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**PROJECT BASED EXPERIENTIAL LEARNING  
PROGRAM (NALAIYA THIRAN)**

**Smart Waste Management System For  
Metropolitan Cities**

**A PROJECT REPORT**

*Submitted by*

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# **1. INTRODUCTION**

## **1.1 Project Overview**

- This project aims to design and implement a combination of IoT and Application Development based Waste Management Systems. This research utilizes the application for Waste Management.
- The hardware part comprises an ultrasonic sensor, which detects the volume of waste present in the bin, Esp8266-wifi module.
- The software part uses Node red for web interface, Python code and C codes for sensor value

## **1.2 Purpose**

- Environmental hygiene is very important for a healthy life. In our daily lives, waste containers should be stored without proper supervision until they overflow and fill up to leak and produce environmental pollutants that cause serious problems for human and environmental health.
- In smart cities, garbage containers need to be monitored and managed to ensure a healthy and smooth environment. In the field of technological progress, real-time monitoring and manipulation of waste treatment is a difficult topic that arouses urgent interest in the research community.
- Traditional methods of monitoring waste in strategically located waste bins are time-consuming, labor intensive, costly, highly tedious and inefficient methods that do not meet the needs of smart cities. By this project we will solve the problem of garbage overflow with less labor.

## 2. LITERATURE SURVEY

### 2.1 Existing Problem

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, diarrhea, 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.

### 2.2 References

SI:N O	TITLE OF THEPAPER	AUTHOR	METHODOLOGY	MERITS	YEAR OF PUBLICATI ON
1	Smart waste bin Management	Parthasarathi Manickaraja	Uses the Ultrasonic sensor to level the dustbin and also uses the GSM module	Provides an alert message once the level has reached to the authority	2022
2	Smart waste management using IOT	Tejasree Kadus	Technology used is a load cell and a Wi-Fi module	Segregate the waste in the dustbin and provides an alert message	2020
3	Smart waste management systems using machine learning	David Rutgvist	Uses automated machine learning for a real life smart waste management	It focusses on problems of detection of emptying of a recycling container using sensor measurements	2019
4	Real time solid waste bin monitoring system framework using wireless sensor network	Thiyagapriyadharshini	Smart bin based on a microcontroller-based platform Arduino which is interfaced with GSM module	Waste management efficiency and it avoids lumping of wastes	2019

5	Smart waste collection system	Muhamad Javed Ramzan	Technology based on sensor-based collection and uses route algorithm	It identifies the status of waste bin levels along with the location to replace the bin	2018
6	Waste management and tracking	B Keerthana	Technology based on ZigBee.	Less expensive Lock based System with acknowledgment alert system	2017
7	Smart RecycleBin	Muhd Helmy Abd Wahab, Aelinae AbdulKadir	A Conceptual Approach of Smart Waste Management with Integrated Web Based System	At the time of trash disposal, the material to be recycled could be identified using RFID technology	2015

### 2.3 Problem Statement Definition

- The main Concern with our environment has been waste management which impacts the society in several ways. The Detection, Monitoring & Management of waste is one of the major problems of present era.
- The traditional may of manually monitoring wastes in waste bins is a cumbersome process and utilizes more human effort, time and cost which can easily be avoided with our proposed model.

### 3. IDEATION & PROPOSED SOLUTION

#### 3.1 Empathy Map Canvas



## 3.2 Ideation & Brainstorming

**1**

**Brainstorm**

Write down any ideas that come to mind that address your problem statement.

0 10 minutes

IoT platform to manage the waste management solution networks	GPS enabled to track the location
Using ultrasonic sensor and placing it at the top	Solar panels that can power the trash function

ASWIN KUMAR V	ANANDA SAILESH
Using IR sensor and placing it at the top	Data analytics to understand the usage
A powerful network that manages the network and trash bins to transmit the data	Weight sensor integrated with arduino

**2**

**Group ideas**

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

0 20 minutes

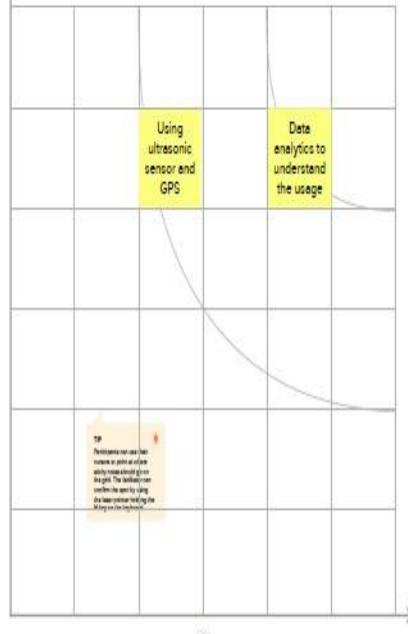
Reduction in collection costs	IoT solution uses the data & selects routes
IoT helps to identify the empty trash bins	Waste collection trucks leads to pickup
Transparency on waste situation Increase efficiency over time	Data analytics can help assess trends to better plan

**3**

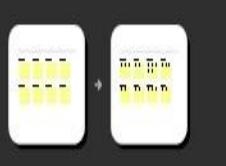
**Prioritize**

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

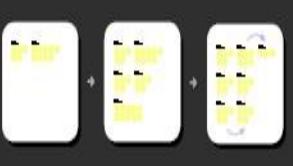
0 20 minutes



The matrix has 'Importance' on the vertical axis and 'Feasibility' on the horizontal axis. A curve starts at the top-left and slopes downwards towards the bottom-right. Two ideas are plotted: 'Using ultrasonic sensor and GPS' is in the top-right quadrant (high importance, high feasibility), and 'Data analytics to understand the usage' is in the middle-right quadrant (moderate importance, moderate feasibility).



A sequence of four icons showing the progression from two separate clusters of ideas to a single prioritized list.



A sequence of four icons showing the progression from a group of ideas to a prioritization matrix.



A sequence of four icons showing the final prioritized list.

### **3.3 Proposed Solution**

**Problem Statement:** The collection and disposal of garbage waste is in unordered, inefficient way which leads to overfilling of bins, routing garbage smell and more fuel consumption of collecting trucks.

#### **Purpose Statement (Goals):**

The purpose of this project is to focus on problems of detection of emptying of a recycling container using sensor measurements.

#### **Solution description:**

- Using sensors, weighing machine; real time monitoring the level of waste in bins.
- The information gets shared with appropriate authorities and fellow citizens through web application

#### **Uniqueness/ Novelty:**

Citizens & industries behaviors during specific festival, events at different seasons are monitored and are predicted for garbage overflowing. Also, to find the shortest path to reach the destiny for trucks in basis of fuel and time consumption.

#### **Social Impact / Customer Satisfaction:**

Informative, effective management of waste in big cities reduces waste impacts over environment pollution

#### **Business Model (Revenue Model):**

- Eco-friendly.
- Optimized route navigation system.
- Reduce fuel consumption.
- Alerts authority by real-time monitoring.
- Promote 3R's (Reduce, Reuse, Recycle).

#### **Scalability of the Solution:**

- The need-driven waste collection eliminates unnecessary traffic blockage.
- Generate important statistical data for monitoring for waste collection.
- Recycling is promoted between residents, results in clean & sustainable environment.

## 3.4 Problem Solution fit

1. CUSTOMER SEGMENT(S) <span style="background-color: #c000ff; color: white; padding: 2px 5px;">CS</span>	6. CUSTOMER CONSTRAINTS <span style="background-color: #c000ff; color: white; padding: 2px 5px;">CC</span>	5. AVAILABLE SOLUTIONS <span style="background-color: #c000ff; color: white; padding: 2px 5px;">AS</span>
<p>Define CS, fit into CC</p> <ul style="list-style-type: none"> <li>1. Our target is Public.</li> <li>2. Municipality and Local authorities of Metropolitan cities of India</li> </ul>	<p>Explore AS, differentiate</p> <ul style="list-style-type: none"> <li>1. Cost</li> <li>2. Recycling is expensive</li> <li>3. Network issue</li> <li>4. More energy</li> <li>5. Size of the bin and separation of various wastes</li> </ul>	<ul style="list-style-type: none"> <li>1. Reduce running cost</li> <li>2. Solar power</li> <li>3. Increases the sustainability of waste services</li> <li>4. Review compliance guidelines</li> </ul>

2. JOBS-TO-BE-DONE / PROBLEMS <span style="background-color: #ff8c00; color: white; padding: 2px 5px;">J&amp;P</span>	9. PROBLEM ROOT CAUSE <span style="background-color: #ff8c00; color: white; padding: 2px 5px;">RC</span>	7. BEHAVIOUR <span style="background-color: #ff8c00; color: white; padding: 2px 5px;">BE</span>
<p>Focus on J&amp;P, tap into BE, understand RC</p> <ul style="list-style-type: none"> <li>1. Germ spreading</li> <li>2. Avoid overflow bins &amp; maintenance</li> <li>3. Perform regular audits on waste management &amp; disposal</li> <li>4. Reduce number of bins &amp; replace smart bins</li> <li>5. Proper Segregating &amp; Minimizing Waste.</li> </ul>	<ul style="list-style-type: none"> <li>1. Lack of waste disposal: If any network issues occurred then the message will not received by the workers, so the waste disposal get delayed.</li> <li>2. Due to lack of proper systems for disposal and collections, wastes &amp; garbage's end up in the roads and surrounding</li> </ul>	<ul style="list-style-type: none"> <li>1. Ai-based smart waste bin, designed for public places, enabling them to Monitor and Manage.</li> <li>2. Sensor sense the amount of waste in trash can.</li> <li>3. The device sends the notification to the agent and they collect the trash.</li> </ul>

3. TRIGGERS <span style="background-color: #008000; color: white; padding: 2px 5px;">TR</span>	10. YOUR SOLUTION <span style="background-color: #008000; color: white; padding: 2px 5px;">SL</span>	8. CHANNELS OF BEHAVIOUR <span style="background-color: #008000; color: white; padding: 2px 5px;">CH</span>
<p>People want to make their environment cleaner and also prevent the spread of health hazards in their community -waste tend to decay faster, and if not carefully managed, decomposition can lead to bad odour-piled up waste also serves as a breeding place for mosquitos and other insects.</p> <p><b>4. EMOTIONS: BEFORE / AFTER <span style="background-color: #008000; color: white; padding: 2px 5px;">EM</span></b></p> <p>BEFORE:</p> <p>More negative emotion associated with increased intention to reduce waste management</p> <p>AFTER:</p> <p>People may feel good and comfortable once all project is set.</p>	<p>ONLINE:</p> <ul style="list-style-type: none"> <li>1. Network issue: Create an emergency readiness plan</li> <li>2. Spending power: solar power usage</li> <li>3. Waste disposal: Perform regular audit on waste management &amp; disposal</li> <li>4. Shop Eco-Friendly with reusable bags and say know disposable water bottle.</li> <li>5. The solution mainly involves in collecting, sorting, recycling and when properly facilitated providing a source of energy and resources</li> </ul>	<p>OFFLINE:</p> <ul style="list-style-type: none"> <li>1. It reaches the customers quickly.</li> <li>2. We can monitor in live</li> <li>3. Information about the level of trashes filled is indicated and the data is transferred to the control room for each bin including its specifications(GSM module).</li> </ul>

## 4. REQUIREMENT ANALYSIS

### 4.1 Functional Requirements

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	<b>Fitting IoT device in the trashcans.</b>	The IoT device need to be fixed in the dustbin with Water proof safety. The IoT device consists Ultrasonic sensor, IR sensor, Weight sensor. To send data to the cloud GPRS/GSM is used.
FR-2	<b>Detailed bin inventory.</b>	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. 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-3	<b>Real Time Bin monitoring</b>	The Dashboard displays real-time data on fill-levels of bins monitored by smart sensors. In addition to the % of fill-level, based on the historical data, the tool predicts when the bin will become full, one of the functionalities that are not included even in the best waste management software.
		Sensors recognize picks as well; so you can check when the bin was last collected. With real-time data and predictions, you can eliminate the overflowing bins and stop collecting half-empty ones.

FR-4	<b>Expensive bins.</b>	<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 depositing discharge</p>
FR-5	<b>Eliminate inefficient picks.</b>	<p>Eliminate the collection of half-empty bins.</p> <p>The sensors recognize picks.</p> <p>By using real-time data on fill-levels and pickrecognition, we can show you how full the bins you collect are.</p>
FR-6	<b>Predictions for bin fullness</b>	<p>It is a <math>24 \times 7</math> monitoring system designed for monitoring the dumpster. If either of the containers is full then an alert message is sent from the dustbin to employees and the cloud. In turn, employees can clear the corresponding dumpster. The bin has Sensors that can recognize picks as well; so you can check when the bin was last collected. With real-time data and predictions, you can eliminate the overflowing bins and stop collecting half empty ones.</p>
FR-7	<b>Plan waste collection routes</b>	<p>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.</p>

## **4.2 Non-functional Requirements**

Following are the non-functional requirements of proposed solution

<b>FR No.</b>	<b>Non-Functional Requirement</b>	<b>Description</b>
NFR -1	<b>Usability</b>	A smart solution has been proposed to make the waste by sorting more simple and accurate and improve the user experience, usability, and satisfaction. It aims to optimize ease of use while offering maximum functionality.
NFR -2	<b>Security</b>	Building and deploying IoT-based smart waste management in cities can be a complex, time consuming and resource intensive process.
NFR -3	<b>Reliability</b>	Smart waste management is also about creating better working conditions for waste collectors and drivers. Operates in a defined environment without failure resulting in less manpower, emissions, fuel use and traffic congestion.
NFR -4	<b>Performance</b>	The system will provide accurate reports, thus increasing the efficiency of the system. The real-time monitoring of the garbage level with the help of sensors and wireless communication will reduce the total number of trips required of Garbage collecting truck. This will reduce the total expenditure associated with the garbage collection.
NFR -5	<b>Availability</b>	Another purpose of this project is to make the proposed waste management system as cheap as possible. By this 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 more cost effect and scalability when we move to sma

# 5. PROJECT DESIGN

## 5.1 Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

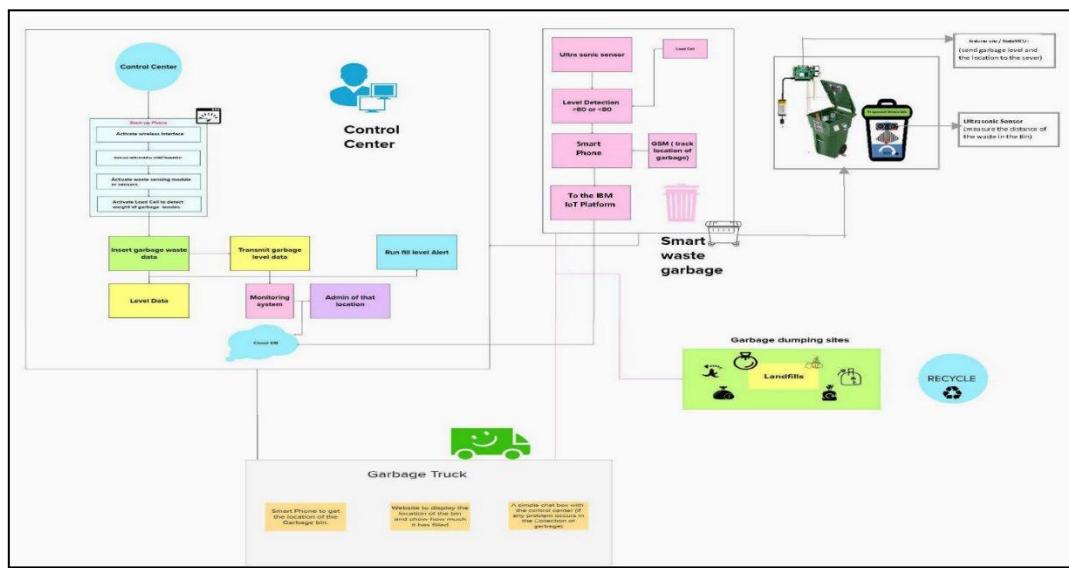
### Flow Diagram:

Our waste generation is constantly growing to form a **global garbage crisis**. Even though we indulge in creating a more sustainable and greener, we still fail to handle our waste generation and management. Combining technology support with a vision of social, economic and environmental sustainability is the best way out of this problem.

It is done in the following manner:

1. The smart bin system undergoes a thorough system check in order to function efficiently.
2. The threshold level levels of the bin are indicated my multiple sensors attached to bin. If the garbage exceeds the level, then an alert message is sent to the garbage collectors as well as to the municipality or area administration.
3. The area in which garbage is found to overflow is allocated to respective garbage collectors in the form of messages through GSM system.
4. Once the waste bin is emptied, an information update is sent to the municipality and server is updated.

This is how the waste from bins can be efficiently handled and managed using technology which in turn keeps the environment clean and healthy.



## 5.2 Solution & Technical Architecture

### Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table 1 and table 2.

**Table-1: Components & Technologies:**

S. No	Component	Description	Technology
1.	User Interface	Web UI	HTML, CSS, JavaScript /Node RED.
2.	Application Logic-1	The bin waste data are collected using sensors via Wokwi	C/C++
3.	Application Logic-2	The collected data are monitored using IOT	IBM Watson service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Application Logic-4	To view the location	World map in Node RED
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage
8.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Server Configuration	Local, Cloud Foundry,

**Table-2: Application Characteristics:**

S. No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Node-Red
2.	Security Implementations	Account are login using mail	Gmail, IBM
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Not sure
4.	Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Not sure
5.	Performance	Design consideration for the performance of the application etc.	IOT

### 5.3 User Stories

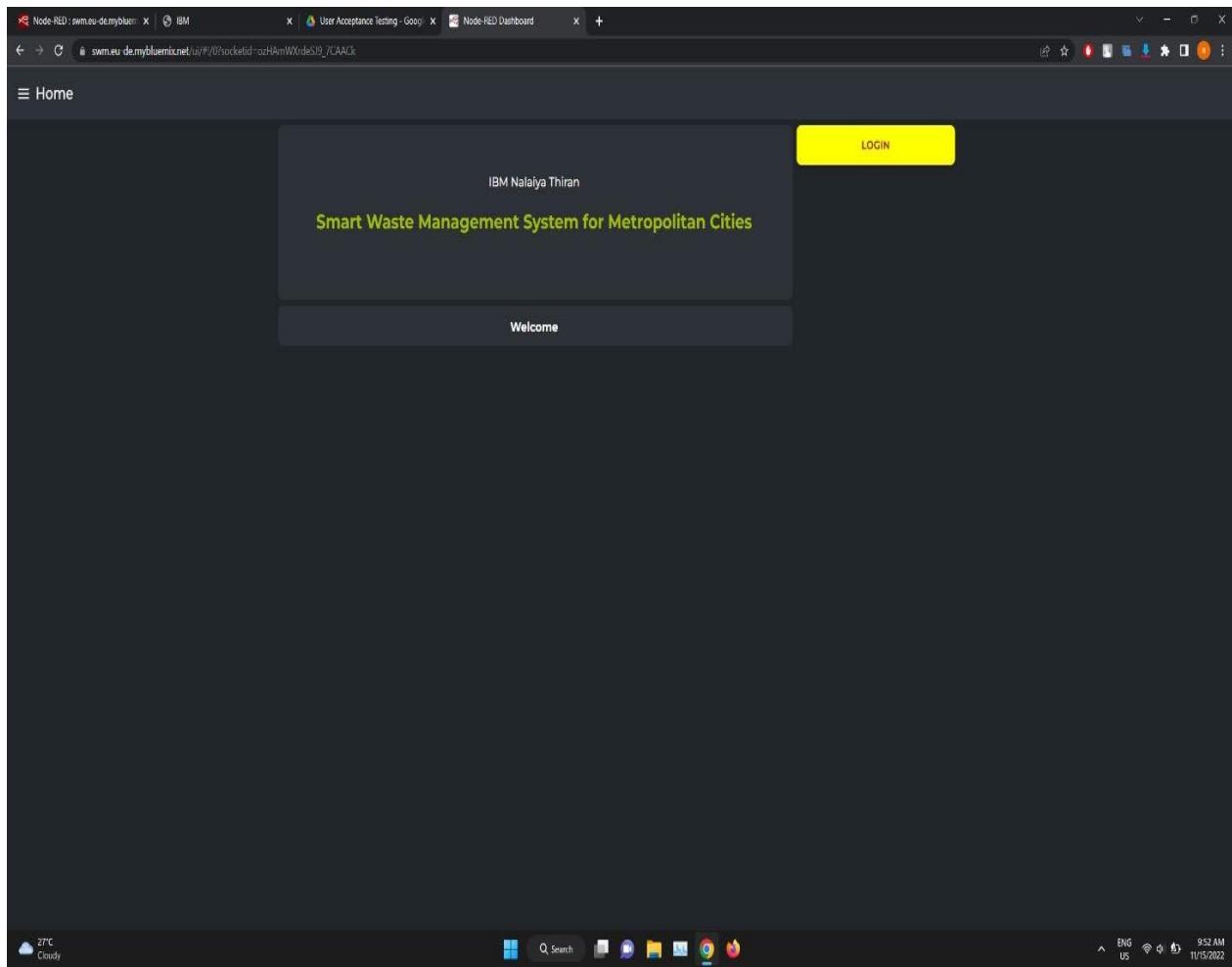
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance Criteria	Priority	Release
Admin (Corporate Authority)	Login	USN-1	As an administrator, I have assigned user names and passwords to each employee and add new dustbins and their location and send mail to Truck Driver when the location is filled	I can manage my online account and dashboard.	Medium	Sprint-2
Truck Driver	Login	USN-2	As a Truck Driver, I'll follow Admin's instruction and the route assigned to reach the filled garbage.	I can take the shortest path assigned to me and reach the waste filled land.	Medium	Sprint-2
Local Garbage Collector	Login	USN-3	As a Local Garbage Collector, I'll gather all the waste collected from the garbage and house and load it onto a garbage truck.	I can collect the trash, pull it to the truck, and send it out.	Medium	Sprint-2
Municipality officer	Login	USN-4	As a Municipality officer, I'll make sure everything is sticked to plan and without any issues.	All of these processes are under my control.	High	Sprint-1

## 6. PROJECT PLANNING & SCHEDULING

### 6.1 Sprint Planning & Estimation

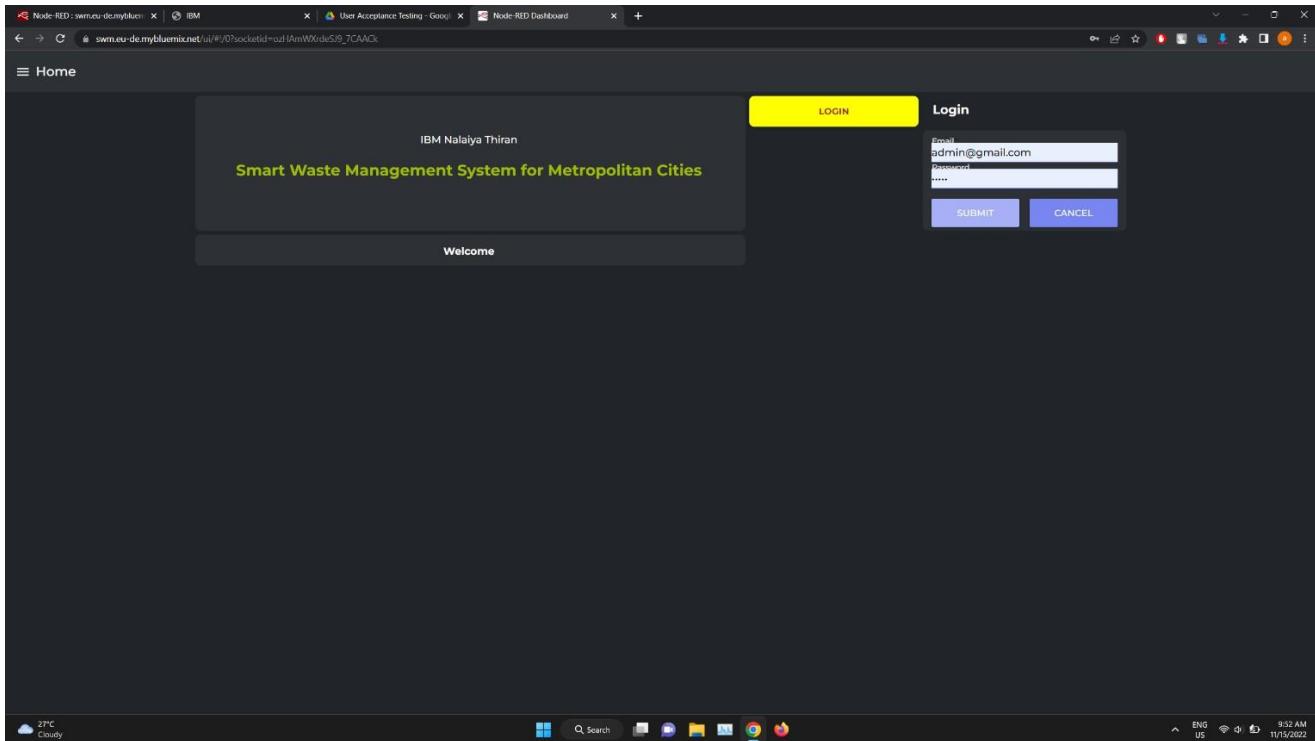
In Sprint 1 we have created the admin page where we can view the dashboard, create, update, remove the co admin. we can also view and delete the truck driverdetails.

#### Home Page:

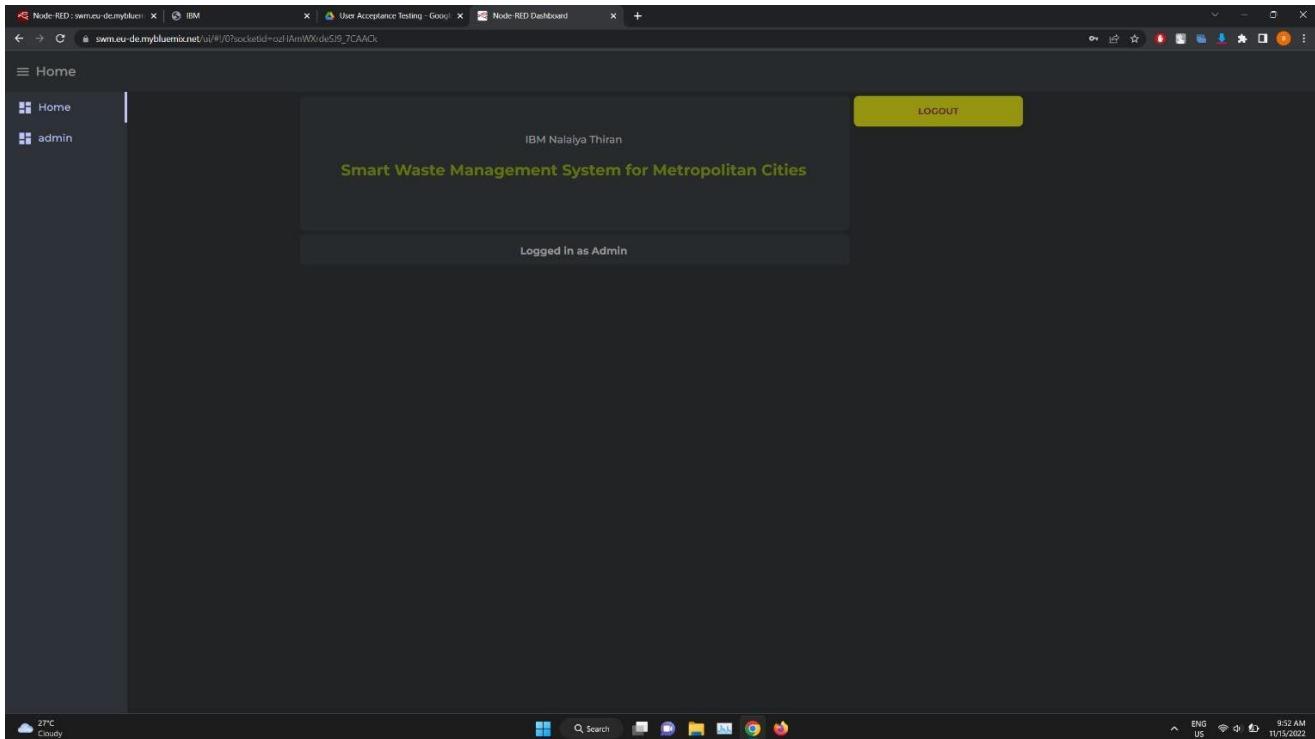


## Login Page:

Once we click on the login button, we can see the Login window appears in the right side. Now we need to enter the admin credentials (i.e.) Email: [admin@gmail.com](mailto:admin@gmail.com)  
Password: "admin"



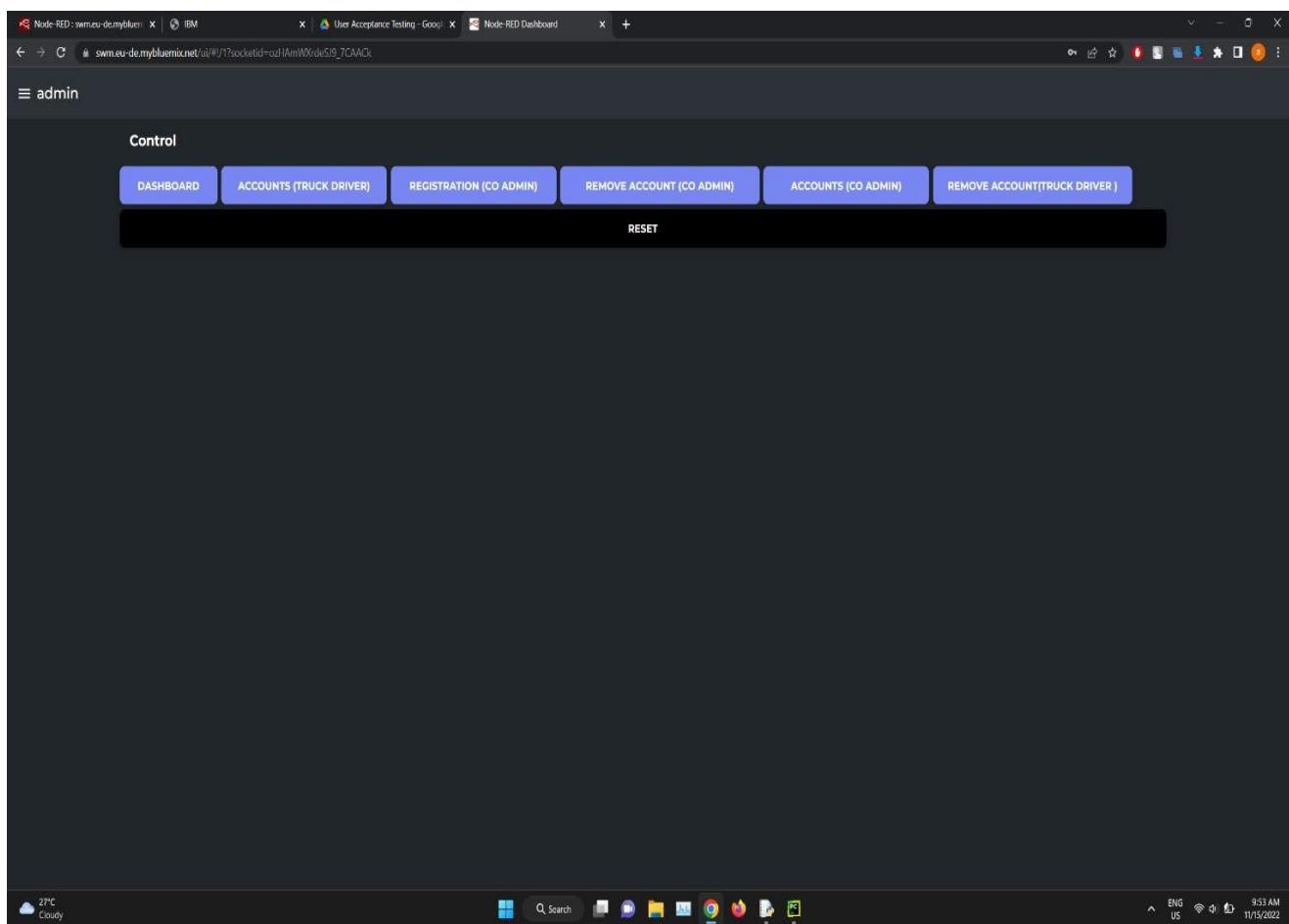
Once we successfully logged in we can see the below status changed into Logged in as Admin and we can see the Admin tab appears.



## **Admin Page:**

This is the admin page, here we can see different buttons.

<b>Button</b>	<b>Functionalities</b>
Dashboard	To view the map, dustbin level etc
Registration ( Co Admin)	To Create a new account for Co admin
Accounts (Co Admin)	To view the co admin's account details
Accounts (Truck Driver)	To view the Truck Driver's account details
Remove Account (Co Admin)	To Delete the Co admin account
Remove Account (Truck Driver)	To Delete the Truck Driver account
Reset	To close all the groups opened (i.e. Dashboard, accounts, remove account etc)



## Dashboard:

**Note:** Here I have used two dustbins. So, we can see both of their Trash Fill percent in their particular location.

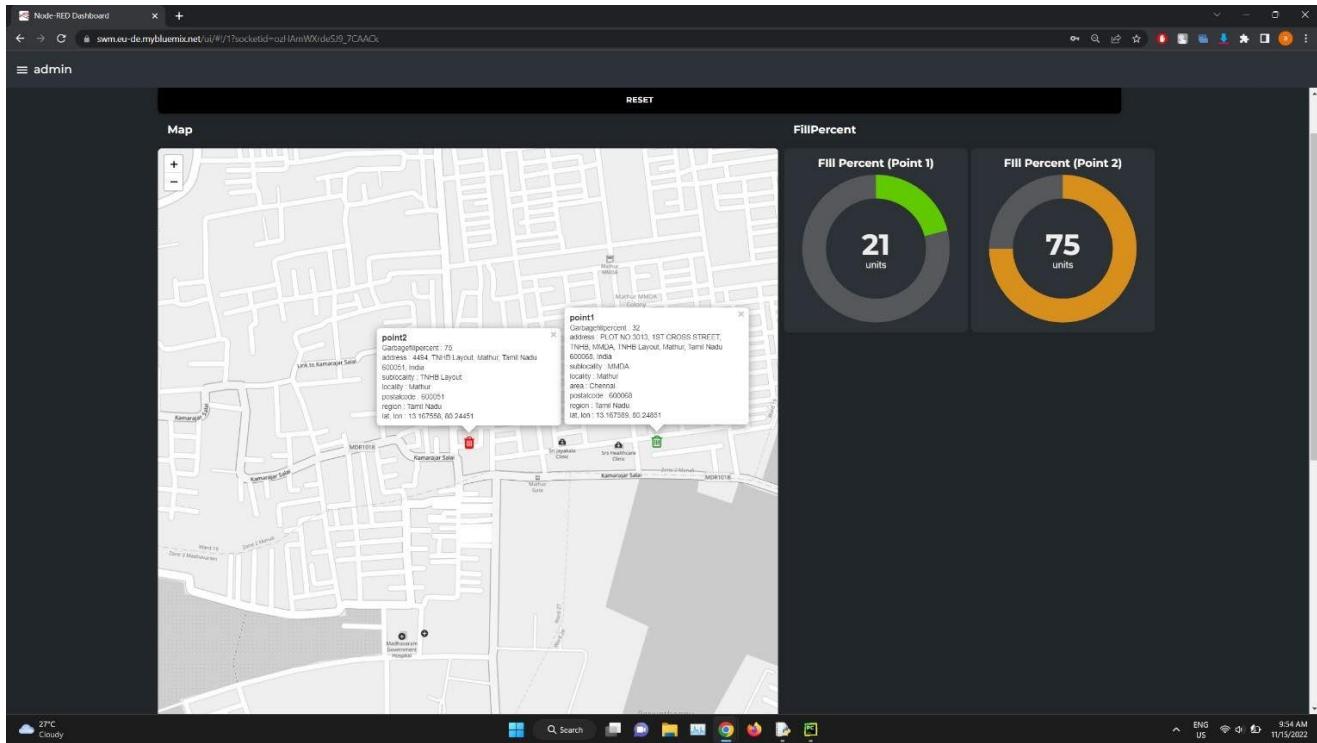
By clicking the dashboard button, we can view the dashboard.

Here we can see the map and the Fill percent for both the garbage bin.

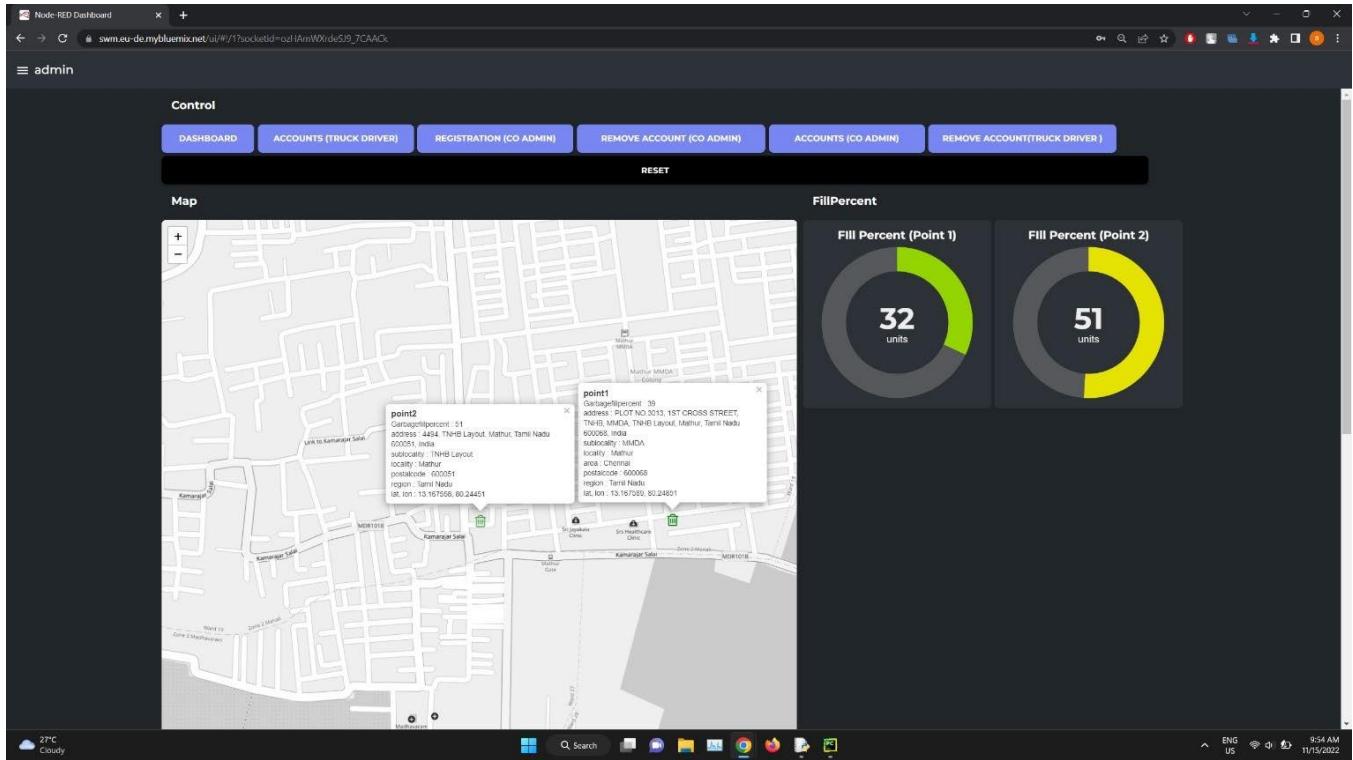
By clicking on the icon in the map we can see the details like

- Fill percent
- Address
- Sub locality
- Postal code
- Region
- Latitude, longitude

**Note:** Here once the bin level crosses their threshold level (here I have set as 60%) the icon color changes to **Red**. if it is below the threshold the icon color changes back to **Green**.



Here we can also see the Gauge where the Fill Percent of each Garbage bin is shown.



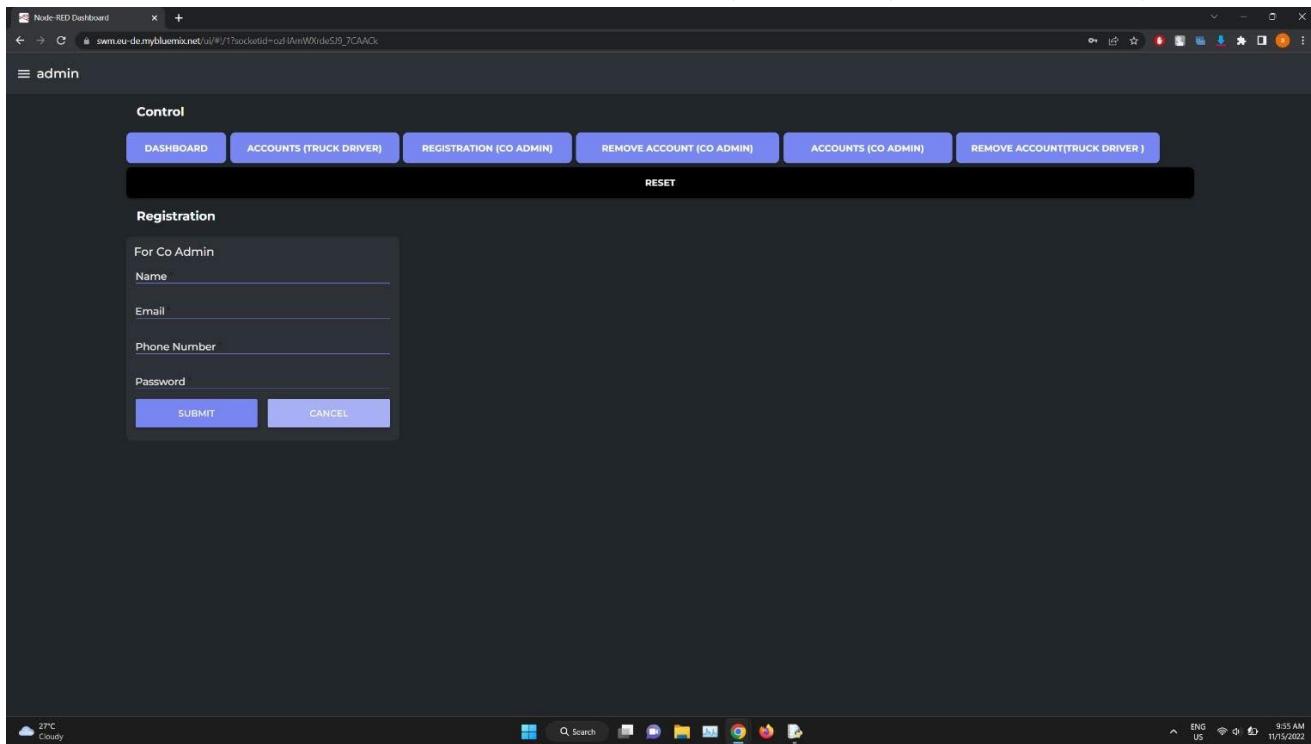
Here we can see the Table where it shows the last filled Timing (i.e., once the garbage bin fill to 100% the table is being updated with their timing)

The screenshot shows a Node-RED dashboard interface. At the top, there is a navigation bar with tabs: DASHBOARD, ACCOUNTS (TRUCK DRIVER), REGISTRATION (CO ADMIN), REMOVE ACCOUNT (CO ADMIN), ACCOUNTS (CO ADMIN), and REMOVE ACCOUNT(TRUCK DRIVER). Below the navigation bar is a 'Control' section with a 'RESET' button. The main area features a map with several points marked. Below the map is a table titled 'Table'. The table has columns: Name, Time, Date, Locality, and Address. It lists multiple entries for 'point1' and 'point2', showing their last filled times and addresses. The bottom of the screen shows a taskbar with various icons and system status indicators like battery level, signal strength, and date/time (11/15/2022, 9:54 AM).

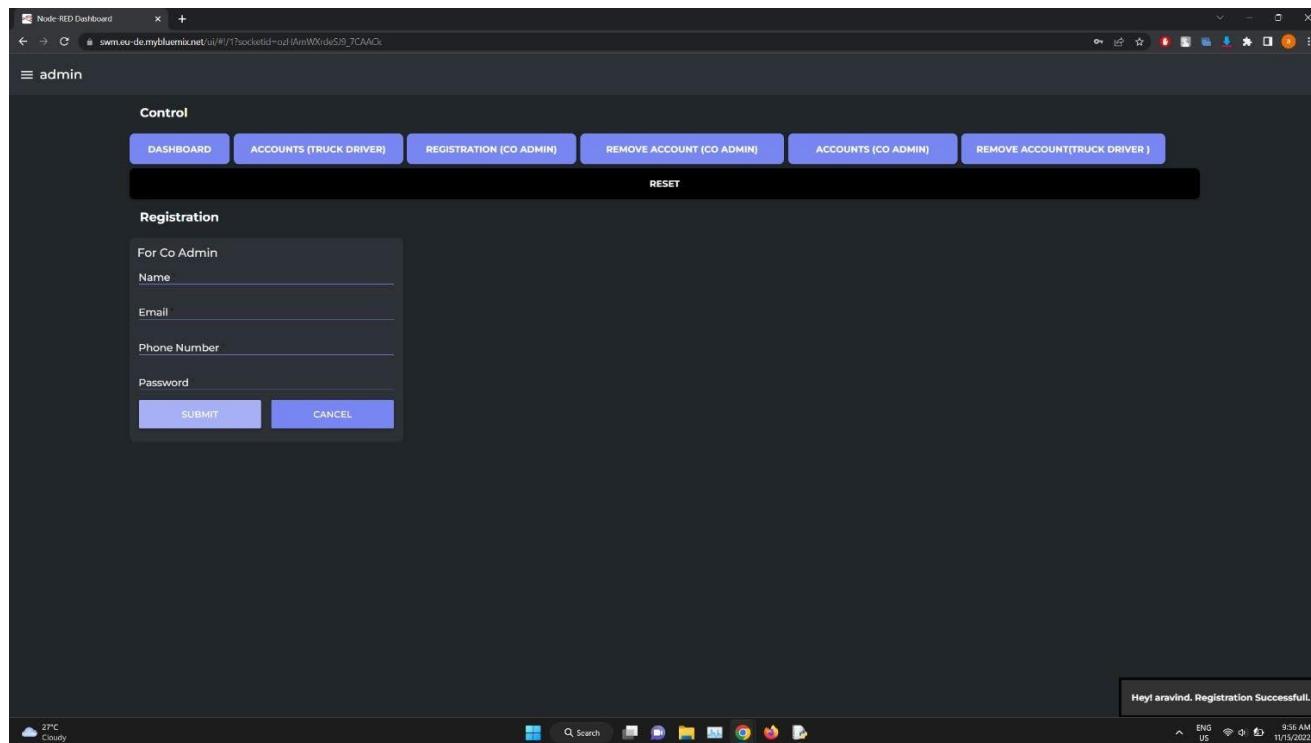
Name	Time	Date	Locality	Address
point2	09:45	2022-11-15	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	09:34	2022-11-15	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	09:33	2022-11-15	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	21:33	2022-11-14	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	21:30	2022-11-14	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	21:00	2022-11-14	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	20:59	2022-11-14	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	20:58	2022-11-14	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	20:58	2022-11-14	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point2	21:02	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	21:00	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	20:59	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	20:59	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	20:59	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	20:58	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	20:58	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	20:57	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	20:57	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India

## Registration (Co Admin):

Once we click on the **Registration (Co Admin)** button we can see the Registration menu. We need to enter the details like Name, Email Id , Phone Number , Password.



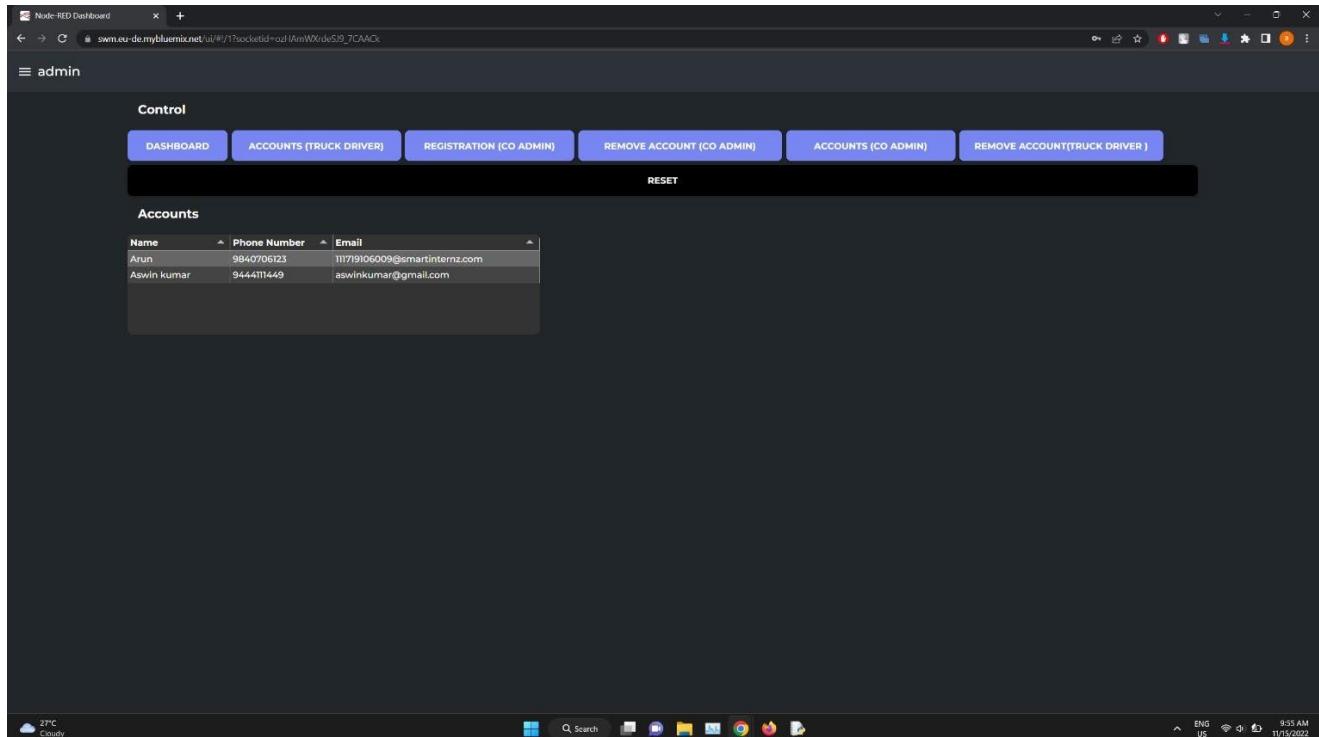
Once we create the account, we can see the notification in the below one



## Accounts (Co Admin):

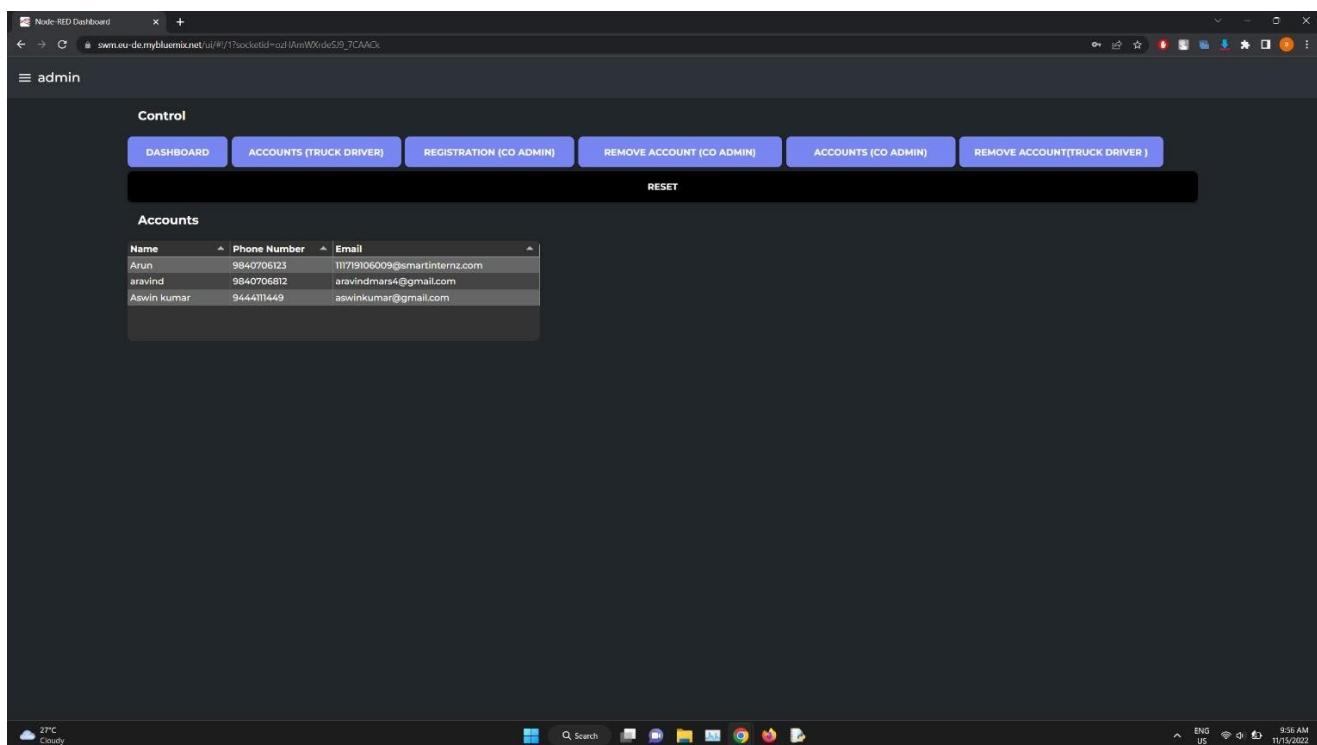
Once we click on the Account (Co Admin) button we can see the List of Co Admin's available and their details like their name, Phone number and Email Id.

## Before Account Creation:



Name	Phone Number	Email
Arun	9840706123	111719106009@smartinternz.com
Aswin kumar	9444111449	aswinkumar@gmail.com

## After Account Creation:



Name	Phone Number	Email
Arun	9840706123	111719106009@smartinternz.com
aravind	9840706812	aravindmars4@gmail.com
Aswin kumar	9444111449	aswinkumar@gmail.com

## Accounts (Truck Driver):

Once we click on the Account (Truck Driver) button. We can see all the Truck Driver details.

The screenshot shows a dark-themed Node-RED dashboard window. At the top, there are several tabs: DASHBOARD, ACCOUNTS (TRUCK DRIVER) (which is highlighted in blue), REGISTRATION (CO ADMIN), REMOVE ACCOUNT (CO ADMIN), ACCOUNTS (CO ADMIN), and REMOVE ACCOUNT (TRUCK DRIVER). Below the tabs is a 'RESET' button. The main content area is titled 'TruckAccount' and contains a table with one row of data:

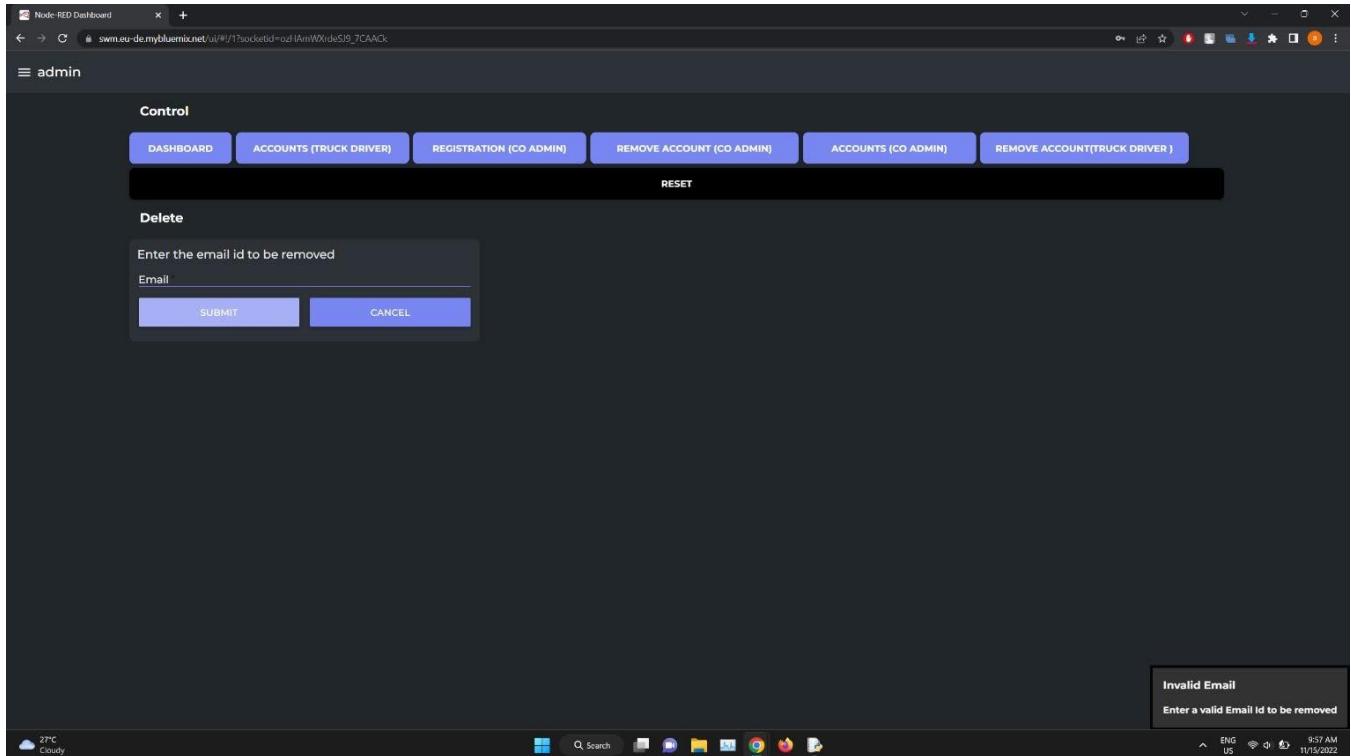
Name	Phone Number	Location	Email
Driver1	9840706123	Madhavaram	madhavaram@gmail.com

## Remove Account (Co Admin):

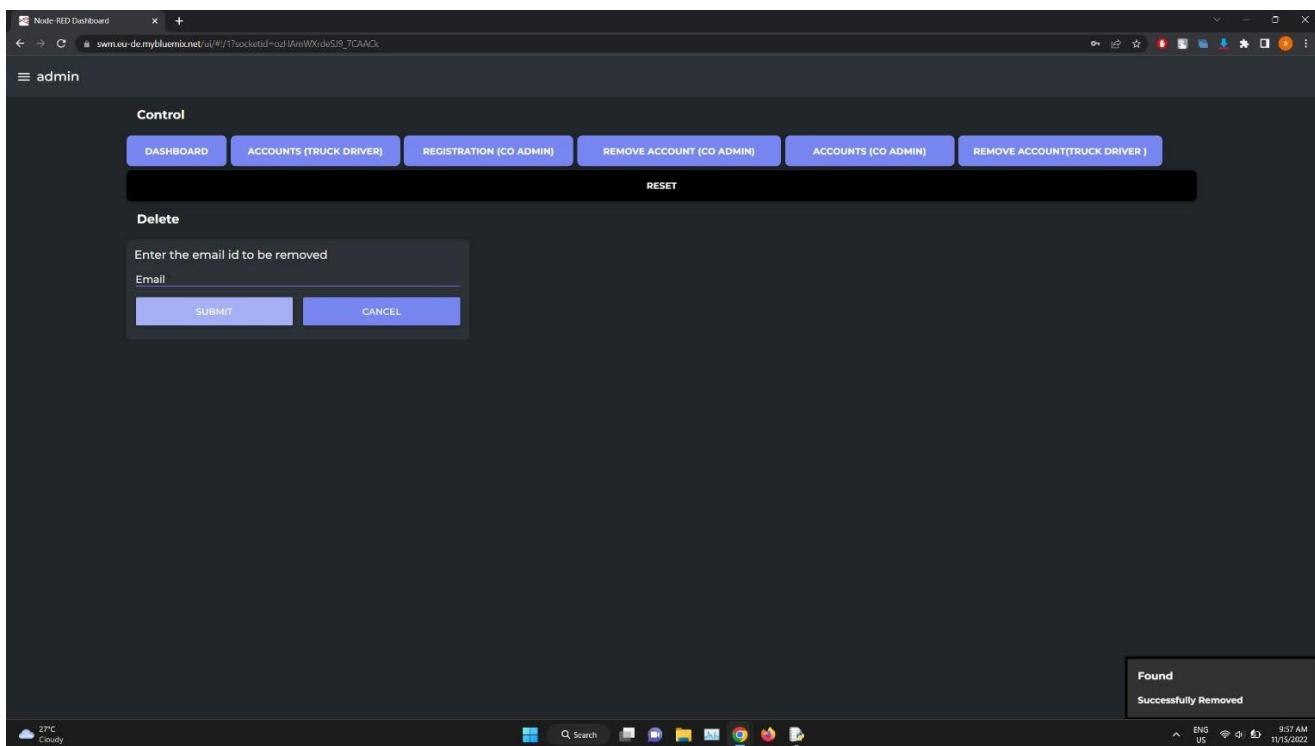
To remove the Co admin account, we need to enter their mail id.

The screenshot shows a dark-themed Node-RED dashboard window. The tabs at the top are: DASHBOARD, ACCOUNTS (TRUCK DRIVER), REGISTRATION (CO ADMIN), REMOVE ACCOUNT (CO ADMIN) (which is highlighted in blue), ACCOUNTS (CO ADMIN), and REMOVE ACCOUNT (TRUCK DRIVER). Below the tabs is a 'RESET' button. The main content area is titled 'Delete' and contains a form with the following text: 'Enter the email id to be removed'. It includes a 'Email' input field and two buttons: 'SUBMIT' and 'CANCEL'.

If we try to remove the account which is not in the Database, we can see the notification as **Invalid email id.**



If we enter the mail id which is in the database we can see as



## Before Deletion:

The screenshot shows a web-based Node-RED dashboard titled "Node-RED Dashboard". The URL is <http://swm.eu-de.mybluemix.net/>. The page has a dark theme with a header labeled "admin". Below the header is a "Control" menu bar with several buttons: DASHBOARD, ACCOUNTS (TRUCK DRIVER), REGISTRATION (CO ADMIN), REMOVE ACCOUNT (CO ADMIN), ACCOUNTS (CO ADMIN), and REMOVE ACCOUNT(TRUCK DRIVER). A "RESET" button is located below the menu. The main content area is titled "Accounts" and contains a table with three rows of data:

Name	Phone Number	Email
Arun	9840706123	111719106009@smartinternz.com
aravind	9840706812	aravindmars4@gmail.com
Aswin kumar	9444111449	aswinkumar@gmail.com

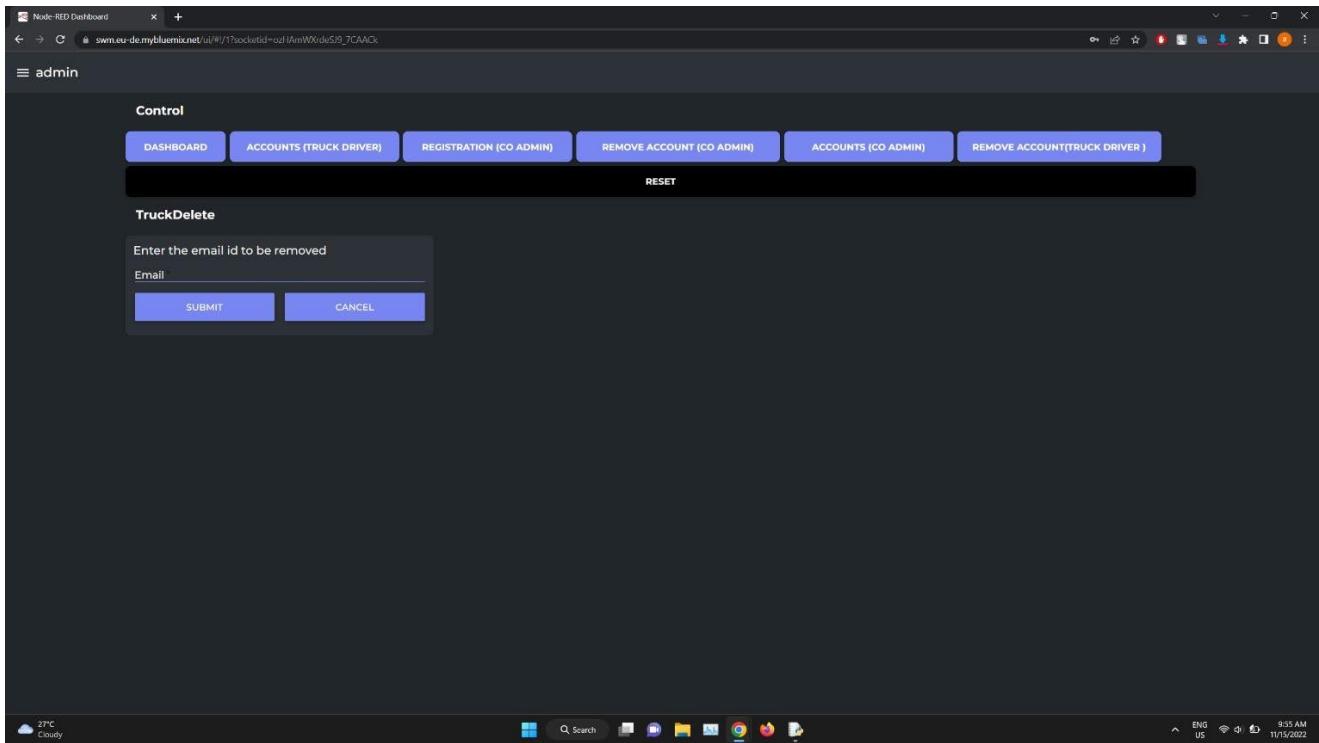
The bottom of the screen shows a Windows taskbar with various icons and system status indicators.

## After Deletion:

This screenshot is identical to the one above, showing the Node-RED dashboard before deletion. It displays the same "Control" menu, "Accounts" table with three entries, and the same system status at the bottom of the screen. There is no visible change in the account list, indicating that the deletion has not yet been applied or is still pending.

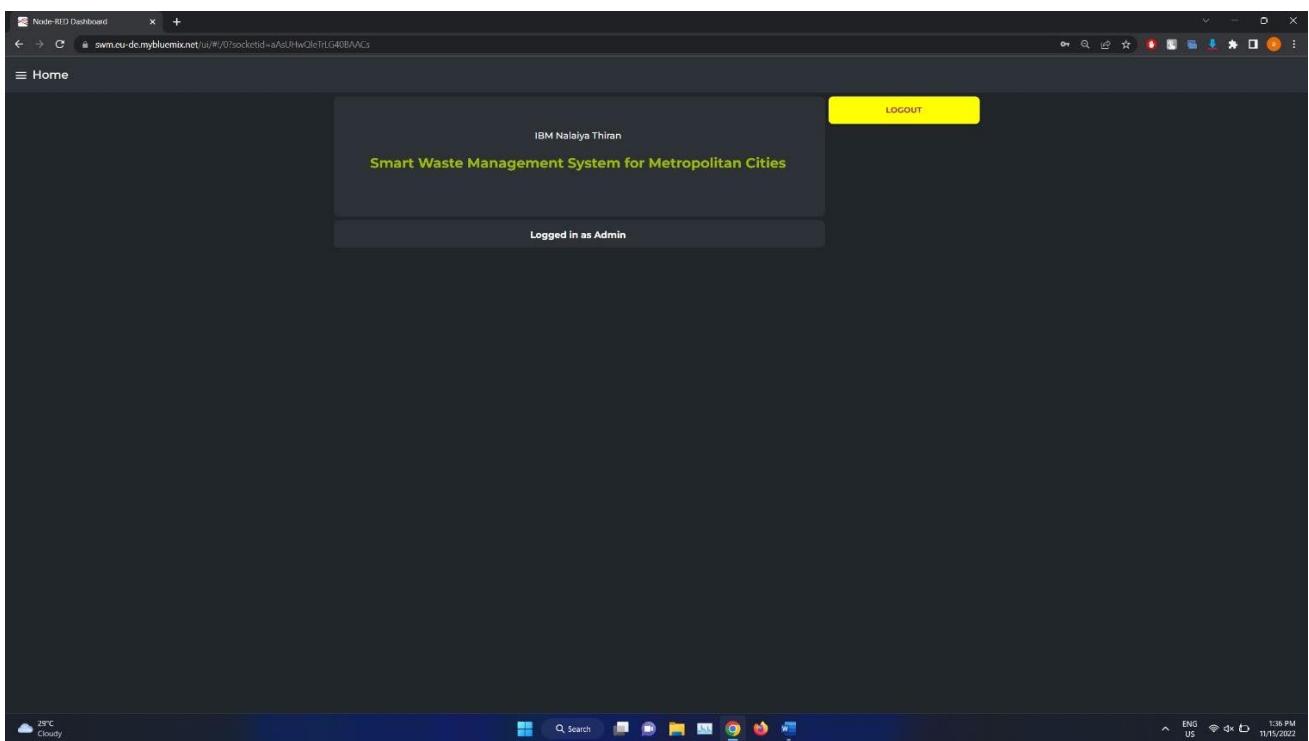
## Remove Account (Truck Driver):

Similarly, we can also able to remove the Truck driver account if the account is not in use.



## Logout Page:

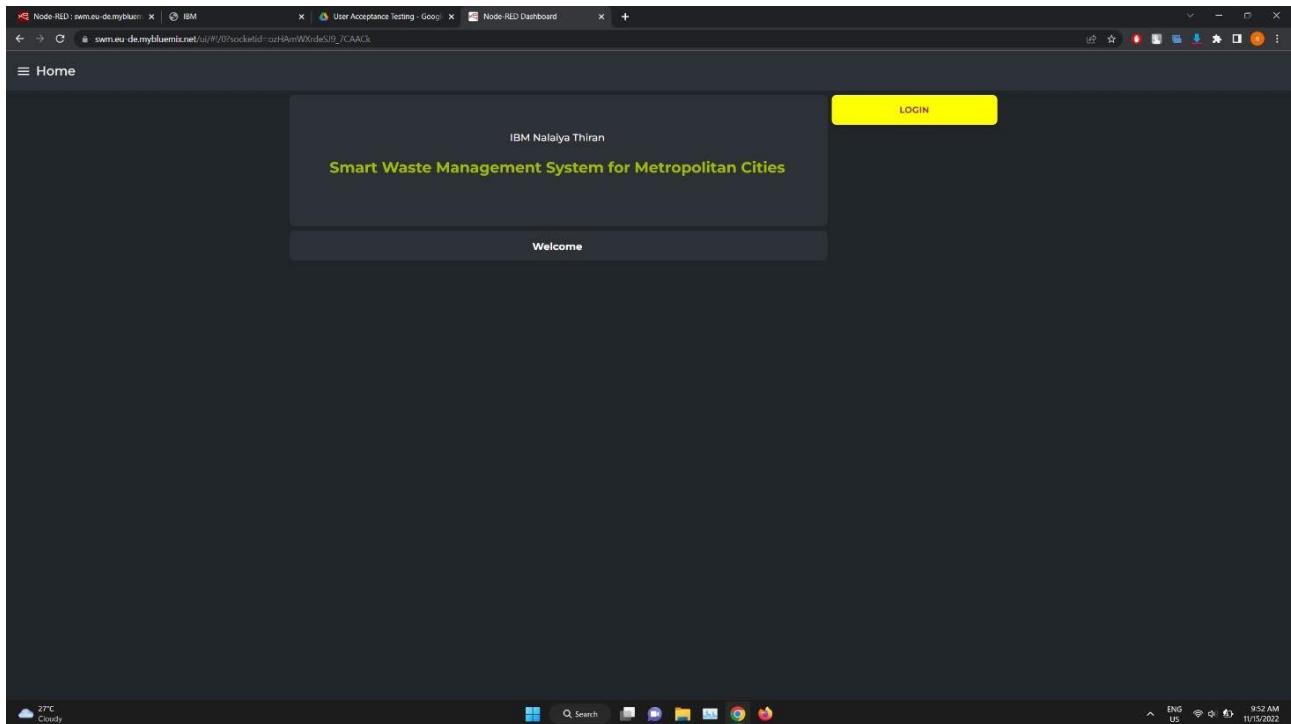
By moving towards the home tab, we can see logout button and then we can again login to any other account if needed.



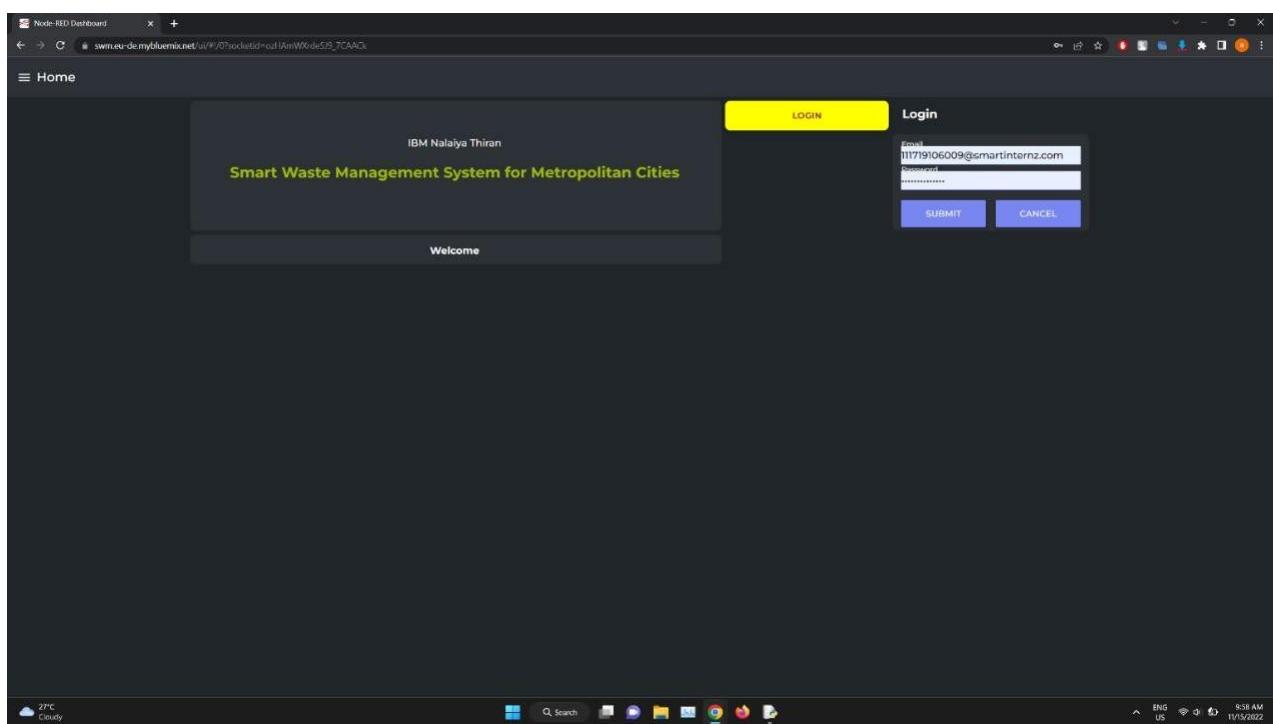
## SPRINT 2

In Sprint 2 we have created the co-admin page where we can view the dashboard, create, update, remove Truck Drivers account.

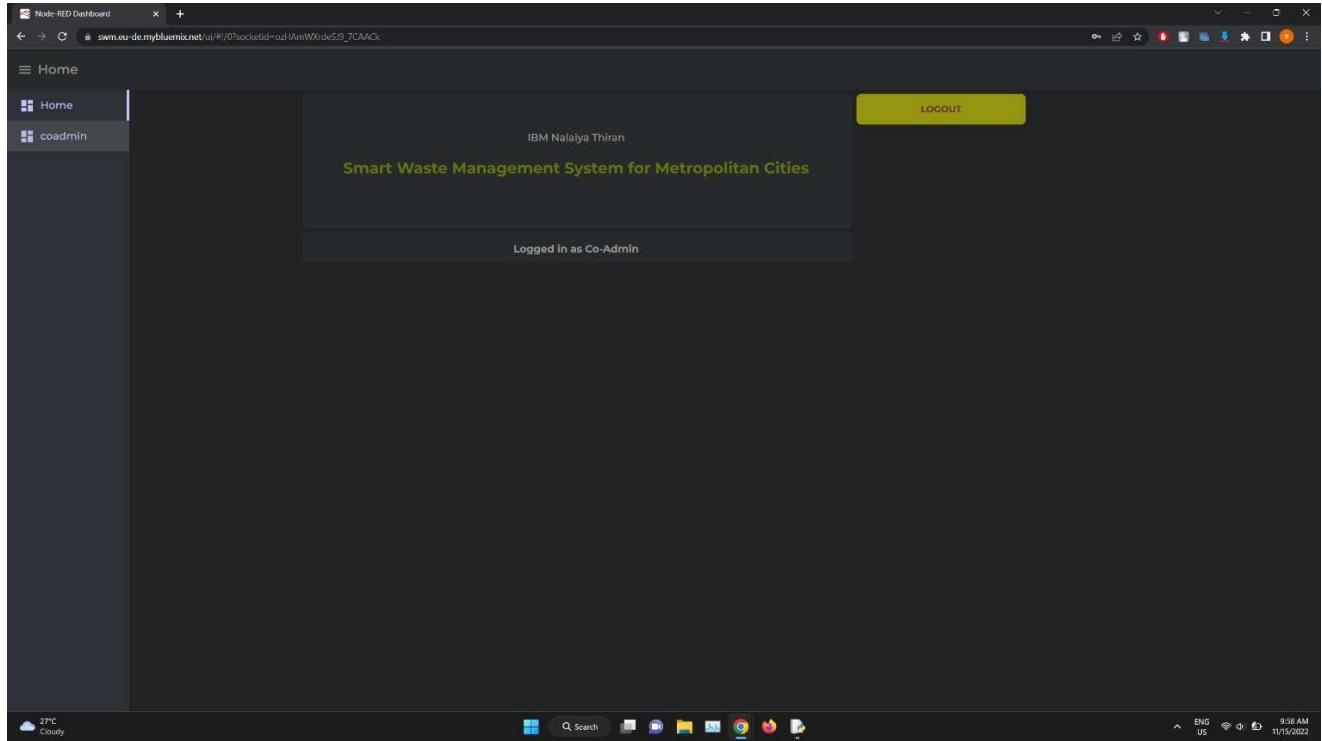
### Home Page



### Login Page:



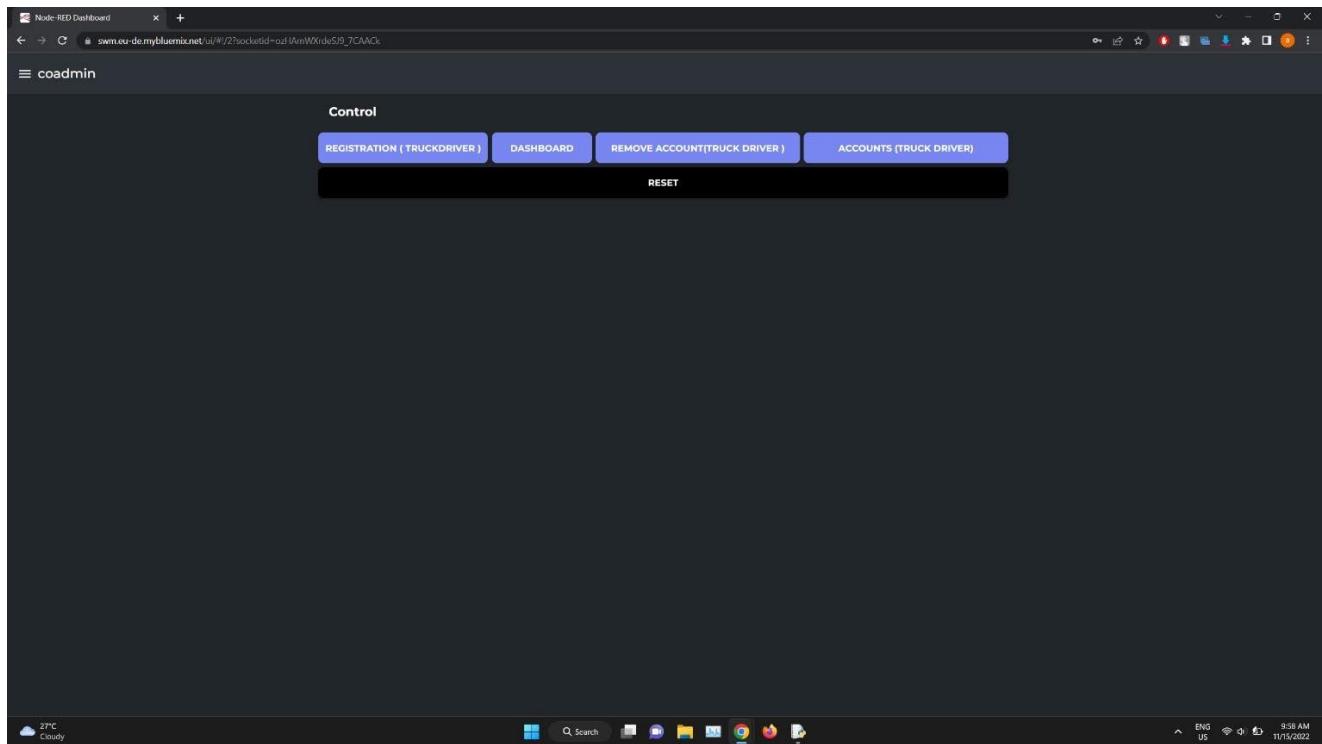
Once we click on the login button, we can see the Login window appears in the right side. Now we need to enter the co-admin credentials.



Once we successfully logged in, we can see the below status changed into Logged in as co-admin and we can see the co-admin tab appears.

### Co - Admin Page:

This is the admin page, here we can see different buttons.



<b>Button</b>	<b>Functionalities</b>
Dashboard	To view the map, dustbin level etc
Registration (Truck Driver)	To Create a new account for Co admin
Accounts (Truck Driver)	To view the Truck Driver's account details
Remove Account (Truck Driver)	To Delete the Truck Driver account
Reset	To close all the groups opened (i.e. Dashboard, accounts, remove account etc)

### **Dashboard:**

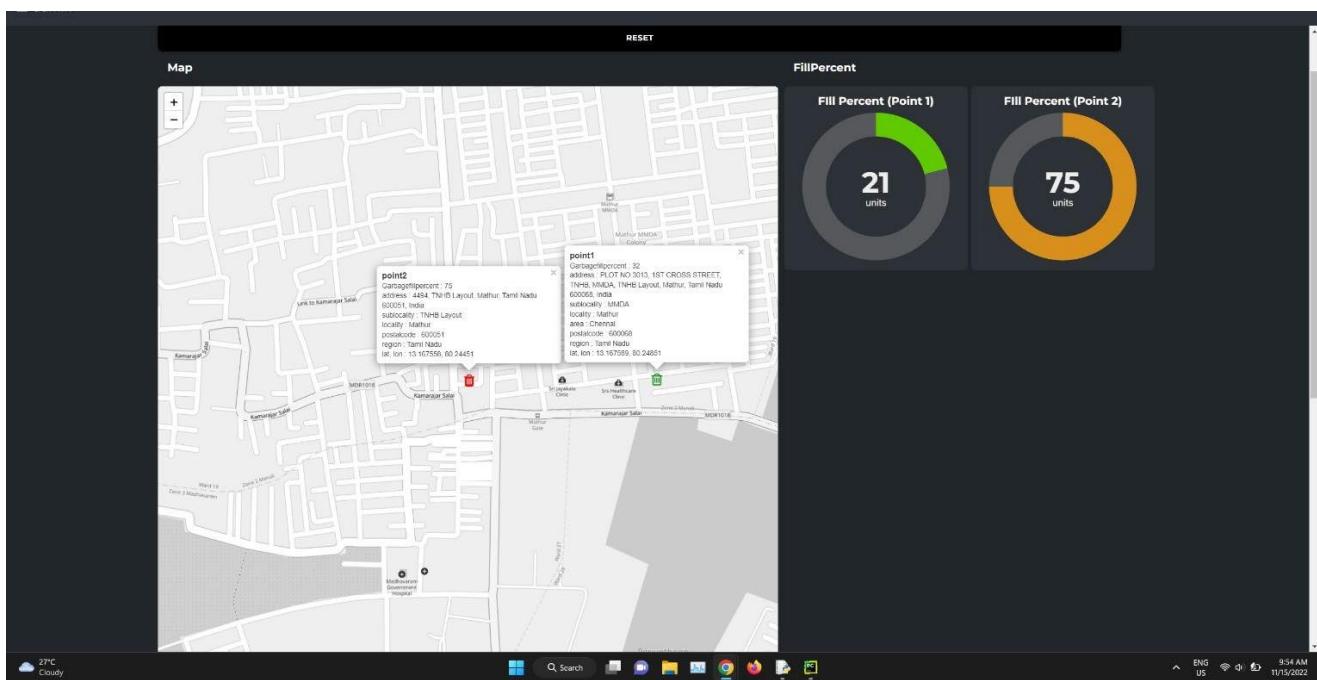
**Note:** Here I have used two dustbins. So, we can see both of their Trash Fill percent in their particular location.

By clicking the dashboard button, we can view the dashboard.

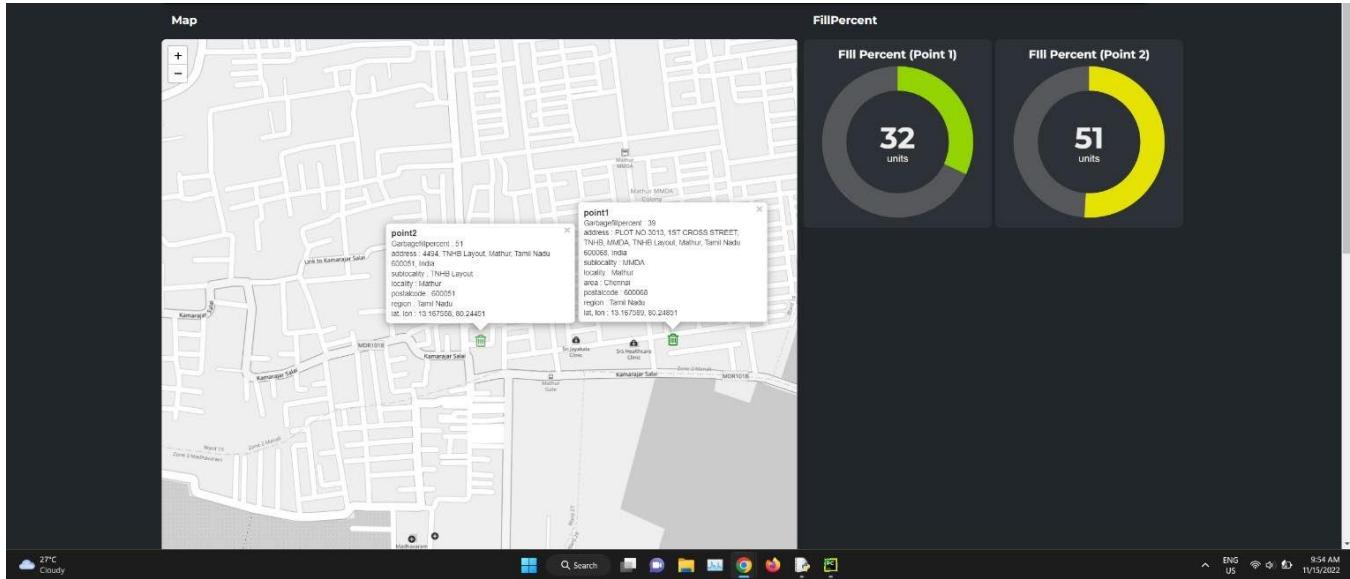
Here we can see the map and the Fill percent for both the garbage bin.

By clicking on the icon in the map we can see the details like

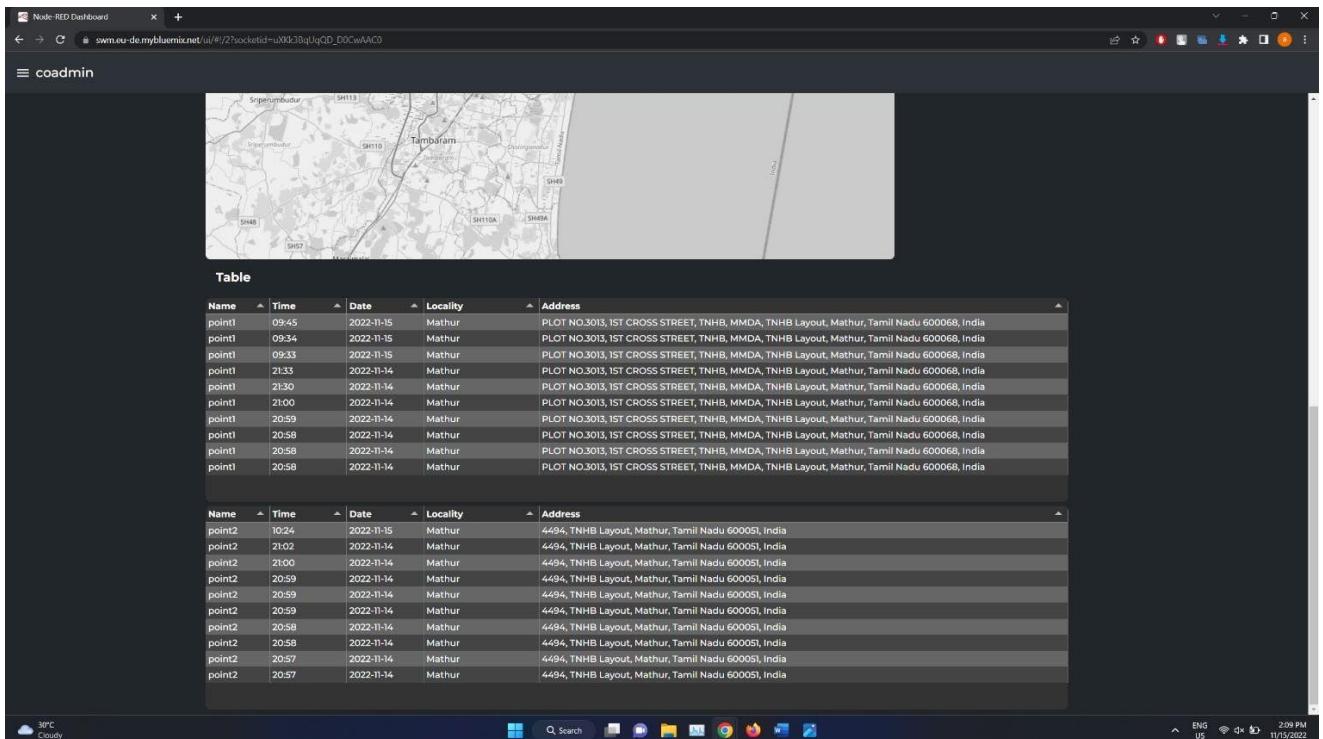
- Fill percent
- Address
- Sub locality
- Postal code
- Region
- Latitude, longitude



**Note:** Here once the bin level crosses their threshold level (here I have set as 60%) the icon color changes to **Red**. if it is below the threshold the icon color changes back to **Green**.



Here we can also see the Gauge where the Fill Percent of each Garbage bin is shown.



Here we can see the Table where it shows the last filled Timing (i.e., once the garbage bin fill to 100% the table is being updated with their timing)

## Registration (Truck Driver):

Once we click on the **Registration (Truck Driver)** button we can see the Registrationmenu. We need to enter the details like Name, Email Id, Phone Number, Password.

The screenshot shows a dark-themed Node-RED dashboard titled "Node-RED Dashboard". In the top navigation bar, there are tabs for "REGISTRATION ( TRUCKDRIVER )", "DASHBOARD", "REMOVE ACCOUNT( TRUCK DRIVER )", and "ACCOUNTS ( TRUCK DRIVER )". The "REGISTRATION ( TRUCKDRIVER )" tab is highlighted. Below the tabs, there is a "RESET" button. On the right side, there is a registration form titled "FOR TRUCK DRIVERS". The form fields include:

- Name: Dharneeshwaran
- Email: 111719106030@smartinternz.com
- Phone Number: 7418520963
- Password: (redacted)
- Location: Madhavaram

At the bottom of the form are "SUBMIT" and "CANCEL" buttons.

Once we create the account, we can see the notification in the below one

The screenshot shows the same dark-themed Node-RED dashboard as the previous one. The "REGISTRATION ( TRUCKDRIVER )" tab is still highlighted. A new message box appears at the bottom right of the screen, displaying the text "Hey! Dharneeshwaran, Registration Successfull." The rest of the interface is identical to the previous screenshot, showing the registration form and its fields.

## Accounts (Truck Driver):

Once we click on the Account (Truck Driver) button. We can see all the Truck Driver details like their Name, Phone number, Location, Email Id.

## Before Account Creation:

The screenshot shows a dark-themed Node-RED dashboard window titled "Node-RED Dashboard". At the top, there are four tabs: "REGISTRATION ( TRUCKDRIVER )", "DASHBOARD", "REMOVE ACCOUNT( TRUCK DRIVER )", and "ACCOUNTS ( TRUCK DRIVER )", with the last one being the active tab. Below the tabs is a "RESET" button. The main area is labeled "Accounts" and contains a table with the following data:

Name	Phone Number	Location	Email
Driver1	9840706123	Madhavaram	madhavaram@gmail.com

The status bar at the bottom of the screen shows the date and time as 11/15/2022, 10:59 AM, and the system temperature as 27°C.

## After Account Creation:

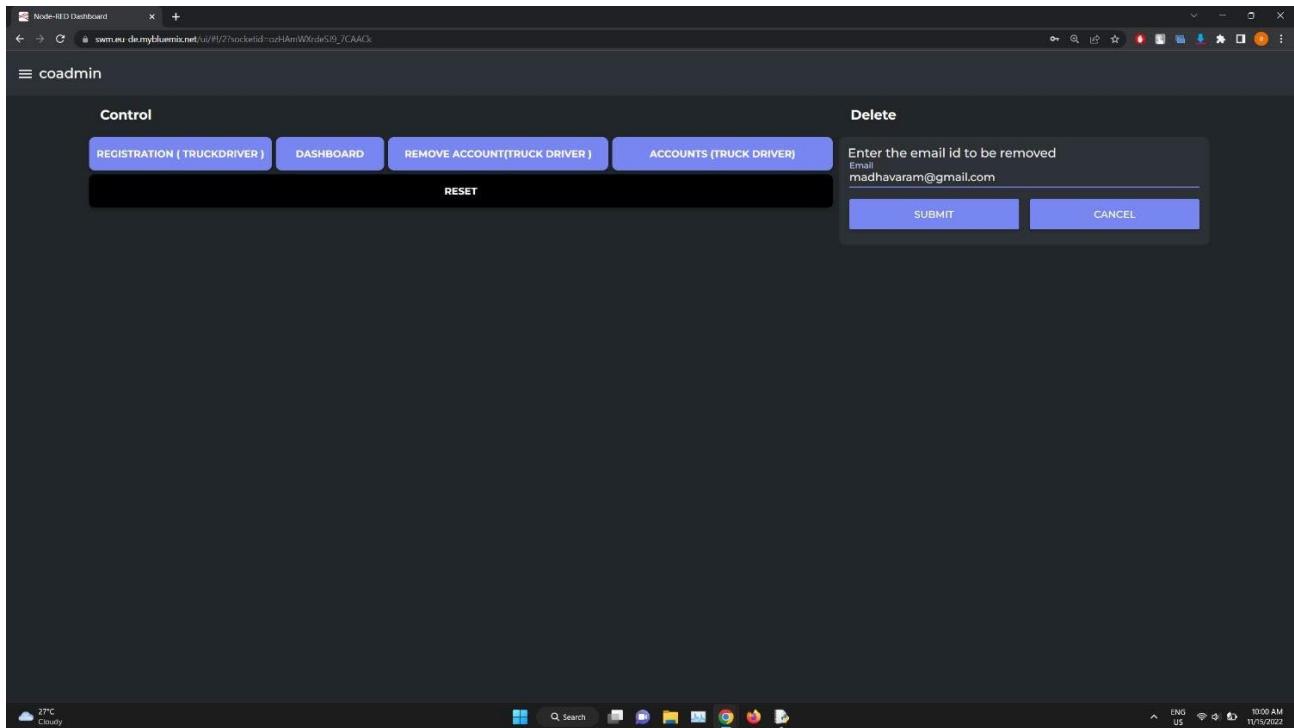
The screenshot shows the same dark-themed Node-RED dashboard window. The "ACCOUNTS ( TRUCK DRIVER )" tab is still active. The "Accounts" table now includes a second row for a new account:

Name	Phone Number	Location	Email
Dharneeshwaran	7416520963	Madhavaram	111779106030@smartinternz.com
Driver1	9840706123	Madhavaram	madhavaram@gmail.com

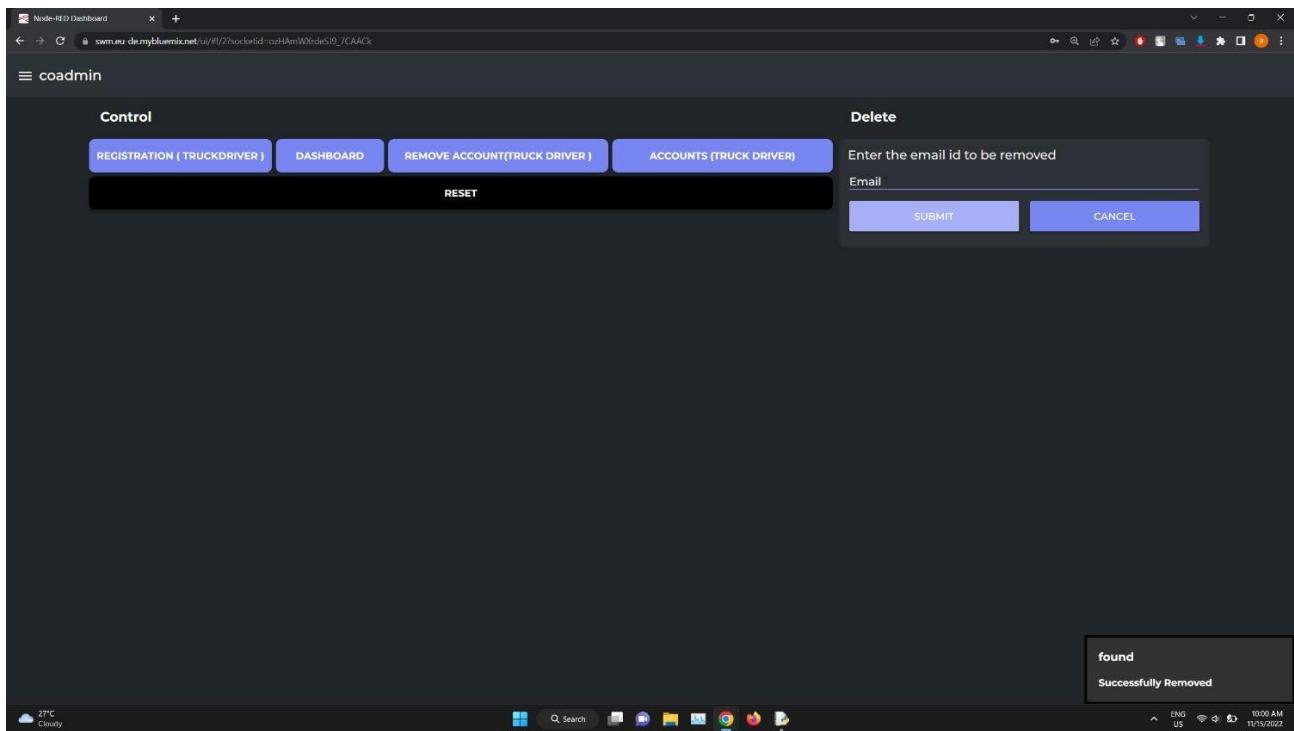
The status bar at the bottom of the screen shows the date and time as 11/15/2022, 10:59 AM, and the system temperature as 27°C.

## Remove Account (Truck Driver):

To remove the Co admin account, we need to enter the email id which should be removed.

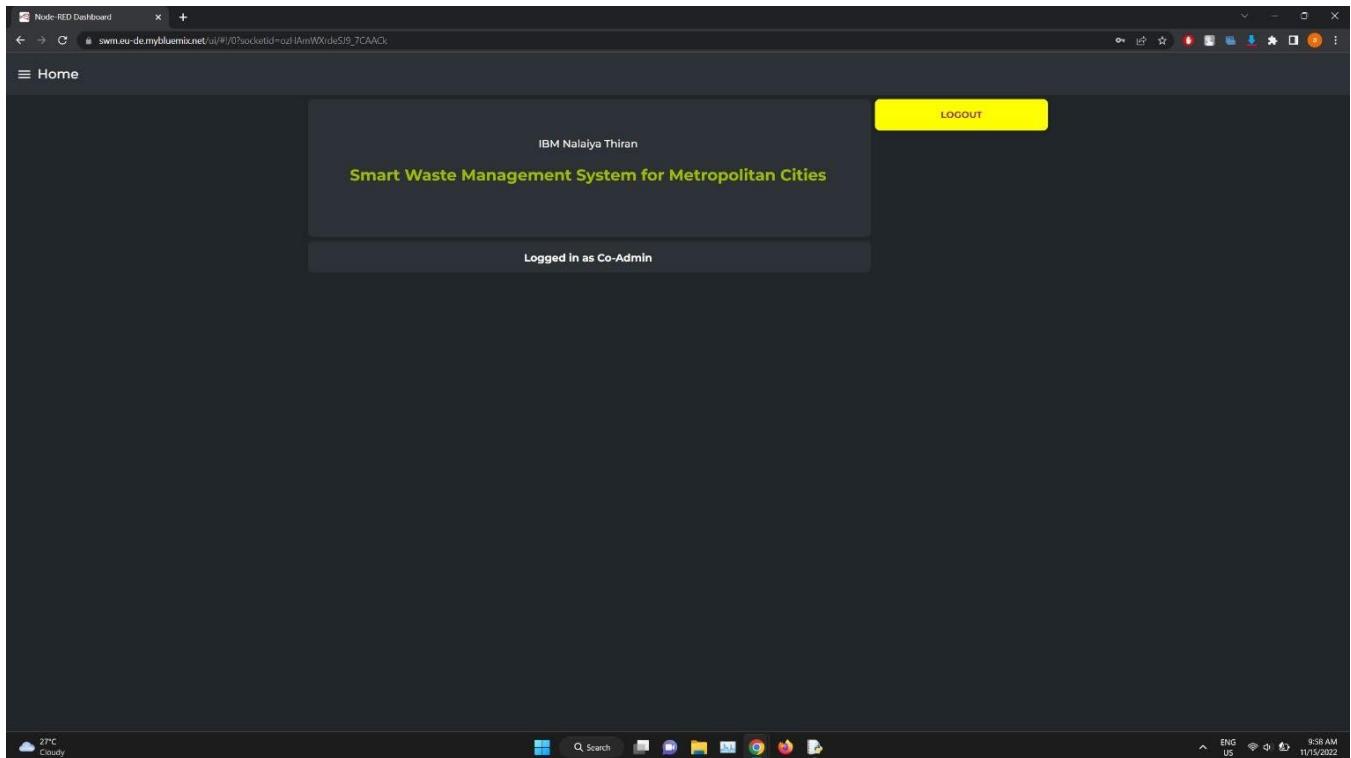


We can see the notification if the account is removed correctly or not.



## Logout Page:

By moving towards the home tab, we can see logout button and then we can again login to any other account if needed.



## SPRINT 3

In this Phase, I will explain about the flow of our project.

- As we mentioned in the Data flow graph, we are first using online simulation tool to send the level of the dustbin with the help of ultrasonic sensor using WOKWI platform and we also send the required data such as location, bin name etc...
- This data is being sent to the IBM Watson IOT platform and which the help of IBM Watson IOT node we can get the data in node red.
- We designed few flows to make the data to be in a required format like maps, tables, gauge.
- Here we store the Admin, Co admin, Truck driver details in the database (Cloudant DB)
- We also store the Timings of the BIN which is being filled for future calculations.
- We have also created a python script to generate random BIN values which can also be used instead of WOKWI to send data to the IBM Watson IOT platform.

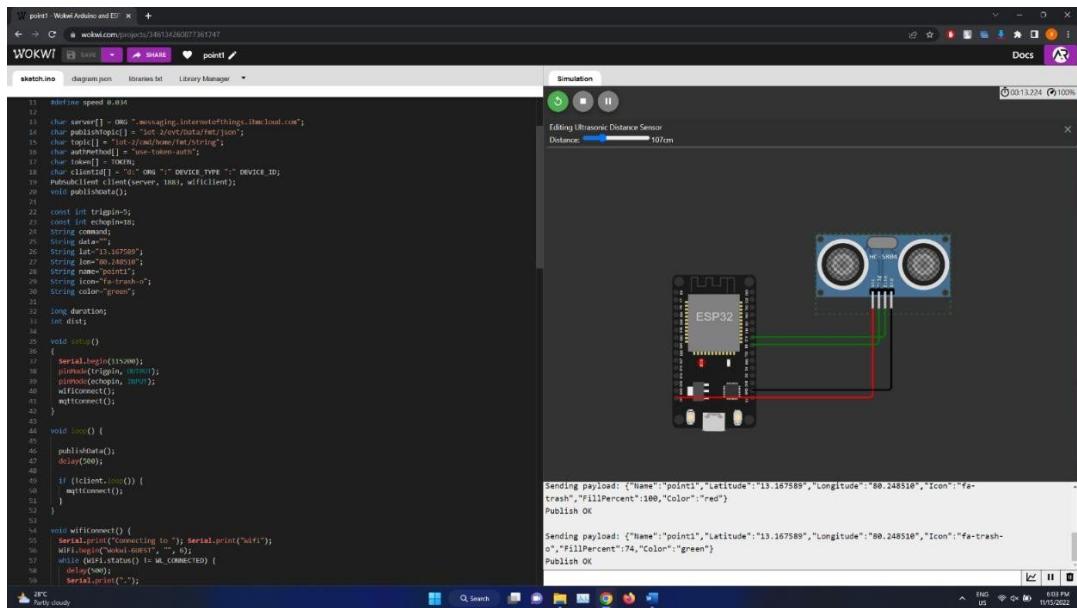
- I've also added few Screenshots of the things we have done.
- And In Bin database, we also delete the data from the database when the number of elements is above 11 for making use of the space effectively.
- We used world map node for displaying the latitude and longitude in the Map.

These are the things we have done in our project in Sprint Phase 3

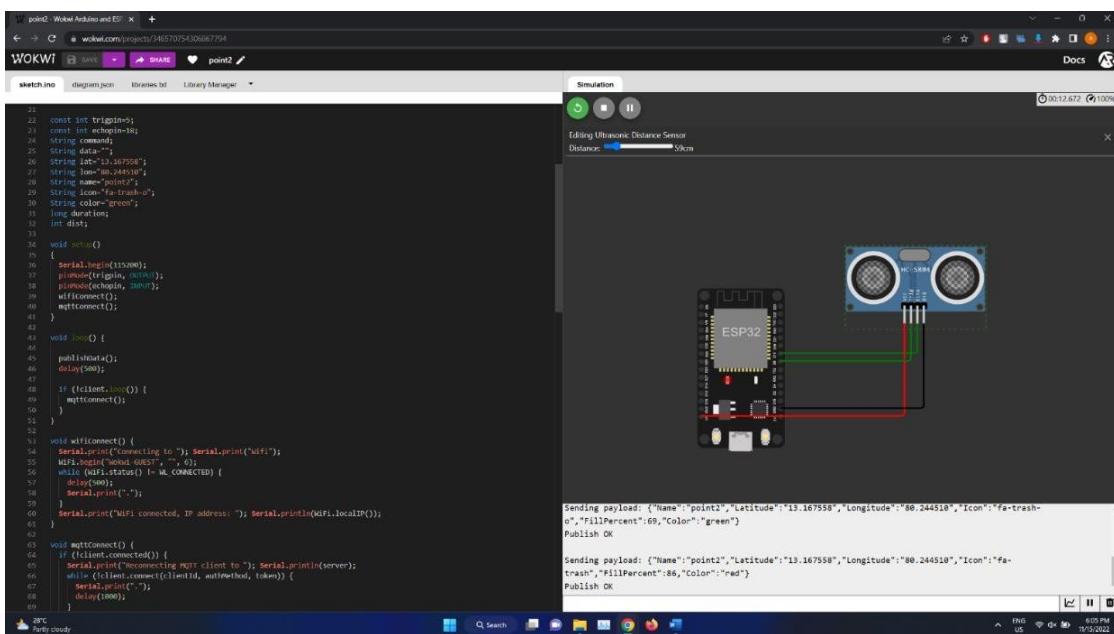
## SCREENSHOTS:

### 1) WOKWI Platform:

As we move the slider of the ultrasonic sensor. The value of the bin get changed



For BIN 1:



For BIN 2:

## **2) Python Code:**

Here we can see the Python Code which is used to connect with IBM Watson IOT platform.

The screenshot shows the PyCharm IDE interface with the following details:

- File Menu:** File, Edit, View, Navigate, Code, Refactor, Run, Tools, VCS, Window, Help.
- Project Bar:** pythonProject2
- Main Editor:** main.py (Content shown below)
- Terminal:** Published data Successfully: %s (Logs shown below)
- Status Bar:** 28°C Partly cloudy, ENG US, 607 PM, 11/15/2022

```
pythonProject2 - MainPy
Project
pythonProject2
  main.py
  External Libraries
  Scratches and Console

main.py
13     "token": "123456789"
14   }
15 }
16
17 lat="13.167589"
18 long="80.248510"
19 name="point1"
20 icon="fa-trash-o"
21 color="green"
22 def myCommandCallback(cmd):
23     print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
24     msgData['command'] = cmd.data['command']
25
26 client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
27 client.connect()
28
29 while True:
30     temp=randint(0,100)
31     if temp>60:
32         icon="fa-trash"
33         color = "red"
34     else:
35         icon = "fa-trash-o"
36         color = "green"
37     myData={"Name":name,"Latitude":lat,"Longitude":long,"Icon":icon,"FillPercent":temp,"Color":color}
38     client.publishEvent(eventName="status", msgFormat="json", data=myData, qos=0, onPublish=None)
39     print("Published data Successfully: %s", myData)
40     client.commandCallback = myCommandCallback
41     time.sleep(10)
42 client.disconnect()
```

```
C:\Users\Arun K\PycharmProjects\pythonProject2\venv\Scripts\python.exe" "C:/Users\Arun K\PycharmProjects\pythonProject2/main.py"
Published data Successfully: %s {'Name': 'point1', 'Latitude': '13.167589', 'Longitude': '80.248510', 'Icon': 'fa-trash-o', 'FillPercent': 21, 'Color': 'green'}
2022-11-15 18:07:24,371 wiotp.sdk.device.DeviceClient INFO Connected successfully: dnhpwo:NodeMCU:12345
Published data Successfully: %s {'Name': 'point1', 'Latitude': '13.167589', 'Longitude': '80.248510', 'Icon': 'fa-trash', 'FillPercent': 99, 'Color': 'red'}
```

For BIN 1:

```
sample2.py - E:\Blink\sample2.py (3.7.4)
File Edit Format Run Options Window Help
import paho.mqtt.client as mqtt
#pip install wiotp-py
import wiotp.sdk
import time
import random
myConfig = {
    "identity": {
        "orgId": "phpvjct",
        "typeId": "raspberrypi",
        "deviceId": "12345"
    },
    "auth": {
        "token": "123456789"
    }
}
#<--(1).192.168.1.10
ip="192.168.1.10"
port=80,24439
name="pi@raspberrypi"
icon="fa-trash-o"
color="green"
def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform: " + cmd.data['command'])
    n=cmd.data['command']
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

while True:
    temp=random.randint(0,100)
    if temp>40:
        icon="fa-crash"
        color = "#red"
    else:
        icon = "fa-trash-o"
        color = "#green"
    myData={"Name":name,"Latitude":lat,"Longitude":lon,"Icon":icon,"FillPercent":temp,"Color":color}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
    print("Published data successfully: ", myData)
    client.commandCallback = myCommandCallback
    time.sleep(10)
client.disconnect()
```

For BIN 2:

### 3) IBM Watson IOT platform:

Event	Value	Format	Last Received
status	{"Name": "point1", "Latitude": "13.167589", "Longitude": "88.344318"}	json	a few seconds ago
status	{"Name": "point1", "Latitude": "13.167589", "Longitude": "88.344318"}	json	a few seconds ago
status	{"Name": "point1", "Latitude": "13.167589", "Longitude": "88.344318"}	json	a few seconds ago
status	{"Name": "point1", "Latitude": "13.167589", "Longitude": "88.344318"}	json	a few seconds ago
status	{"Name": "point1", "Latitude": "13.167589", "Longitude": "88.344318"}	json	a few seconds ago

Here we can see the output which has been passed from WOKWI Platform or Python Script to IBM Watson IOT platform.

Event Name	status
Time Received	Nov 15, 2022 7:54 PM

```
1+ [ {  
2+   "name": "point1",  
3+   "latitude": "13.167589",  
4+   "longitude": "88.344318",  
5+   "color": "#00ff00",  
6+   "fillPercent": 50,  
7+   "color": "green"  
8+ } ]
```

The Value which is passed is shown here.

## 4) Cloudant DB:

The screenshot shows the Cloudant Dashboard interface. On the left is a sidebar with icons for databases, documents, queries, and more. The main area is titled "Databases" and lists six databases: admin, bin1, bin2, coadmin, projectnalaiyathiran, and truckdriver. Each database entry includes columns for Name, Size, # of Docs, Partitioned, and Actions (with icons for edit, lock, and delete).

Name	Size	# of Docs	Partitioned	Actions
admin	85 bytes	1	No	[Edit, Lock, Delete]
bin1	2.2 KB	11	No	[Edit, Lock, Delete]
bin2	1.0 KB	11	No	[Edit, Lock, Delete]
coadmin	211 bytes	2	No	[Edit, Lock, Delete]
projectnalaiyathiran	103.7 KB	4	No	[Edit, Lock, Delete]
truckdriver	137 bytes	1	No	[Edit, Lock, Delete]

## Admin Database:

The screenshot shows the Cloudant Admin Database interface for the "admin" database. The left sidebar lists "All Documents", "Query", "Permissions", "Changes", and "Design Documents". The main area displays a single document with the ID "admin@gmail.com". The document details are shown in a table with columns for id, key, and value.

id	key	value
admin@gmail.com	admin@gmail.com	{"rev": "1-2f028571dd08a9b0d9c24df5346eb0b"}

## Co-admin Database:

The screenshot shows the Cloudant Dashboard interface for a database named 'coadmin'. The left sidebar contains navigation links for 'All Documents', 'Query', 'Permissions', 'Changes', and 'Design Documents'. The main area displays a table with two documents. The columns are 'id', 'key', and 'value'. The first document has an id of '111719106009@smartinternz.com' and a key of '111719106009@smartinternz.com', with a value object containing a rev field. The second document has an id of 'aswinkumar@gmail.com' and a key of 'aswinkumar@gmail.com', with a value object containing a rev field.

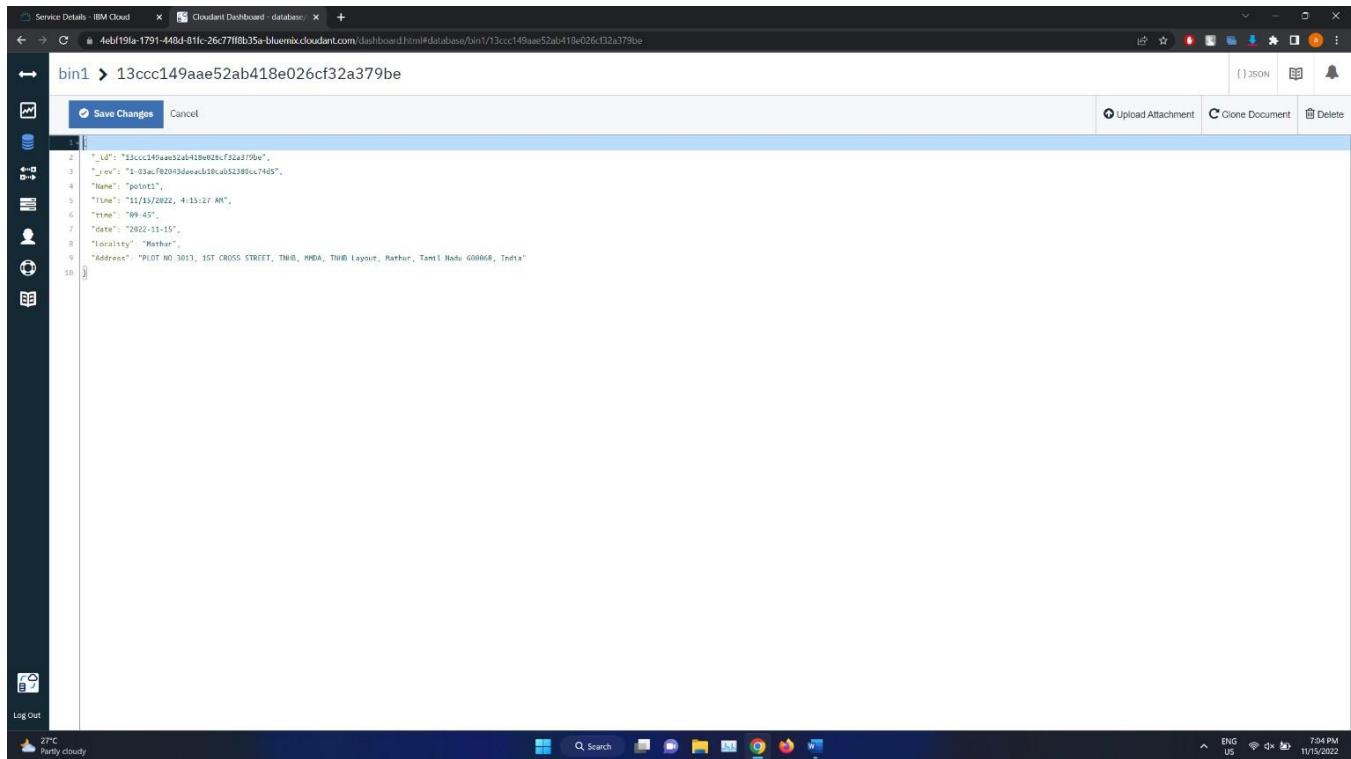
id	key	value
111719106009@smartinternz.com	111719106009@smartinternz.com	{"rev": "3-7951ba80d9fd8f73336e7d5d325fa98"}
aswinkumar@gmail.com	aswinkumar@gmail.com	{"rev": "1-2016876a97af01c9d986c0f1fed28080"}

The screenshot shows the Cloudant Dashboard interface for a database named 'truckdriver'. The left sidebar contains navigation links for 'All Documents', 'Query', 'Permissions', 'Changes', and 'Design Documents'. The main area displays a table with one document. The columns are 'id', 'key', and 'value'. The document has an id of '111719106030@smartinternz.com' and a key of '111719106030@smartinternz.com', with a value object containing a rev field.

id	key	value
111719106030@smartinternz.com	111719106030@smartinternz.com	{"rev": "1-3c62ab799d3ac4830690412414b02213"}

## Truck Driver Database:

## BIN 1 Database

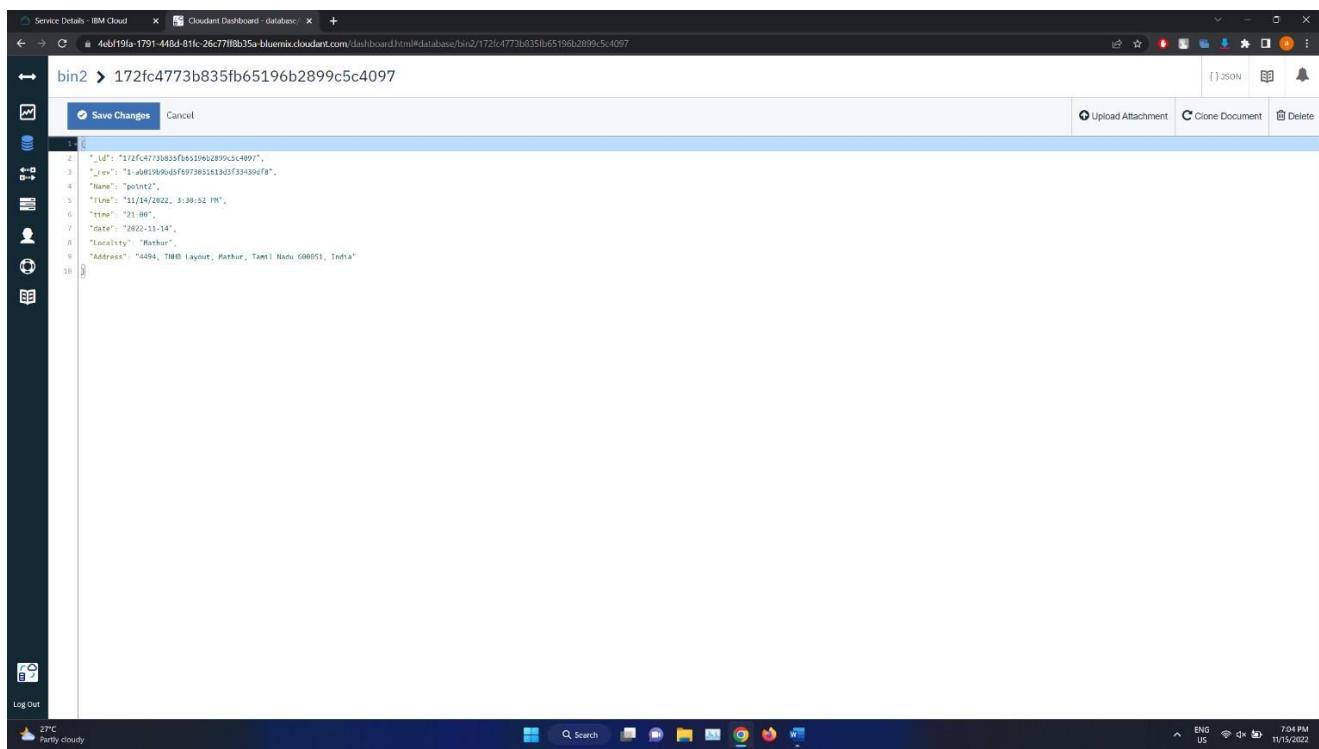


The screenshot shows a web browser window with the URL <https://4ebf19fa-1791-448d-81fc-26c77ff8b35a-bluemix.cloudant.com/dashboard.html#/database/bin1/13ccc149aae52ab418e026cf32a379be>. The page displays a JSON document with the following content:

```
1: {
2:   "_id": "13ccc149aae52ab418e026cf32a379be",
3:   "_rev": "1-03acf02093adeac59ca052380cc74d5",
4:   "Name": "potnt1",
5:   "Time": "11/13/2022, 4:15:27 AM",
6:   "Time": "09:45",
7:   "Date": "28/22-11-15",
8:   "Locality": "Muthur",
9:   "Address": "PLOT NO.3013, 1ST CROSS STREET, TNB, RMDA, TNB Layout, Muthur, Tamil Nadu 608668, India"
10: }
```

The dashboard includes standard Cloudant navigation and document management buttons like Save Changes, Upload Attachment, Clone Document, and Delete. The bottom of the screen shows a Windows taskbar with various icons and system status information.

## BIN 2 Database



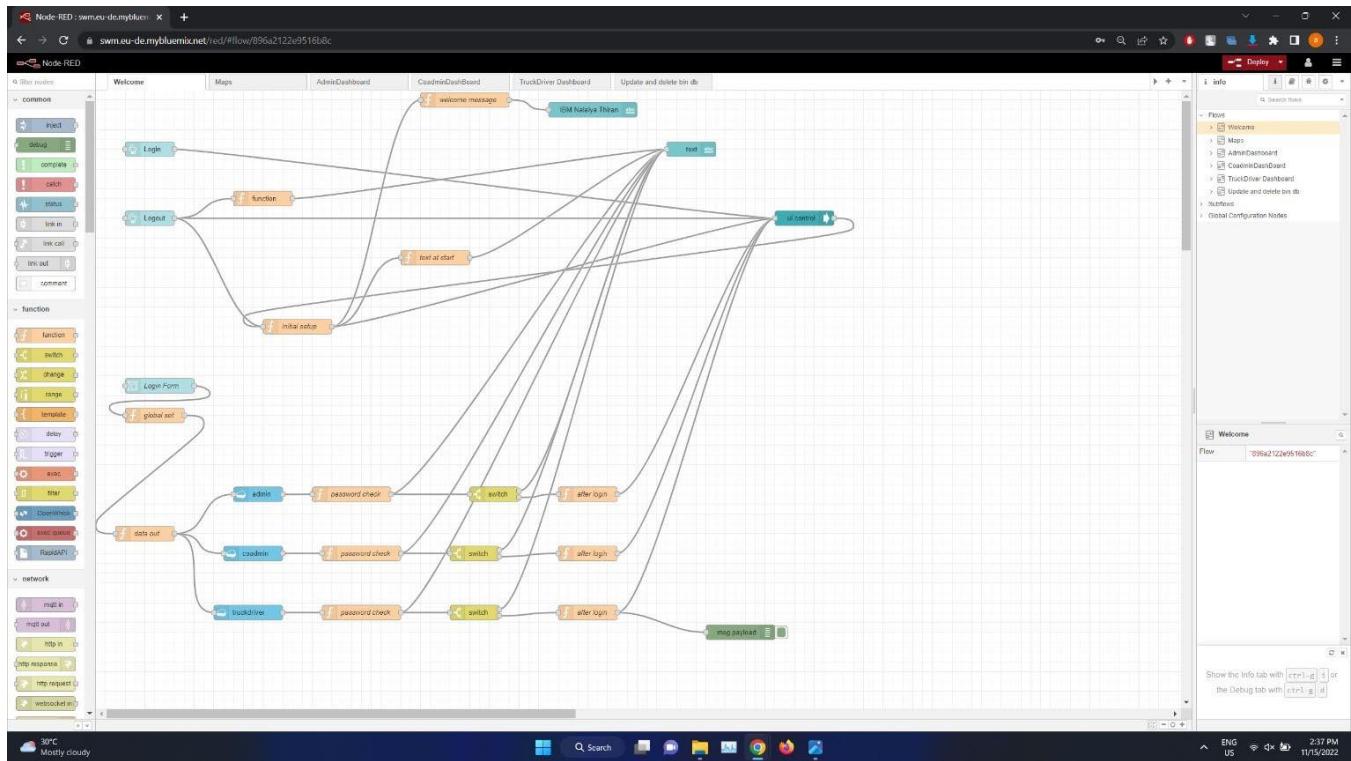
The screenshot shows a web browser window with the URL <https://4ebf19fa-1791-448d-81fc-26c77ff8b35a-bluemix.cloudant.com/dashboard.html#/database/bin2/172fc4773b835fb65196b2899c5c4097>. The page displays a JSON document with the following content:

```
1: {
2:   "_id": "172fc4773b835fb65196b2899c5c4097",
3:   "_rev": "1-4b019690d5f5973851813d3f33439ef8",
4:   "Name": "potnt2",
5:   "Time": "11/14/2022, 3:39:52 AM",
6:   "Time": "01:00",
7:   "Date": "28/22-11-14",
8:   "Locality": "Muthur",
9:   "Address": "4494, TNB Layout, Muthur, Tamil Nadu 608651, India"
10: }
```

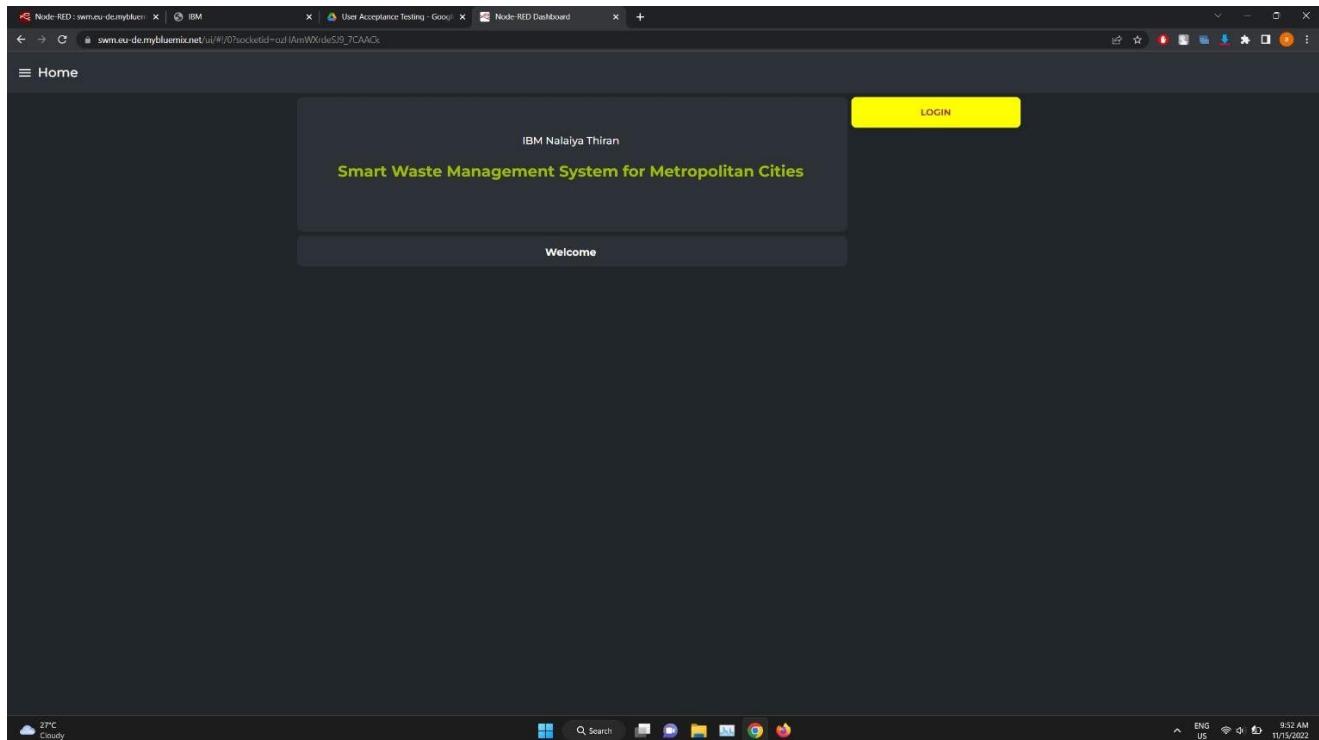
The dashboard includes standard Cloudant navigation and document management buttons like Save Changes, Upload Attachment, Clone Document, and Delete. The bottom of the screen shows a Windows taskbar with various icons and system status information.

## 5) Node RED flow

### Login/Logout (Home Page) Flow:

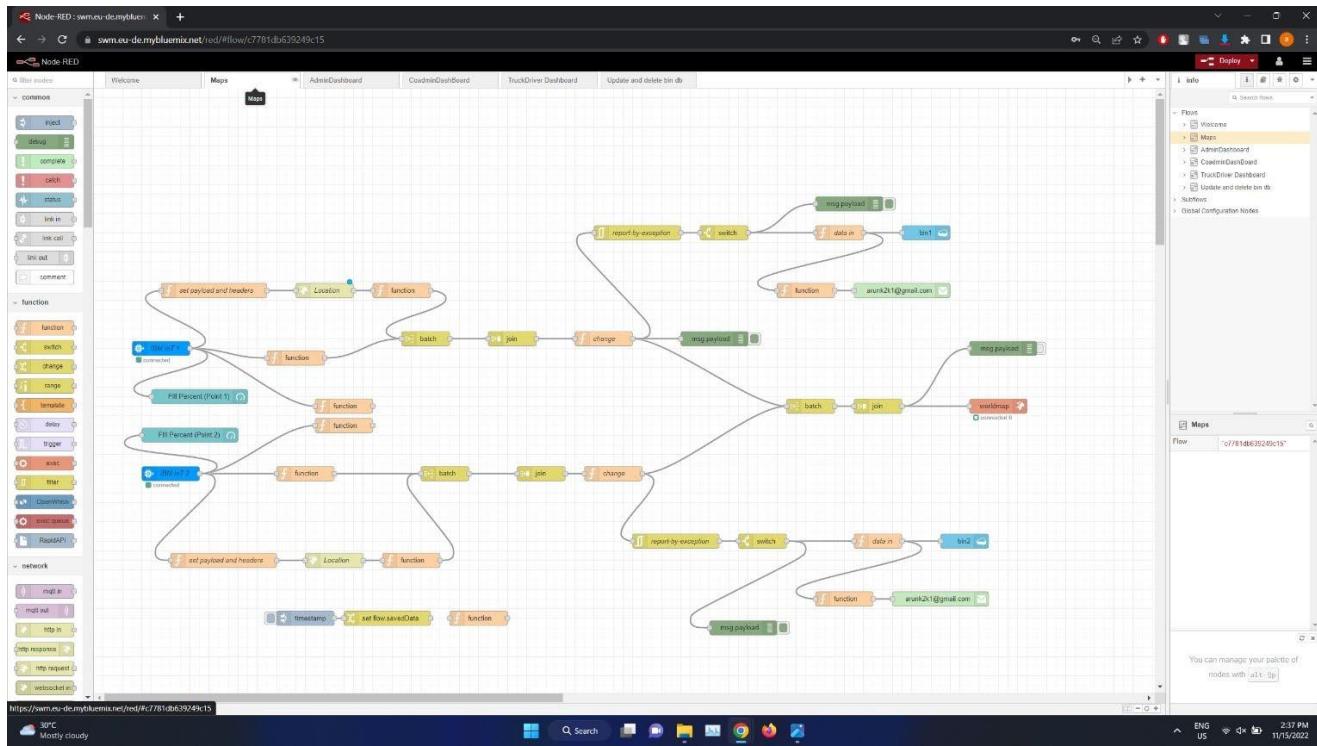


### Home Page:

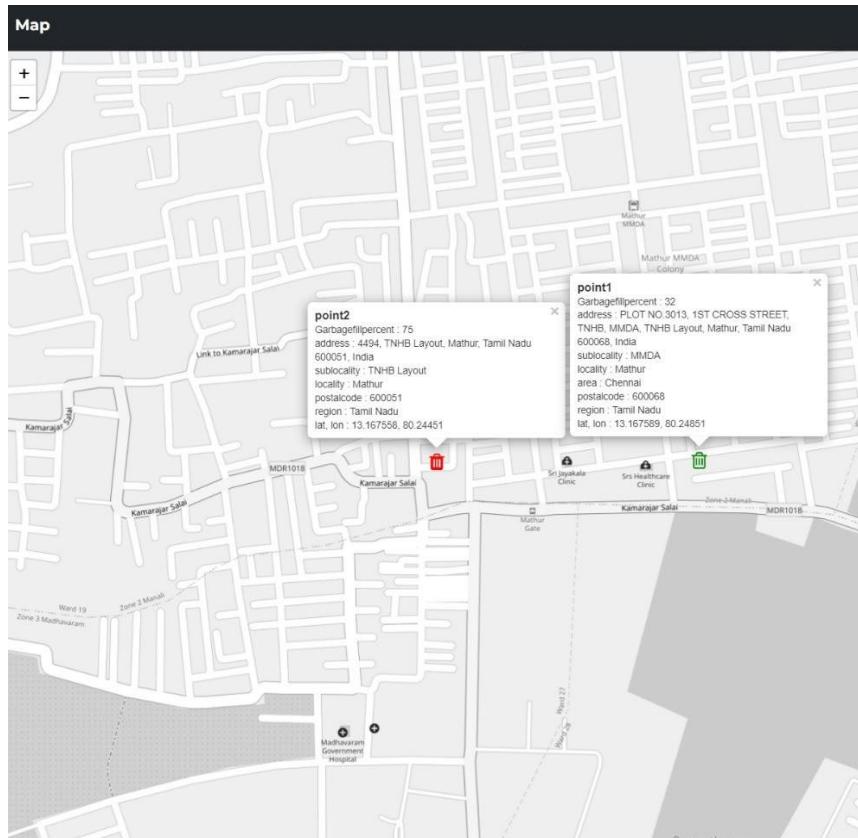


## Map Flow:

It is used to push bin values got from the IBM Watson IOT platform and push them into Database

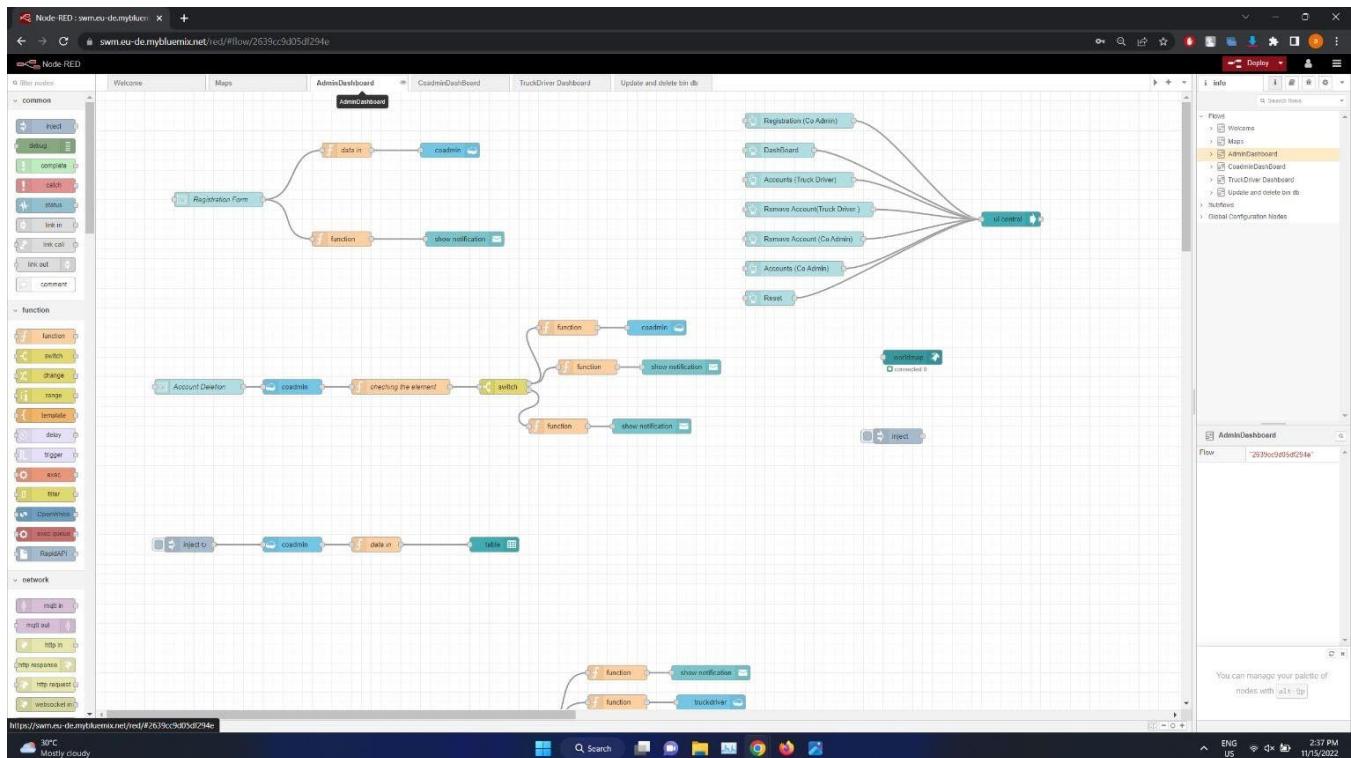


## Map Output page:

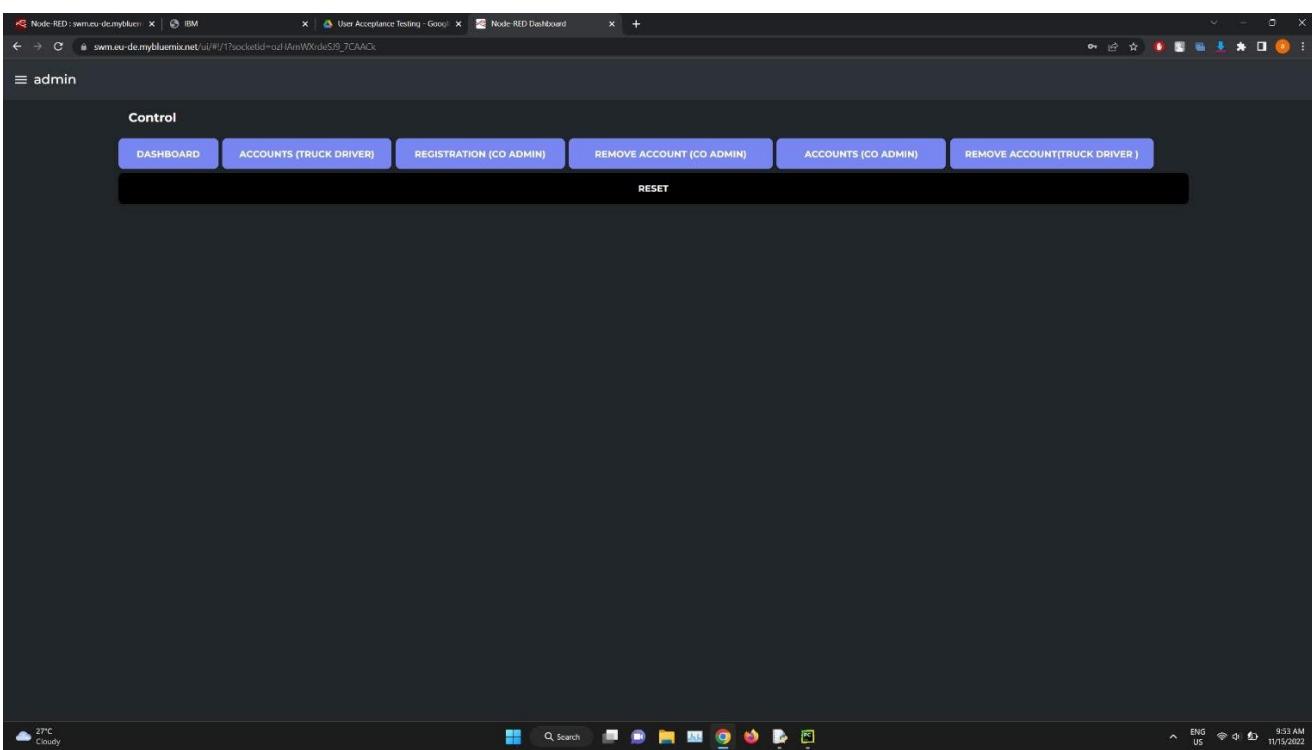


## Admin Flow:

This flow helps to create all the buttons and UI for Admin page

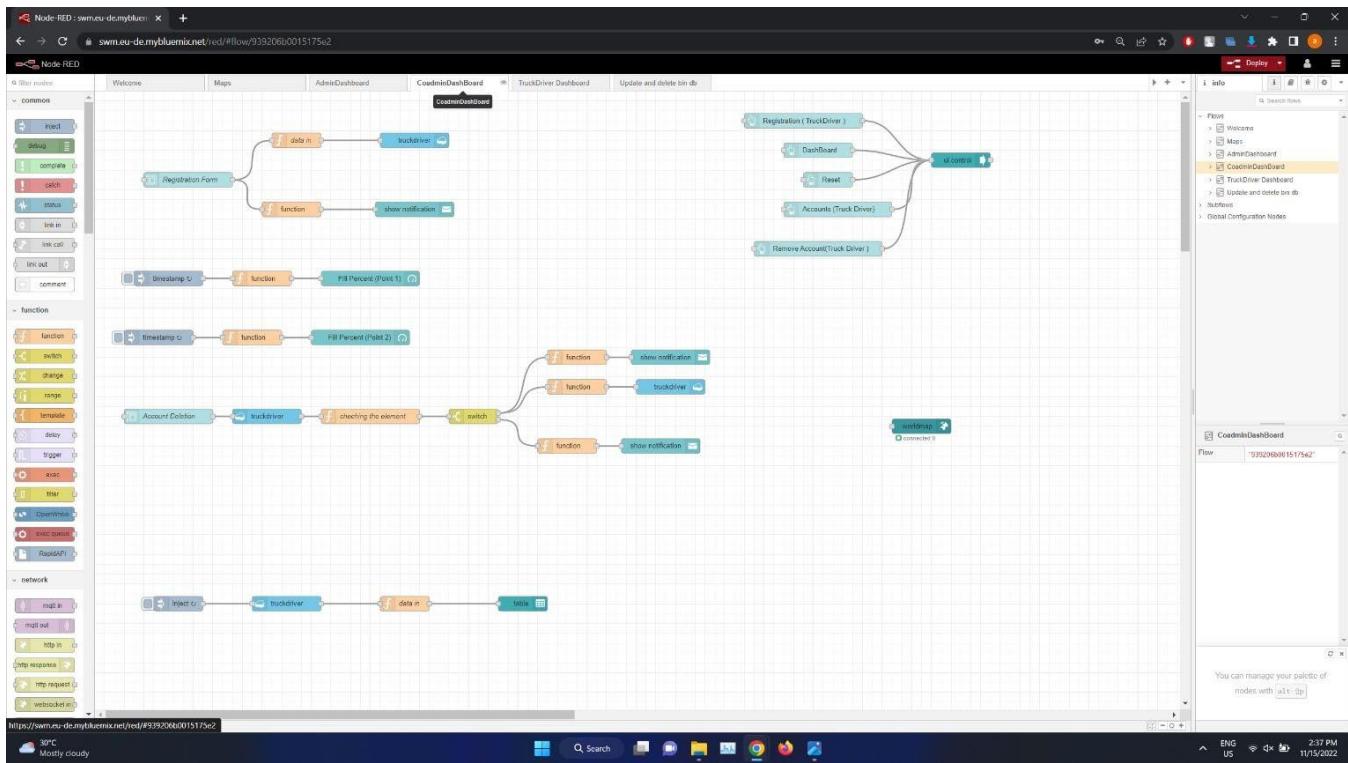


## Admin Page:

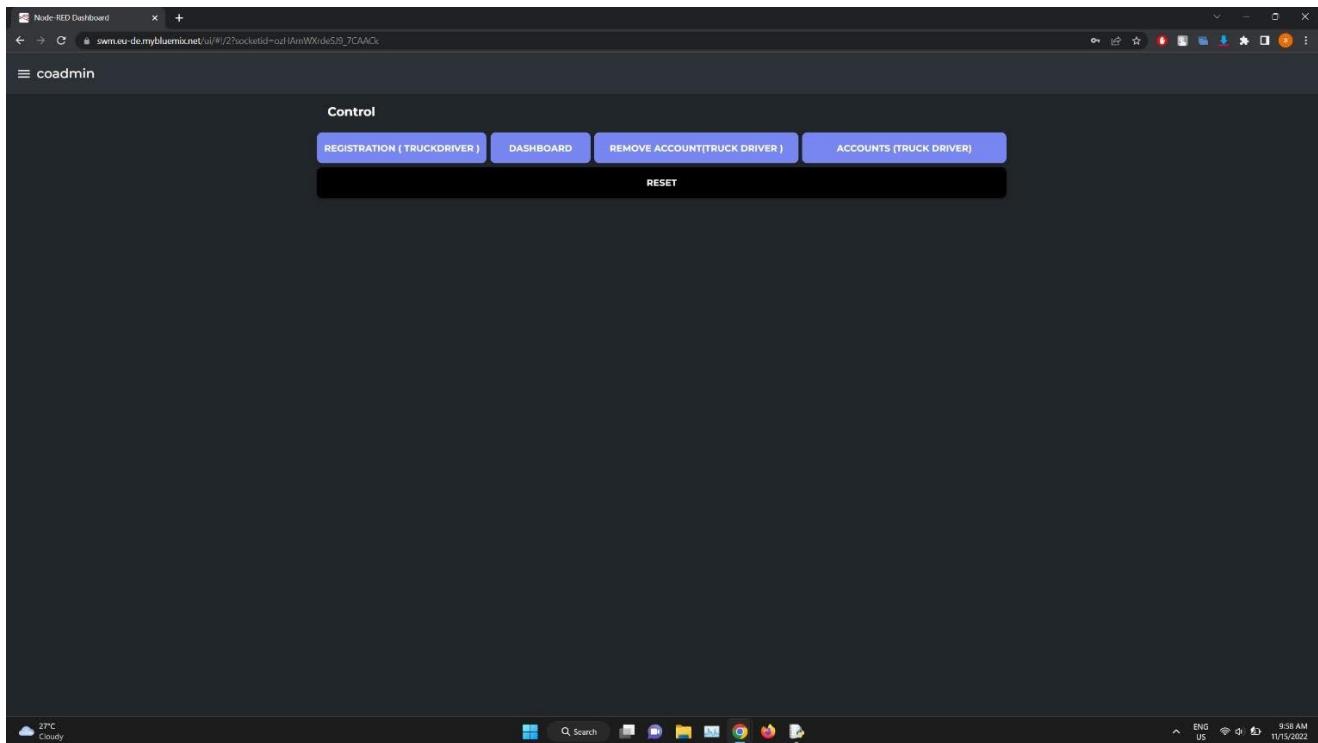


## Co-Admin Flow:

Here we can see all the UI based functions used for Co-admin page.

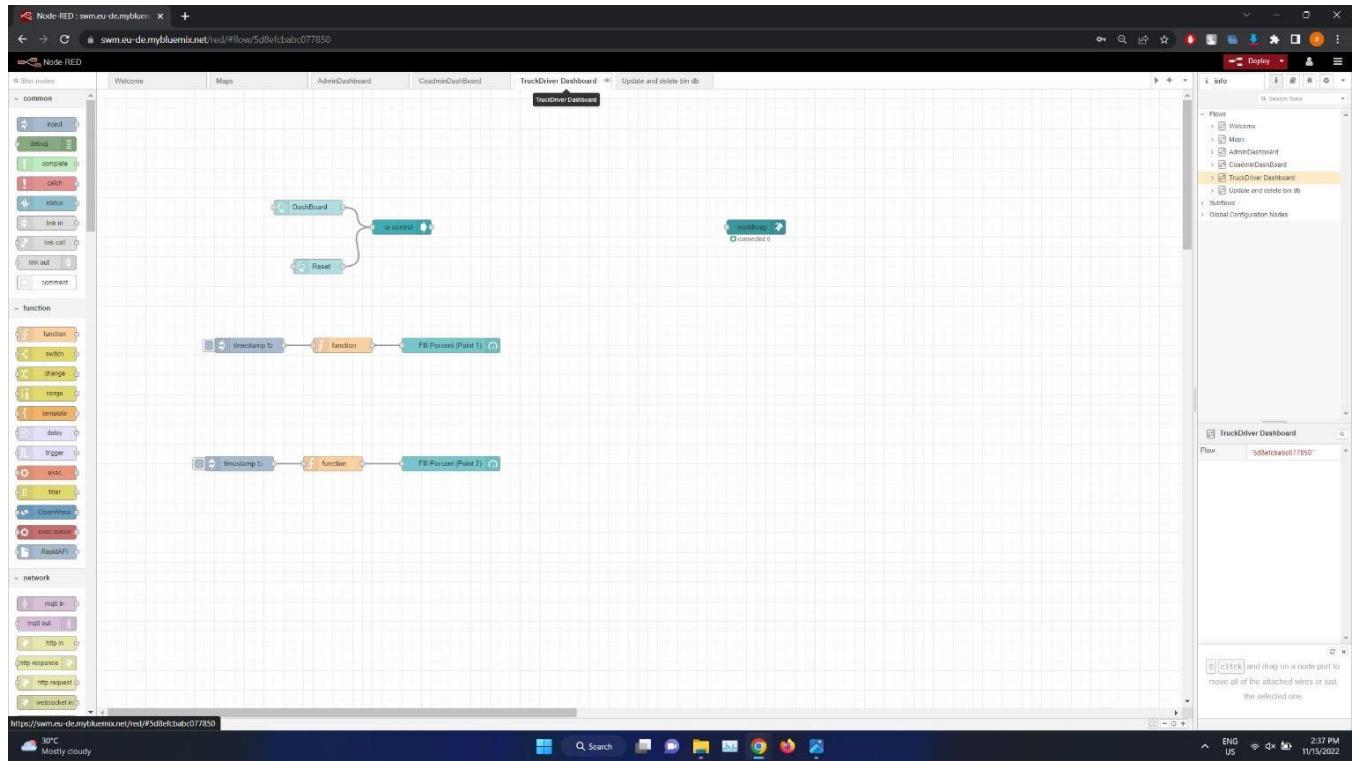


## Co-Admin Output page:

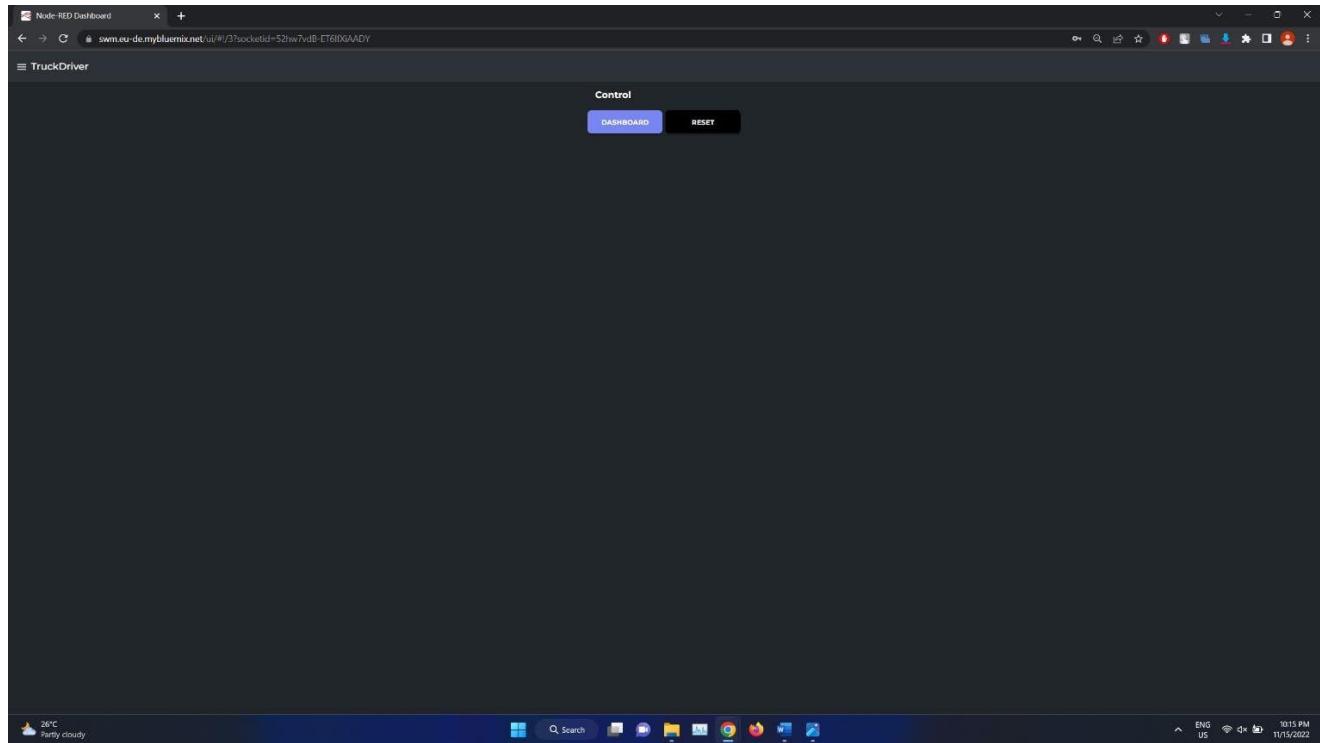


## Truck Driver Flow:

Here we can see all the UI based functions used for Truck Driver page.

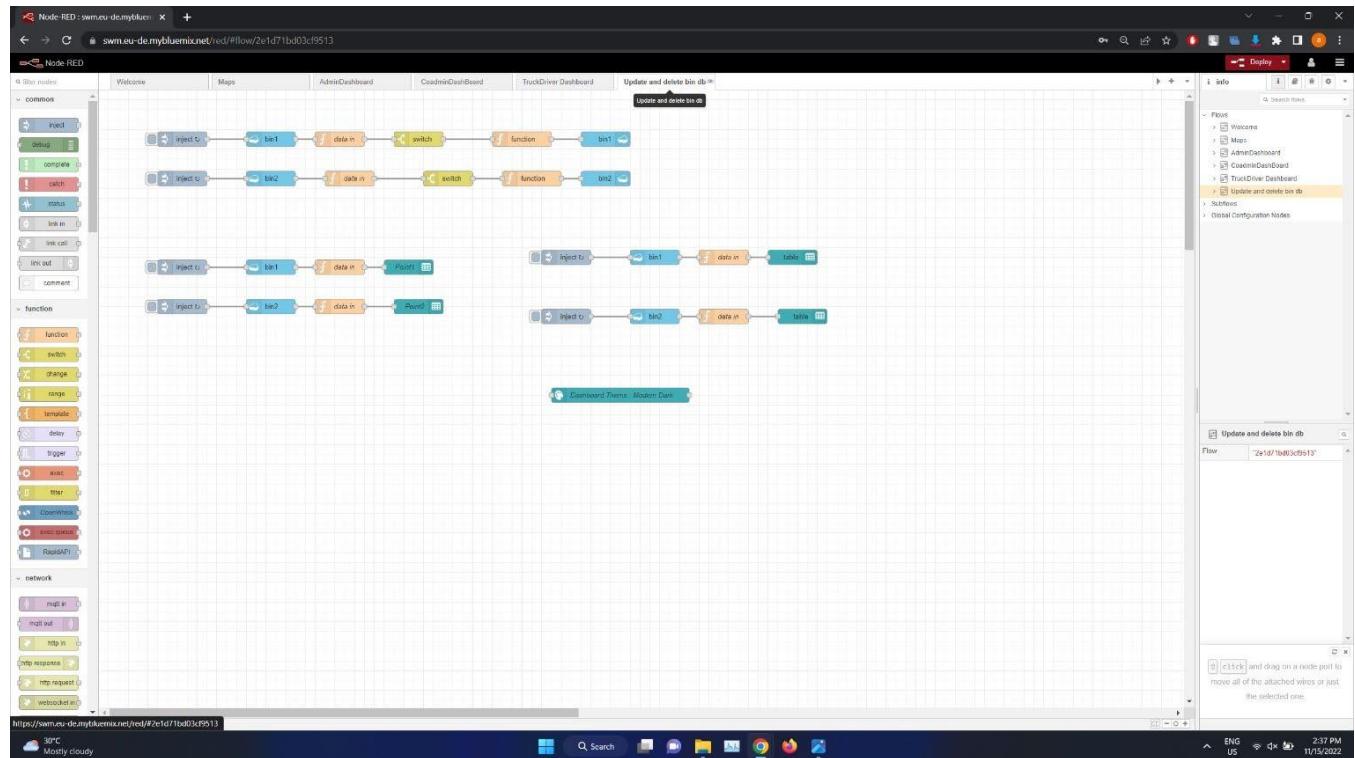


## Truck Driver Output page:



## Bin table Flow:

This flow used retrieve the data from the Database and push them into the Table.



## Output:

**Table**

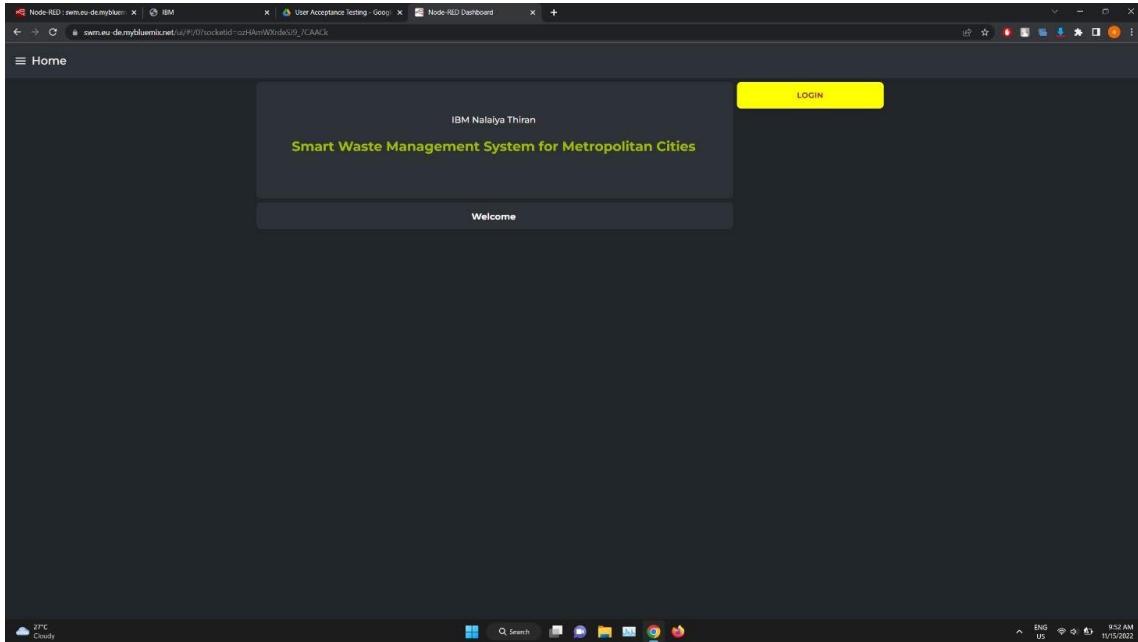
Name	Time	Date	Locality	Address
point1	09:45	2022-11-15	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	09:34	2022-11-15	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	09:33	2022-11-15	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	21:33	2022-11-14	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	21:30	2022-11-14	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	21:00	2022-11-14	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	20:59	2022-11-14	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	20:58	2022-11-14	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	20:58	2022-11-14	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
point1	20:58	2022-11-14	Mathur	PLOT NO.3013, 1ST CROSS STREET, TNHB, MMDA, TNHB Layout, Mathur, Tamil Nadu 600068, India
Name	Time	Date	Locality	Address
point2	10:24	2022-11-15	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	21:02	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	21:00	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	20:59	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	20:59	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	20:59	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	20:58	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	20:58	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	20:57	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India
point2	20:57	2022-11-14	Mathur	4494, TNHB Layout, Mathur, Tamil Nadu 600051, India

## SPRINT 4

In this Sprint phase 4,

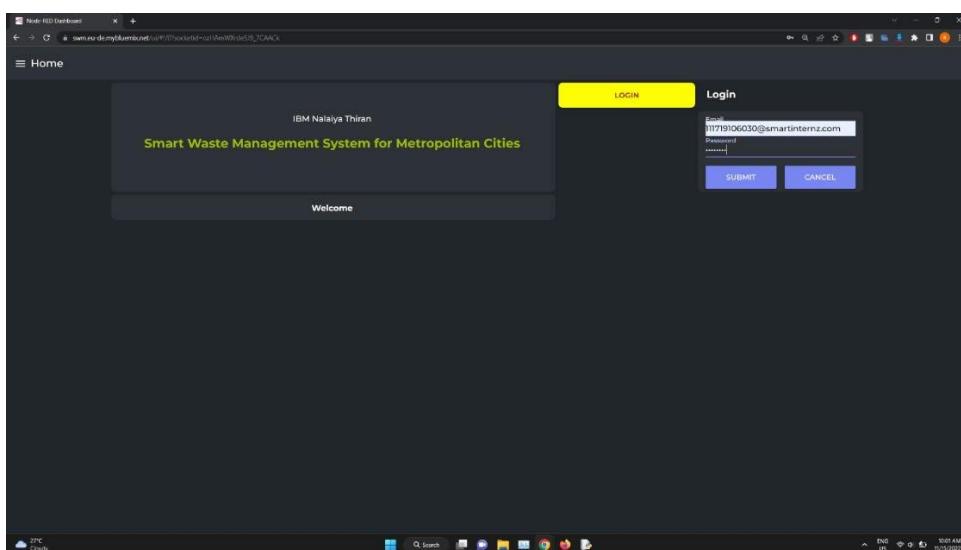
- We have created Truck Driver's Page where we can see the dashboard.
- We have also used API to get the Address of the given latitude and longitude which is commonly called as **Reverse Geolocation**.
- We have also added Email service in which once the Dustbin get filled upEmail will be sent automatically to the respective person.

### Home Page

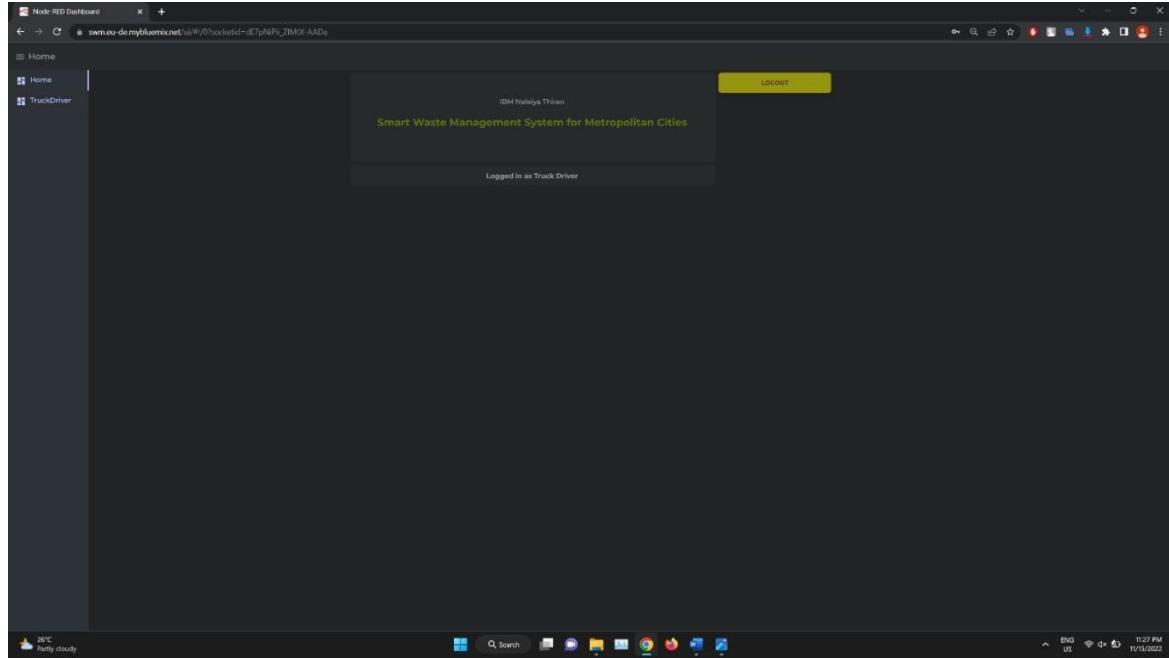


### Login Page:

Once we click on the login button, we can see the Login window appears in the right side. Now we need to enter the Truck Driver credentials.



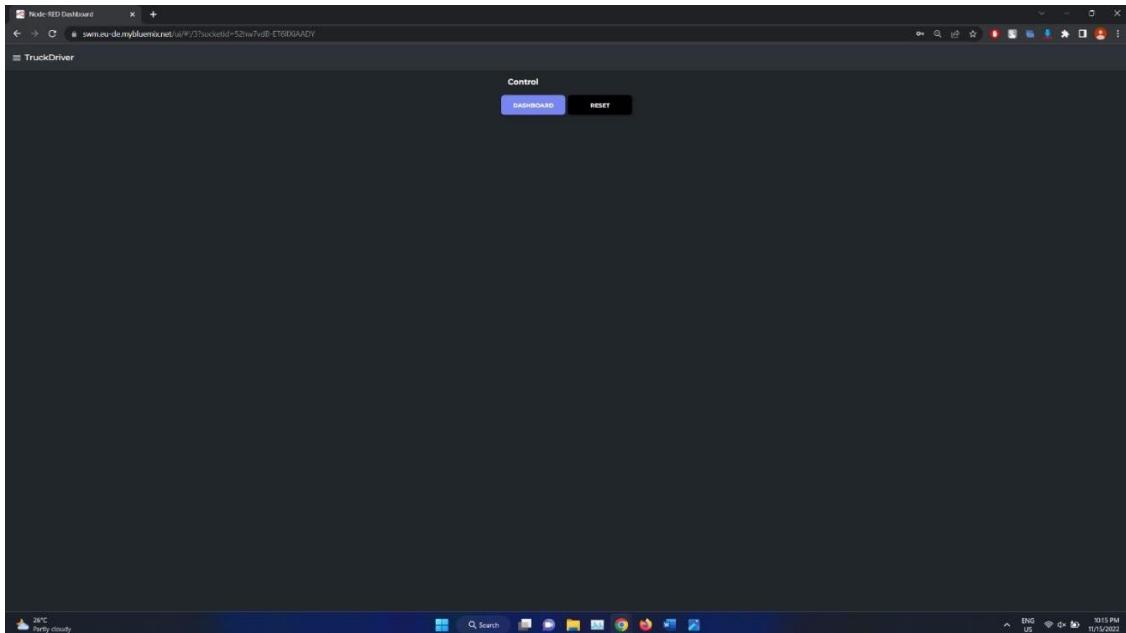
Once we successfully logged in, we can see the below status changed into Logged in as Truck Driver and we can see the Truck Driver tab appears.



### Truck Driver Page:

This is the Truck Driver page, here we can see different buttons.

Button	Functionalities
Dashboard	To view the map, dustbin level etc
Reset	To close all the groups opened (i.e., Dashboard)



## Dashboard:

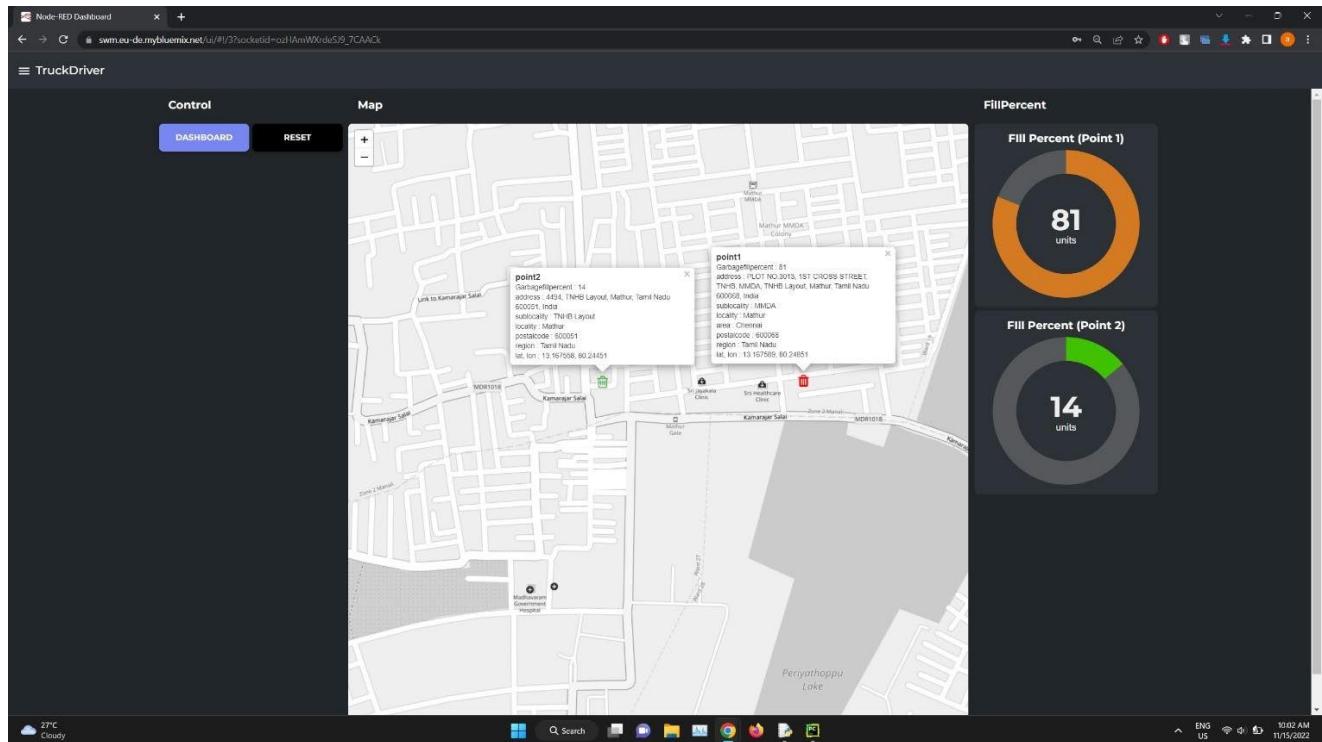
**Note:** Here I have used two dustbins. So, we can see both of their Trash Fill percent in their particular location.

By clicking the dashboard button, we can view the dashboard.

Here we can see the map and the Fill percent for both the garbage bin. By clicking on the icon in the map we can see the details like

- Fill percent
- Address
- Sub locality
- Postal code
- Region
- Latitude, longitude

**Note:** Here once the bin level crosses their threshold level (here I have set as 60%) the icon color changes to **Red**. if it is below the threshold the icon color changes back to **Green**.



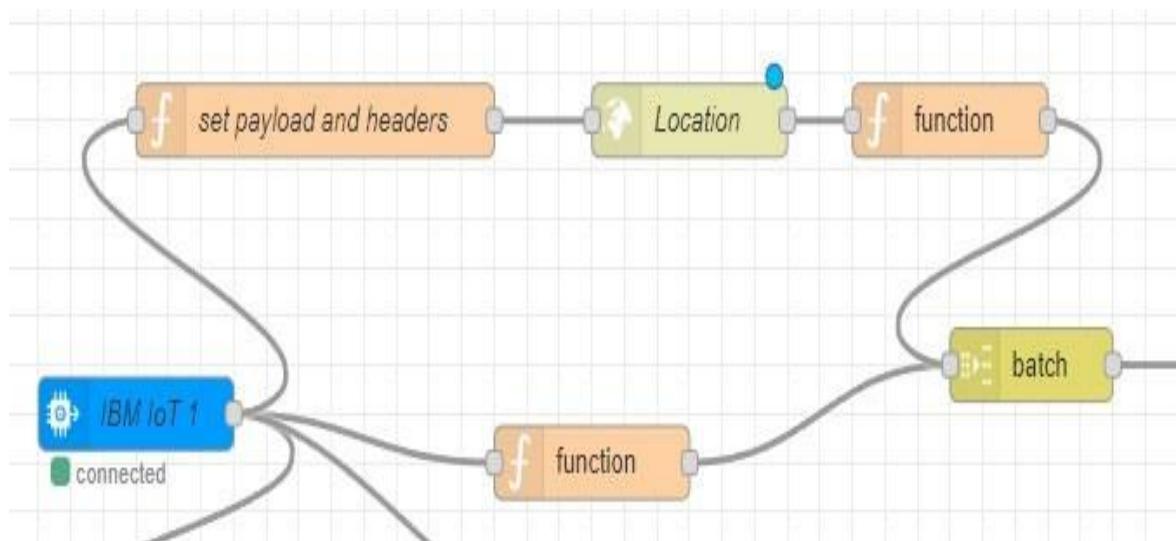
## Reverse Geo location:

For Reverse Geo location we can convert the latitude and longitude to a JSON format. And from that we have modified the JSON file into our desired file.

This is the Website where I've logged in and I have used the API service.

The screenshot shows the TrueWay Geocoding API Documentation page on the RapidAPI platform. The page includes the API's logo, popularity rating (9.8 / 10), latency (425ms), and service level (100%). It features sections for Endpoints, About, Tutorials, Discussions, and Pricing. A search bar at the top allows users to search for endpoints. Below the search bar, there are two main sections: "Obtain address for location" and "Code Snippets". The "Obtain address for location" section contains fields for Personal Account (set to "trunk"), RapidAPI App (set to "default\_application\_6797654"), Request URL (set to "rapidapi.com"), Header Parameters (X-RapidAPI-Key and X-RapidAPI-Host), and Required Parameters (location). The "Code Snippets" section displays a Node.js code example using Axios to make a GET request to the API endpoint with the provided parameters. The code includes error handling for the response.

This is the flow where we pass latitude and longitude value and we get the JSON file as output and we modify the JSON value and then we pass them to WORLD MAP node.

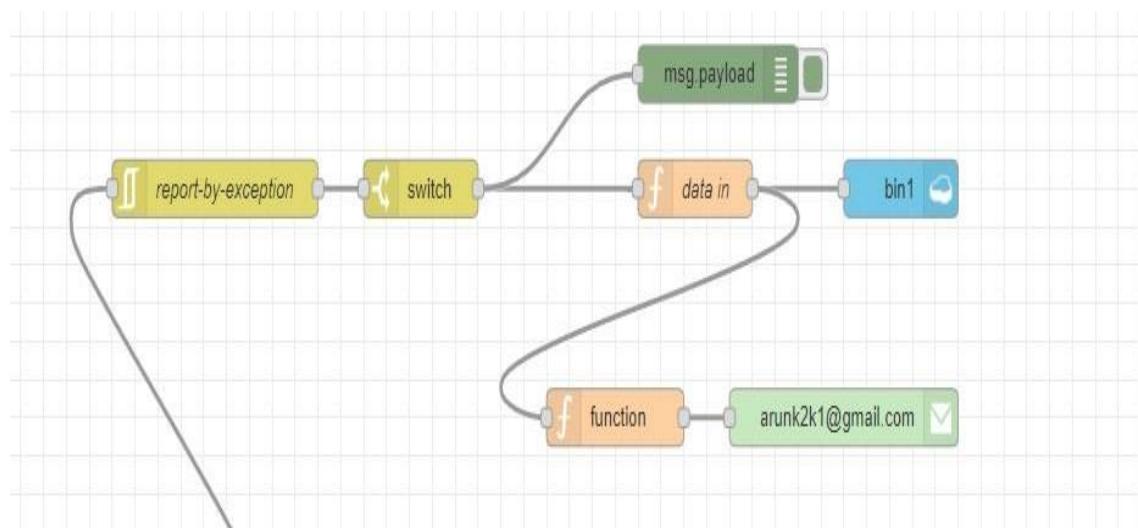


Here you can see the output of the world map.



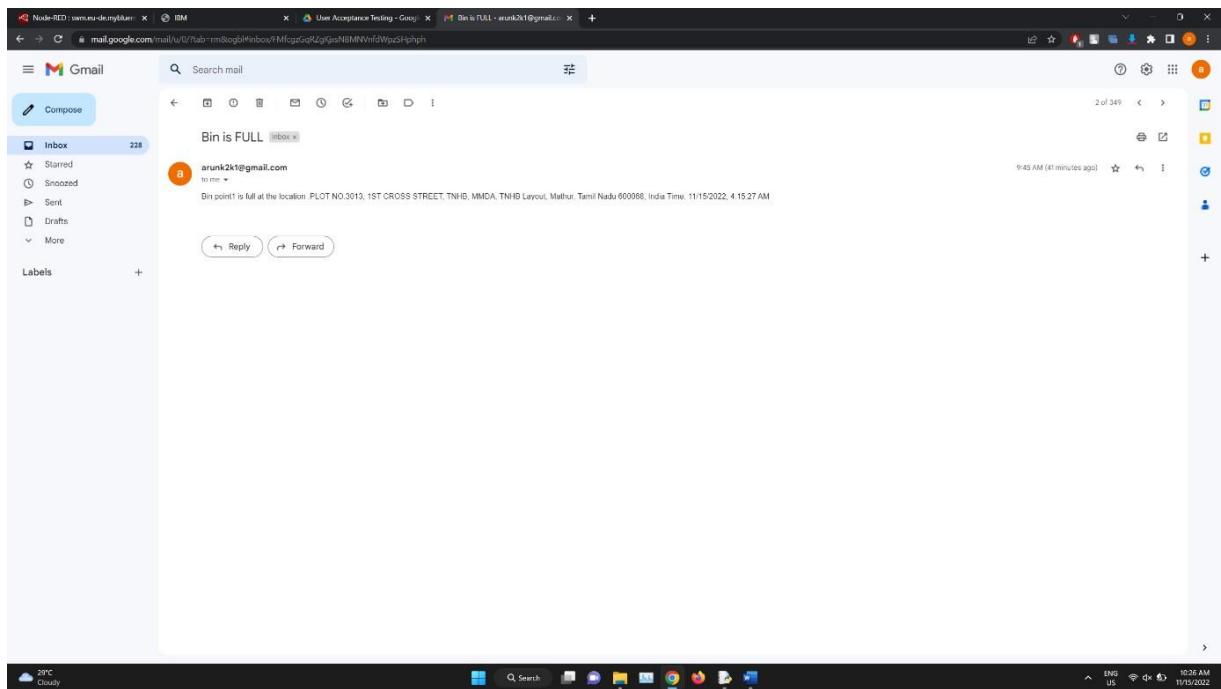
### Email Service:

- We have used email node for sending emails.
- The mail is sent only when the BIN gets filled to 100%

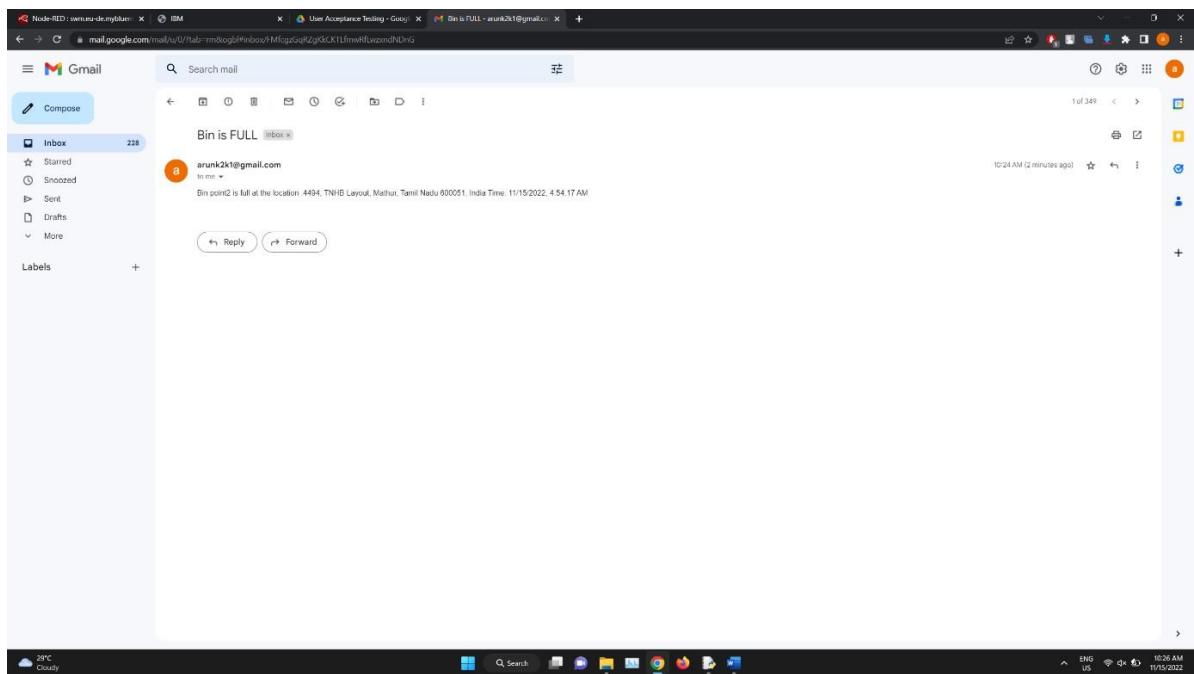


## Samples of the Email sent:

This is the Email sent when the **BIN 1** was filled to 100%.



This is the Email sent when the **BIN 2** was filled to 100%.



## 6.2 Sprint Delivery Schedule:

We have completed the Sprint delivery based on the Scheduled date.

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)	TEAM MEMBER
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022	HARSHA PRABHA
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022	APSARA S
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	07 Nov 2022	VETRISELVAN
Sprint-4	20	6 Days	17 Nov 2022	19 Nov 2022	20	16 Nov 2022	SARATH BABU R

## 6.3 Reports from JIRA (Link – [Click here](#) )

The screenshot shows a Jira Agile board for the 'Smart waste management Nalaya Thiran' project. The board is divided into three main columns: TO DO ISSUE, IN PROGRESS 1 ISSUE, and DONE 3 ISSUES. The TO DO ISSUE column contains one item: 'Creation of Truck driver page and adding email service and API's for Reverse Geolocation' (issue ID SWIMNT-10). The IN PROGRESS 1 ISSUE column contains one item: 'Creation of dashboard and managing other data flow' (issue ID SWIMNT-9). The DONE 3 ISSUES column contains three items: 'Admin page need to be done' (issue ID SWIMNT-7), 'Co admin need to be done' (issue ID SWIMNT-8), and 'Managing the databases' (issue ID SWIMNT-11). The sidebar on the left provides navigation links for Planning, Backlog, and Board, along with Project pages, Add shortcut, and Project settings. The top navigation bar includes links for Jira Software, Your work, Projects, Filters, Dashboards, People, Apps, and Create, along with a search bar and various icons for account and settings.

Smart waste management Nalaiya Thiran

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## Backlog

Planning

- Roadmap
- Backlog**
- Board

Development

- Code
- Project pages
- Add shortcut
- Project settings

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AK Insights

SWMNT Sprint 1 24 Oct - 29 Oct (1 issue)

- SWMNT-7 Admin page need to be done

+ Create issue

SWMNT Sprint 2 31 Oct - 5 Nov (1 issue)

- SWMNT-8 Co admin need to be done

+ Create issue

SWMNT Sprint 3 7 Nov - 12 Nov (2 issues)

- SWMNT-11 Managing the databases
- SWMNT-9 Creation of dashboard and managing other data flow

+ Create issue

SWMNT Sprint 4 14 Nov - 19 Nov (1 issue)

- SWMNT-10 Creation of Truck driver page and adding email service and API's for Reverse Geolocation

+ Create issue

Quickstart

This screenshot shows the Jira Backlog page for the 'Smart waste management Nalaiya Thiran' project. The backlog is organized into four sprints: Sprint 1 (Oct 24-29), Sprint 2 (Oct 31-Nov 5), Sprint 3 (Nov 7-12), and Sprint 4 (Nov 14-19). Each sprint contains one or more tasks, each with a status indicator (e.g., Done, In Progress) and a progress bar. The sidebar on the left provides navigation links for planning, development, and project management.

Smart waste management Nalaiya Thiran

Give feedback Share Export View settings

Projects / Smart waste management Nalaiya Thiran

## Roadmap

Planning

- Roadmap
- Backlog
- Board

Development

- Code
- Project pages
- Add shortcut
- Project settings

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Status category Epic

Sprints

Date	Oct	Nov	Dec
27	21	22	23
28	24	25	26
29	27	28	29
30	29	31	1
31	1	2	3
1	3	4	5
2	5	6	7
3	7	8	9
4	9	10	11
5	11	12	13
6	13	14	15
7	15	16	17
8	17	18	19
9	19	20	21
10	21	22	23
11	23	24	25
12	25	26	27
13	27	28	29
14	29	30	31
15	31	1	2
16	1	3	4
17	3	5	6
18	5	7	8
19	7	9	10
20	9	11	12
21	11	13	14
22	13	15	16
23	15	17	18
24	17	19	20
25	19	21	22
26	21	23	24
27	23	25	26
28	25	27	28
29	27	29	30
30	29	31	1
31	31	1	2

SWMNT-1 Home Page

SWMNT-2 Login

SWMNT-3 Admin Page

SWMNT-4 Co Admin Page

SWMNT-5 Dashboards

SWMNT-6 Tables and DataBase

SWMNT-7 API and Email service

+ Create Epic

Today Weeks Months Quarters

Quickstart

This screenshot shows the Jira Roadmap page for the 'Smart waste management Nalaiya Thiran' project. The roadmap displays a timeline from October 27 to December 31, divided into four sprints: Sprint 1 (Oct 24-29), Sprint 2 (Oct 31-Nov 5), Sprint 3 (Nov 7-12), and Sprint 4 (Nov 14-19). Each sprint is represented by a horizontal bar showing the duration and tasks assigned to it. The sidebar on the left provides navigation links for planning, development, and project management.

## 7. CODING & SOLUTIONING

### 7.1 Feature 1

As we mentioned in the Sprint Delivery phase, we have created a website where we can manage all the member and other user and we have given Priority to each one of them.

As the Hierarchy goes by:

Admin	<ul style="list-style-type: none"><li>• Able to create a new Co admin account</li><li>• Able to view the Co admin account details</li><li>• Able to view Truck Driver Account details</li><li>• Able to Delete co admin account</li><li>• Able to View the Dashboard which has maps, dust bin live fill value and Past filled details</li></ul>
Co Admin	<ul style="list-style-type: none"><li>• Able to create a new Truck driver account</li><li>• Able to Delete Truck driver's account</li><li>• Able to view the dashboard</li><li>• Able to view the Truck Driver's Account details</li></ul>
Truck Driver	<ul style="list-style-type: none"><li>• Able to view only the Dashboard with live fill percent of the Garbage BIN</li></ul>

#### Coding / Solution Link:

For Admin flow – [click here](#)

For Co Admin flow – [click here](#)

For Truck Driver flow - [click here](#)

For Dashboard flow - [click here](#)

For Home Page - [click here](#)

## 7.2 Feature 2

- As we mentioned in the above Sprint Delivery, we have used API for Reverse Geolocation to send mails to the Garbage Collector based on their location.
- We have created an automation, that the mail will be sent mails only when the Garbage in that area is filled up automatically based on the Sensor Values in the Garbage.
- We have used Email node for sending Mail to the Respective Drivers.

### Coding / Solution Link:

For API Link - [click here](#)

For Updating of Table Flow - [click here](#)

## 7.3 Database Schema

Name	Size	# of Docs	Partitioned	Actions
admin	85 bytes	1	No	[Edit, Lock, Delete]
bin1	2.2 KB	11	No	[Edit, Lock, Delete]
bin2	1.8 KB	11	No	[Edit, Lock, Delete]
cloudadmin	211 bytes	2	No	[Edit, Lock, Delete]
projectulajyothiun	1037 KB	4	No	[Edit, Lock, Delete]
truckdriver	137 bytes	1	No	[Edit, Lock, Delete]

# 8. TESTING

## 8.1 Test Cases ( Link - [click here](#) )

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute		Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation/Y/N	BUG ID	Executed By				
					Date	Team ID												
LoginPage_TC_OO1	UI	Home Page	Verify whether user is able to access the Home page	Notification	1) Click on the Test data of this Row 2) It will open our website 3) user can see our website home page		Our Website	No Home Page displayed	Failed to Display	Fail	Wrong browser selected / Cluster may be down	NO	101	ARUN K				
LoginPage_TC_OO2	UI	Home Page	Verify whether user is able to access the Home page	Notification	1) Click on the Test data of this Row 2) It will open our website 3) user can see our website home page		Our Website	Home page displayed	Displayed	Pass	Used cloud boundary	yes	102	ARUN K				
Login Validation_TC_003	Functional	Login Page	Verifying the email id and password with the database	CLOUD	1) Go to the URL 2) Enter the Test data in the Login Form		email id : admin@gmail.co m password: admin	Invalid Password/Email	Show as the expected	Pass	Connect to correct DB	NO	103	ASWIN KUMAR V				
LoginValidation_TC_OO4	Functional	Login Page	Verifying the email id and password with the database	CLOUD	1) Click on the Test data of this Row 2) It will open our website 3) user can see our website home page		email id : admin@gmail.co m password: admin	Show Admin Page	Displayed	Pass	Changed the Database setting	yes	104	ARUN K				
CloudStorage_TC_OO5	Functional	CLOUDANT	Manage the USER registration like co admin, Truck Driver Details	CLOUD	1) Login using Admin Id 2) Register An Co admin account 3) verify with the Database		email id : admin@gmail.co m password: admin	New Account details should be updated in DB	Does not change / added	Fail	Could not connected	NO	107	ARUN K				
CloudStorage_TC_OO6	Functional	CLOUDANT	Manage the USER registration like co admin, Truck Driver Details	CLOUD	1) Login using Admin Id 2) Register An Co admin account 3) verify with the Database		email id : admin@gmail.co m password: admin	New Account details should be updated in DB	Now it changes dynamically	Pass	Could connected	YES	108	ARUN K				
Response_TC_OO7	Functional	IOT Device/WOK W,L IBM IOT WATSON	Receiving the sensor values correctly and at time	IOT Device/WOKWI	1) Click on the Test data for the LINK of WOKWI 2) Run the Simulation 3) We can see the changes in NODE RED website		SIMULATION LINK WOKWI	Displayed without time delay	Displayed with time delay	Fail	Check the WOKWI /Use Python Script	NO	116	ASWIN KUMAR V				
Response_TC_OO8	Functional	IOT Device Python aScript IBM IOTWATSON	Receiving the sensor values correctly and at time	IOT Device/Python Script	1) Download the Python script which is updated in the Final code in GitHub 2) Install the required module and RUN the Script 3) We can see the changes in NODE RED website		URL for Python Script	Displayed without time delay	Displayed without time delay	Pass	Now verified	YES	117	ARUN K				
Response_TC_OO9	Functional	Node Red UI dashboard	Differentiating the threshold values to the user	World map UI	1) RUN the simulation 2) keep the value above 80% 3) We can see the icon Colour Changes in Map Dashboard		Our Project in WOKWI	Display as Green when below threshold and Red as above threshold	Same as the Expected Result	Pass	Verified	YES	118	ARUN K				
Output_TC_010	Functional	CLOUD	Verify the location and indicates if any bins are full	CLOUD	1) Run any simulation either WOKWI or Python Script 3) We also see the location of the BIN in the MAP 2) We can see the sensor values getting changes in our Dashboard		Garbage bin's location data	Showing the location of theBIN	Same as the Expected Result	Pass	Can we fast without Delay	NO	119	ASWIN KUMAR V				
Output_TC_011	Functional	CLOUD Email Service	Verify the location and indicates if any bins are full using Email service	CLOUD / mail Account	Once the Garbage is filled the Message will be sent the respective Truck Driver Mail ID		Garbage Bin Value when it is filled	Indication for collecting the garbage as per pinned location	Location data included	Pass	Verified	YES	120	DHARNEESH/WARAN GB				
TTS-TC_012	Functional	API	Converting the Lat and lon location to ADDRESS	API for Reverse GeoLocation	Using API to Generate the Location and Address for Sending the Notification to the Particular Truck Driver based on the Location		Displayed location as per the situation	Showed the Right Address	Same as the Expected Result	Pass	we can use Google API for faster data Retrieval	YES	135	ARUN K				
TTS-TC_013	Functional	NODE RED CLOUDANT	Updating the Timing when the Bin get filled up	CLOUDANT DB	Set the BIN Value to 100% Check the BIN table in the Dashboard		WOKWI, Our Website	Values get Updated in thetable	Same as the Expected Result	Pass	we can use other DB for avoiding time delay	YES	140	ARUN K				
Final Output_TC_014	Functional	IOT Device-WOK W,L IBM IOT WATSON , REVERSE geolocation API, Node RED service	Verify all the responses are showed and dynamically changed in the single display	IOT Device /NODE RED DEVICE	Get the sensor values from the WOKWI and send to the IBM IOT Watson and we can see the results in our Website and Mail is also been sent based on the sensor values		Our Website	Show all the BIN level and their location and sendmail based on the sensor values	Same as the Expected Result	Pass	All factors showed in the display	YES	145	ARUN K				

## 8.2 User Acceptance Testing (Link – [click here](#))

### 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 at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	5	3	1	1	11
Duplicate	1	0	0	0	3
External	2	1	0	0	3
Fixed	10	2	8	8	24
Not Reproduced	0	0	0	0	0
Skipped	0	0	0	0	1
Won't Fix	0	0	0	0	0
Totals	18	6	9	9	42

### 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	15	0	0	15
Client Application	35	0	0	35
Security	4	0	0	4

# 9. Results

## 9.1 Performance Metrics

NFT - Risk Assessment								Risk Score	Justification
S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Impact of Downtime	Load/Volume Changes		
1	Smart Waste Management System in Metropolitan cities	Existing	Moderate	Moderate	Low	Loss of users and delay in run time	>10 to 30%	ORANGE	Since there are moderate changes in function and hardware, it may add setup time in the long run

NFT - Detailed Test Plan				
S.No	Project Overview	NFT Test approach	Assumptions/Dependencies/Risks	Approvals/SignOff
1	Managing the collection of trash in busy cities with location	LOAD, STRESS	May request advanced versions in software Requires speed test	Approval

End Of Test Report								
S.No	Project Overview	NFT Test approach	NFR - Met	Test Outcome	GO/NO-GO decision	Recommendations	Identified Defects (Detected/Closed/Open)	
1	Managing the collection of waste by using smart bins which alerts the garbage collector when it is full	LOAD, STRESS T	ME	Our project can operates efficiently even when the number of users is increased	GO	Recommended to have App which can be easily accessed.	Closed	Approval

Performance Metrics link – [click here](#)

## 10. Advantage & Disadvantage

### Advantages:

- 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.
- It further reduces manpower requirements to check the garbage collection process.

### Disadvantage:

- Sensor nodes used in the dustbins have limited memory size.
- It reduces man power requirements which results into increase in unemployment for unskilled people.
- The training has to be provided to the people involved in the smart waste management system.
- Well-secured information for the user will cost a lot

## **11. Conclusion**

- This project work is the implementation of smart garbage management system using ultrasonic sensor, Esp8266-wifi module.
- This system assures the cleaning of dustbins soon when the garbage level reaches its maximum. This reduces the total number of trips of garbage collection vehicle and hence reduces the overall expenditure associated with the garbage collection. It ultimately helps to keep cleanliness in the society.
- Therefore, the smart garbage management system makes the garbage collection more efficient. Smart dustbin helps us to reduce pollution. This project ensures waste collection on time which in turn ensures less contamination of environment, no spread of disease and a cleaner surrounding

## **12. Future Scope**

- There isn't any dead end for innovation. The future scope for this project is the use of an alternate source of energy.
- Even though the system uses solar energy, which is a renewable source of energy, but, during rainy days, constant energy support is required. The piezo-electric power supply can be one of the alternative energy sources to power up the instruments.
- The parallel recycling process means a way of collecting different types of waste that is e-waste, plastic waste, medical waste, food waste, and many more.
- The biodegradable wastes can be used as compost. Vermicompost - compost that is made with the help of earthworms. This can be distributed either to the area of residence or given to the farmers in need, in turn producing a sustainably developed model.

## **13. Appendix**

### **13.1 Source Code**

Final Source Code – [click here](#)

### **13.2 GitHub & Project Demo**

**Link:** For GitHub Link –

[click here](#) For Project Demo

– [click here](#)