINE Searching through the internet to get detailed statistics about the waste you collected, data for optimizing waste collection
- OFFLINE Create an efficiency campaign to raise awareness about waste management.

9. PROBLEM ROOT CAUSE:

- Poor waste management which leads to adverse health outcomes.
- Rapid urbanization, population growth and economic development will push global waste generation to increase by 70%.

10. YOUR SOLUTION:

The designed system can result in the availability of valuable materials to reuse. The designed system also reduces labour time and avoids unnecessary lumping of waste on roadsides.

Solution Architecture:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behaviour and other aspects of the software to projectstakeholders.
- Define features, development phases and solution requirements.
- Provide specifications according to which the solution is defined, managed and delivered.

Features:

To produce stable equipment of weighing sensors and other communication IoT devices to createa best and most efficient Smart-Waste Management System.

1. Communication sensors

2. GPS

3. Notify Alert signal

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT(FR)

FR NO.	Functional Requirement (Epic)	Sub Requirement (Story / Sub Task)

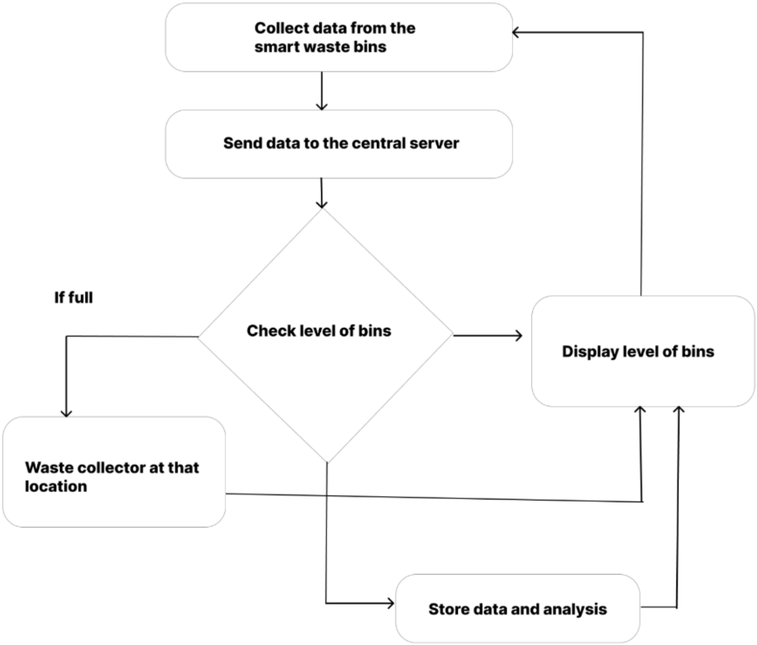
FR-1	Detailed bin inventory	Bins or stands are visible on the map as green, orange or red circles. You can see bin details in the Dashboard – capacity, waste type, last measurement, GPS location and collection schedule or pick recognition.
FR-2	Real time bin monitoring	The Dashboard displays real time 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.
FR-3	Expensive bins	The tool considers the average distance to depo-bin discharge in the area. The tool assigns bin a rating(1-10) and calculates distance from depo-bin discharge.
FR-4	Adjust bin distribution	Based on the historical data, you can adjust bin capacity or location where necessary. Identify areas with either dense or sparse bin distribution.
FR-5	Eliminate inefficient picks	Eliminate the collection of half empty bins. The sensors recognize picks. The report shows how full the bin was when picked. You immediately see any inefficient picks below 80% full.
FR-6	Plan waste collection routes	The tool semi-automated 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. You can compare planned vs. executed routes to identify any inconsistencies.

4.2 NON-FUNCTIONAL REQUIREMENTS (NFR)

NFR NO.	Non- functional Requirements	Description
NFR-1	Usability	IoT devices 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 indeedhelp designers better understand users’ potential needsin waste management, behavior and experience.
NFR-2	Security	User reusable bottles Use reusable grocery bags Purchase wisely and recycle Avoid single use 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	Using a variety of IoT networks, the sensors send the data to sensono’s smart waste management Software system, a powerful cloud-based platform , for data driven daily operations , available also as a waste management app. Customers hence provide 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 reduces the number of bins inside town , cities because we are able to monitor the garbage 24/7 for more cost effect and scalability when we move to smarter.

PROJECT DESIGN

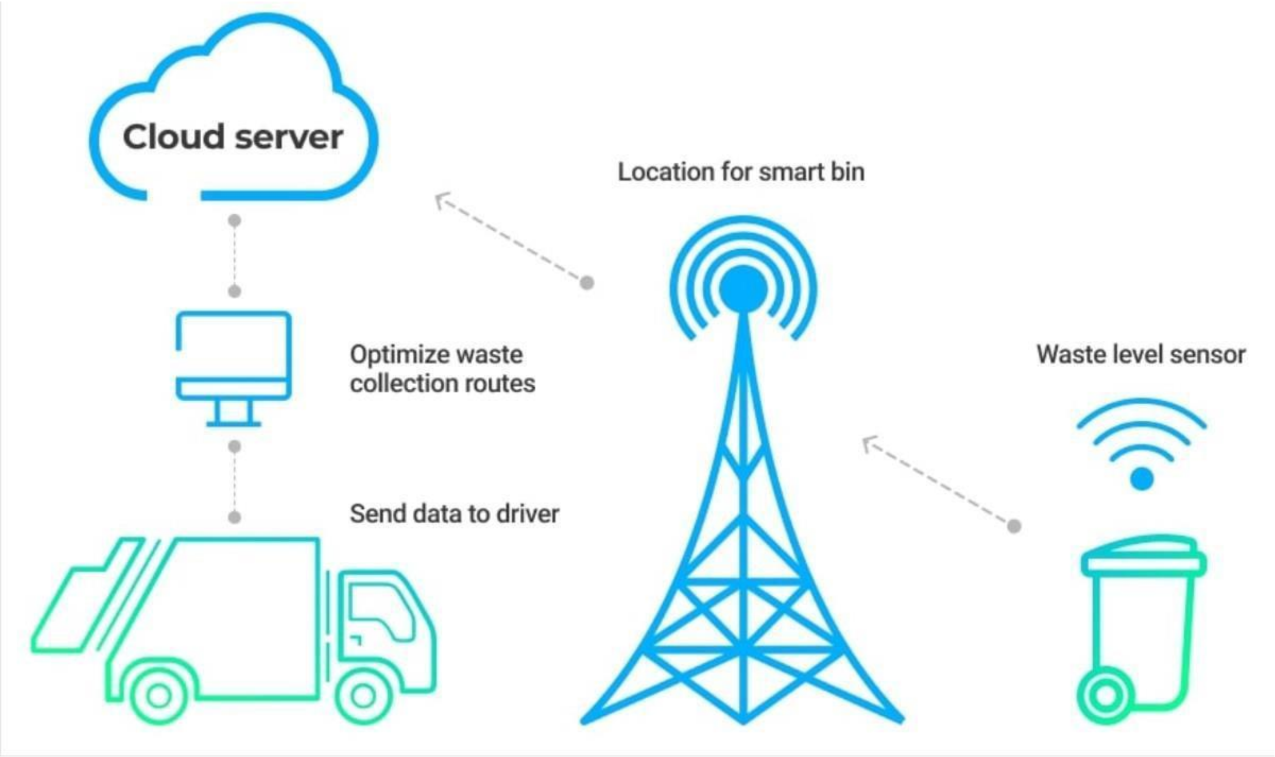
5.1 DATA FLOW DIAGRAM


Collect data from the smart waste bins
Send data to the central server
If full
Check level of bins
Display level of bins
Waste collector at that location
Store data and analysis

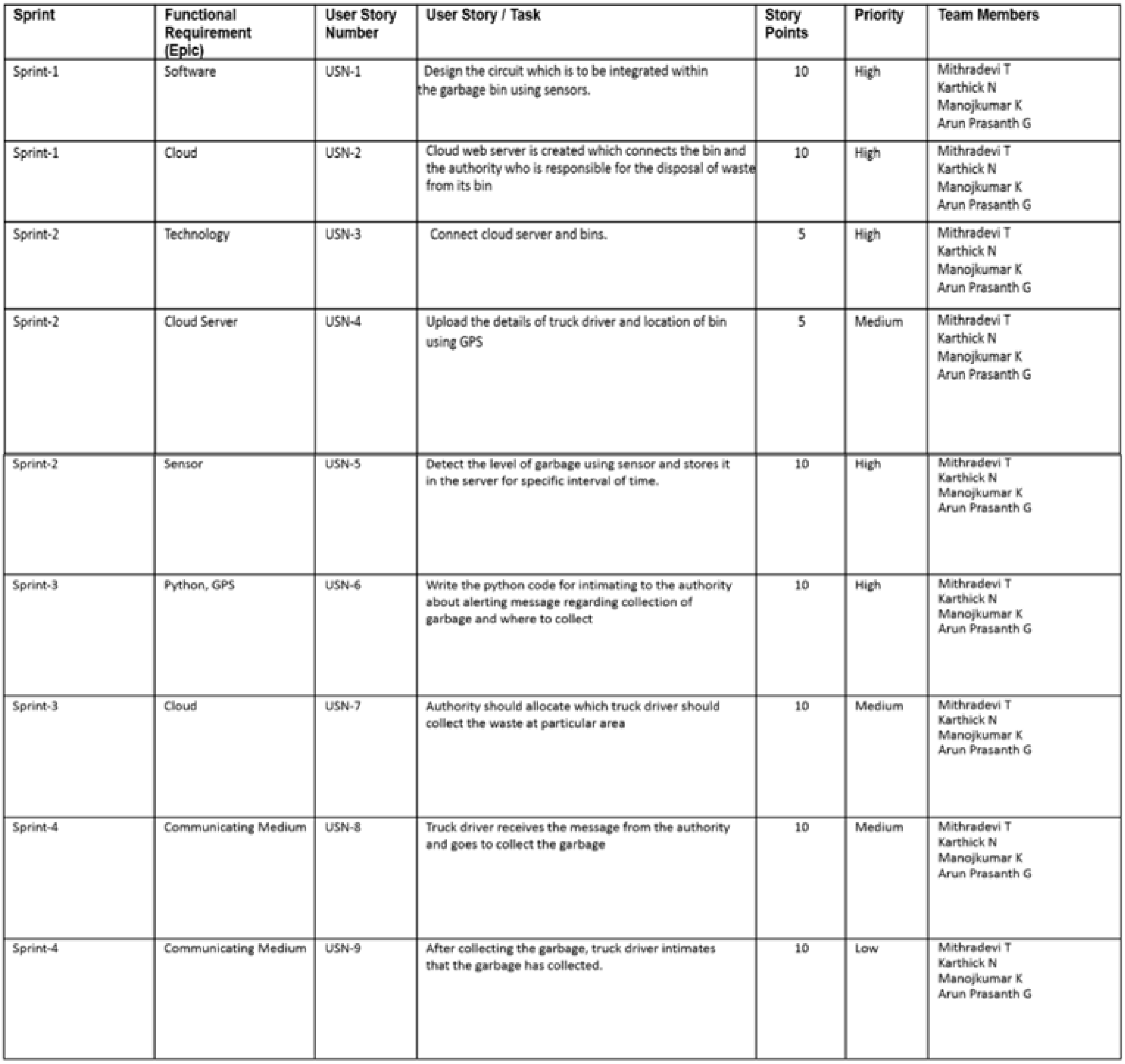
5.2 SOLUTION AND TECHNICAL ARCHITECTURE

S.No	Characteristics	Description	Technology
1.	User Interface	Web Portal	HTML, CSS, Node-Red, JavaScript. oron
2.	Application logic-1	To calculate the distance of the dreck and show the real-time level in the web portal, information gets via ultrasonic sensor and The alert message activates with Python script to the web portal.	Ultrasonic sensor/Python.
3.	Application logic-2	To calculate the weight of the garbage and show the real-time weight in the web portal, this info gets via load cell and the alert message activates with python to	Load cell, python

		Web portal.	
4.	Application logic -3	Getting location of the Garbage.	GSM/ GPS
5.	Cloud database	Database service on cloud	IBMDB2,IBM Cloudant etc.
6.	File storage	File storage requirements	Github, Local file system.
7.	External API 1	Fire base is a set of hosting Services for any type of application. It offers No SQL and real time hosting of databases , content, social authentication, and notifications, or services, such as a real- time Communication server.	Firebase
8.	Ultrasonic sensor	To throw alert message when Garbage is getting full	Distance Recognition Model.
9.	Infrastructure	Application Deployment On Local System/Cloud Local Server Configuration:localhost Configuration:localhost,Firebase	Local host ,web portal



5.3 USER STORIES



Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Software	USN-1	Design the circuit which is to be integrated within the garbage bin using sensors.	10	High	Mithradevi T Karthick N Manojkumar K Arun Prasanth G
Sprint-1	Cloud	USN-2	Cloud web server is created which connects the bin and the authority who is responsible for the disposal of waste from its bin	10	High	Mithradevi T Karthick N Manojkumar K Arun Prasanth G
Sprint-2	Technology	USN-3	Connect cloud server and bins.	5	High	Mithradevi T Karthick N Manojkumar K Arun Prasanth G
Sprint-2	Cloud Server	USN-4	Upload the details of truck driver and location of bin using GPS	5	Medium	Mithradevi T Karthick N Manojkumar K Arun Prasanth G
Sprint-2	Sensor	USN-5	Detect the level of garbage using sensor and stores it in the server for specific interval of time.	10	High	Mithradevi T Karthick N Manojkumar K Arun Prasanth G
Sprint-3	Python, GPS	USN-6	Write the python code for intimating to the authority about alerting message regarding collection of garbage and where to collect	10	High	Mithradevi T Karthick N Manojkumar K Arun Prasanth G
Sprint-3	Cloud	USN-7	Authority should allocate which truck driver should collect the waste at particular area	10	Medium	Mithradevi T Karthick N Manojkumar K Arun Prasanth G
Sprint-4	Communicating Medium	USN-8	Truck driver receives the message from the authority and goes to collect the garbage	10	Medium	Mithradevi T Karthick N Manojkumar K Arun Prasanth G
Sprint-4	Communicating Medium	USN-9	After collecting the garbage, truck driver intimates that the garbage has collected.	10	Low	Mithradevi T Karthick N Manojkumar K Arun Prasanth G

PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

TITLE	DESCRIPTION	DATE
Literature Survey & Information Gathering	Literature survey on the selected project & gathering information by referring the, technical papers, research publications etc	20-September-2022
Prepare Empathy Map	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements	22-September-2022
Ideation	List them by organizing the brainstorming session and prioritize the top 3 ideas based on feasibility & importance.	25-September-2022
Proposed Solution	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	28-September-2022

Problem Solution Fit	Prepare problem - solution fit document.	3-October-2022
Solution Architecture	Prepare a solution architecture document.	4-October-2022
Customer Journey	Prepare the customer journey maps to understand the user interactions & experiences with the application	13-November-2022
Functional Requirement	Prepare the functional requirement document	13-November-2022
Data flow diagrams	Draw the data flow diagrams and submit for review	16-November-2022
Technology architecture	Prepare the technology architecture diagram.	13-November-2022
Prepare milestone and activity list	Prepare the milestones & activity list of the project	15-October-2022
Project Development, delivery of sprints-1,2,3 & 4	Develop & submit the developed code by testing it.	29-October-2022

6.2 DELIVERY SCHEDULE

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
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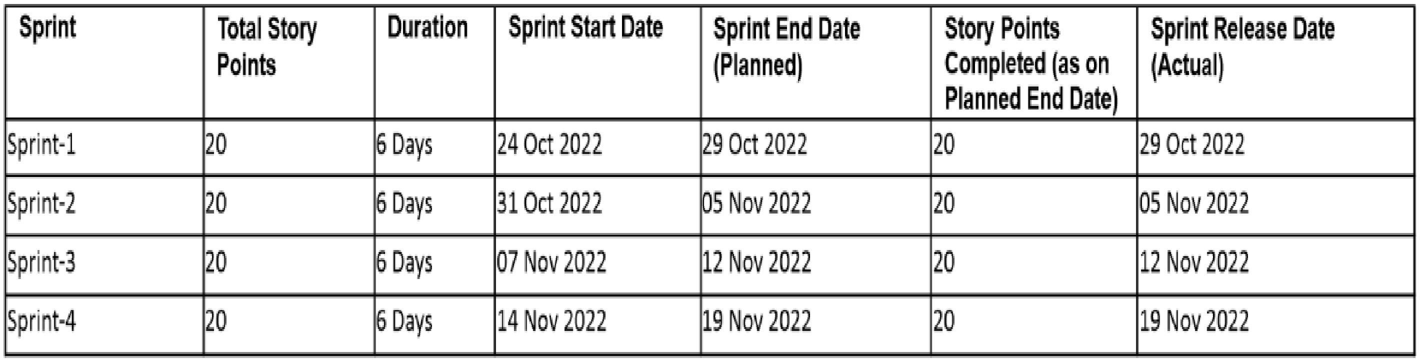
Sprint-4	Communicating Medium	USN-9	After collecting the garbage, truck driver intimates that the garbage has collected.	10	Low	Mithradevi T Karthick N Manojkumar K Arun Prasanth G

PROJECT TRACKER, VELOCITY AND BURNDOWN CHART:

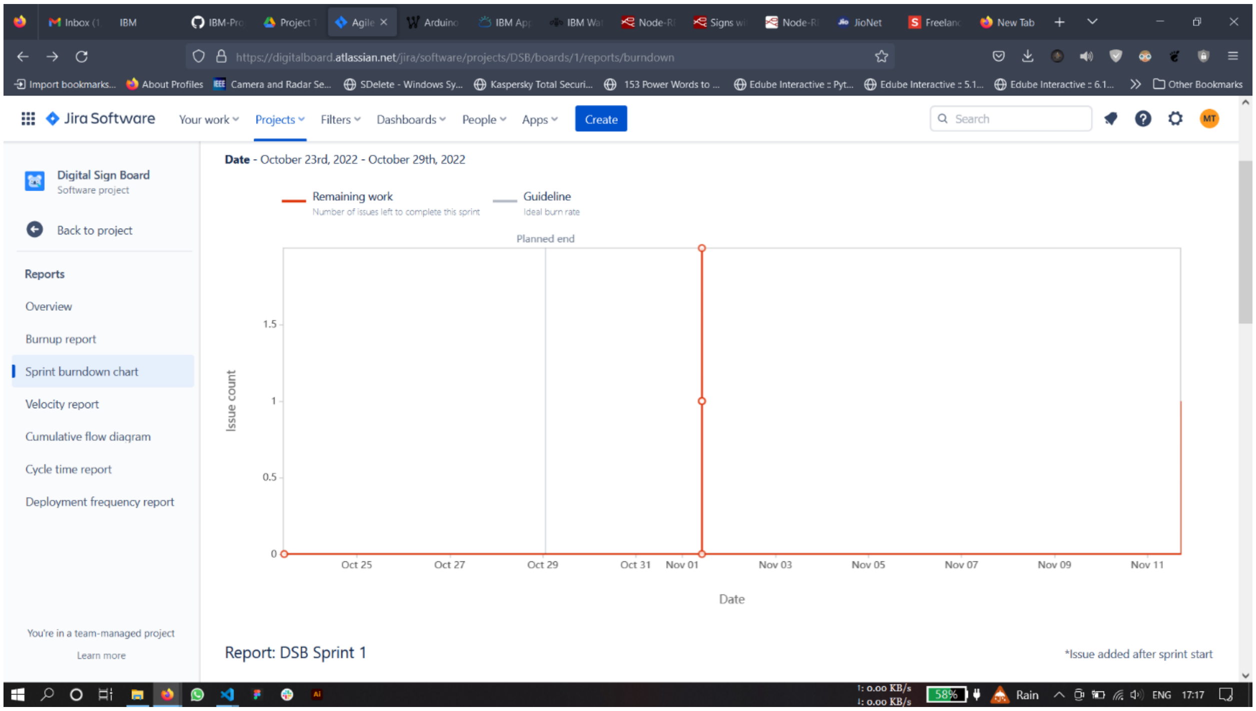


Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 REPORTS FROM JIRA

SMART WASTE MANAGEMENT SYSTEM IN THE JIRA SOFTWARE PLATFORM:

Sprint 1



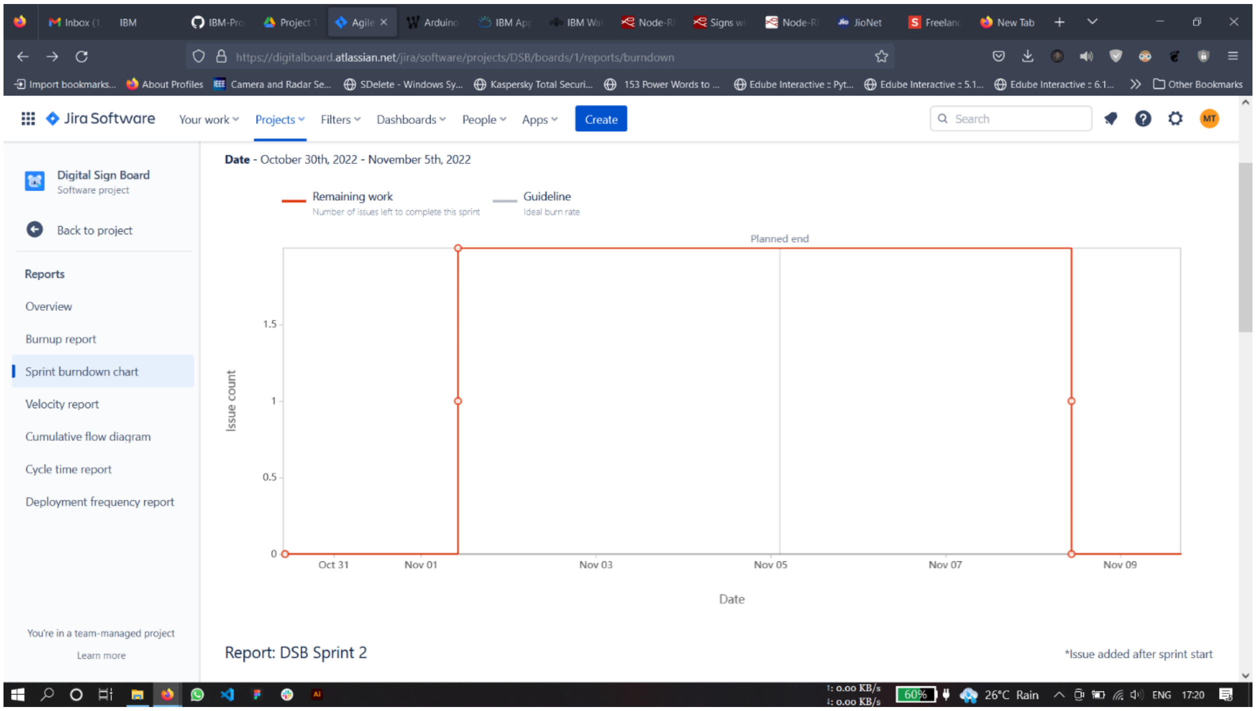
https://digitalboard.atlassian.net/jira/software/projects/DSB/boards/1/reports/burndown

Date - October 23rd, 2022 - October 29th, 2022

Report: DSB Sprint 1

*Issue added after sprint start

Sprint 2

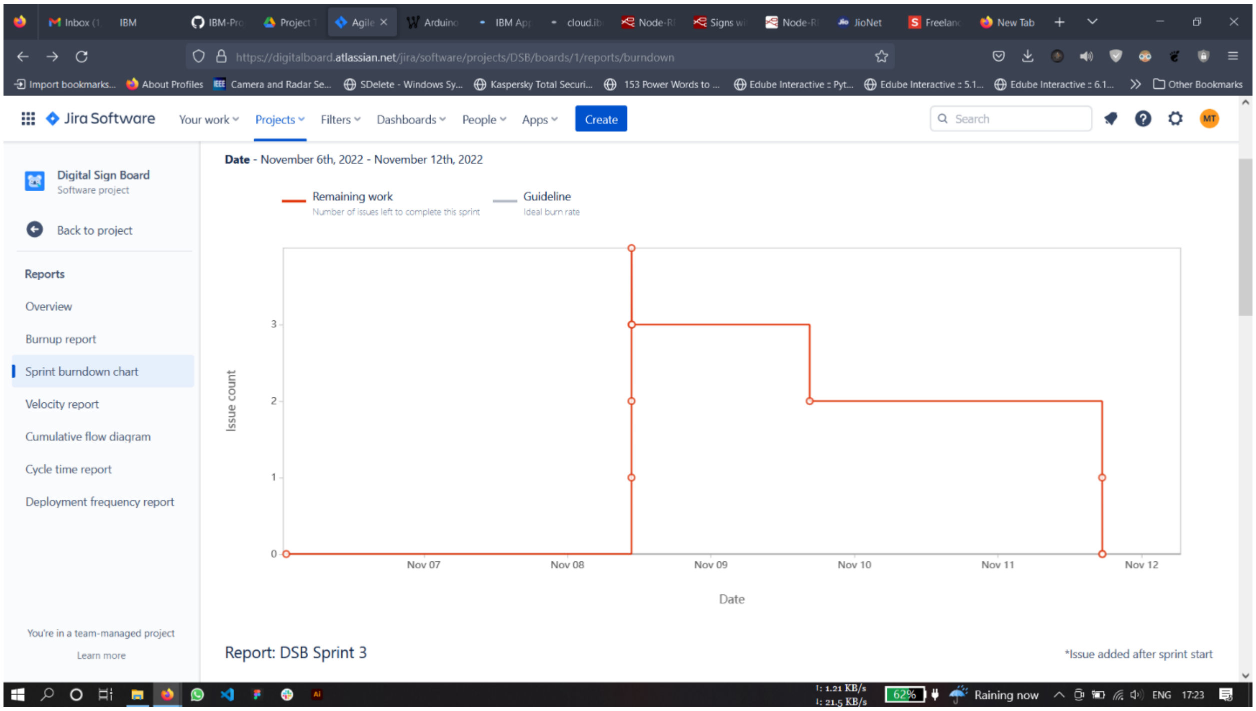


Date - October 30th, 2022 - November 5th, 2022

Report: DSB Sprint 2

*Issue added after sprint start

Sprint 3

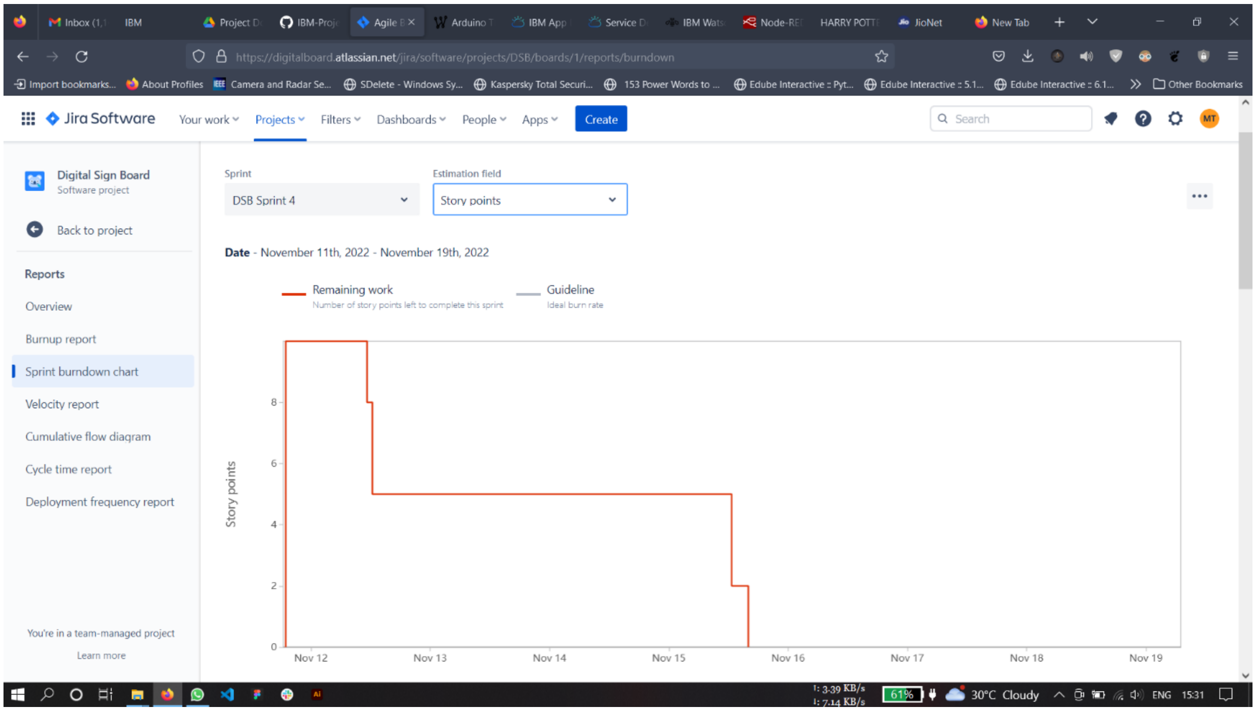


Date - November 6th, 2022 - November 12th, 2022

Report: DSB Sprint 3

*Issue added after sprint start

Sprint 4



Sprint: DSB Sprint 4

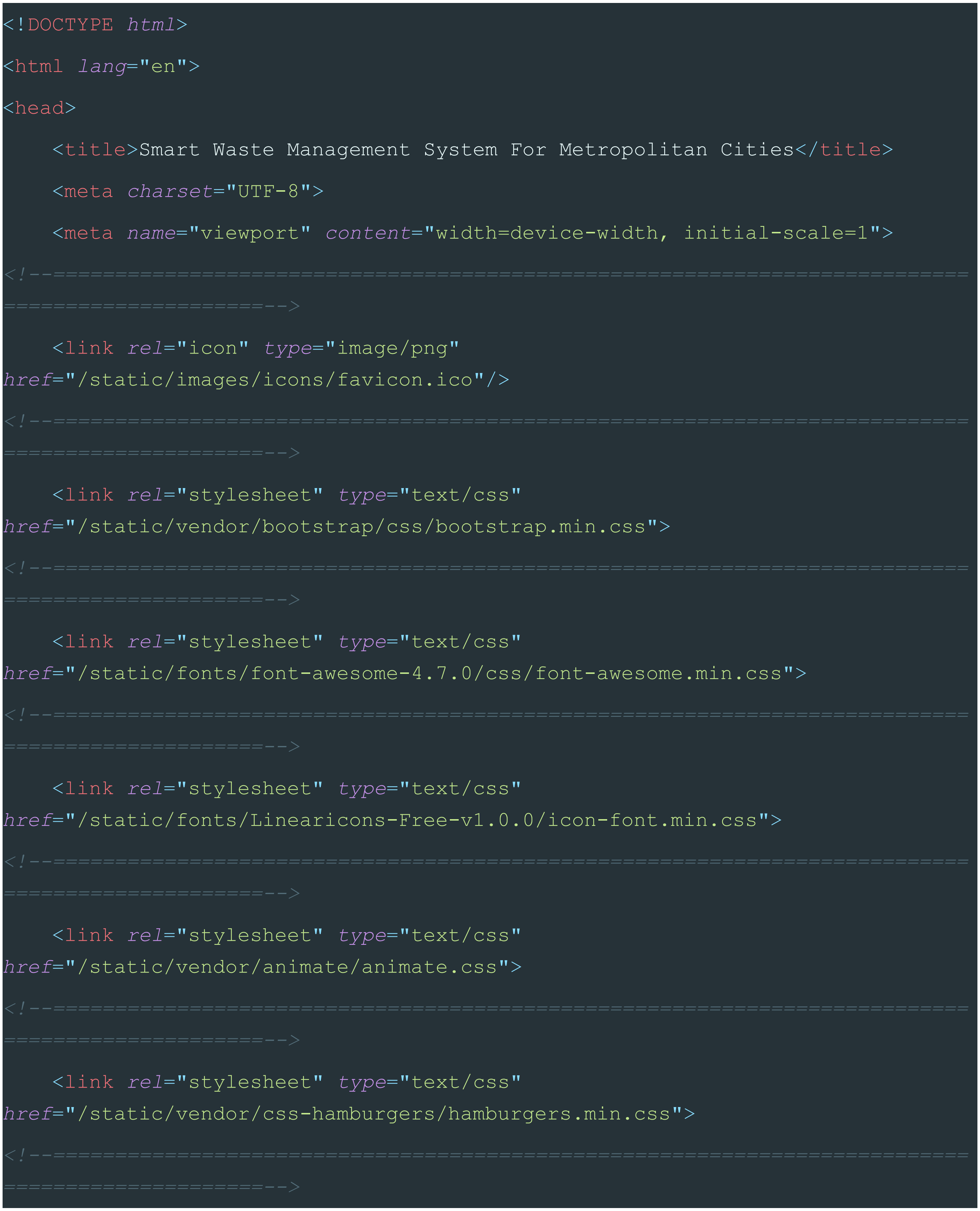
Estimation field: Story points

Date - November 11th, 2022 - November 19th, 2022

CODING AND SOLUTIONING

7.1 WEBSITE CODES

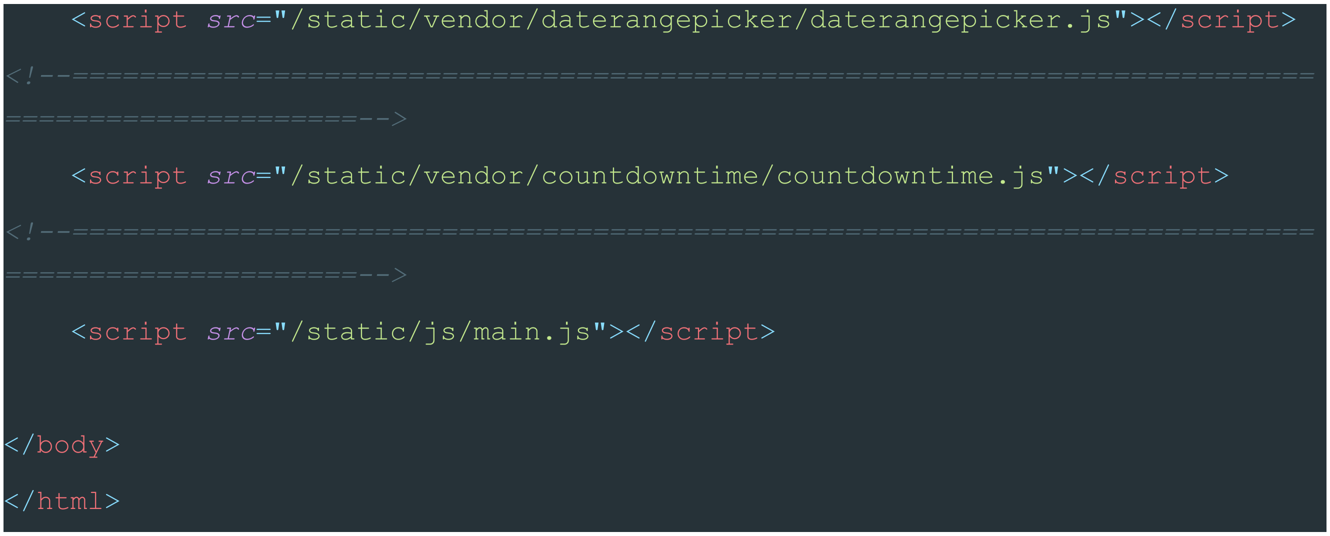
WELCOME PAGE CODES (HTML)



```
<!DOCTYPE html>
<html lang="en">
<head>
    <title>Smart Waste Management System For Metropolitan Cities</title>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1">
<!--==========================================================================
=====================-->
    <link rel="icon" type="image/png"
href="/static/images/icons/favicon.ico"/>
<!--==========================================================================
=====================-->
    <link rel="stylesheet" type="text/css"
href="/static/vendor/bootstrap/css/bootstrap.min.css">
<!--==========================================================================
=====================-->
    <link rel="stylesheet" type="text/css"
href="/static/fonts/font-awesome-4.7.0/css/font-awesome.min.css">
<!--==========================================================================
=====================-->
    <link rel="stylesheet" type="text/css"
href="/static/fonts/Linearicons-Free-v1.0.0/icon-font.min.css">
<!--==========================================================================
=====================-->
    <link rel="stylesheet" type="text/css"
href="/static/vendor/animate/animate.css">
<!--==========================================================================
=====================-->
    <link rel="stylesheet" type="text/css"
href="/static/vendor/css-hamburgers/hamburgers.min.css">
<!--==========================================================================
=====================-->
```

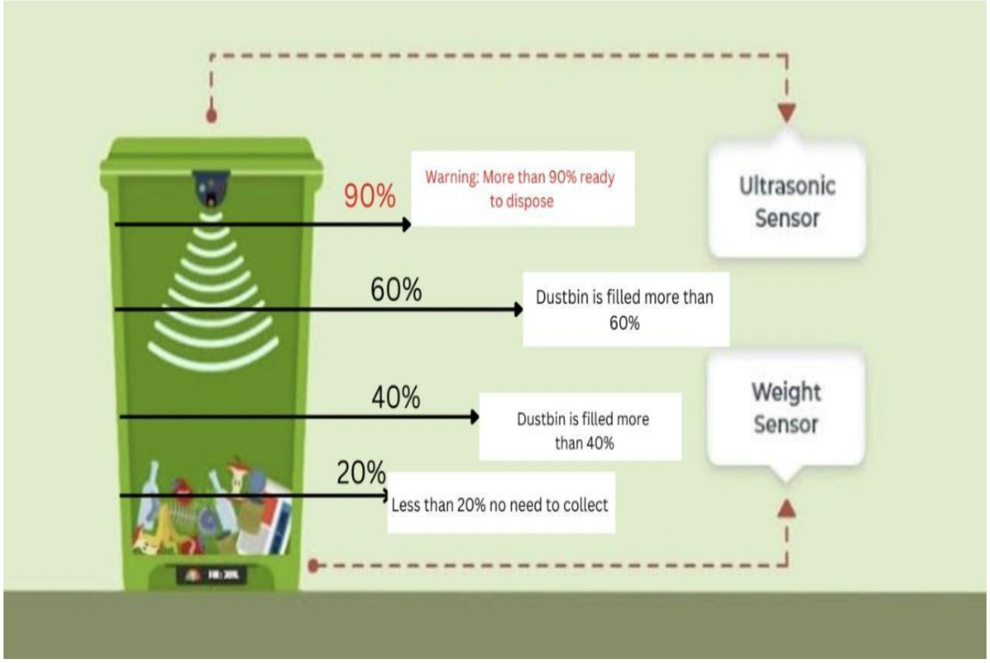
```
    <link rel="stylesheet" type="text/css" href="/static/vendor/animsition/css/animsition.min.css">
<!--===============================================================================================-->
    <link rel="stylesheet" type="text/css" href="/static/vendor/select2/select2.min.css">
<!--===============================================================================================-->
    <link rel="stylesheet" type="text/css" href="/static/vendor/daterangepicker/daterangepicker.css">
<!--===============================================================================================-->
    <link href="{{ url_for('static', path='/css/main.css') }}" rel="stylesheet">
    <link href="{{ url_for('static', path='/css/util.css') }}" rel="stylesheet">
<!--===============================================================================================-->
</head>
<body>


    <div class="limiter">
        <div class="container-login100" style="background-image: url({{ url_for('static', path='/images/bg1.jpg') }});">
            <div class="wrap-login100 p-l-110 p-r-110 p-t-62 p-b-33">
                <form class="login100-form validate-form flex-sb flex-w">
                    <span class="login100-form-title p-b-53">
                        Sign In With
                    </span>


                    <a href="#" class="btn-face m-b-20">
                        <i class="fa fa-facebook-official"></i>
                        Facebook
                    </a>


                    <a href="#" class="btn-google m-b-20">
```

```
                        <img src="static/icons/icon-google.png" alt="GOOGLE">
                        Google
                    </a>

                    <div class="p-t-31 p-b-9">
                        <span class="txt1">
                            Username
                        </span>
                    </div>
                    <div class="wrap-input100 validate-input" data-validate = "Username is required">
                        <input class="input100" type="text" name="username" >
                        <span class="focus-input100"></span>
                    </div>

                    <div class="p-t-13 p-b-9">
                        <span class="txt1">
                            Password
                        </span>

                        <a href="#" class="txt2 bo1 m-l-5">
                            Forgot?
                        </a>
                    </div>
                    <div class="wrap-input100 validate-input" data-validate = "Password is required">
                        <input class="input100" type="password" name="pass" >
                        <span class="focus-input100"></span>
                    </div>

                    <div class="container-login100-form-btn m-t-17">
                        <button class="login100-form-btn">
                            Login
                        </button>
                    </div>

                    <div class="w-full text-center p-t-55">
                        <span class="txt2">
                            Not a member?
                        </span>

                        <a href="#" class="txt2 bo1">
                            Sign up now
                        </a>
                    </div>
                </form>
            </div>
        </div>
    </div>


    <div id="dropDownSelect1"></div>

<!--===============================================================================================-->
    <script src="/static/vendor/jquery/jquery-3.2.1.min.js"></script>
<!--===============================================================================================-->
    <script src="/static/vendor/animsition/js/animsition.min.js"></script>
<!--===============================================================================================-->
    <script src="/static/vendor/bootstrap/js/popper.js"></script>
    <script src="/static/vendor/bootstrap/js/bootstrap.min.js"></script>
<!--===============================================================================================-->
    <script src="/static/vendor/select2/select2.min.js"></script>
<!--===============================================================================================-->
    <script src="/static/vendor/daterangepicker/moment.min.js"></script>
```

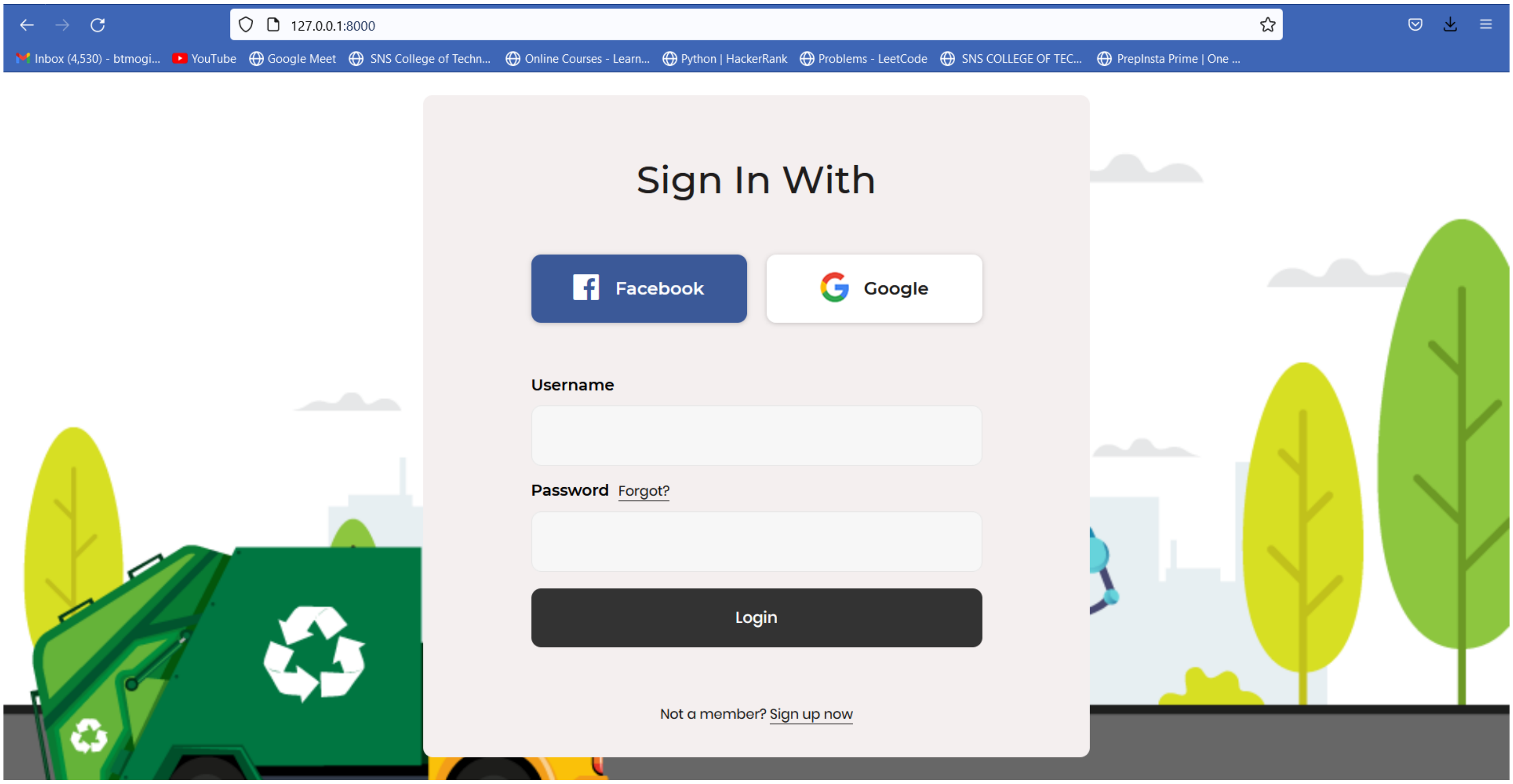


```
    <script src="/static/vendor/daterangepicker/daterangepicker.js"></script>
<!--==========================================================================
=====================-->
    <script src="/static/vendor/countdowntime/countdowntime.js"></script>
<!--==========================================================================
=====================-->
    <script src="/static/js/main.js"></script>

</body>
</html>
```

WORKING MODEL :


90%
Warning: More than 90% ready to dispose
60%
Dustbin is filled more than 60%
40%
Dustbin is filled more than 40%
20%
Less than 20% no need to collect
Ultrasonic Sensor
Weight Sensor

APPLICATION OUTLOOK :



127.0.0.1:8000

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Facebook Google

Username

Password Forgot?

Login

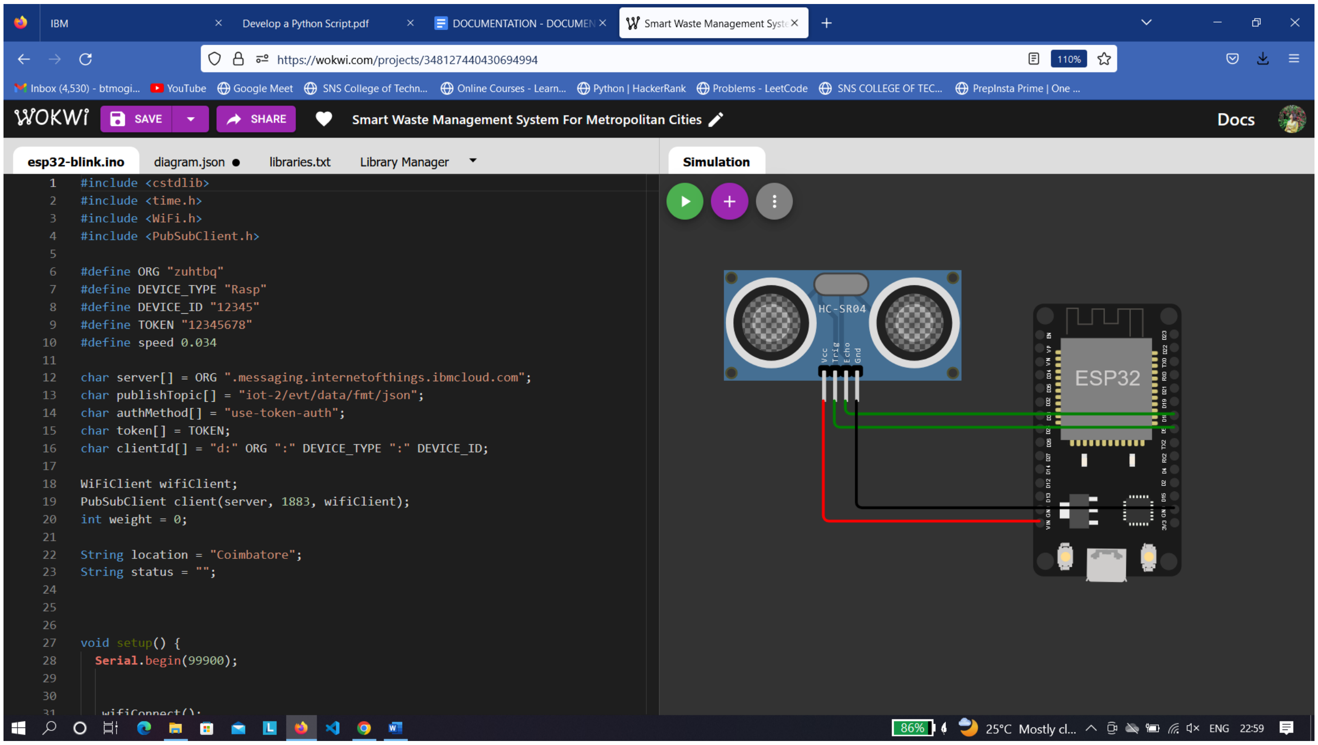
Not a member? Sign up now

PYTHON CODE FOR HARDWARE

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials
organization = "nw3318"
deviceType = "123"
deviceId = "1234567"
authMethod = "token"
authToken = "12345678"
# Initialize GPIO
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="lighton":
        print ("led is on")
    elif status == "lightoff":
        print("led is off")
    elif status == "motoron":
        print("motor is on")
    elif status == "motoroff":
        print("motor is off")
    else :
    print ("please send proper command")
    #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
temp=random.randint(0,100)
humid=random.randint(0,100)
soilmoist=random.randint(0,100)
```

```
data = { 'temp' : temp, 'humid': humid, 'soilmoist': soilmoist }
#print data
def myOnPublishCallback():
        print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % humid,"Soilmoisture =
        %s %%" % soilmoist, "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()
```

Simulation :



```
#include <cstdlib>
#include <time.h>
#include <WiFi.h>
#include <PubSubClient.h>

#define ORG "zuhtbq"
#define DEVICE_TYPE "Rasp"
#define DEVICE_ID "12345"
#define TOKEN "12345678"
#define speed 0.034

char server[] = ORG ".messaging.internetofthings.ibmcloud.com";
char publishTopic[] = "iot-2/evt/data/fmt/json";
char authMethod[] = "use-token-auth";
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;

WiFiClient wifiClient;
PubSubClient client(server, 1883, wifiClient);
int weight = 0;

String location = "Coimbatore";
String status = "";



void setup() {
  Serial.begin(99900);


    wifiConnect();
```

Simulation Code:

```
#include <cstdlib>
#include <time.h>
#include <WiFi.h>
#include <PubSubClient.h>

#define ORG "zuhtbq"
#define DEVICE_TYPE "Rasp"
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char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;

WiFiClient wifiClient;
PubSubClient client(server, 1883, wifiClient);
int weight = 0;

String location = "Coimbatore";
String status = "";



void setup() {
  Serial.begin(99900);


   wifiConnect();
   mqttConnect();
}

void loop() {

  srand(time(0));

    //initial variable
    int p;
```
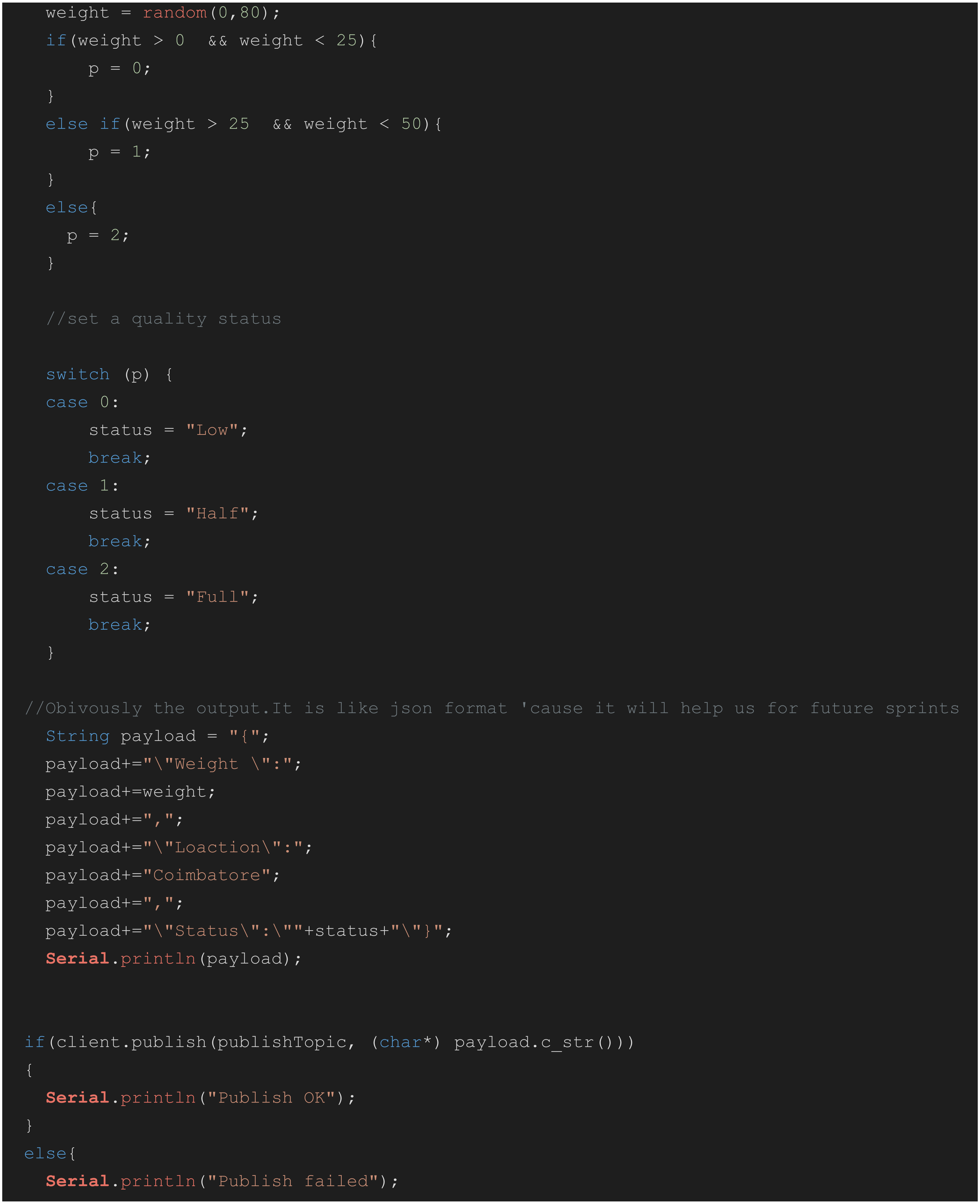
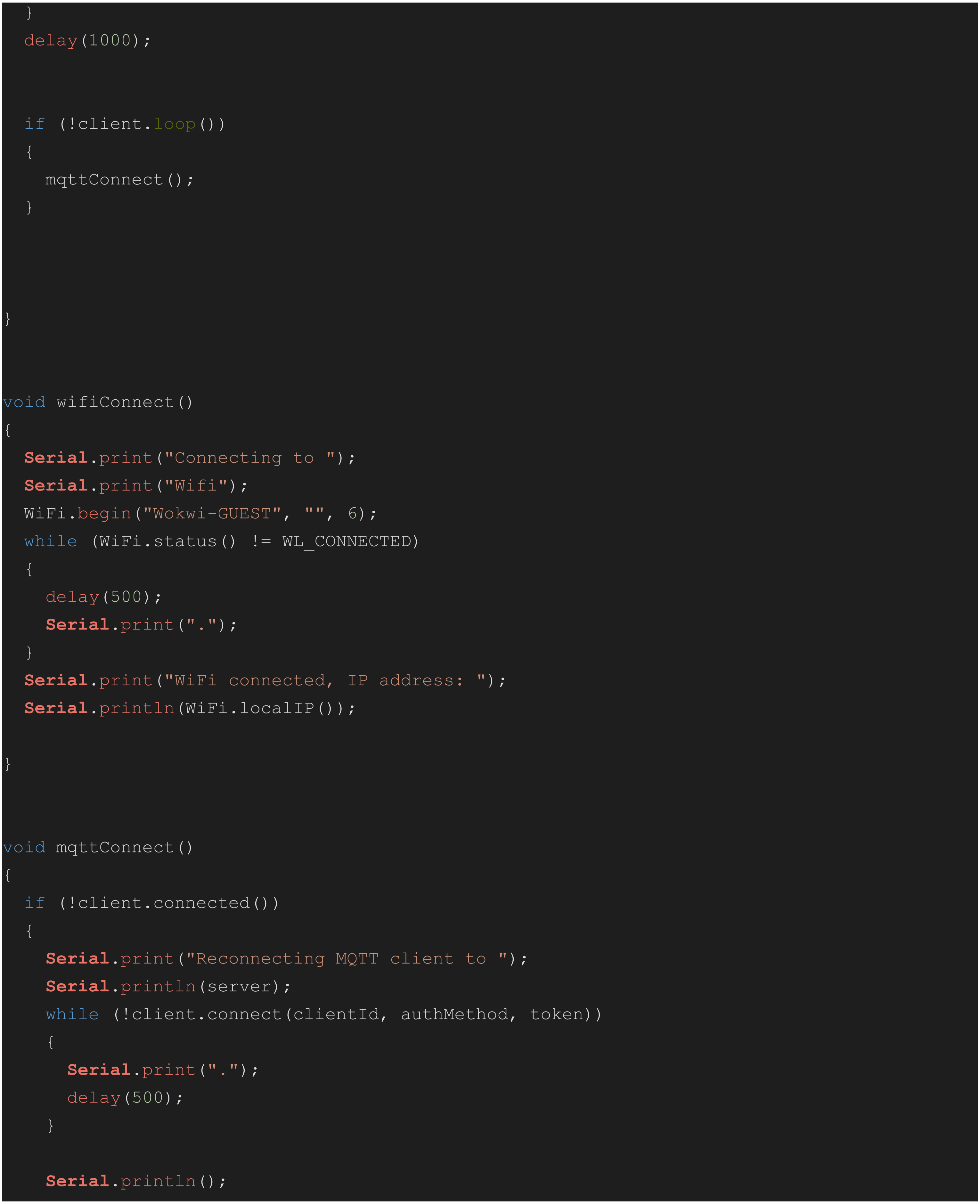
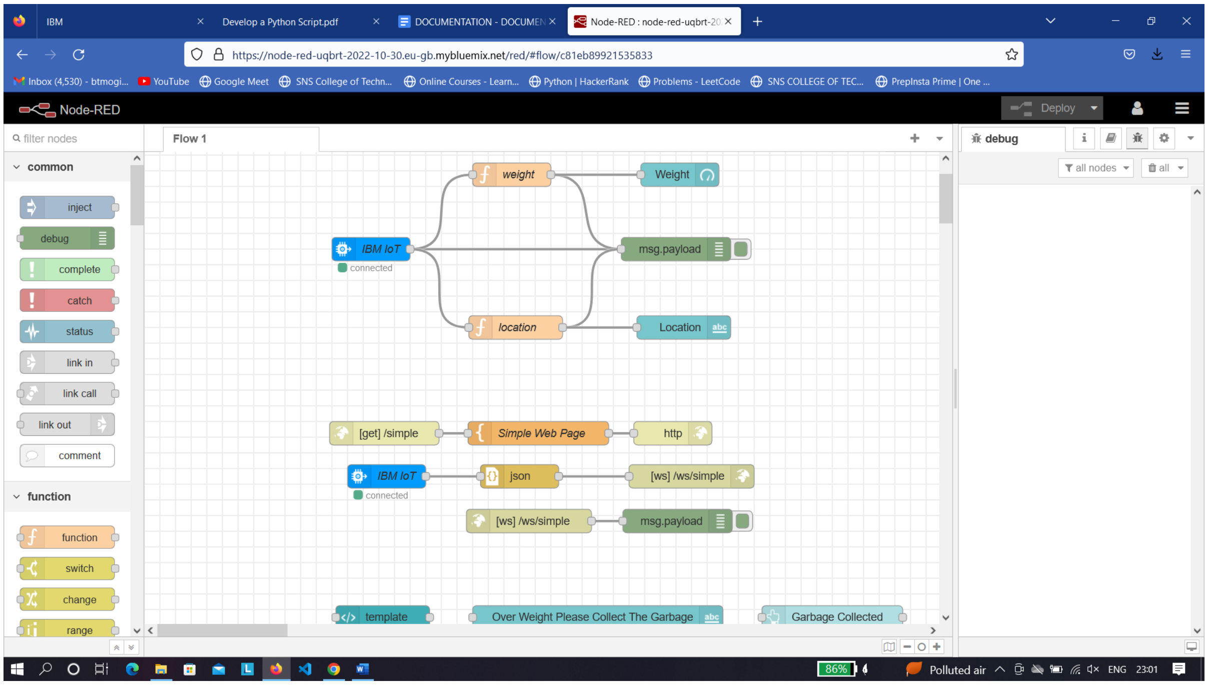



```
  weight = random(0,80);
  if(weight > 0  && weight < 25){
      p = 0;
  }
  else if(weight > 25  && weight < 50){
      p = 1;
  }
  else{
    p = 2;
  }

  //set a quality status

  switch (p) {
  case 0:
      status = "Low";
      break;
  case 1:
      status = "Half";
      break;
  case 2:
      status = "Full";
      break;
  }

//Obivously the output.It is like json format 'cause it will help us for future sprints
  String payload = "{";
  payload+="\"Weight \":";
  payload+=weight;
  payload+=",";
  payload+="\"Loaction\":";
  payload+="Coimbatore";
  payload+=",";
  payload+="\"Status\":\""+status+"\"}";
  Serial.println(payload);


if(client.publish(publishTopic, (char*) payload.c_str()))
{
  Serial.println("Publish OK");
}
else{
  Serial.println("Publish failed");
```

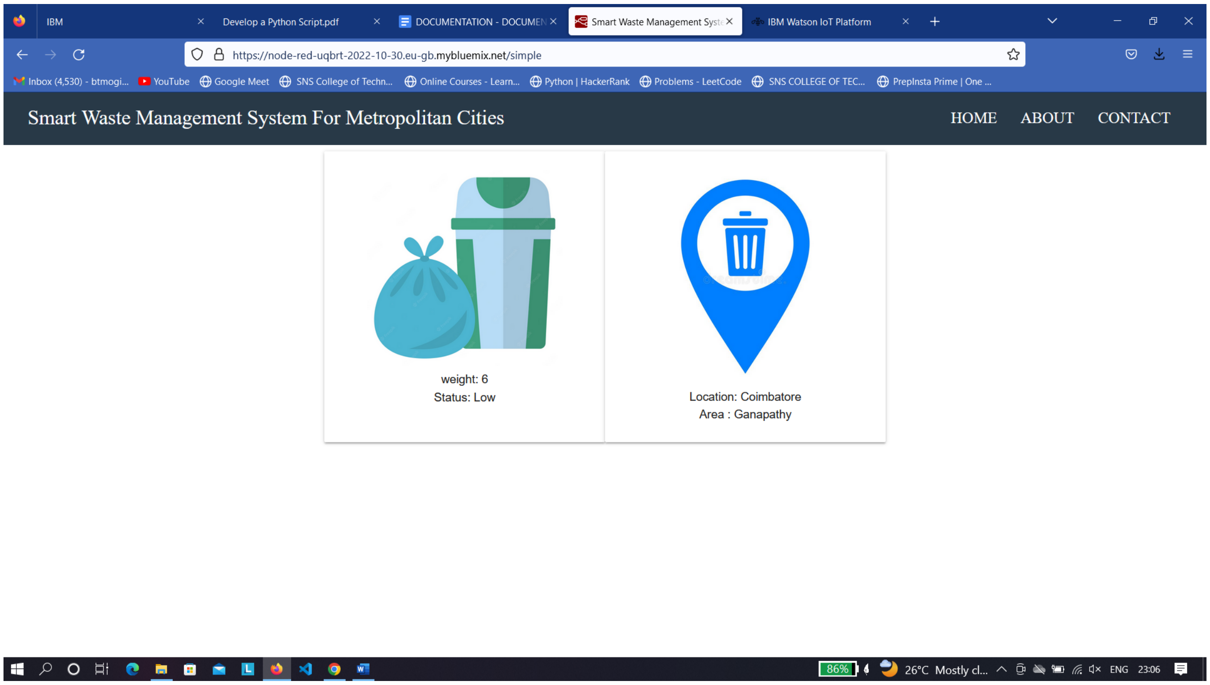


```
  }
  delay(1000);


  if (!client.loop())
  {
    mqttConnect();
  }



}


void wifiConnect()
{
  Serial.print("Connecting to ");
  Serial.print("Wifi");
  WiFi.begin("Wokwi-GUEST", "", 6);
  while (WiFi.status() != WL_CONNECTED)
  {
    delay(500);
    Serial.print(".");
  }
  Serial.print("WiFi connected, IP address: ");
  Serial.println(WiFi.localIP());

}


void mqttConnect()
{
  if (!client.connected())
  {
    Serial.print("Reconnecting MQTT client to ");
    Serial.println(server);
    while (!client.connect(clientId, authMethod, token))
    {
      Serial.print(".");
      delay(500);
    }

    Serial.println();
    }
}
```

Node-Red:



OUTLOOK:


IBM
Develop a Python Script.pdf
DOCUMENTATION - DOCUMEN
Smart Waste Management Syst
IBM Watson IoT Platform
https://node-red-uqbrt-2022-10-30.eu-gb.mybluemix.net/simple
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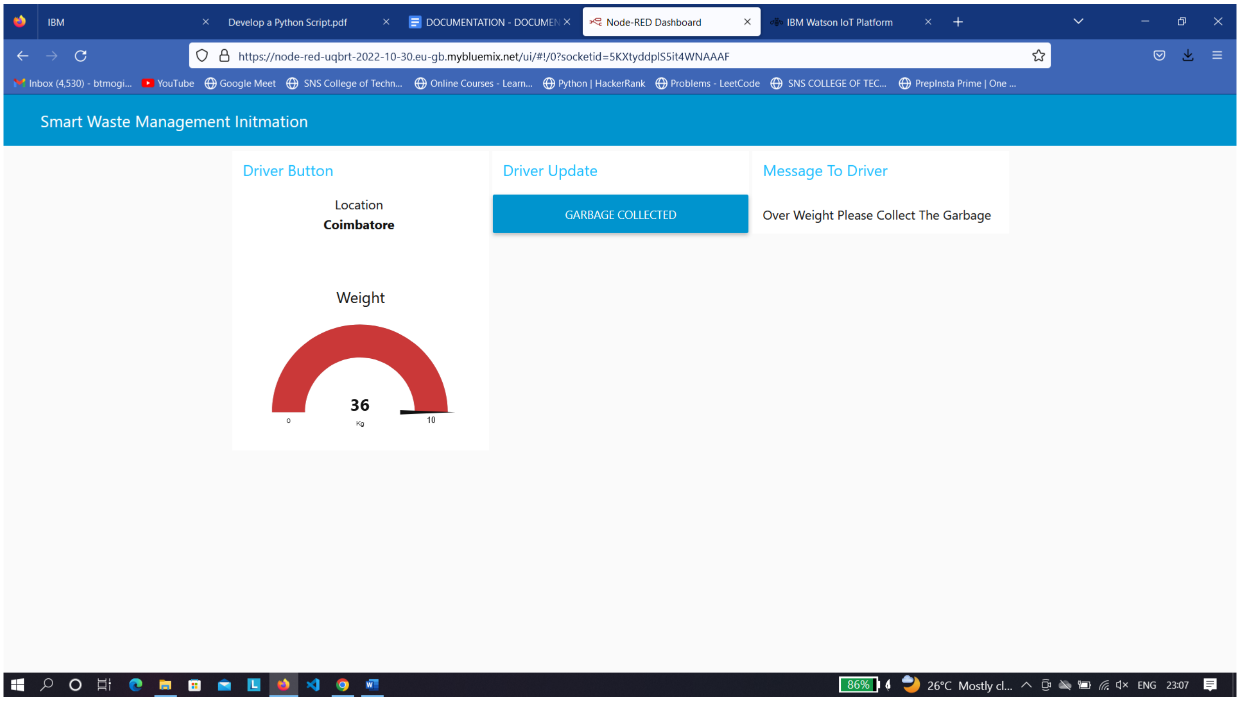
YouTube
Google Meet
SNS College of Techn...
Online Courses - Learn...
Python | HackerRank
Problems - LeetCode
SNS COLLEGE OF TEC...
PrepInsta Prime | One ...
86%
26°C Mostly cl...
ENG
23:06

Smart Waste Management System For Metropolitan Cities

HOME ABOUT CONTACT

weight: 6
Status: Low

Location: Coimbatore
Area : Ganapathy



Smart Waste Management Initmation

Driver Button

Location
Coimbatore

Weight

36

Driver Update

GARBAGE COLLECTED

Message To Driver

Over Weight Please Collect The Garbage

TESTING

8.1 TEST CASE:

TEST CASE 1:
WEIGHT: 0 KG
STATUS: NOT FILLED, DUSTBIN IS EMPTY

TEST CASE 2:
WEIGHT: 10KG
STATUS:20% FILLED, NOT READY TO DISPOSE

TEST CASE 3:
WEIGHT: 20KG
STATUS: 40% FILLED, NOT READY TO DISPOSE

TEST CASE 4:
WEIGHT: 30KG
STATUS: 60% FILLED, NOT READY TO DISPOSE

TEST CASE 5:
WEIGHT: 45KG
STATUS: 90% FILLED, READY TO DISPOSE

RESULTS

9.1 PERFORMANCE METRICS

Total MSW Generated = Total tons Recycled + Total tons Recovered + Total tons Disposed MSW = Municipal Solid Waste (does not include industrial, special and demolition wastes)

ADVANTAGES:

- **A reduction in the number of waste collections needed by up to 80%,**
- **Less manpower, emissions, fuel use and traffic congestion**.
- A reduction in the number of waste bins needed.
- Analytics data to manage collection routes and the placement of bins more effectively.

DISADVANTAGES:

- Though waste management creates employment, it only has the ability to produce low-quality jobs.
- These jobs include right from sorting the garbage collector to the intensive and laborious jobs that are needed in the factories and outlets.

CONCLUSION:

Monitoring the fullness of bins through the use of sensors, it is possible to achieve a more efficient system than the current existing. Our idea of “Smart waste management system”, mainly concentrates on Monitoring the waste management, providing a smart technology for waste system, avoiding human intervention, reducing human time and effort and which results in healthy and waste ridden environment. The proposed idea can be implemented for smart cities where the residents would be busy enough with their hectic schedule and wouldn’t have enough time for managing waste. The bins can be implemented in a city if desired where there would be a large bin that can have the capacity to accumulate the waste of solid type for a single apartment. The cost could be distributed among the residents leading to cheaper service provision.