Smart Garbage System Management Using IBM Watson Platform

INTRODUCTION

The Internet of Things (IoT) is a concept in which surrounding objects are connected through wired and wireless networks without user intervention. In the field of IoT, the objects communicate and exchange information to provide advanced intelligent services for users. Owing to the recent advances in mobile devices equipped with various sensors and communication modules, together with communication network technologies such as Wi-Fi and LTE, the IoT has gained considerable academic interests.

This project deals with the problem of Waste management in smart cities, where the garbage collection system is not optimized. This project enables the organizations to meet their needs of smart garbage management system. This system allows the user to know the fill level of each garbage bin in a locality or city at all time, to give a cost effective and time saving route to the truck drivers.This paper proposes an IoT-based smart garbage system (SGS) composed of a number of smart garbage bins (SGBs), routers, and servers. Each SGB, which plays a role in collecting food waste, is battery operated for mobility and, considering the convenience to residents, performs various techniques through wireless communication. The server collects and analyzes the status of all SGBs and resident information collected through RFID readers. The router is used for server load distribution.

PURPOSE

The Internet of Things (IoT) shall be able to incorporate transparently and seamlessly a large number of different and heterogeneous end systems, while providing open access to selected subsets of data for the development of a plethora of digital services. Building a general architecture for the IoT is hence a very complex task, mainly because of the extremely large variety of devices, link layer technologies, and services that may be involved in such a system. One of the main concerns with our environment has been solid waste management which in addition to disturbing the balance of the environment also has adverse effects on the health of the society. The detection, monitoring and management of wastes is one of the primary problems of the present era. The traditional way of manually monitoring the wastes in waste bins is a complex, cumbersome process and utilizes more human effort, time and cost which is not compatible with the present day technologies in any way. This an advanced method in which

waste management is automated. This project IoT Garbage Monitoring system is a very innovative system which will help to keep the cities clean. This system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a web page.

LITERATURE SURVEY

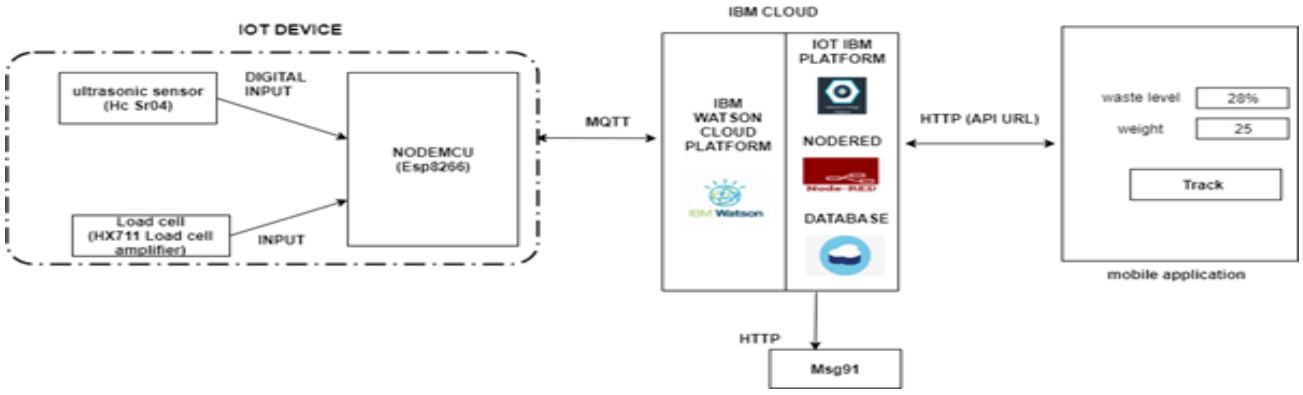
The idea of smart garbage bins and systems have been in discussion for quite a long time. The technologies used at disposal to develop this smart system have also evolved, Internet of Things (IoT). Each idea seems to be similar but is slightly different at its core and our proposed work is no exception from the same. After the IoT field, finding its hold in our lives, this is our original plan for designing a smart garbage collection system which has provision for citizen participation and analysis of data for better decision making. At hardware level, the smart system is a garbage bin with ultrasonic sensor, a micro-controller and Wi-Fi module for transmission of data. The worldwide implementation of Internet of Things is possible with a Cloud centric vision. This work exploits the future possibilities, key technologies and application that are likely to drive IoT research. But a strong foundation to our work is provided, where the basics and applications of Arduino board is explained . It is quite interesting as it implements a GAYT (Get As You Throw) system concept as a way to encourage recycling among citizens. As we would discuss further, the citizen participation part of our system is quite influenced by their work.

PROPOSED SYSTEM

The main objective of our project involves applying IoT technology (electronics and applications) to the current urban waste management scenario and enables a two way communication between the infrastructures deployed in the city and the operators/administrators. A centralized system for real-time monitoring is our goal to achieve. In this way both the municipal and citizens benefit from an optimized system which results in major cost savings and less urban pollution.

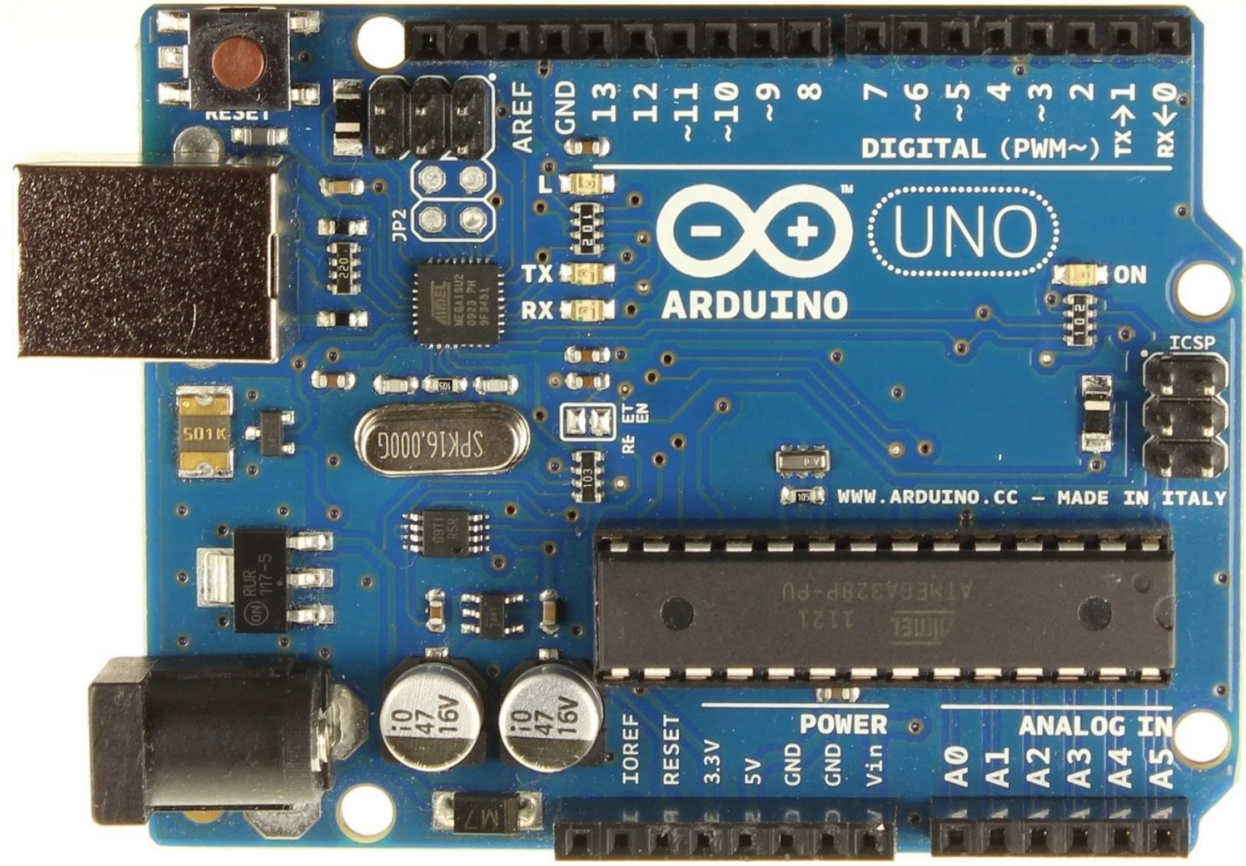
THEOROTICAL ANALYSIS

>Block Diagram



HARDWARE

*Arduino UNO Board

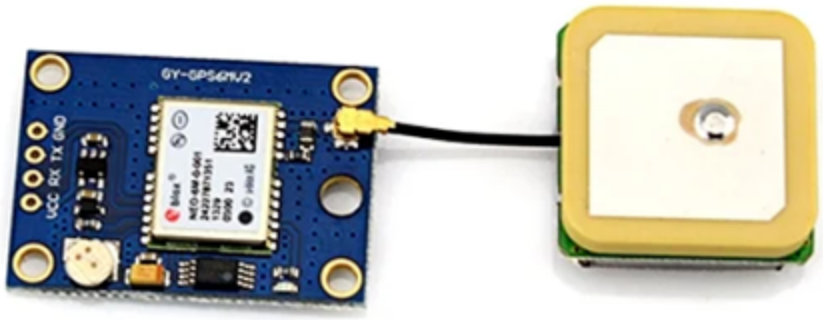


Arduino UNO Board The hardware consists of an Arduino microcontroller development board, Ultrasonic Sensors and a Wi Fi module to collect & transfer data to cloud. Data is collected rom ultrasonic sensors using Arduino Uno microcontroller. Arduino 18 an open source hardware platform which is compatible with various sensors and communication technology. There are different types of Arduino microcontroller that are used for different purposes. It not only control devices but also can read data from all types of sensor Arduino Uno is a microcontroller board based on the ATmega328P It is simple, low cost, easy to use and easily available in the market. It takes SV voltage input at the speed of 16 MHz Arduino Uno contains 14 digital input/output pins and 6 analog input pins to connect various sensors that gives analog inputs.

Ultra Sonic Sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

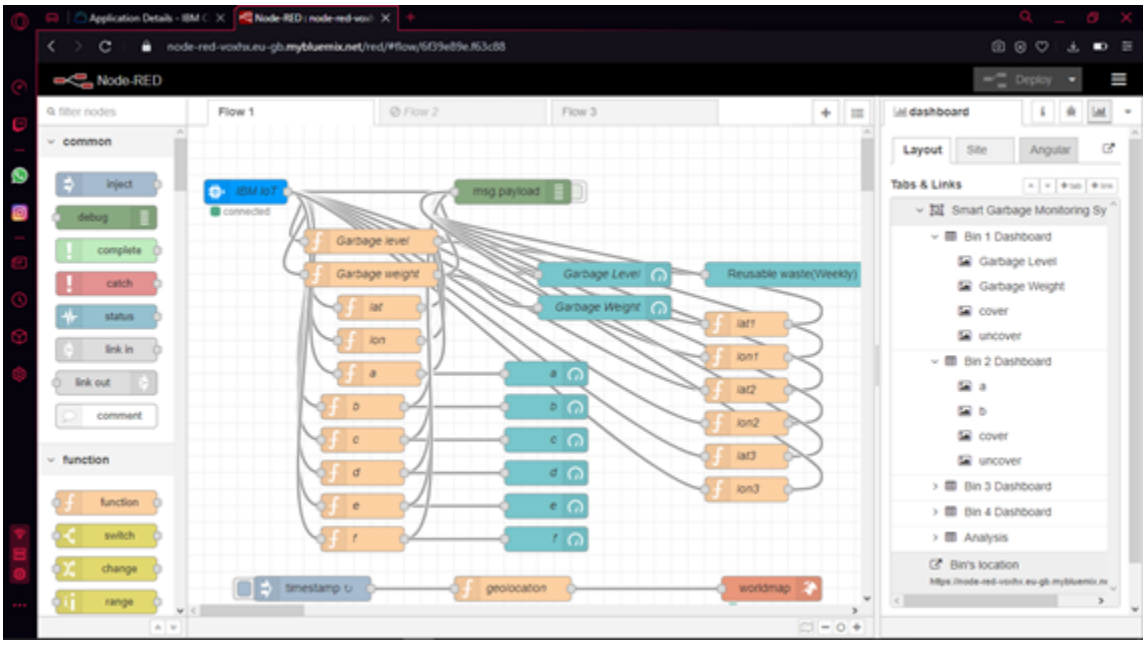
Neo 6m gps module

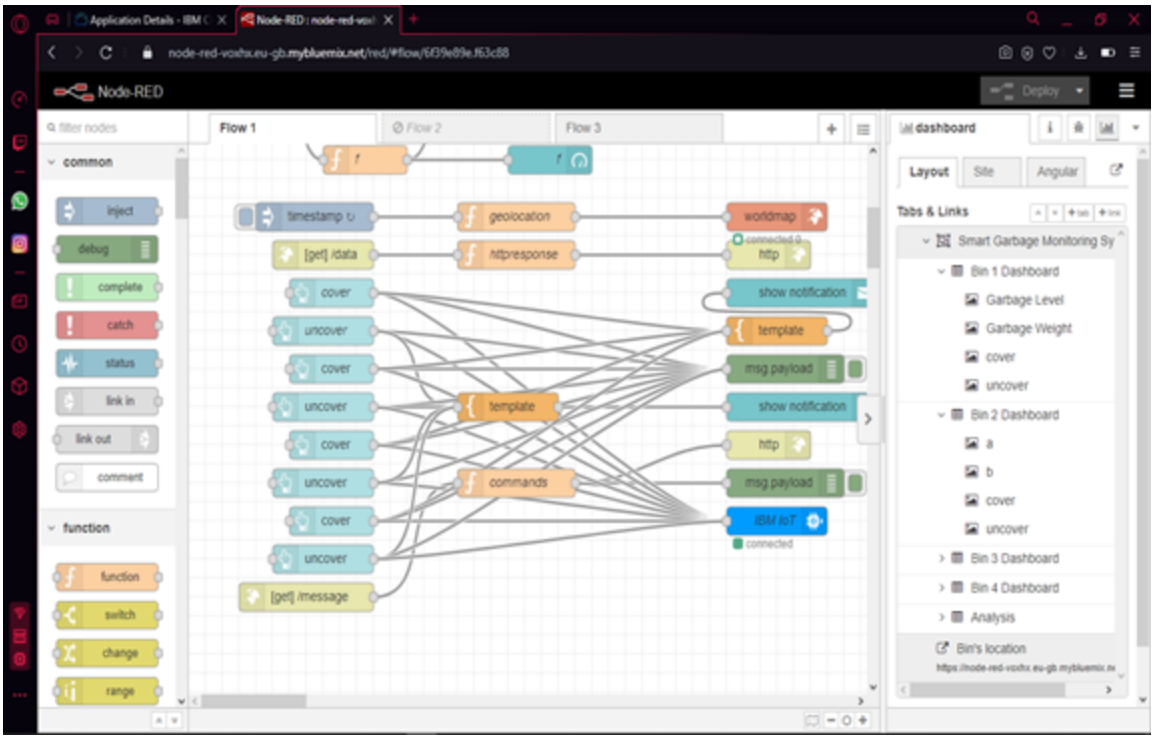


The **NEO**-6M **module** includes one configurable UART interface for serial communication, but the default UART (TTL) baud rate here is 9,600. Because the GPS signal is right-hand circular-polarized (RHCP), the style of the GPS antenna will be different from the common whip antennas used for linear polarized signals.

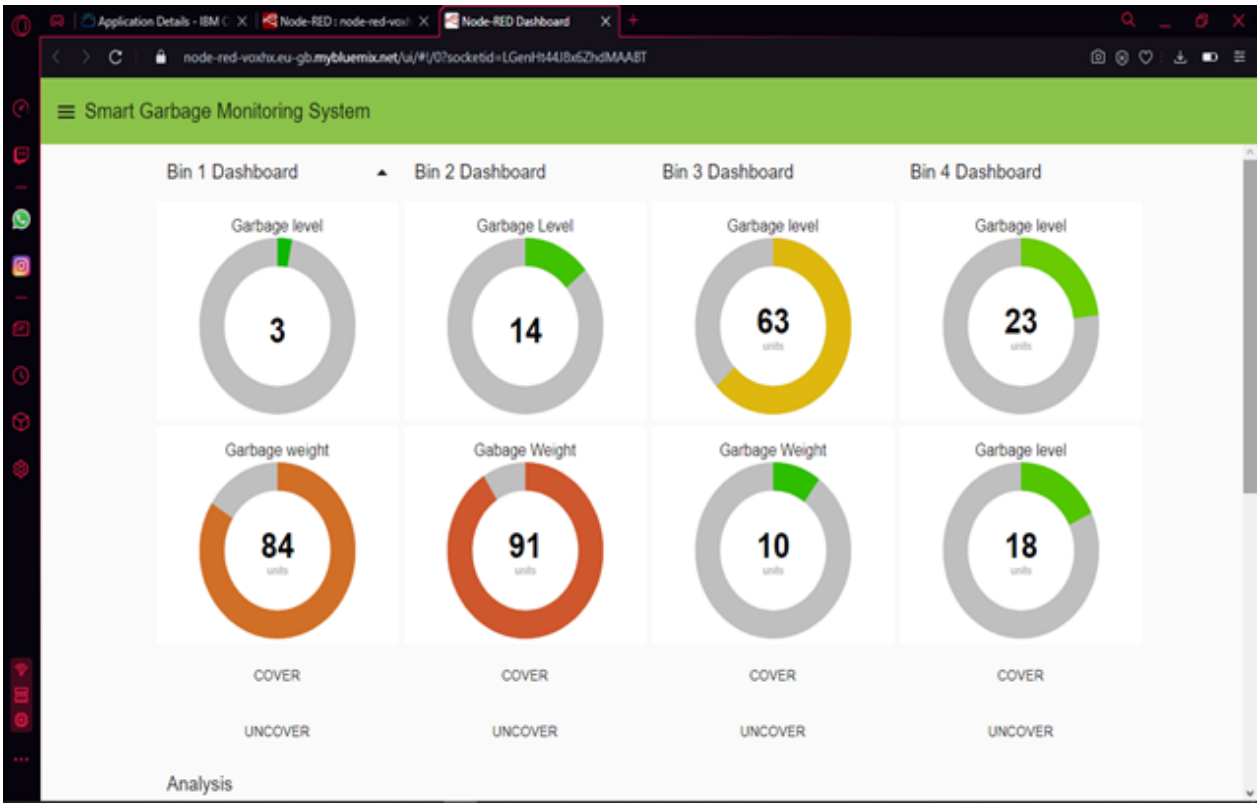
1. # SOFTWARE DESINGING

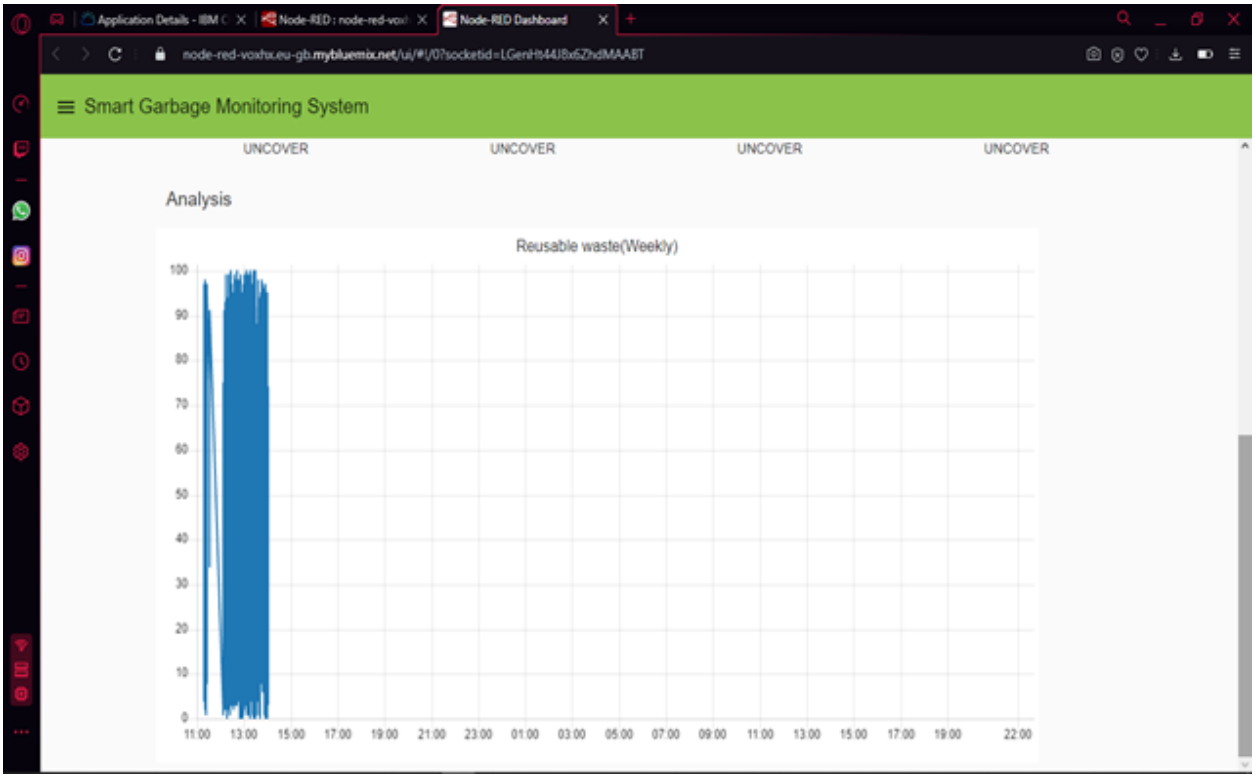
- Create a Web UI to visualize the Garbage Level and Garbage Weight of the Dustbins.
- Create a IBM account and in that create node red, cloudant, Watson IoT platform .
- After creating the above services go to IBM cloud dashboard, click on Cloud Foundary apps
- A new window appears where we need to NODE-RED app created before.
- After opening the node red service, take the nodes which are required for representing Garbage level, Garbage weight, debug nodes, function nodes etc.
- Connect the nodes to IBM IoT nodes to get the values to Garbage level, Garbage weight etc.





- After connecting all the nodes , Copy the Node Red URL till .net and paste in the new tab by typing /ui along with the Node Red URL and press ENTER which will display the UI.

- 
Application Details - IBM
Node-RED : node-red-voxl
Node-RED Dashboard
node-red-voxhx.eu-gb.mybluemix.net/ui/#!/0?socketid=LGenHt44J8x6ZhdMAABT
Smart Garbage Monitoring System
Bin 1 Dashboard
Bin 2 Dashboard
Bin 3 Dashboard
Bin 4 Dashboard
Garbage level
3
Garbage Level
14
Garbage level
63
units
Garbage level
23
units
Garbage weight
84
units
Gabage Weight
91
units
Garbage Weight
10
units
Garbage level
18
units
COVER
COVER
COVER
COVER
UNCOVER
UNCOVER
UNCOVER
UNCOVER
Analysis


Application Details - IBM
Node-RED : node-red-voxl
Node-RED Dashboard
node-red-voxhx.eu-gb.mybluemix.net/ui/#!/0?socketid=LGenHt44J8x6ZhdMAABT
Smart Garbage Monitoring System
UNCOVER
UNCOVER
UNCOVER
UNCOVER
Analysis
Reusable waste(Weekly)
100
90
80
70
60
50
40
30
20
10
0
11:00
13:00
15:00
17:00
19:00
21:00
23:00
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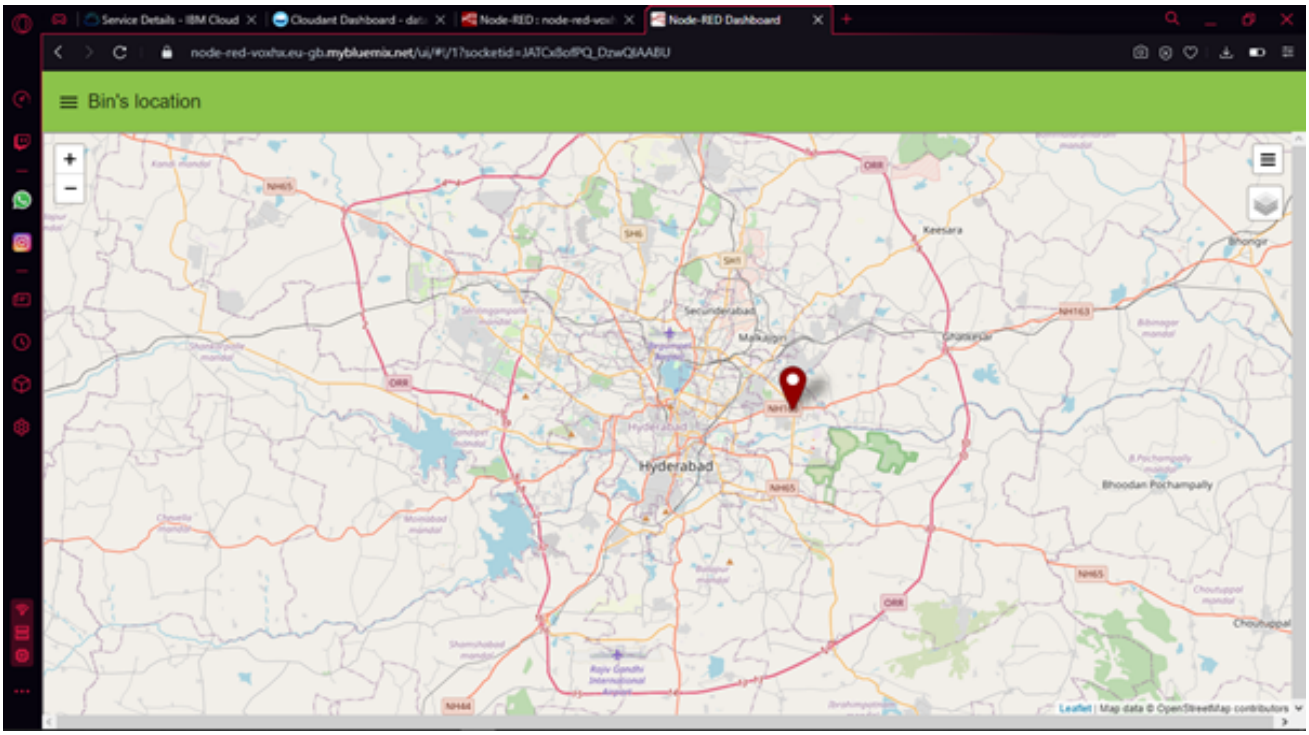
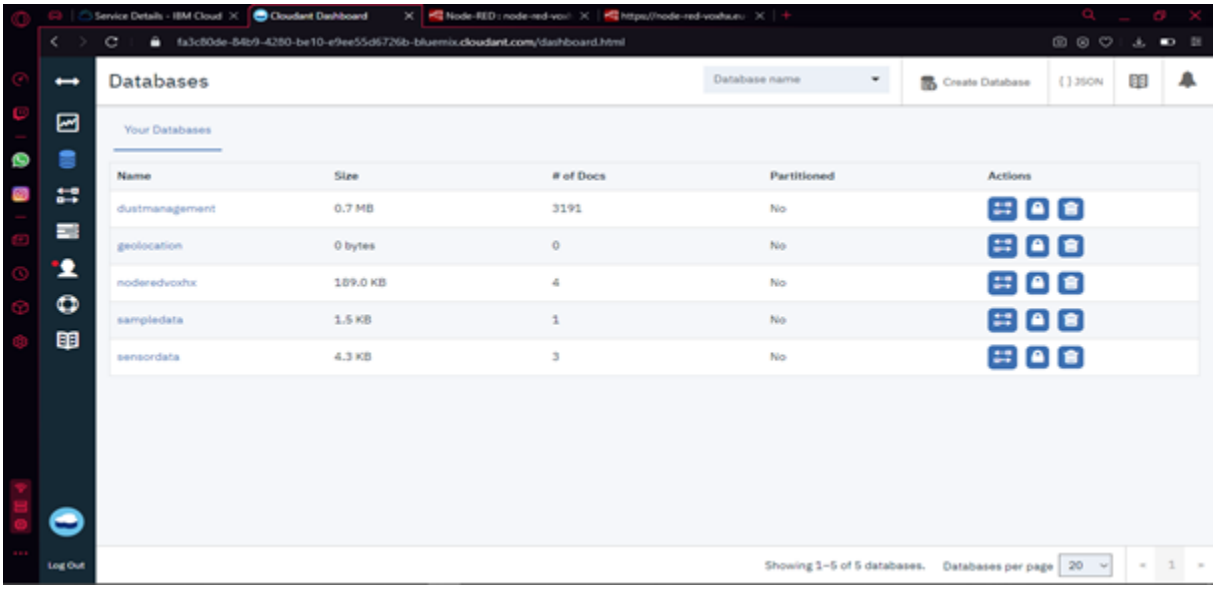
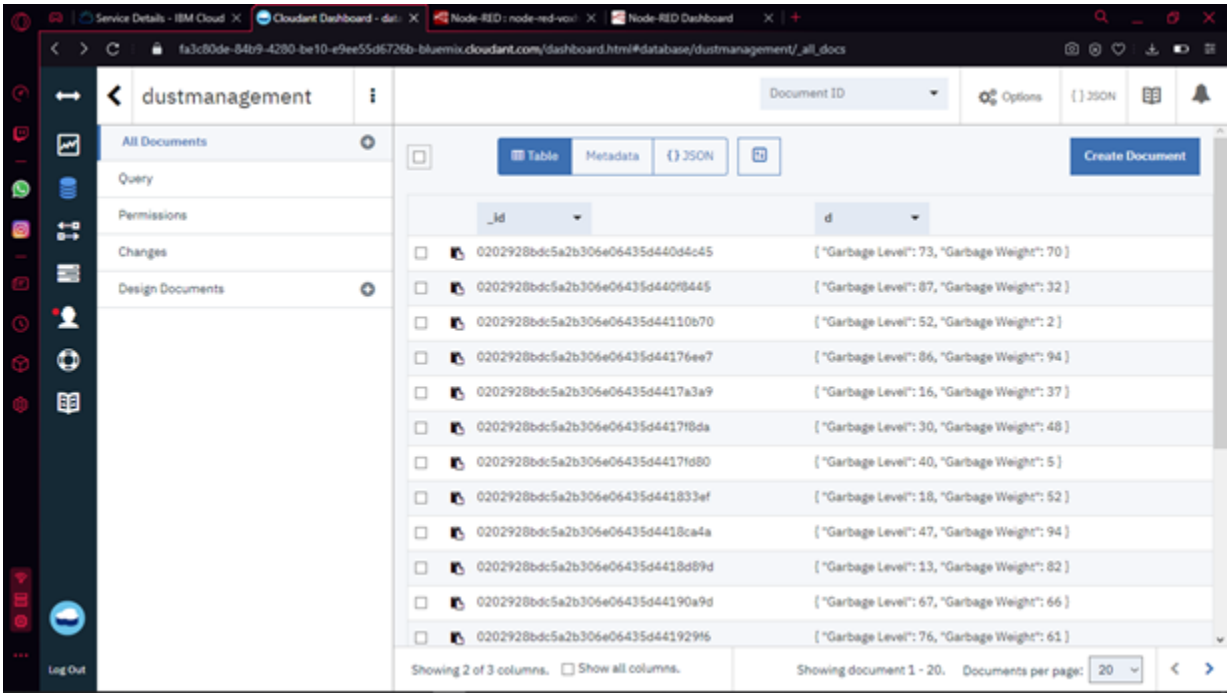


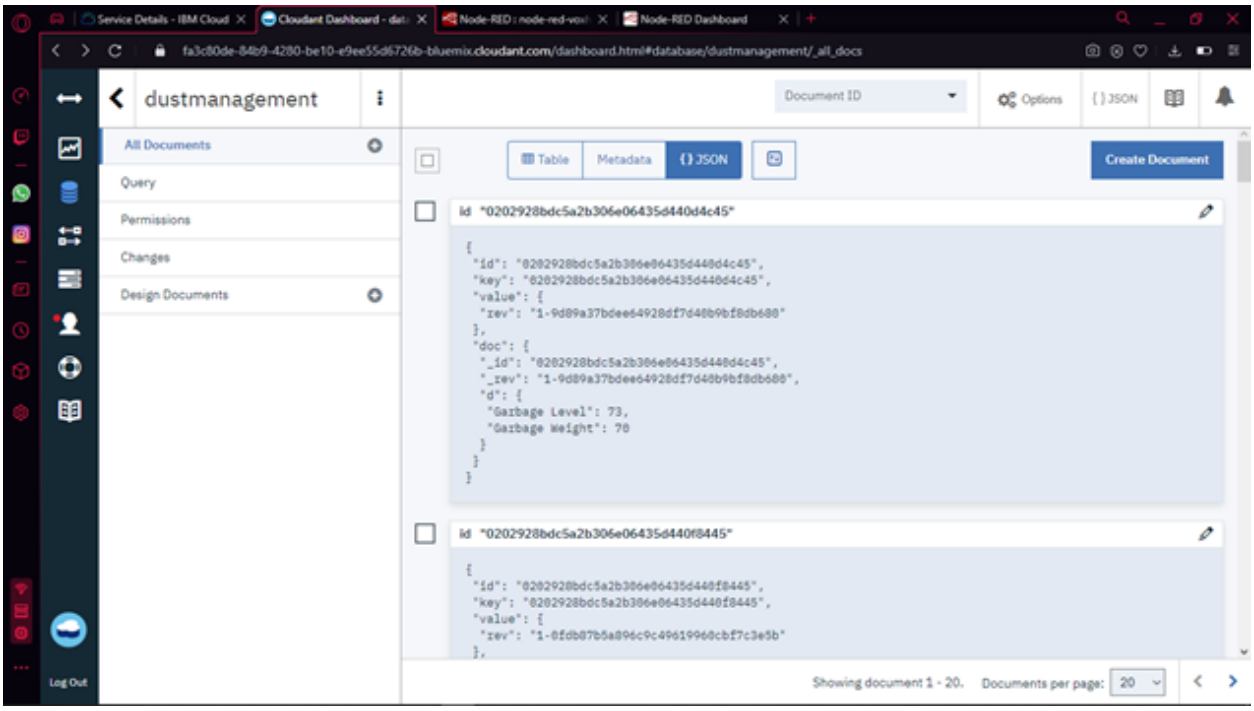
- Copy the URL in the Node Red flow till .net and paste in the new tab by appending “/data” along with the URL and press Enter. Both the tank level and flow rate values will be displayed on the webpage

- As the values are sent to cloudant with the given file name.

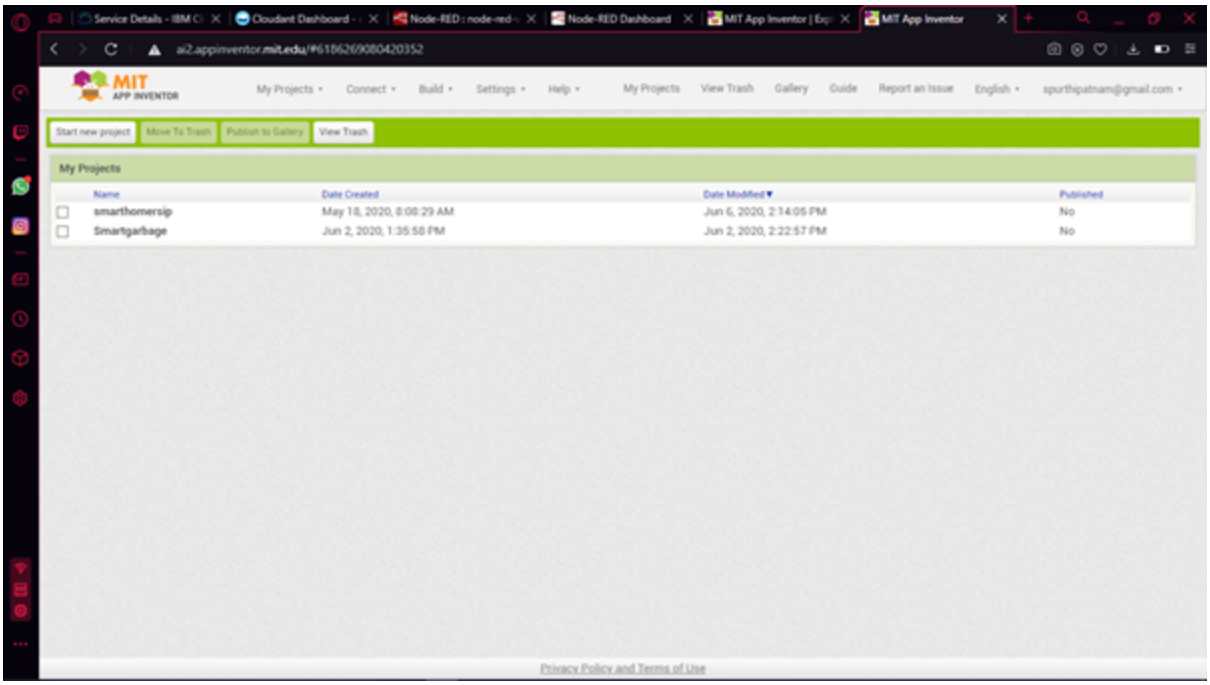




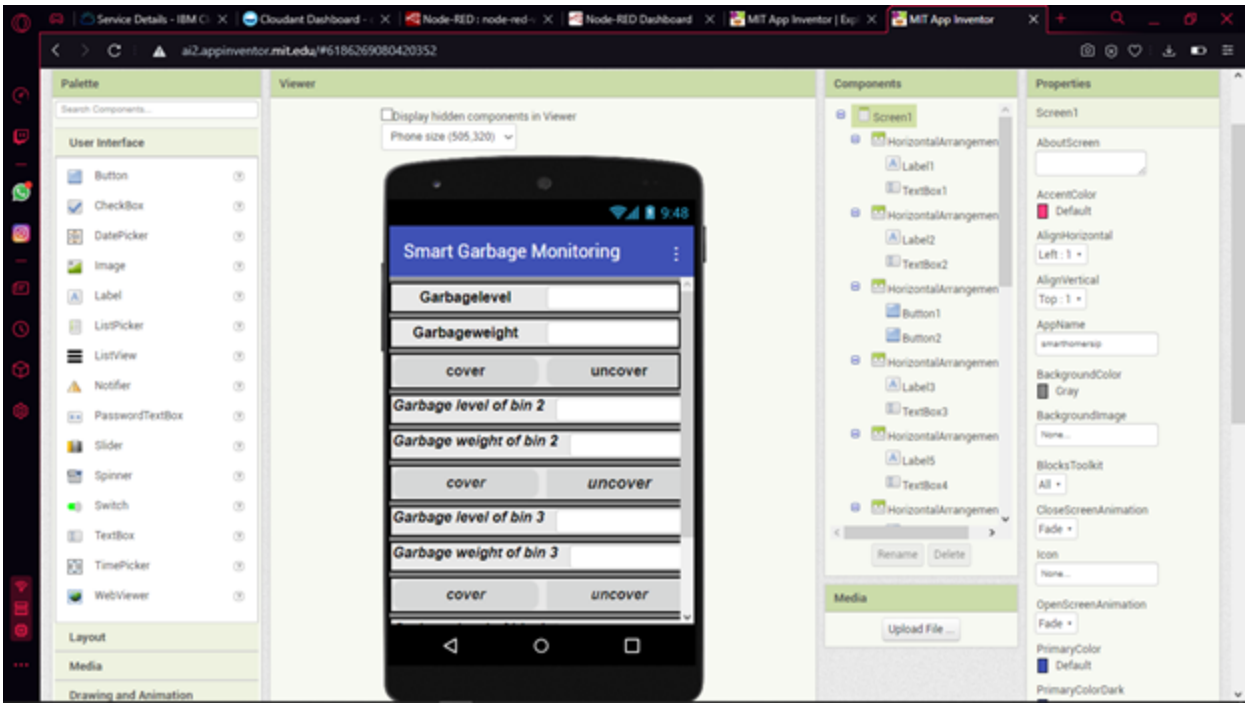
- The data is stored in the json format.

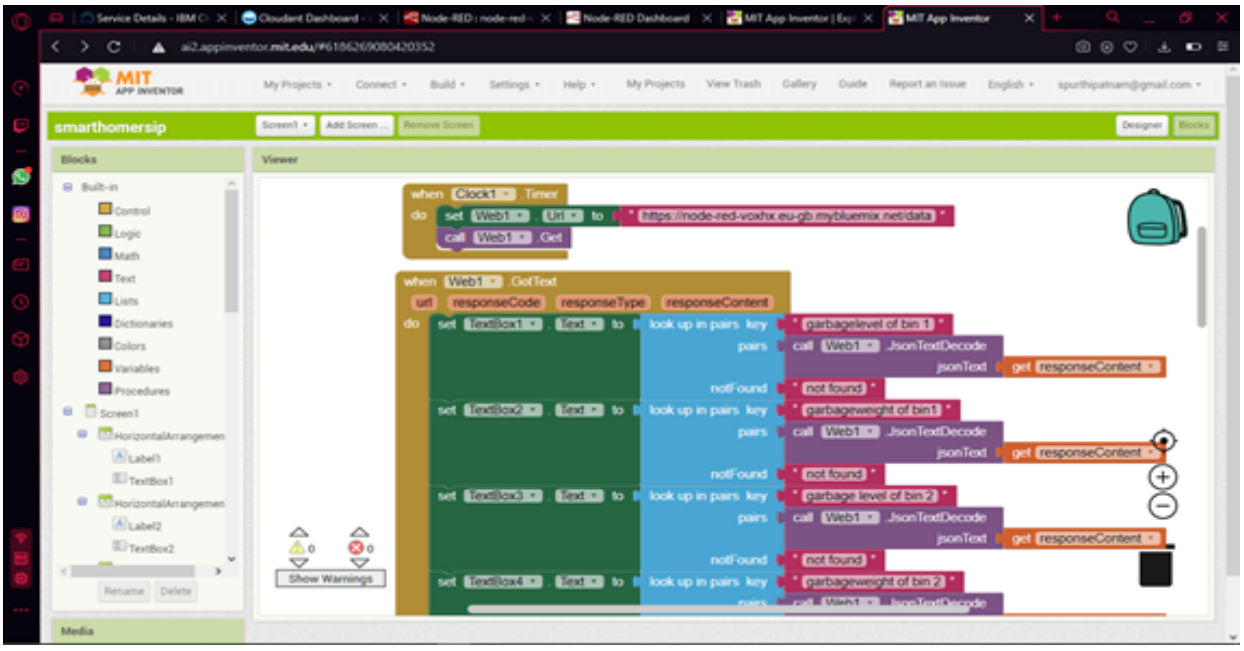


- **Create a mobile application visualizing the sensor reading and buttons to control.**
- MIT App login
- Type MIT App inventor in google search and press Enter, select the first link in the search engine
- Click on the first link you will be redirected to MIT App Inventor dashboard.



- Click on Create Apps! It will redirect to the Gmail login page. Through Gmail account by typing your Username and Password, you can log in to the MIT App flow editor.
- Agree with terms and conditions.
  By agreeing with the terms and conditions you will be redirected to the Dashboard and click on Start new project.


Smart Garbage Monitoring
Garbagelevel
Garbageweight
cover
uncover
Garbage level of bin 2
Garbage weight of bin 2
cover
uncover
Garbage level of bin 3
Garbage weight of bin 3
cover
uncover


smarthomersiip
when Clock1 Timer
do set Web1 Url to https://node-red-voxhx.eu-gb.mybluemix.net/data
call Web1 Get
when Web1 GotText
url responseCode responseType responseContent
do set TextBox1 Text to look up in pairs key garbagelevel of bin 1
pairs call Web1 JsonTextDecode
jsonText get responseContent
notFound not found
set TextBox2 Text to look up in pairs key garbageweight of bin1
pairs call Web1 JsonTextDecode
jsonText get responseContent
notFound not found
set TextBox3 Text to look up in pairs key garbage level of bin 2
pairs call Web1 JsonTextDecode
jsonText get responseContent
notFound not found
set TextBox4 Text to look up in pairs key garbageweight of bin 2
Show Warnings

- Displaying the Garbage Level and Garbage Weight values and controlling the m Dustbin lid, alerts for areas using the Mobile app

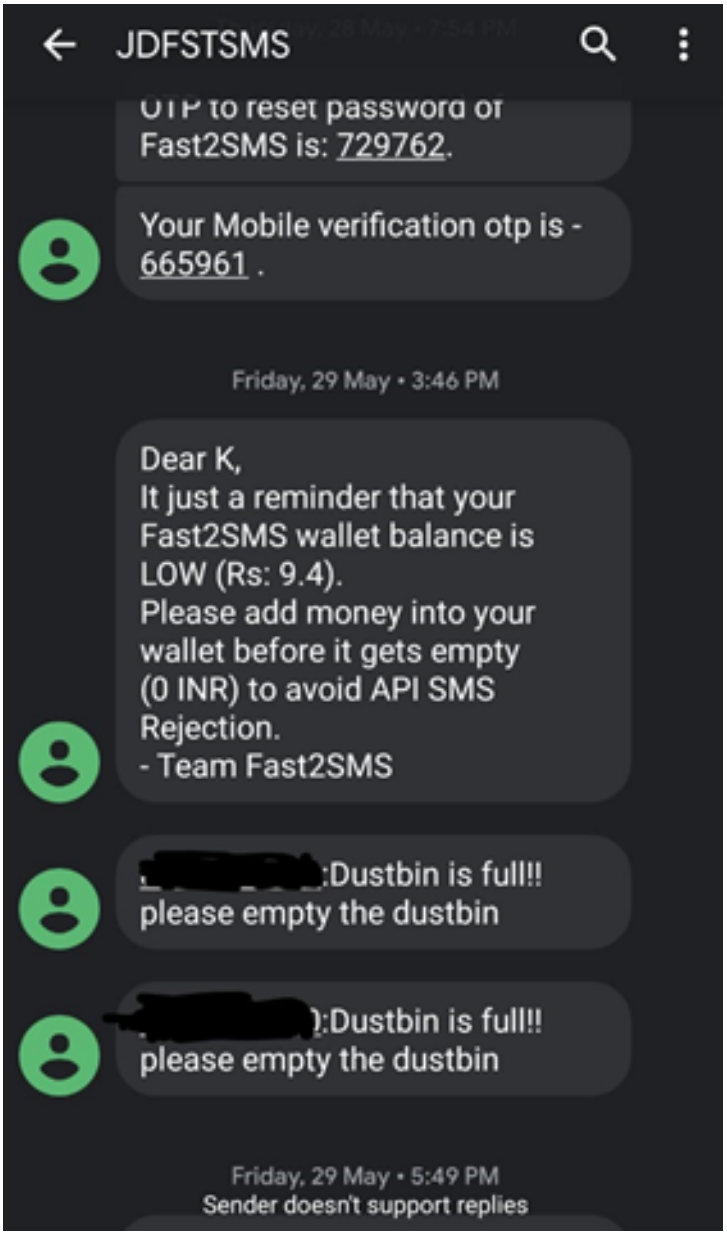
1. Create a UI to display the tank level and flow rate value in the Mobile App

2. Drag and Place two horizontal Arrangement in the mobile UI from the layout which is present in the palette.

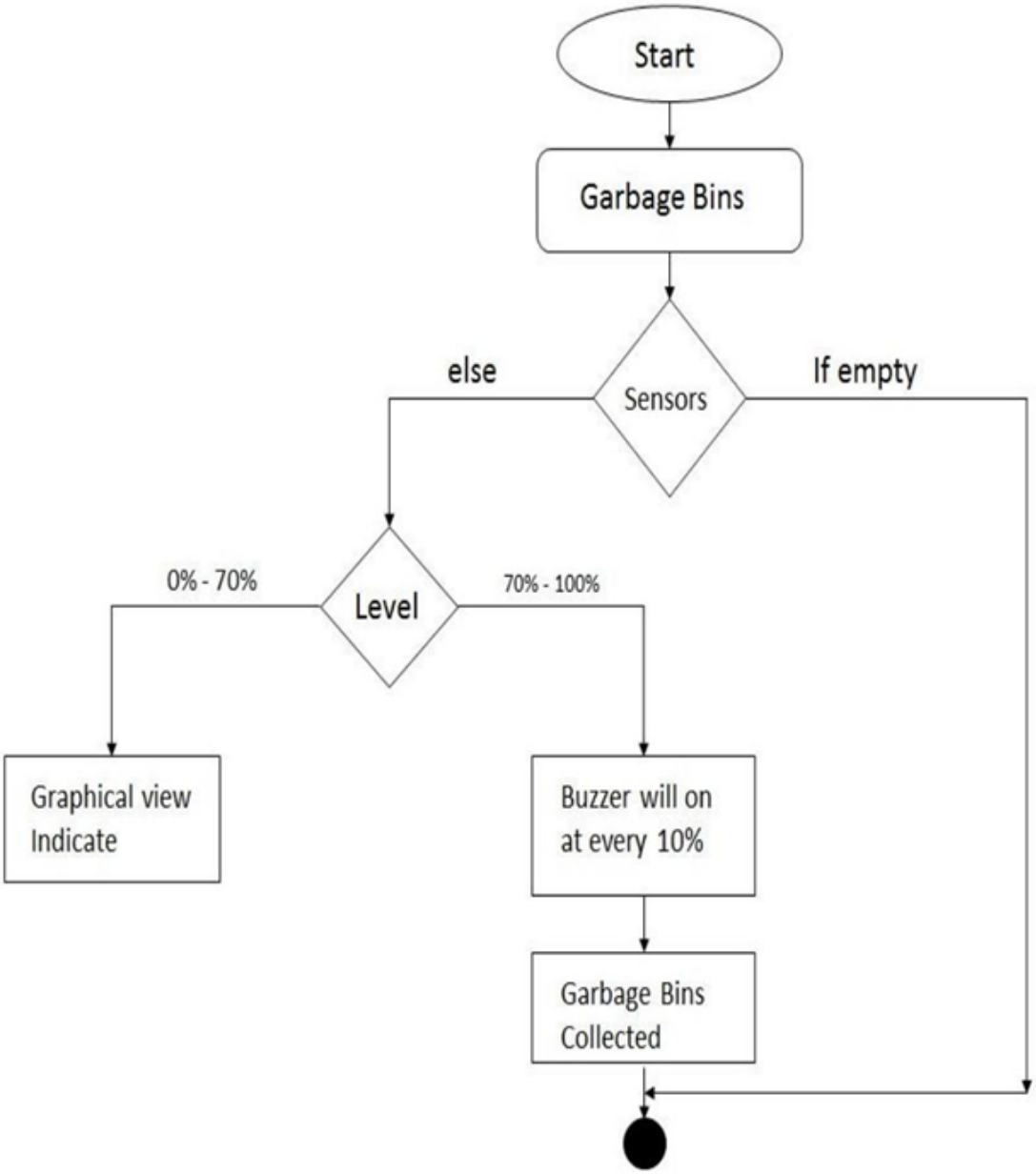
Alert System:

SMS Alert : SMS alert system is implemented in such a way that SMS will be triggered when to empty the bin and also SMS will be triggered to corresponding areas when the area buttons are pressed ,then SMS is

sent to the concerned persons in that specific areas. And also alert is sent when ever level of garbage in bin goes above threshold set the user.



FLOW CHART



ADVANTAGES

1.Real time information on the fill level of the dustbin
2.Deployment of dustbin based on the actual needs.
3.Cost Reduction and resource optimization.
4.Improves Environment quality -Fewer smells - Cleaner cities
5.Intelligent management of the services in the city.
6.A reduction in the number of waste collections needed by up to 80%, resulting in less

manpower, emissions, fuel use and traffic congestion
7.A reduction in the number of waste bins needed
8.Analytics data to manage collection routes and the placement of bins more effectively
Improved environment (i.e. no overflowing bins and less unpleasant odours)

DISADVANTAGES

1.System requires more number of waste bins for separate waste collection as per population in the city. This results into high initial cost due to expensive smart dustbins
compare to other methods.
2.Sensor nodes used in the dustbins have limited memory size.
3. Wireless technologies used in the system such as zigbee and wifi have shorter range and lower data speed. In RFID based systems, RFID tags are affected by surrounding metal objects (if any).
4.Trainining It reduces man power requirements which results into increase in unemployments for unskilled people.

APPLICATIONS IN SMART GARBAGE MANAGEMENT

1. Waste Level detection inside the garbage bins. Transmission of the information wirelessly to concerned officials .
2. System can be accessed anytime and from anywhere.
3. Real-time data transmission and access.
4. Avoids the overflows of garbage bins.
5. This project can only be used by municipal authorities or other private firms to tackle the current problem of urban waste collection.
6.Improves Environment quality-Fewer smells-Cleaner cities.
7. This system has no individual use, but can be used by a city, state or a country.
8. Using this system, waste collection would become efficient and also reduction in transportation costs can be witnessed.

CONCLUSION

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

FUTURE SCOPE

There are several future works and improvements for the proposed system

1. Change the system of user's authentication and atomic lock of bins which would help in securing the bin from any kind of damage or theft.
2. Concept of green-points that would encourage the involvement of the residents or the end users making the idea successful and helping to achieve joined efforts for the waste management and hence fulfilling the idea of Swachch Bharath.
3. Having a case study or data analytics on the type and times the waste is collected on the type of days or season making the bin filling predictable and removing the dependency on electronic components and fixing the coordinates.
4. Improving graphical interfaces for the Server and complete Android applications has possibility of extending the system adding other use cases and applications for smart cities.
5. Moreover, the proposed solution is flexible and decoupled with respect to the determination of optimal number of bins and vehicles or to the algorithm that define the best route for vehicles.

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[2] Basic Feature, "Solid waste Management Project by MCGM".

[3] Microtronics Technologies, "GSM based garbage and waste collection bins overflow indicator", September 2013.

[4] Hindustan Embedded System, "City Garbage collection indicator using RF (ZigBee) and GSM technology".

[5] Z embedded, "GSM modem interfacing with 8051 for SMS" August 2012.