

# TEAM ID:PNT2022TMID08778

## Project Report Format

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## **ABSTRACT**

This Waste management is one of the serious challenges of the cities, the system now used in cities, we continue to use an old and outmoded paradigm that no longer serves the entail of municipalities, Still find over spilled waste containers giving off irritating smells causing serious health issues and atmosphere impairment. The Smart Waste Management System will simplify, with the Web applications and mobile phone, the solid and hydric waste inspecting process, and the management system of this presentation's total collection process. The proposed system is a GPS based. The suggested device and implementation will track waste storage and monitor the vehicle's waste driver. This method helps to make the customer aware of accountability behind the job such as the system for solid waste inspection and management, integrating communications technology for truck control systems such as GPS.

# **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, 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. It reduces manual labor, increases sustainable development, and reduces common health issues related to improper waste management techniques.

## **CHAPTER 2**

### **LITERATURE SURVEY**

#### **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 Saffer, et al. enhance the point about the health impacts of incineration, landfill, composting, landspreading 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,

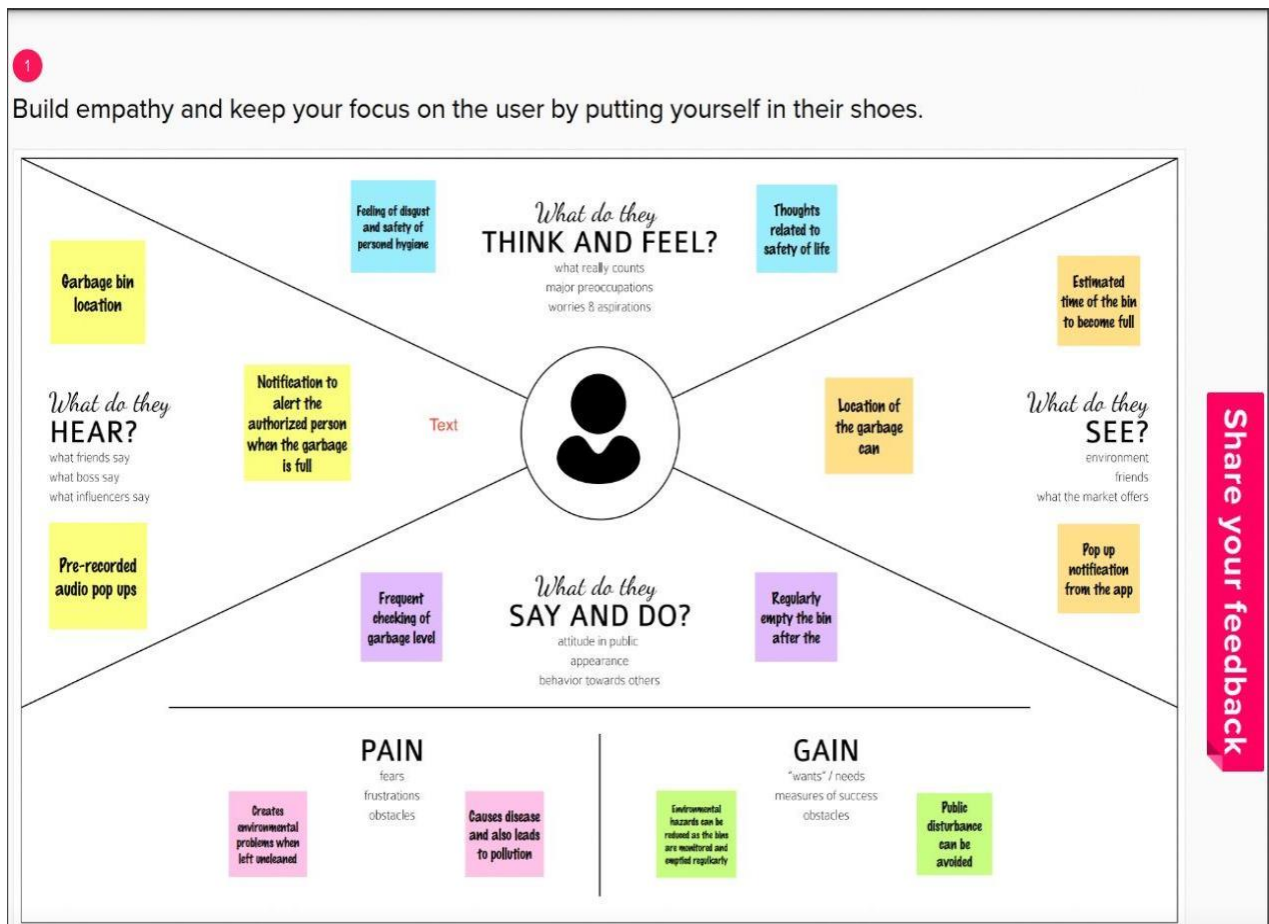
## **2.3 PROBLEM STATEMENT DEFINITION**

Waste management in metropolitan cities faces numerous challenges. The main problem faced by the metropolitan cities are detecting the garbage level whether 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 & PROCESSING





S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	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.
2.	Idea / Solution description	Smart waste management is characterized by the usage of technology in order to be more efficient when it comes to managing waste. This makes it possible to plan more efficient routes for the trash collectors who empty the bins, but also lowers the chance of any bin being full for over a week.
3.	Novelty / Uniqueness	A reduction in the number of waste collections needed by up to 80%, resulting in less manpower, emissions, fuel use and traffic congestion.
4.	Social Impact / Customer Satisfaction	Reducing waste will not only protect the environment but will also save on costs or reduce expenses for disposal. In the same way, recycling and/or reusing the waste that is produced benefits the environment by lessening the need to extract resources and lowers the potential for contamination.
5.	Business Model (Revenue Model)	Waste Management generates revenue through the provision of various waste management and disposal services and recycling solutions to residential, commercial, industrial, and municipal clients. The Company derives its revenue in the form of various fees associated with its service offerings.
6.	Scalability of the Solution	As the product is offered with subscription service , further development in both software and hardware can be made

### 3.4 PROBLEM SOLUTION FIT

<b>CUSTOMER SEGMENT</b>  Government and Industries	<b>CUSTOMER CONSTRAINTS</b>  <ul style="list-style-type: none"> <li>• Difficulty in garbage level indication</li> <li>• insufficient Technology</li> </ul>	<b>AVAILABLE SOLUTION</b> <ul style="list-style-type: none"> <li>• Sharing location of bin to the sanitary worker via notification from the application.</li> <li>• It also contains information such as level and weight of the bin</li> </ul>
<b>JOBS-TO-BE-DONE / PROBLEMS</b> <ul style="list-style-type: none"> <li>• Need to know the exact location of the garbage bins</li> <li>• Need to know the level and the weight of the garbage bins</li> </ul>	<b>PROBLEM ROOT CAUSE</b> The level of garbage bins cannot be identified by the sanitary workers.As a result , the overflow of garbage occurs which results in disturbance for both sanitary workers and residents living nearby.	<b>BEHAVIOUR</b>  Focus in web application can help to indicate the garbage status and to point the location of the bins
<b>TRIGGERS</b>  Garbage bins overflow leads to unhealthy society and give discomfort to the sanitary workers  BEFORE : Insecurity,illness,fear AFTER : Secured living,relief,unburden	<b>YOUR SOLUTION</b> Implementation of ultrasonic sensor and weight sensor to the garbage bins and by connecting bins to internet we can point the exact location on the website.	<b>CHANNELS of BEHAVIOUR</b> <b>ONLINE :</b> Information will be conveyed to avoid the overflow of garbage bin. <b>OFFLINE :</b> With the information of location of garbage sanitary workers will take necessary actions.

## CHAPTER 4

### REQUIREMENT ANALYSIS

#### 4.1 FUNCTIONAL REQUIREMENT

##### Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIn
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Detailed bin inventory	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-4	Real time bin monitoring	The Dashboard displays real-time data on fill-levels of bins monitored by smart sensors. In addition to the % of fill-level, based on the historical data, the tool predicts when the bin will become full, one of the functionalities that are not included even in the best waste management software.. 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-5	Eliminate inefficient picks	Eliminate the collection of half-empty bins. The sensors recognize picks. By using real-time data on fill-levels and pick recognition, we can show you how full the bins you collect are. The report shows how full the bin was when picked. You immediately see any inefficient picks below 80% full.
FR-6	Plan waste collection routes	The tool semi-automates waste collection route planning. Based on current bin fill-levels and predictions of reaching full capacity, you are ready to respond and schedule waste collection. You can compare planned vs. executed routes to identify any inconsistencies.

## 4.2 NON-FUNCTIONAL REQUIREMENTS

### Non-functional Requirements:

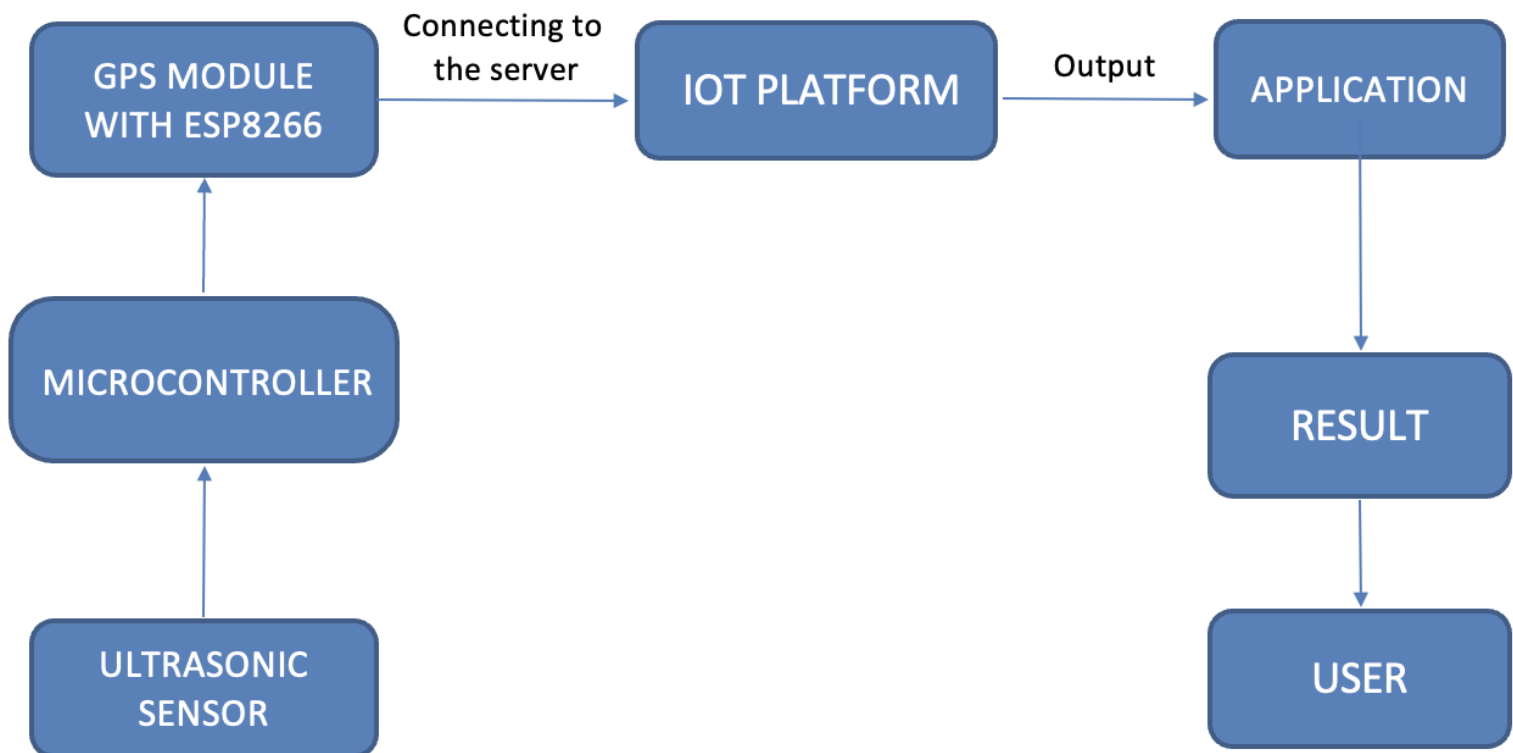
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	<b>Usability</b>	IoT device verifies that usability is a special and important perspective to analyze user requirements, which can further improve the design quality. In the design process with user experience as the core, the analysis of users' product usability can indeed help designers better understand users' potential needs in waste management, behaviour and experience
NFR-2	<b>Security</b>	Use a reusable bottles Use reusable grocery bags Purchase wisely and recycle Avoid single use food and drink containers
NFR-3	<b>Reliability</b>	Smart waste management is also about creating better working conditions for waste collectors and drivers. Instead of driving the same collection routes and servicing empty bins, waste collectors will spend their time more efficiently, taking care of bins that need servicing.
NFR-4	<b>Performance</b>	The Smart Sensors 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-Io T, GPRS), the sensors send the data to Smart Waste Management Software System, a powerful cloud-based platform, for data driven daily operations, available also as a waste management app. Customers are hence provided data-driven decision making, and optimization of waste collection routes, frequencies, and vehicle loads resulting in route reduction by at least 30%.
NFR-5	<b>Availability</b>	By developing & deploying resilient hardware and beautiful software we empower cities, businesses, and countries to manage waste smarter.
NFR-6	<b>Scalability</b>	Using smart waste bins reduce the number of bins inside town , cities coz we able to monitor the garbage 24/7 more cost effect and scalability when we moves to smarter.

## CHAPTER 5

### PROJECT DESIGN

#### 5.1 Project Design Phase-II Data Flow Diagram & User Stories



## 5.2 SOLUTION ARCHITECTURE

### SOLUTION ARCHITECTURE

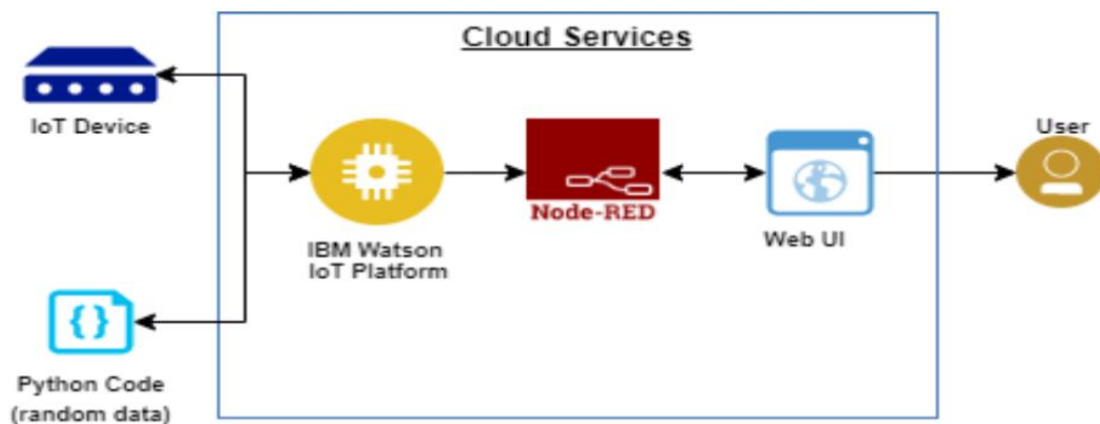
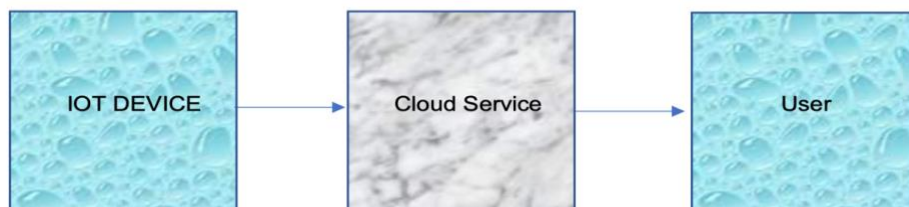
#### Design

- 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

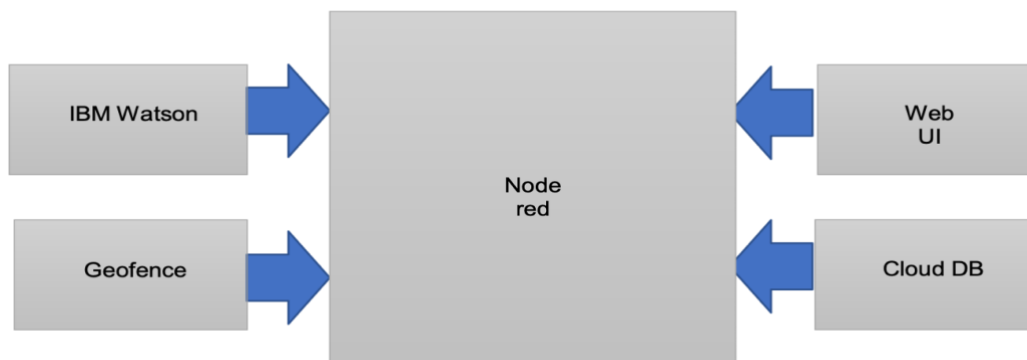
#### Block diagram:



## 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

<b>TITLE</b>	<b>DESCRIPTION</b>	<b>DATE</b>
<b>Literature Survey &amp; Information Gathering</b>	Literature survey on the selected project & gathering information by referring the, technical papers, research publications etc.	12 SEPTEMBER 2022
<b>Prepare Empathy Map</b>	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements	24 SEPTEMBER 2022
<b>Ideation</b>	List the by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance.	25 SEPTEMBER 2022
<b>Proposed Solution</b>	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	23 SEPTEMBER 2022
<b>Problem Solution Fit</b>	Prepare problem - solution fit document.	02 OCTOBER 2022
<b>Solution Architecture</b>	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 an Administrator, I need to give user id and pass code for every worker over there in municipality	10	High	Kathikeyan.S
Sprint-2	Login	USN-2	As a Co-Admin, I will control the waste level by monitoring them via real time web portal. Once the filling happens, I will notify trash truck with location of bin with bin ID	10	High	Gokul.T
Sprint-3	Dashboard	USN-3	As a Truck Driver, I'll follow Co-Admin's Instruction to reach the filling bin in short routes and save time	20	Low	Vasuki.R
Sprint-4	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 and I'll make sure everything is proceeding as planned and without any problems	20	Medium	Uvan Veer Sankar.G

## 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	5 Days	26 Oct 2022	28 Oct 2022	20	28 Oct 2022
Sprint-2	20	5 Days	2 Nov 2022	06 Nov 2022	20	06 Nov 2022
Sprint-3	20	5 Days	07 Nov 2022	15 Nov 2022	20	15 Nov 2022
Sprint-4	20	5 Days	13 Nov 2022	19 Nov 2022	20	19 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)

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

## 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**

```
labl_0 = Label(base, text="Registration form",width=20,font=("bold",  
20))
```

```

labl_0.place(x=90,y=53)

lb1= Label(base, text="Enter Name", width=10, font=("arial",12))

lb1.place(x=20, y=120)

en1= Entry(base) en1.place(x=200, y=120)

lb3= Label(base, text="Enter Email", width=10, font=("arial",12))

lb3.place(x=19, y=160)

en3= Entry(base) en3.place(x=200, y=160)

lb4= Label(base, text="Contact Number", width=13,font=("arial",12))

lb4.place(x=19, y=200)

en4= Entry(base) en4.place(x=200, y=200)

lb5= Label(base, text="Select Gender", width=15, font=("arial",12))

lb5.place(x=5, y=240)

var = IntVar()

Radiobutton(base, text="Male", padx=5,variable=var,

value=1).place(x=180, y=240)

Radiobutton(base, text="Female", padx =10,variable=var,

value=2).place(x=240,y=240)

Radiobutton(base, text="others", padx=15, variable=var,

value=3).place(x=310,y=240)

list_of_cntry = ("United States", "India", "Nepal", "Germany") cv =

StringVar()

drplist= OptionMenu(base, cv, *list_of_cntry) drplist.config(width=15)

```

```

cv.set("United States")

lb2= Label(base, text="Select Country", width=13,font=("arial",12))

lb2.place(x=14,y=280)

drplist.place(x=200, y=275)

lb6= Label(base, text="Enter Password", width=13,font=("arial",12))

lb6.place(x=19, y=320)

en6= Entry(base, show='*') en6.place(x=200, y=320)

lb7= Label(base, text="Re-Enter Password", width=15,font=("arial",12))

lb7.place(x=21, y=360)

en7 =Entry(base, show='*') en7.place(x=200, y=360)Button(base,

text="Register", width=10).place(x=200,y=400) base.mainloop()

def generateOTP() :

# Declare a digits variable # which stores all digits digits = "0123456789"

OTP = ""

# length of password can be changed # by changing value in range

for i in range(4) :

OTP += digits[math.floor(random.random() * 10)] return OTP

# Driver code

if __name__ == "__main__" :

print("OTP of 4 digits:", generateOTP()) digits="0123456789"

OTP=""

for i in range(6): OTP+=digits[math.floor(random.random()*10)]

```

```

otp = OTP + " is your OTP" msg= otp

s = smtplib.SMTP('smtp.gmail.com', 587) s.starttls()

s.login("Your Gmail Account", "Your app password") emailid =
input("Enter your email: ")

s.sendmail('&&&&&&&&&&',emailid,msg) a = input("Enter Your
OTP >>: ")

if a == OTP: print("Verified")

else:

print("Please Check your OTP again")

```

## 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	ABDUL RAHMAN
2	FUNCTIONAL	REGISTRATION	REGISTRATION THROUGH FORMS	REGISTRATION FORM TO BE FILLED AND DISPLAYED	WORKING AS EXPECTED	PAVITHRA
3	FUNCTIONAL	WOKWI	TO DEVELOP THE IOT DEVICE AND CODE THE IOT DEVICE	SENSE THE DATA	WORKING AS EXPECTED	PRAVEEN
4	FUNCTIONAL	IBM WATSON	PUSH THE SENSED DATA FROM WOKWI	SENSED DATA IN IBM WATSON	WORKING AS EXPECTED	PRANOOVE
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	ABDUL RAHMAN, PAVITHRA
6	TESTING	TEST THE ENTIRE WORK	TO CHECK ALL THE MENTIONED TESTCASE ARE WORKING PROPERLY	TEST CASE ARE WOKING PROPERLY	WORKING AS EXPECTED	PRANOOVE, PRAVEEN

## CHAPTER 9

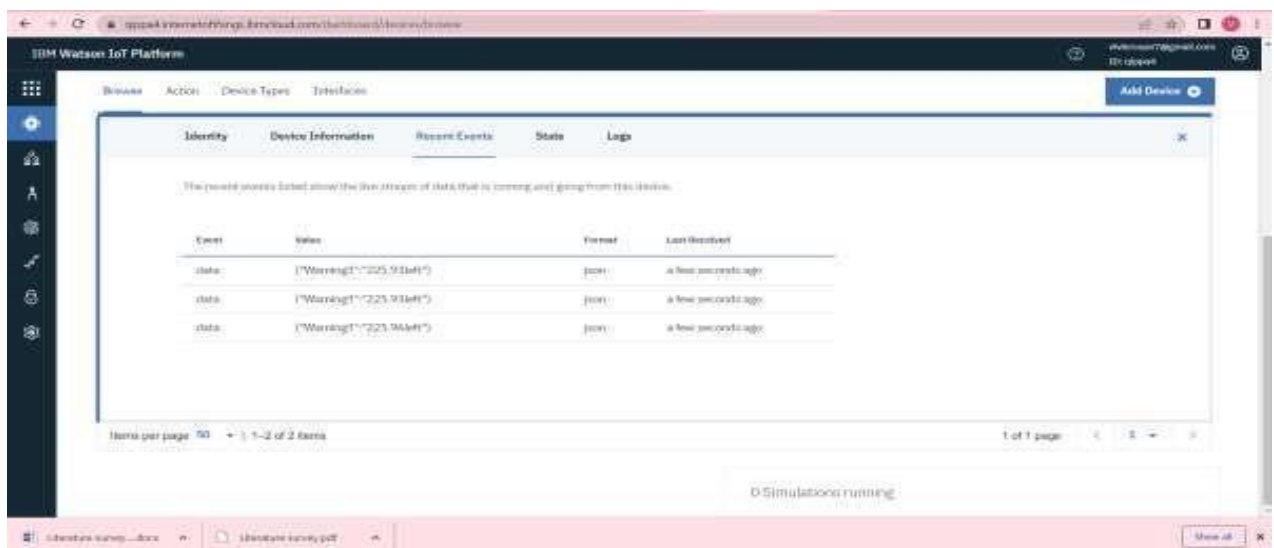
### RESULTS

#### 9.1Perfomance Metrics

- IOT DEVICE SIMULATION IN WOKWI SOFTWARE

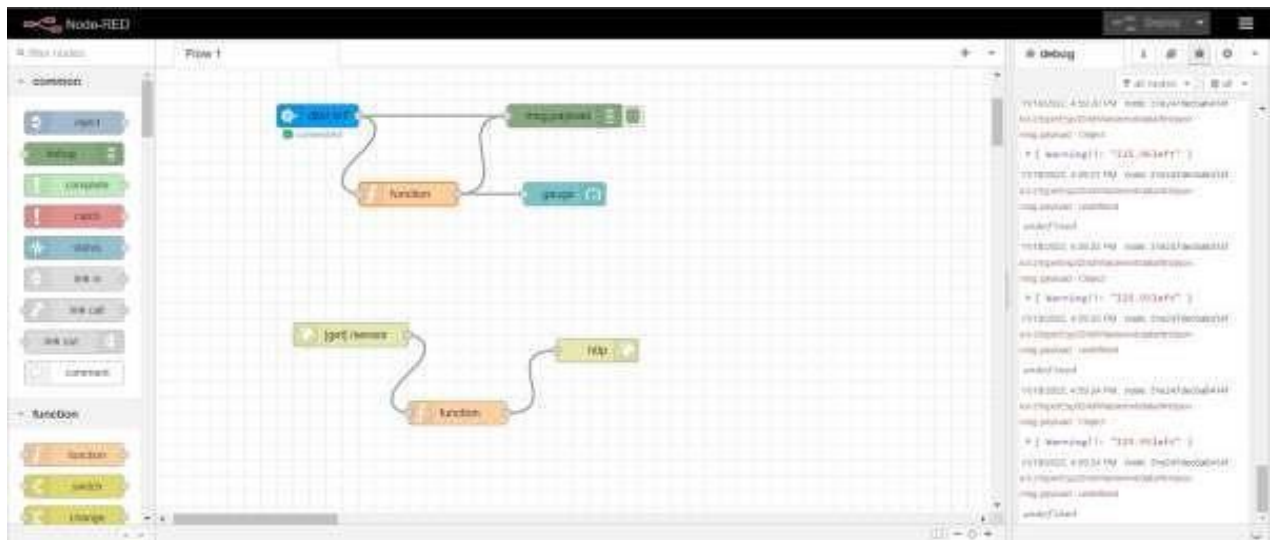


- SENSED THE DATA VISUALIZATION IN IBM WATSON

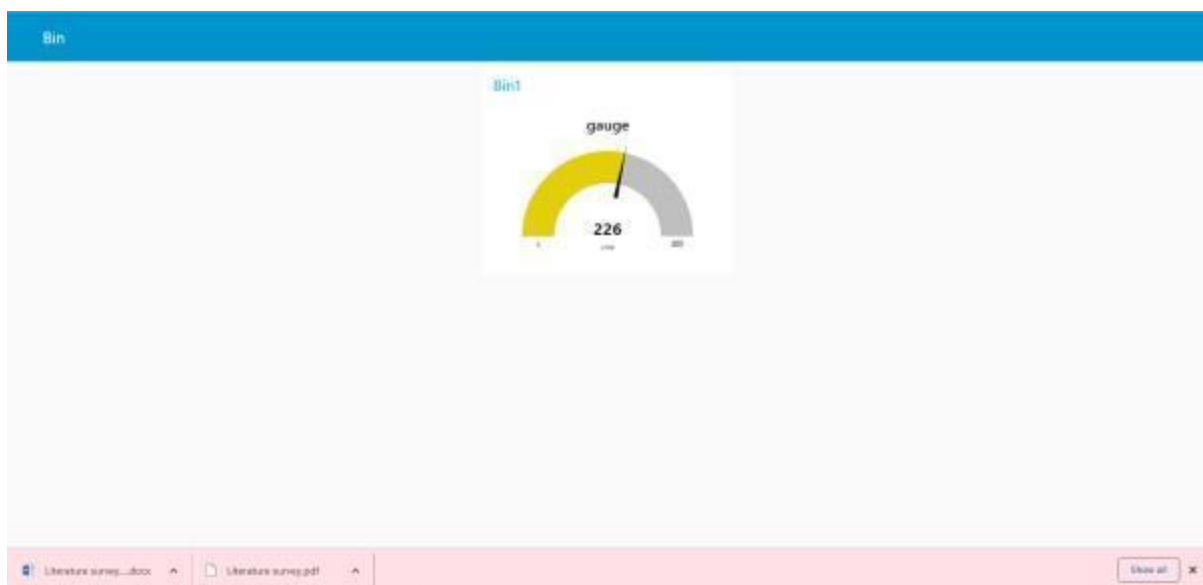


- NODE RED CONNCETIONS





- **VISUALIZATION OF SENSED DATA IN NODE RED DASHBOARD**



- **SAMPLE OF OUR WEBPAGE UI**

## Smart Waste Management System For Metropolitan Cities

Login

Home, Reports, and Profiles are available in a future release!

### Coimbatore

#### Pollachi



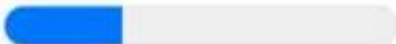
50kg

#### Mettupalayam



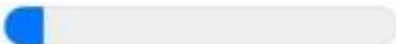
50kg

#### Sulur



50kg

#### Kinathukadavu



50kg

## 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 from the 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 from the 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**

GitHub Link:

<https://github.com/IBM-EPBL/IBM-Project-7177-1658849125>