PNT2022TMID41546

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Information technology

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CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

This project aims to design and implement a combination of IoT and Application Development based Waste Management Systems. The combination of IoT and Application Development has plenty of applications such as home security systems, payment technologies, intruder recognition systems, etc. This research utilizes the application for Waste Management. The kit consists of hardware and software parts. The hardware part comprises a sensor unit, which detects the volume of waste present in the bin, a weight-detecting garbage system, a GPS locator, and a GSM module to communicate with a mobile device. The software part uses Python codes and C codes.

1.2 PURPOSE

The purpose of this project is a small step to Reduce Air, Water, and Soil Pollution. The world faces major environmental challenges associated with waste generation and inadequate waste collection, transport, treatment, and disposal. It is a matter of health safety. Tuberculosis, pneumonia, diarrhoea, tetanus, whooping cough, etc. are other common diseases spread due to improper waste management. The toxic wastes can lead to different kinds of pollution - air, water, and soil. Our current systems cannot cope with the volumes of waste generated by an increasingly urban population and this has a huge impact on the environment and public health. It reduces manual labour, increases sustainable development, and reduces common health issues related to improper waste management techniques.

CHAPTER 2

LITERATURESURVEY

2.1 EXISTING PROBLEM

Waste management plays a crucial role these days. As environmental concerns grow, wastes are to be properly managed and recycled. Improper management will lead to air pollution, and soil erosion may even affect human health. Lisa Safer, et al. enhance the point about the health impacts of incineration, landfill, composting, land spreading sewage sludge, and sewage discharges. A step to reduce the risks is the proposed work of waste management using IoT. Gopal Krishna Shyam, et al. submitted a work that utilizes sensors and uses an IoT algorithm that can read, collect, and transmit a huge volume of data over the Internet. These data, when put into a Spatio-temporal context and processed by intelligent and optimized algorithms, can be dynamically handled by waste collection processes. The published work by Tran Anh Khoa et al put forth a low-cost IoT architecture that efficiently achieves waste management by predicting the probability of the waste level in trash bins, using machine learning and graph theory, and determining the shortest path of waste collection. It also examines the data transfer on the LoRa module and demonstrates the advantages of the system, which is implemented through a simple circuit designed with low cost, ease of use, and replaceability. "Challenges and Opportunities of Waste Management in IoT-Enabled Smart Cities: A Survey" by Theodoros Anagnostopoulos, et al. gives detailed information on various aspects of IoT in waste management. With the above references, this project proposes a Smart Waste Management System For Metropolitan Cities that detects the level of Garbage in bins, and the weight of the garbage in the bin and alerts the authorized person to empty the bin whenever the bins are full. With further advancements, the Garbage level of the bins can be monitored through a Web App through which we can view the location of every bin by sending GPS location from the device.

2.2 REFERENCES

[1] Shyam, Gopal Kirshna, Sunilkumar S. Manvi, and Priyanka Bharti. "Smart waste management using Internet-of-Things (IoT)." IEEE Computing and Communications Technologies (ICCCT), (2017) pp. 199-203.

[2] Kurre, Vishesh Kumar."Smart Garbage Collection Bin overflows Indicator using IOT." International Research Journal of Engineering and Technology (IRJET) (2016).

[3] Folianto, Fachmin, Yong Sheng Low, and Wai Leong Yeow. "Smartbin: Smart waste management system." Tenth IEEE International conference on Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP), (2015).

[4] Vu, Dung, and Georges Kaddoum. "A waste city management system for smart cities applications." (2017).2017 Advances in Wireless and Optical Communications

[5] Kumar, S. Vinoth, T. Senthil Kumaran, A. Krishna Kumar, and MahanteshMathapati. "Smart garbage monitoring and clearance system using internet of things." IEEE Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials, (2017).

[6] Swati Dewangan,IoT- Enabled Intelligent Solid Waste Management System for Smart City: A Survey, ISSN NO : 2249-7455

[7] Amoo OM, Fangbale RL (2013). Renewable municipal solid waste pathways for energy generation and sustainable development in the Nigerian context. International Journal of Energy and Environmental Engineering, 4(1): 42.J.H. Chuang. Potential-Based Approach for Shape Matching and Recognition. Pattern Recognition,

2.3 PROBLEM STATEMENT DEFINITION

Waste management in metropolitan cities faces numerous challenges. The main problem faced by the metropolitan cities are detecting the garbage level weather it filled or not and also we need to measure the weight of the garbage bin. Then alerts the authorized person to empty the bin whenever the bins are full. We need to develop a web application to monitor the status of the bins remotely at anywhere. The application should provide the location of the every bin connected in the application with the help of global positioning system (GPS). The indication of the bins and the location of the every bin should be provided by web applications simultaneously.
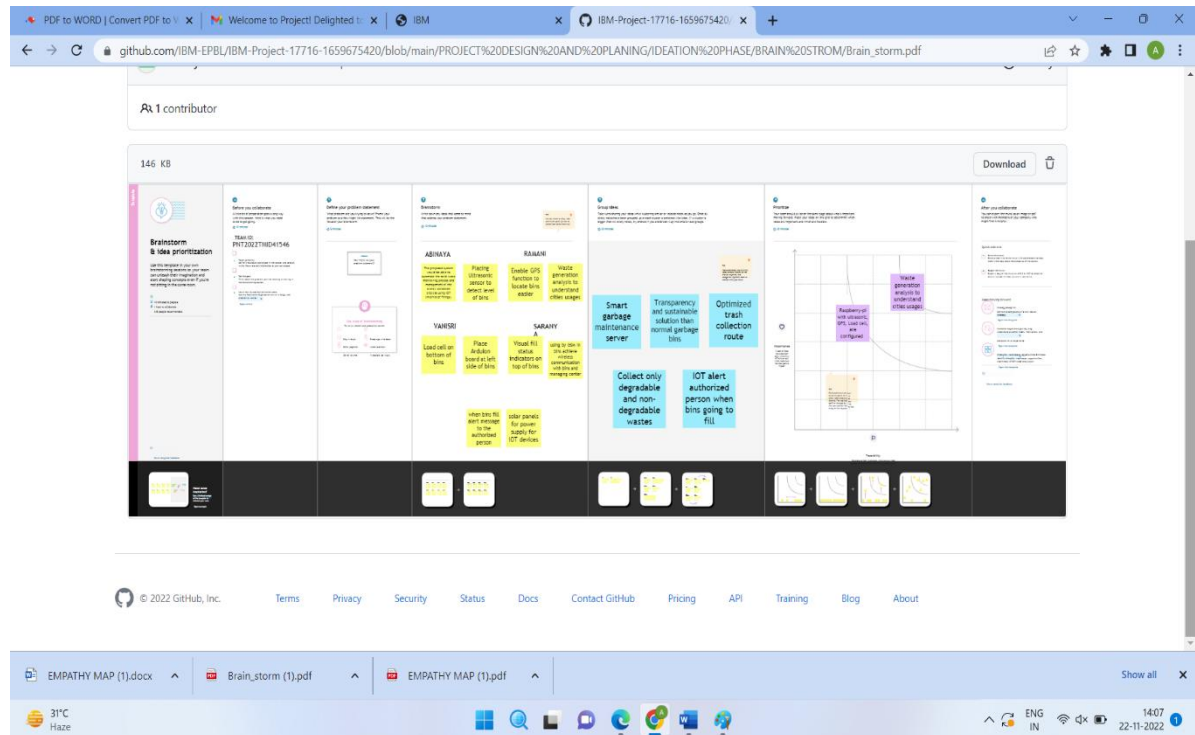
CHAPTER 3

IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

3.2 IDEATION & PROCESSIING

3.3 PROPOSED SOLUTION

S. No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To develop economic waste management system for each village and city
2.	Idea / Solution description	To seggregate the different types of wastes by using modern technologies.
3.	Novelty / Uniqueness	Trash talker, Image processing technique, using rasperry PI camera,pick up hand, conveyor belt ,hand sensor smart bins,giving notifcaton by sector alarm.
4.	Social Impact / Customer Satisfaction	By implementing this we can make our environment clean and control the spreading of infectious diseases from garbage
5.	Scalability of the Solution	Image processing technique , Conveyor belt, pick up hand, Trash talker and sensors are usedto separate the wastes , control the overfow of waste and gives alarm to the respective sector.

3.4 PROBLEM SOLUTIONFIT

1. CUSTOMER SEGMENT(S) **CS**	6. CUSTOMER LIMITATIONS EG. BUDGET, DEVICES **CL**	5. AVAILABLE SOLUTIONS PLUSES & MINUSES **AS**
The government, local authorities. neighboring community, public. environmental activists and media has been identified as a key stakeholders	Provide better control over odor. Reduce pollution.	Recycling the nonbiodegradable waste material .Advanced technologies By reusing the product.
2. PROBLEMS / PAINS + ITS FREQUENCY **PR**	**9. PROBLEM ROOT / CAUSE** **RC**	**7. BEHAVIOR** + ITS INTENSITY **BE**
1. Tried of bugs and insects. 2. Air emission. 3. Good harvest. 4. Possibility of customisation	Industrial waste , drainage waste, Household waste , manufacturing and agriculture	A creative environment, Big complex garden, Place for experiment.
3. TRIGGERS TO ACT **TR**	**10. YOUR SOLUTION** **SL**	**8. CHANNELS of BEHAVIOR** **CH**
Offer something to get something bigger in return.	Reduce the amount of waste that is created. Reuse waste material that would be disgraded.	ONLINE: May be they go for advance technologies.
4. EMOTIONS BEFORE / AFTER **EM**		
BEFORE: tension. Low confidence ,thinking about problem and solution. AFTER: they are very happy , getting more confidence and ideas		OFFLINE: Frequent food waste collection, to encourage participation.

CHAPTER 4
REQUIRMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

Functional Requirements:

Following are the functional requirements of the proposed solution.

4.2 NON-FUNCTIONALREQUIREMENTS

Non-functional Requirements:

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

NFR No.	Non-Functional Requirement	Description
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 needsin waste management, behavior and experience.
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.
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.
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%.

CHAPTER 5

PROJECT DESIGN

5.1 Project Design Phase-II Data Flow Diagram & User Stories
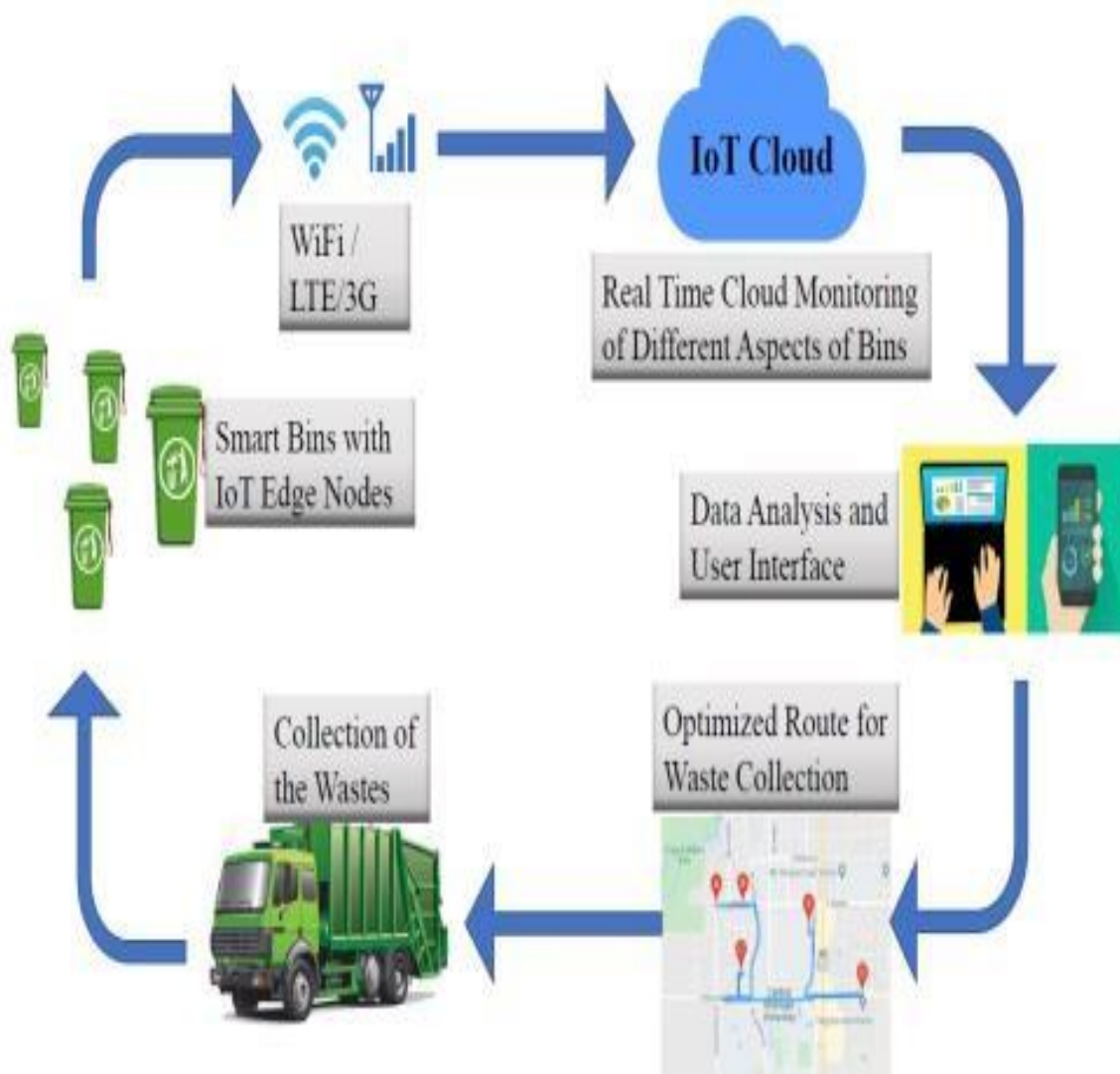
5.2 SOLUTION ARCHITECTURE

SOLUTIONARCHITECTURE

Design

- 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.
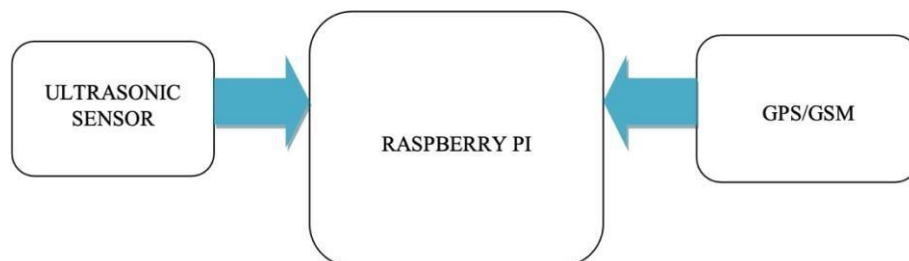
Software and system required:

- Python IDLE
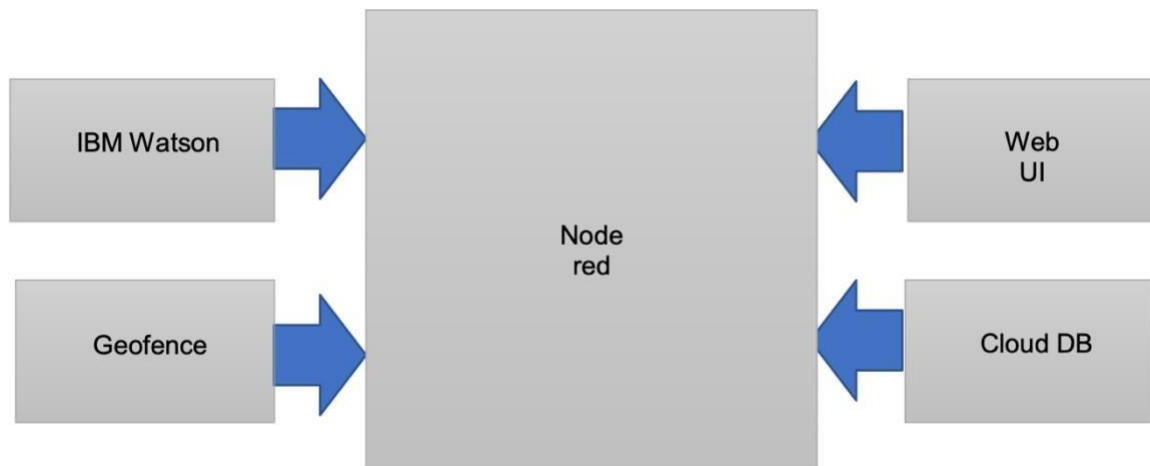- 4GB processor and OS-Windows/Linux/MAC

Block diagram:
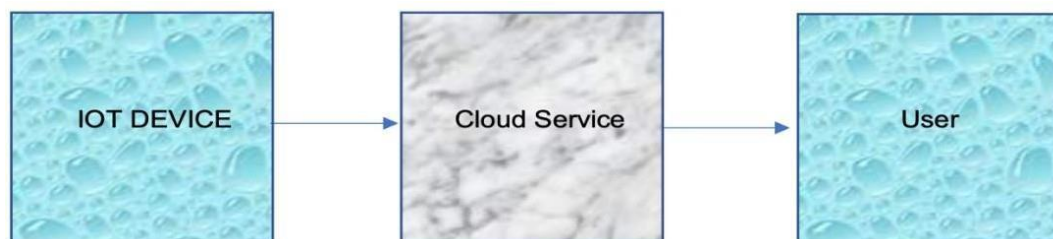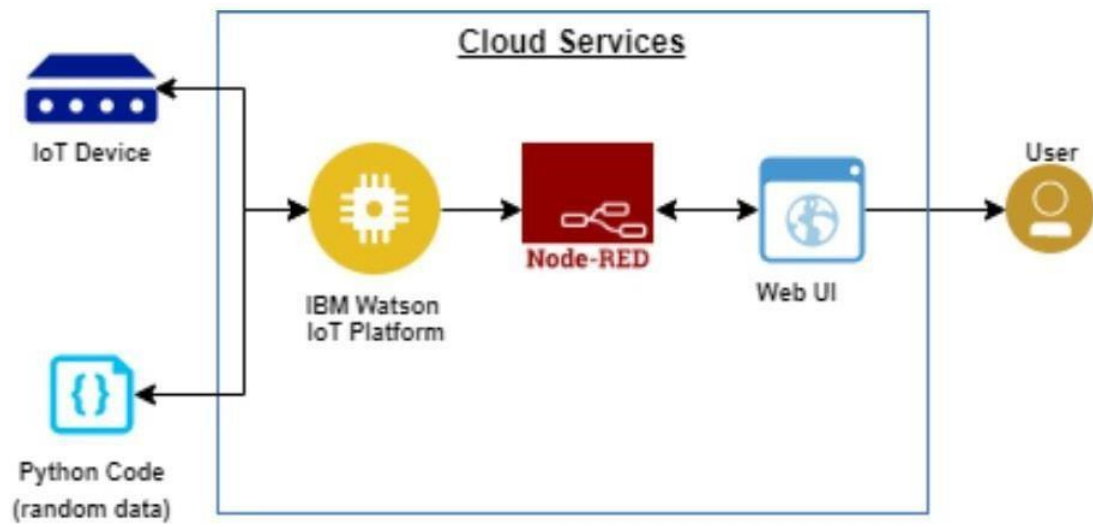
IOT Device

Cloud service:

5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Web user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can able to access the status the status every bin in the city	High	Sprint-1
Customer (Cloud user)	Access	USN-2	As a user, I can access database of the garbage bin	I can receive confirmation email & click confirm	High	Sprint-2
Customer Care Executive	Gmail account	USN 3	As a user, I can register for the application through Gmail	I can register and access the model	Medium	Sprint-1
Administrator	Login	USN 4	As a Admin, I can log into the application by entering email & password	I can access the garbage database directly	High	Sprint-1
Customer (User)	Internet Facility	USN 5	As a user I can give input to the model through the website	I can get location and status of the bin	High	Sprint-2
Customer (User)	Laptop or Computer or Mobile	USN 6	As a user I can view the pictorial garbage status and able to view the location of the bin in a maps	I can insights on garbage status	High	Sprint-2

CHAPTER 6

PROJECT PLANNING& SCHEDULING

6.1 Sprint Planning & Estimation

TITLE	DESCRIPTION	DATE
Literature Survey & Information Gathering	Literature survey on the selected project & gathering information by referring the, technical papers,research publications etc.	12 SEPTEMBER 2022
Prepare Empathy Map	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements	24 SEPTEMBER 2022
Ideation	List the by organizing the brainstorming session and prioritize the top 3 ideas based on the 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.	23 SEPTEMBER 2022
Problem Solution Fit	Prepare problem - solution fit document.	02 OCTOBER 2022
Solution Architecture	Prepare solution architecture document.	03 OCTOBER 2022

6.2 Sprint Delivery Schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	login	USN-1	As a Administrator, I need to give user id and passcode for ever workers over there in municipality .	10	High	ABINAYA
,Sprint-1	Login	USN-2	As a Co-Admin, I'll control the waste level by monitoring them vai real time web portal. Once the filling happens, I'll notify trash truck with location of bin with bin ID	10	High	SARANYA
Sprint-2	Dashboard	USN-3	As a Truck Driver, I'll follow Co-Admin's Instruction to reach the filling bin in short roots and save time	20	medium	RAMANI
Sprint-3	Dashboard	USN-4	As a Local Garbage Collector, I'll gather all the waste from the garbage, load it onto a garbage truck, and deliver it to Landfills	20	Medium	VANISRI
Sprint-4	Dashboard	USN-5	As a Municipality officer, I'll make sure everything is proceeding as planned and without any problems		High	

Project Tracker, Velocity & 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	30 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	30	3 NOV 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	49	6 NOV 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	50	9 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)

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

CHAPTER 7

CODING & SOLUTION

7.1 Feature 1

- IOT DEVICE

- WOKWI SOFTWARE

- IOT WATSON PLATFORM

- NODE RED

- WEB UI

- CLOUDANT DB

7.2 Feature 2

- REGISTRATION

- LOGIN

- VERIFICATION

- SELECT THE CITY

- DISPLAY THE STATUS OF BIN

- ADD QUERY

7.3. DATA BASE SCHEME

```javascript
const cap_status = document.getElementById('cap_status');

const alert_msg = document.getElementById('alert_msg');

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

ref.on("value", function(snapshot)
{
  snapshot.forEach(function (childSnapshot) {
    var value = childSnapshot.val();

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


        alert_msg.innerHTML= `${alert_msg_val}`;
  });
}, function (error) {
  console.log("Error: " + error.code);
});
```
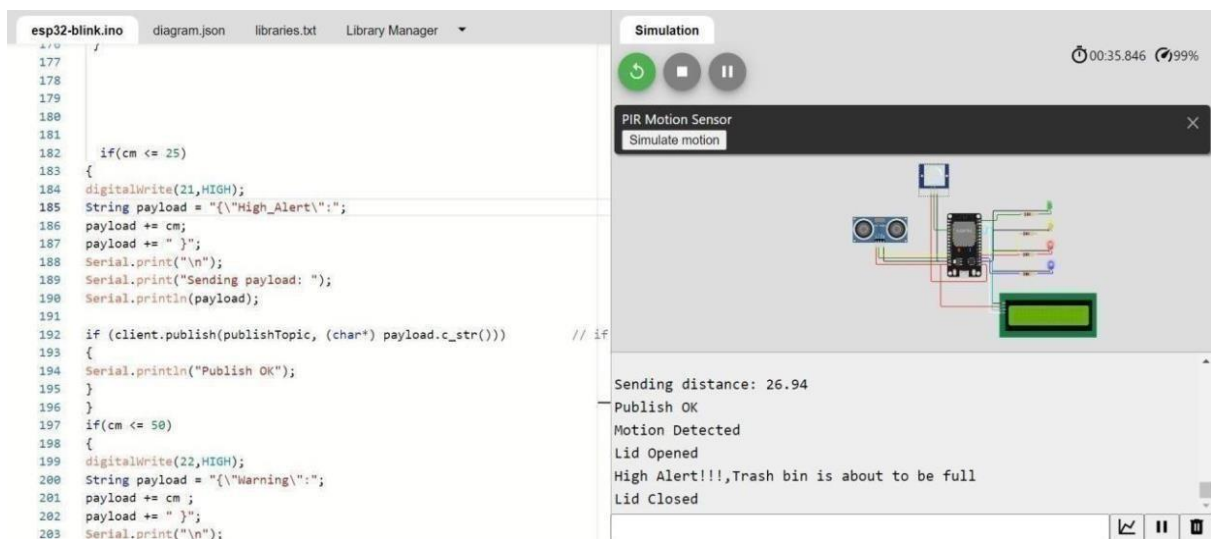
CHAPTER 8

TESTING

8.1 Test Cases

S NO	TEST CASE	FEATURE	STEPS TO EXECUTE	EXPECTED RESULT	ACTUAL RESULT	EXECUTED BY
1	FUNCTIONAL	LOGIN	LOGIN TO EXECUTE BY FILLING THE DETAILS	CORRECT LOGIN CREDENTIALS	WORKING AS EXPECTED	**SATHISH KUMAR K**
2	FUNCTIONAL	REGISTRATION	REGISTRATION THROUGH FORMS	REGISTRATION FORM TO BE FILLED AND DISPLAYED	WORKING AS EXPECTED	PRAVEEN K
3	FUNCTIONAL	WOKWI	TO DEVELOP THE IOT DEVICE AND CODE THE IOT DEVICE	SENSE THE DATA	WORKING AS EXPECTED	RAJA KUMAR YADAV
4	FUNCTIONAL	IBM WATSON	PUSH THE SENSED DATA FROM WOKWI	SENSED DATA IN IBM WATSON	WORKING AS EXPECTED	PRINCE RAJ
5	FUNCTIONAL	NODE RED	TO CONNECT WITH THE IBM WATSON AND THEN COLLECT THE SENSED DATA AND DISPLAY IN NODE RED DASHBOARD	VISUAL REPRESENTATION OF SENSED DATA IN NODE RED DASHBOARD	WORKING AS EXPECTED	SATHISH KUMAR K AND PRAVEEN K
6	TESTING	TEST THE ENTIRE WORK	TO CHECK ALL THE MENTIONED TESTCASE ARE WORKING PROPERLY	TEST CASE ARE WOKINGPROPERLY	WORKING AS EXPECTED	RAJA KUMAR YADAV AND PRINCE RAJ

CHAPTER 9

RESULTS

9.1 Perfomance Metrics
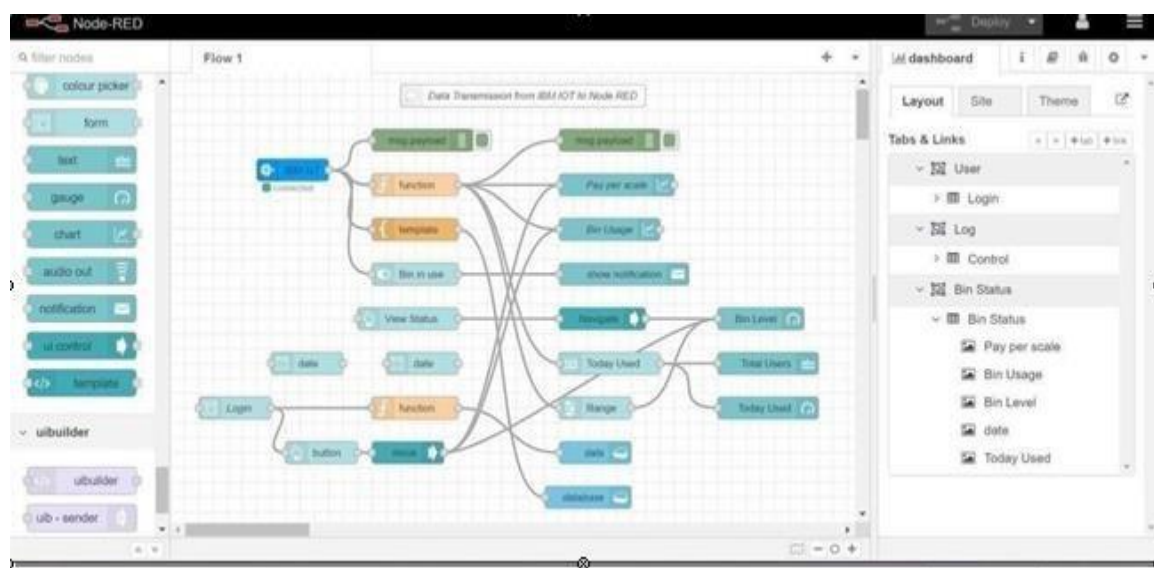
- ### IOT DEVICE SIMULATION IN WOKWI SOFTWARE

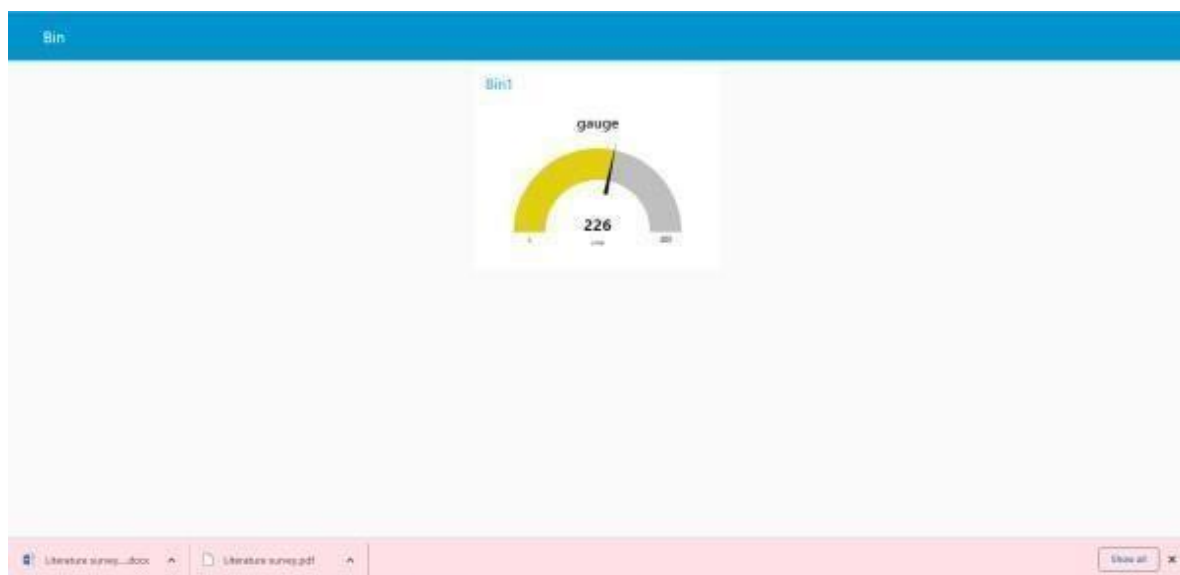- ### SENSED THE DATA VISUALIZATION IN IBM WATSON

- NODE RED CONNCETIONS

- VISUALIZATION OF SENSED DATA IN NODE RED DASHBOARD

CHAPTER 10

ADVANTAGES & DISADVANTAGES

Advantages

The advantage of using this system is that it overcomes the health and environmental hazards of improper waste management processes to a certain extent. This cannot be the only solution but one of the solutions to sustainable development. The use of solar panels to produce the required energy can be of great use as it is not a renewable resource, but it powers the sensor for detection and the IoT Devices present in the Truck for real-time GPS Tracker. This system is cheap and very efficient. The door - to door collection also helps the differently abled to manage the waste properly. The utilization of simple everyday gadgets makes it easy to understand for the customers to completely use the product. Anyone from age 5-90 can use the product. This is not the restriction that is mentioned but the ease and comfort of the app for all ages. One of the main advantages is that awareness is created among the users. They come to know about the anthropocentric character that degrades the environment to a great level and in turn affects health. This acts as a change or at least a motivation to a certain extent to support, love and care for mother Earth which has done everything to satisfy our needs and all we do is degrade it. But it's time we repay it, help her and stop the antagonist's torture, and live happily.

Disadvantages

If something has a lot of positive effects there would be something negative. Nothing can be perfect or in an ideal condition. All we can do is satisfy a certain level and make it more advantageous than considering the disadvantages. One of these kinds is the adaptation to the new technology would take a lot of time to get accustomed to as a daily life habit. Another disadvantage is considering security. Well-secured information for the user will cost a lot and would make the project a more reliable one, as the user's personal information is collected, it is the owner's responsibility or the creator's responsibility to make it with a desirable or highly secured system. Considering the high competition in this market, the initial cost would be high. Investing in a good cause makes us satisfied. Investing in a profitable system makes us innovate more but the drawback is that in the initial stages a very high amount is expected or compelled to be spent to market or advertise the product.

CHAPTER 11

CONCLUSION

A proper waste management system is essential for sustainable development. This would be a small step towards a developing nation overcoming the limitations of waste management. This step secures us fromthe environmental and health hazards that are being induced as a slow poison is interrelated. The technology in this period of the 21st century refines us and the surroundings to a better persona and a better place to live. It is the time when we have to bring in change and portray respect, love and care toward the beings that have helped us for our survival. There is a solution. And, this Project is just one very small part of it.

CHAPTER 12

FUTURE SCOPE

A proper waste management system is essential for sustainable development. This would be a small step towards a developing nation overcoming the limitations of waste management. This step secures us fromthe environmental and health hazards that are being induced as a slow poison is interrelated. The technology in this period of the 21st century refines us and the surroundings to a better persona and a better place to live. It is the time when we have to bring in change and portray respect, love and care toward the beings that have helped us for our survival. There is a solution. And, this Project is just one very small part of it.

CHAPTER 13

APPENDIX

SOURCE CODE

- Code for IoT device in Wokwi

```
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 16, 2); // I2C address 0x3F, 16 column and 2 rows
int trigPin = 9;   // TRIG pin
int echoPin = 8;   // ECHO pin
float duration_us, distance_cm,distance;
void setup() {
 lcd.init();            // initialize the lcd
 lcd.backlight();
 pinMode(7,OUTPUT);
 pinMode(6,OUTPUT);
 pinMode(5,OUTPUT);
 pinMode(4,OUTPUT);      // open the backlight
 pinMode(trigPin, OUTPUT); // config trigger pin to output mode
 pinMode(echoPin, INPUT); // config echo pin to input mode
}
void loop() {
 // generate 10-microsecond pulse to TRIG pin
 digitalWrite(trigPin, HIGH);
 delayMicroseconds(10);
 digitalWrite(trigPin, LOW);
 // measure duration of pulse from ECHO pin
 duration_us = pulseIn(echoPin, HIGH);
 // calculate the distance
 distance_cm = 0.017 * duration_us;
 distance=400-distance_cm;
 lcd.clear();
```

```
 lcd.setCursor(0, 0); // start to print at the first row
 lcd.print("waste level: ");
 lcd.print(distance);
 digitalWrite(6,HIGH);
 digitalWrite(7,LOW);
 digitalWrite(5,LOW);
 digitalWrite(4,LOW);
 if(distance>=175)
 {
  digitalWrite(5,HIGH);
  digitalWrite(6,LOW);
  digitalWrite(7,LOW);
  digitalWrite(4,LOW);
 }
 if(distance>=275)
 {
  digitalWrite(4,HIGH);
  digitalWrite(6,LOW);
  digitalWrite(5,LOW);
  digitalWrite(7,LOW);
 }
 if(distance>=375)
 {
  digitalWrite(7,HIGH);
  digitalWrite(6,LOW);
  digitalWrite(5,LOW);
  digitalWrite(4,LOW);
 }

 delay(500);
}
```

- Code for connecting to IoT Watson

```
#include <LiquidCrystal_I2C.h>
#include <WiFi.h>
#include <PubSubClient.h>
#include<WiFiClient.h>
LiquidCrystal_I2C lcd(0x27, 20, 4); // I2C address 0x3F, 16 column and 2 rows


int trigPin = 2;    // TRIG pin
int echoPin = 15;   // ECHO pin


#define ORG "qippa4"
#define DEVICE_TYPE "Esp32"
#define DEVICE_ID "Waste"
#define TOKEN "C72(GeQy)UPSVtHdUw"
char server[] = ORG ".messaging.internetofthings.ibmcloud.com"; // server name
char publishTopic[] = "iot-2/evt/data/fmt/json";
char topic[] = "iot-2/cmd/led/fmt/String"; // cmd Represent type and command is test format of strings
char authMethod[] = "use-token-auth"; // authentication method
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID; //Client id


WiFiClient wifiClient; // creating instance for wifi
PubSubClient client(server, 1883, wifiClient);

void setup() {
 lcd.init();          // initialize the lcd
 lcd.backlight();
 pinMode(5,OUTPUT);
 pinMode(18,OUTPUT);
 pinMode(19,OUTPUT);
 pinMode(23,OUTPUT);
 pinMode(34,INPUT);
 pinMode(14,OUTPUT);
```

28

```
   // open the backlight
   pinMode(trigPin, OUTPUT); // config trigger pin to output mode
   pinMode(echoPin, INPUT);
   Serial.begin(115200);
   wifiConnect();
   mqttConnect();
// config echo pin to input mode
}


float readcmCM()
{
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
int duration = pulseIn(echoPin, HIGH);
return duration * 0.034 / 2;
}


void  loop()
{


lcd.clear();


publishData();
delay(500);
if (!client.loop())
{
mqttConnect(); // function call to connect to IBM
}
}


/* -retrieving to cloud  */
```

```cpp
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);
}
initManagedDevice();
Serial.println();
}
}
void initManagedDevice()
{
if (client.subscribe(topic))
{
Serial.println("IBM subscribe to cmd OK");
}
```

```
else
{
Serial.println("subscribe to cmd FAILED");
}
}
void publishData()
{
float cm = readcmCM();


if(digitalRead(34))
{
Serial.println("Motion Detected"); Serial.println("Lid Opened"); digitalWrite(14, HIGH);


}
else
{
digitalWrite(14, LOW);
} //PIR motion detection



if(digitalRead(34))
{
if(cm <= 100)
//Bin level detection
{
digitalWrite(23, HIGH);
Serial.println("High Alert!!!,Trash bin is about to be full");
Serial.println("Lid Closed");
lcd.print("Full! Don't use");
delay(2000);
lcd.clear();
digitalWrite(18,LOW);
digitalWrite(19,LOW);
digitalWrite(5,LOW);
```

```
}
else if(cm > 100 && cm < 200)
{
digitalWrite(5, HIGH);
Serial.println("Warning!!,Trash is about to cross 75% of bin level");
digitalWrite(18,LOW);
digitalWrite(19,LOW);
digitalWrite(23,LOW);
}
else if(cm > 200 && cm < 300)
{
digitalWrite(18, HIGH);
Serial.println("Warning!!,Trash is about to cross 50% of bin level");
digitalWrite(5,LOW);
digitalWrite(19,LOW);
digitalWrite(23,LOW);
}
else if(cm > 300 && cm <=400)
{
digitalWrite(19, HIGH);
Serial.println("Bin is available");
digitalWrite(5,LOW);
digitalWrite(18,LOW);
digitalWrite(23,LOW);
}
delay(10000);
Serial.println("Lid Closed");
}
else
{
Serial.println("No motion detected");
}


if(cm <= 100)
```

```
{

        digitalWrite(21,HIGH);

        String payload = "{\"High Alert!!\":\"";payload += cm; payload += "left\" }";

         Serial.print("\n");

         Serial.print("Sending payload: ");

         Serial.println(payload);

        if (client.publish(publishTopic, (char*) payload.c_str()))

        // if data is uploaded to cloud successfully,prints publish ok or prints publish failed

        {

        Serial.println("Publish OK");

        }

        }

        if(cm <= 250)

        {

        digitalWrite(22,HIGH);

         String payload = "{\"Warning!!\":\"";payload+= cm; payload += "left\" }";

        Serial.print("\n");

        Serial.print("Sending distance: ");

         Serial.println(cm);

        if(client.publish(publishTopic, (char*) payload.c_str()))

        {

        Serial.println("Publish OK");

        }

        else

        {

        Serial.println("Publish FAILED");
```

```
        }

        }


        float inches = (cm / 2.54); //print on LCD

        lcd.setCursor(0,0);

        lcd.print("Inches");

        lcd.setCursor(4,0);

        lcd.setCursor(12,0);

        lcd.print("cm"); lcd.setCursor(1,1);

        lcd.print(inches, 1);

        lcd.setCursor(11,1);

        lcd.print(cm,1);

        lcd.setCursor(14,1);

        delay(1000);

         lcd.clear();

}
```

- Code for login page

```
<html>

<head>

<meta name="viewport" content="width=device-width, initial-scale=1">

<style>

body {font-family: Arial, Helvetica, sans-serif;}


/* Full-width input fields */

input[type=text], input[type=password] {

width: 100%;

 padding: 12px 20px;

 margin: 8px  0;

 display: inline-block;

 border: 1px solid #ccc;

 box-sizing: border-box;

}


/* Set a style for all buttons */

button {

 background-color: #04AA6D;

 color: white;

 padding: 14px 20px;

 margin: 8px 0;

 border: none;

 cursor: pointer;

 width: 100%;

}
```

```css
button:hover {

 opacity: 0.8;

}


/* Extra styles for the cancel button */

.cancelbtn {

 width: auto;

 padding: 10px 18px;

 background-color:#f44336;

}

 /* Center the image and position the close button */

 .imgcontainer {

  text-align: center;

  margin: 24px 0 12px 0;

  position: relative;

 }


 img.avatar {

  width: 40%;

  border-radius: 10%;

 }


 .container {

  padding: 16px;

 }


 span.psw {
```

```css
  float: right;

  padding-top: 16px;

  }


/* The Modal (background) */

.modal {

  display: none; /* Hidden by default */

  position: fixed; /* Stay in place */

  z-index: 1; /* Sit on top */

  left: 0;

  top: 0;

  width: 100%; /* Full width */

  height: 100%; /* Full height */

  overflow: auto; /* Enable scroll if needed */ background-

  color: rgb(0,0,0); /* Fallback color */ background-color:

  rgba(0,0,0,0.4); /* Black w/ opacity */padding-top: 60px;

  }


/* Modal Content/Box */

.modal-content {

  background-color:#fefefe;

  margin: 5% auto 15% auto; /* 5% from the top, 15% from the bottom and centered */

  border: 1px solid #888;

  width: 80%; /* Could be more or less, depending on screen size */

}

/* The Close Button (x) */

.close {
```

```css
  position: absolute;

  right: 25px;

  top: 0;

  color: #000;

  font-size: 35px;

  font-weight: bold;

}


.close:hover,

.close:focus {

  color: red;

  cursor: pointer;

}


/* Add Zoom Animation */

.animate {

  -webkit-animation: animatezoom 0.6s;

  animation: animatezoom 0.6s

}


@-webkit-keyframes animatezoom {

  from {-webkit-transform: scale(0)}

  to {-webkit-transform: scale(1)}

}


@keyframes animatezoom {

  from {transform: scale(0)}

  to {transform: scale(1)}
```

```
        }


    /* Change styles for span and cancel button on extra small screens */

    @media screen and (max-width: 300px) {

     span.psw {

        display: block;

        float: none;

     }

     .cancelbtn {

        width: 100%;

     }


    }

    </style>

</head>

    <body style="text-align: center;">


    <h1 style="padding-top: 200px; text-align: center;">Smart Waste Management System For
Metropolitan Cities</h1>


    <button                    onclick="document.getElementById('id01').style.display='block'"
style="width:auto; ">Login</button>


    <div id="id01" class="modal">


     <form class="modal-content animate" method="post">

       <div class="imgcontainer">
```

```html
      <span onclick="document.getElementById('id01').style.display='none'" class="close"
title="Close Modal">&times;</span>
       <img src="goLogo.jpg" alt="Avatar" class="avatar">
     </div>


     <div class="container">
      <label for="uname"><b>Username</b></label>
      <input id="frm1" type="text" placeholder="Enter Username" name="uname"
required>


       <label for="psw"><b>Password</b></label>
       <input type="password" placeholder="Enter Password" name="psw" required>



       <button    style="color:    black"    onclick="window.location.href=('district.html')"
type="submit">signin</button>
       <label>
        <input type="checkbox" checked="checked" name="remember"> Remember me
       </label>
     </div>


     <div class="container" style="background-color:#f1f1f1">
       <button                                                        type="button"
onclick="document.getElementById('id01').style.display='none'"
class="cancelbtn">Cancel</button>
       <span class="psw">Forgot <a href="#">password?</a></span>
     </div>
    </form>
```

```
        </div>

<p style="text-align: center;font-size: 10px; color: #04AA6D;">Reuse, Recycle, and Reduce

the waste for a better future !</p>

    <script>


    function myFunction() {

     var x = document.getElementById("frm1");

     var text = "";

     var i;

     for (i = 0; i < x.length ;i++) {

      text += x.elements[i].value + "<br>";

     }

     document.getElementById("demo").innerHTML = text;


    }

    // Get the modal action_page.php

    var modal = document.getElementById('id01');


    // When the user clicks anywhere outside of the modal, close it

    window.onclick = function(event) {

      if (event.target == modal) {

        modal.style.display = "none";

      }

    }

    </script>


    </body>

</html>
```

- Code of Coimbatore district

```html
<!DOCTYPE html>

<html>

<head>

<meta name="viewport" content="width=device-width, initial-scale=1">

<style>

body {font-family: Arial, Helvetica, sans-serif;}


/* Full-width input fields */

input[type=text], input[type=password] {

width: 100%;

 padding: 12px 20px;

 margin: 8px  0;

 display: inline-block;

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 width: 100%;
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```css
  }


button:hover {

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 height: 100%; /* Full height */

 overflow: auto; /* Enable scroll if needed */ background-

 color: rgb(0,0,0); /* Fallback color */ background-color:

 rgba(0,0,0,0.4); /* Black w/ opacity */padding-top: 60px;

}


/* Modal Content/Box */

.modal-content {

 background-color:#fefefe;

 margin: 5% auto 15% auto; /* 5% from the top, 15% from the bottom and centered */

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/* The Close Button (x) */

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.close:focus {

 color: red;

 cursor: pointer;

}


/* Add Zoom Animation */

.animate {

 -webkit-animation: animatezoom 0.6s;

 animation: animatezoom 0.6s

}


@-webkit-keyframes animatezoom {

 from {-webkit-transform: scale(0)}

 to {-webkit-transform: scale(1)}

}
```

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```
@keyframes animatezoom {

 from {transform: scale(0)}

 to {transform: scale(1)}

}


/* Change styles for span and cancel button on extra small screens */

@media screen and (max-width: 300px) {

 span.psw {

   display: block;

   float: none;

 }

 .cancelbtn {

   width: 100%;

 }


}

</style>

</head>

<body style="text-align: center;">


<h1 style="padding-top: 200px; text-align: center;">Smart Waste Management System For
Metropolitan Cities</h1>


<button            onclick="document.getElementById('id01').style.display='block'"
style="width:auto; ">Login</button>


<div id="id01" class="modal">
```

```html
<form  class="modal-content animate" method="post">

  <div class="imgcontainer">

    <span onclick="document.getElementById('id01').style.display='none'" class="close"
title="Close Modal">&times;</span>

    <img src="goLogo.jpg" alt="Avatar" class="avatar">

  </div>


  <div class="container">

    <label for="uname"><b>Username</b></label>

    <input id="frm1" type="text" placeholder="Enter Username" name="uname"
required>


    <label for="psw"><b>Password</b></label>

    <input type="password" placeholder="Enter Password" name="psw" required>


    <button    style="color:    black"    onclick="window.location.href=('district.html')"
type="submit">signin</button>

    <label>

      <input type="checkbox" checked="checked" name="remember"> Remember me

    </label>

  </div>


  <div class="container" style="background-color:#f1f1f1">

    <button                                                          type="button"
onclick="document.getElementById('id01').style.display='none'"

class="cancelbtn">Cancel</button>

    <span class="psw">Forgot <a href="#">password?</a></span>
```

```
        </div>

        </form>

      </div>

      <p style="text-align: center;font-size: 10px; color: #04AA6D;">Reuse, Recycle, and

Reduce the waste for a better future !</p>

      <script>

      function myFunction() {

       var x = document.getElementById("frm1");

       var text = "";

       var i;

       for (i = 0; i < x.length ;i++) {

        text += x.elements[i].value + "<br>";

       } document.getElementById("demo").innerHTML = text;

       }

      // Get the modal action_page.php

      var modal = document.getElementById('id01');


      // When the user clicks anywhere outside of the modal, close it

      window.onclick = function(event) {

        if (event.target == modal) {

          modal.style.display = "none";

        }

      }

      </script>


      </body>

</html
```

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GitHub Link:

https://github.com/IBM-EPBL/IBM-Project-17716-1659675420