Project Report Format

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PROJECT REPORT

Team ID: PNT2022TMID50923
Project Name: Smart waste management system for metropolitan cities

1.INTRODUCTION

This paper introduces you to the use of IoT on one such area, that is, Garbage Detection in smart ways using IoT and see how this can also be a major part of developing a city into a smart city.

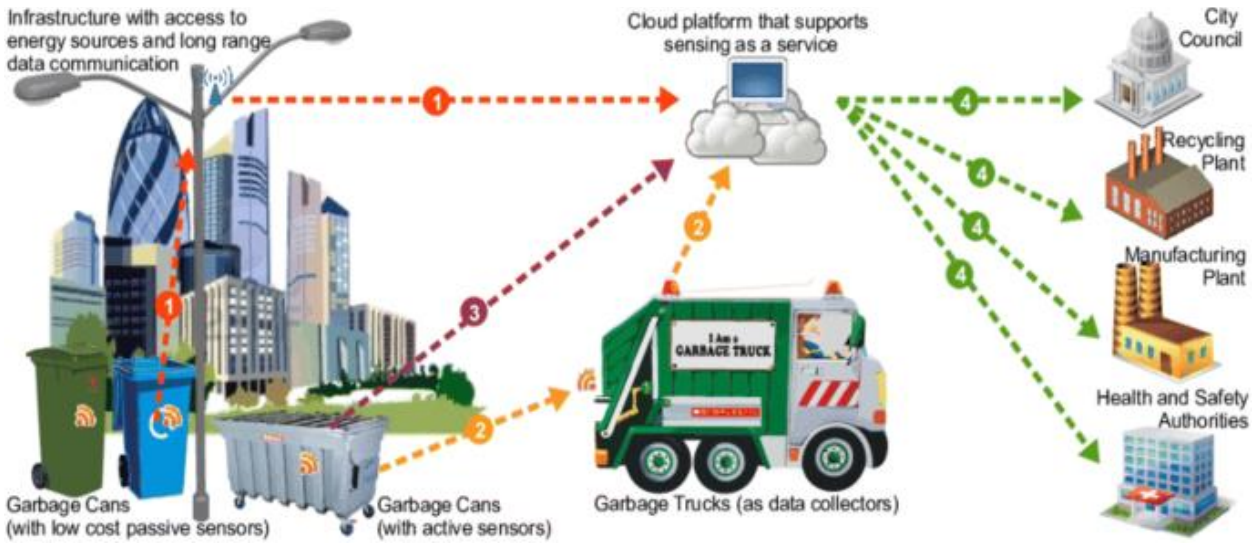
Internet of Things is nothing but the applications performing with the help of internet access.IoT Communication over the internet has grown from user - user interaction to device – device interactions these days. The IoT concepts were proposed years back but still it's in the initial stage of commercial deployment. Home automation industry and transportation industries are seeing rapid growth with IoT. The basic project idea is to design a smart waste detection system which would automatically notify the officials about the current status of various garbage bins in the city, would have real-time monitoring capabilities, which would be remotely controlled using IoT techniques.

The amount of waste produced everyday by the industries and the households is increasing at an appalling rate, and the major reason for this is soaring use of packaged items, textiles, paper, food, plastics, metals, glass etc, thus management of this refuse becomes a crucial part in our everyday life.in most of the developed countries there are many efficient techniques which are used for the proper management of this waste, but in

some countries especially the developing ones the careless attitude of people towards maintaining clean surroundings, along with this many issues such as no stringent laws for using the biodegradable materials, no proper environ policies ,no laws for sustainable development are the seed for the fatal results of waste management. Due to the increasing waste, the public bins which are used for collecting this waste are overflowing, the locality is jumbled of trash, causing not only malodorous streets but also a negative impact on the health and environment.

As prosperity grows, 62 million tons of garbage is generated everyday by the 377 million people living in urban India, now the world's third largest garbage generator. However, it's not the amount of waste generated that's as much of an issue as the fact that more than 45 million tons, or 3 million trucks worth, of garbage is untreated and disposed of by municipal authorities every day in an unhygienic manner. It is very salient issue to deal and discover the proper remedies for it some of them are like government should enact stringent laws against the people throwing trash, against the industries for not using biodegradable material, more use of recycle items, reduce the use of non-degradable stuff, reuse the items, thus implementing this can reduce the waste up to some extent. Along with this use of technology for proper dumping of trash and diminishing its hazardous effects is the concept put forward. The internet nowadays has the world under its spell. Not a single person lives without internet, phone, tab or laptop. It is believed without connectivity u cannot move ahead in today's world but sometimes due to heavy plans or connectivity issues we can't access to the internet, and thus attracting people towards free Wi-Fi. providing free Wi-Fi facility for dumping waste into the dustbin would solve the issue of waste and the internet facility plus availability of free service would help people go crazy and would act as reward for maintain cleanliness in the locality.

Waste management is **intended to reduce adverse effects of waste on human health, the environment, planetary resources and aesthetics**. The aim of waste management is to reduce the dangerous effects of such waste on the environment and human health.Smart city waste management technology **allows crews to empty bins before they become overflowing with trash or recycling, and before infestation becomes an issue**. Smart waste sensors can also alert crews when bins develop unpleasant smells which can then be treated to eliminate odors. The waste Management and Handling Rules in India were introduced by the Ministry of Environment and Forests (MoEF) [4], although compliance is variable and limited.



1.1Project Overview

The paper is based on the concept of Automation used in waste management system under the domain of Cleanliness and Hygiene. Dumping garbage onto the streets and in public areas is a common synopsis found in all developing countries and this mainly end up

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

In the present day scenario, many times we see that the garbage bins or Dust bin are placed at public places in the cities that are overflowing due to an increase in the waste every day. It creates the unhygienic condition for the people and creates bad smell around the surroundings this leads in spreading some deadly diseases & human illness, to avoid such a situation we are planning unique ID will be provided for every dustbin in the city so that it is easy to identify which garbage bin is full. When the level reaches the threshold limit, the device will transmit the level along with the unique ID provided. These details can be accessed by the concerned authorities from their place with the help of the Internet and immediate action can be made to clean the dustbins. This paper is a proposed IOT based smart waste clean management system that checks the waste level over the dustbins by using Sensor systems.

Urban India generates tonnes of wastes annually. Our country faces major challenges associated with waste management. Conventional garbage collection is not efficient since the authorities are not notified until the waste bin is full, and this leads to overflow of waste material. Efficient way of waste disposal and collection of disposed garbage is essential for a sustainable and clean India. This paper presents smart waste management using IoT based waste bin for collection and monitoring the level of waste inside bin. The system is implemented using two ultrasonic sensors which is being controlled by Node MCU. One of the ultrasonic sensor detects the level of the waste in the bin and other detects the person approaching the bin to dispose the waste. This detection helps in automatic opening and closing of the lid. Servo motor is connected to the lid which serves the action of closing and opening of the lid. In this system, level of waste in the bin will be sent to concerned authorities. The IoT data is stored and monitored using Blynk app. The proposed system is reliable, cost effective and can be easily implemented.

Waste bins are part of our lives for decades and mostly its condition are overflowing due to improper waste dumping, collection and management, which leads in foul smell and unhygienic condition, thus inherently results in environment pollution. Therefore, in this paper, design of a Waste Bin with real time monitoring is presented and a smart waste management system is proposed using the recent technical advancements of automation and Internet of Things (IoT). The capacitance sensor in the bin continuously monitors the level of the bin in real time and communicates to the central cloud where the bins are connected. Ultrasonic sensor is used to open and close the lid of the bin whenever the persons are nearby the bin. Such smart bins are connected to the cloud, where the bin status are communicated, recorded and monitored by the local bodies

through and android app or a centralized server. Thus the designed smart bin and proposed waste management system have better level of smartness compared to existing ones in metropolitan citie.

A big challenge in the urban cities is that of waste management as there is a rapid growth in the rate of urbanization and thus there is a need of sustainable urban development plans. As the concept of smart cities is very much trending these days and the smart cities cannot be complete without smart waste management system. There needs to be system that gives prior information of the filling of the bin that alerts the municipality so that they can clean the bin on time and safeguard the environment. To avoid all such situations we intend to propose a solution for this problem "Smart Garbage Bin", which will alarm and inform the authorized person when the garbage bin is about to fill. Then message will be send to the authorized person to collect the garbage from the particular area. The authorized person will sends the message from his web application to the garbage collectors by sending a SMS .This system maintain a dry waste and a wet waste separately. This will help to reduce the overflow of the garbage bin and thus keeping the environment clean.

1.2 Purpose

The growing population and mass relocation of citizens from urban and semi-urbanareas to Smart Cities have resulted in exponential growth in Smart Cities and thereby certain challenges. One of the major challenges Smart Cities are facing is to control, manage and process waste generation on a daily basis. Waste collection and processing at a wider scale is not an easy job. The growing population and resource constraints in waste management activities are the primary reasons, which have made waste management a tough job. To deal with this challenging process, Smart Cities use Smart Waste Management System. This paper has provided an overview of a typical Smart Waste Management system

and a review of selected research papers on Smart Waste Management. We tried to identify areas of improvement with existing Smart Waste Management Solutions and proposed an innovative solution called "iSmartWMS" for carrying out waste management specifically for Smart Cities.

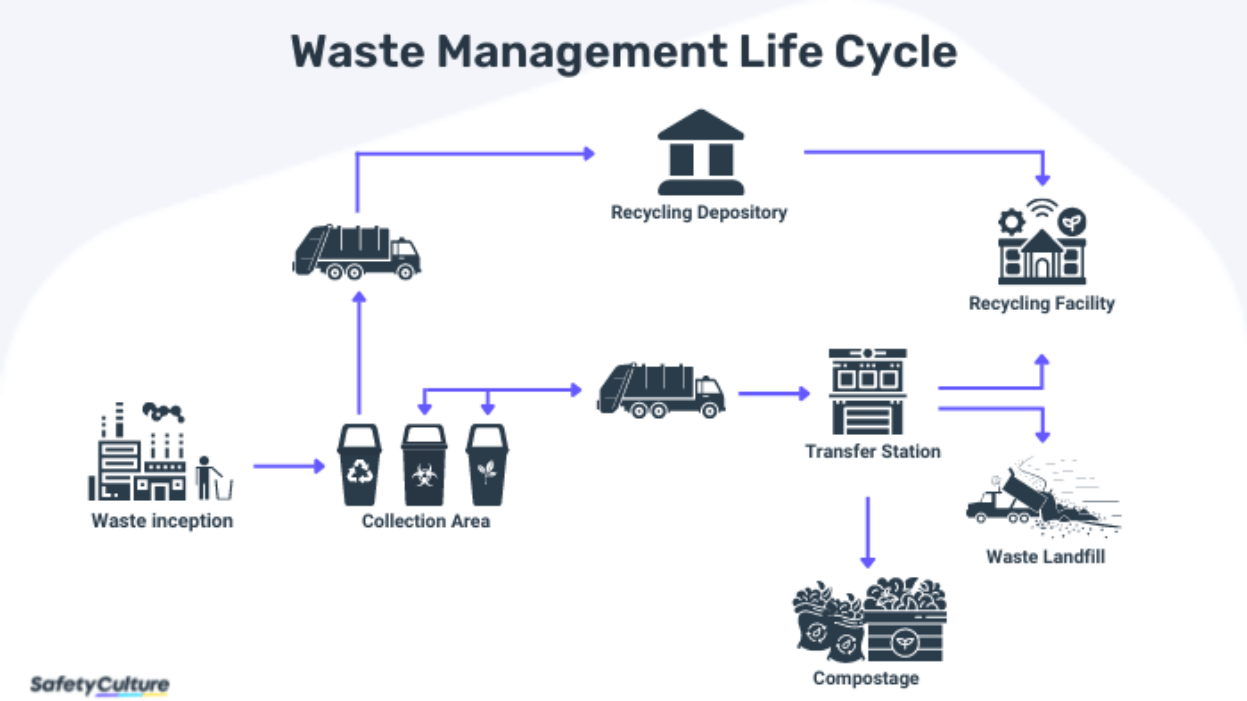
The paper has discussed in detail the architecture and building blocks of the proposed Smart Waste Management System, along with the details of software tools, sensors, and technologies proposed in iSmartWMS. The Paper has finally discussed results with respect to the prototype implementation of iSmartWMS and also future plans to further improve the iSmartWMS smart waste management system.

A waste management system is the strategy an organization uses **to dispose, reduce, reuse, and prevent waste**. Possible waste disposal methods are recycling, composting, incineration, landfills, bioremediation, waste to energy, and waste minimization.

Smart waste management is about using technology and data to create a more efficient waste industry. Based on IoT (Internet of Things) technology, smart waste management aims to **optimize resource allocation, reduce running costs, and increase the sustainability of waste services.**

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!

Waste management is intended to **reduce adverse effects of waste on human health, the environment, planetary resources and aesthetics**. The aim of waste management is to reduce the dangerous effects of such waste on the environment and human health.



While most of us are familiar with the frequently cited benefits of proper solid waste management -- **conservation of natural resources, reduction of air, water and land pollution, support for community development** -- the advantages go beyond simply protecting our health and environment.

One of the essential aspects of waste management is **recycling**, and when you do it, you're helping in the conservation of natural resources by reusing materials such as glass, plastic, oil, and paper.

The main advantage of sustainable waste management is to lessen the impact on the environment, by improving air and water quality and contributing to the reduction of greenhouse gas emissions. Besides, reducing food waste also helps reduce the heavy environmental cost of producing more.

2.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.

IOT based dustbin was implemented and effectuated much before. Some authors presented systems where the sensors in the bin checked if the bin are filled up to the brim or not. If it was filled an automated message was sent to the server end of the system, through the Arduino SIM module, which used the application of the Arduino board. Once the server received the message it forwarded the message to the worker in charge, if the worker was available, he would notify his/her presence by accepting the work and would reach the required destination. If the worker was not available, the work would be transferred to another worker. Some authors also implemented real time waste

management system by using smart dustbins to check the filled level of dustbins whether they were filled. In this system the information of all smart dustbins can be accessed from anywhere and anytime by the concern person and he/she can take a decision accordingly. By implementing this proposed system, the cost reduction, resource optimization, effective usage of smart dustbins was carried out. This system indirectly reduced traffic in the city. In major cities the garbage collection vehicle visited the area's everyday twice or thrice depending on the population of the particular area. The System informed the status of each and every dust bin in real time so that the concerned authority can send the garbage collection vehicle only when the dustbin is full.

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.

2.1 Existing problem

There are significant safety challenges facing the waste/recycling industry. They include chemical exposure, combustible dust explosions, machine guarding hazards, and exposure to powerful equipment with moving parts.

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2.3 Problem Statement Definition

Smart Cities are rapidly growing and globally set up by various countries for providing world-class services and enjoyable life to their residents. This has attracted many citizens to Smart Cities by leaving their existing cities and hometowns. This has resulted in exponential growth and expansion of SmartCities population and to effectively control the waste produced by the huge population, let it be human beings made waste, industrial waste, environmental waste and or medical waste. If a large amount of generated waste is not handled correctly and efficiently, it can generate a hazardous situation and can cause danger to a great extent to the

Smart City Residents. Also, a shortfall can be possible with some of the necessary items which go to waste after initial use,and if we do not recycle them, such items cost gets increases over time due to shortfall in supply and causes impacting the economy.If we can find out a way to ensure safe and efficient waste management with low cost and low processing time, it will not only help to maintain healthy surroundings but also by recycling reusable waste, it can easily boost the economy and manage the shortfall of necessary items such as paper,footwear, stationery items, tyres, remouldable plastic and so on.

3.IDEATION & PROPOSED SOLUTION

Smart netbin a normal dustbin elevated using a microcontrollerbased platform Arduino Uno board interfaced with Load sensor and Wi-Fi module.it consists of 2 main modules the mechanical designed components and the electric components. The mechanical components consist of shredder and the load sensing plate while the electric components consist of various components that are the Arduino Loadcell, LCD Display screen, IR Sensor, Amplifier, Relay module, Wi-Fi Router.When the user dumps the trash into the dustbin the trash will be first crashed within the shredder and the shredded trash will the get collected onto the load sensing plate present in the dustbin.

The load sensor us been attached to the load sensing plate this sensor will measure the weight of the trash been dumped in the bin. once the set limit of weight is been satisfied the password of the router will get displayed on the LCD screen, although the router is still off .after the password has been displayed the user have to pull this plate outside so that the

trash which has been collected on the plate falls down in the dustbin. This motion of the falling trash is captured by the IR sensor and once the IR sensor sense the falling motion.

Some proposed smart garbage management system using IR sensor, microcontroller and Wi-Fi module. This system assured the cleaning of dustbins soon when the garbage level reached its maximum.

PROPOSED APPLICATIONS

1. Waste Level detection inside the garbage bins. Transmission of the information wirelessly to concerned officials .

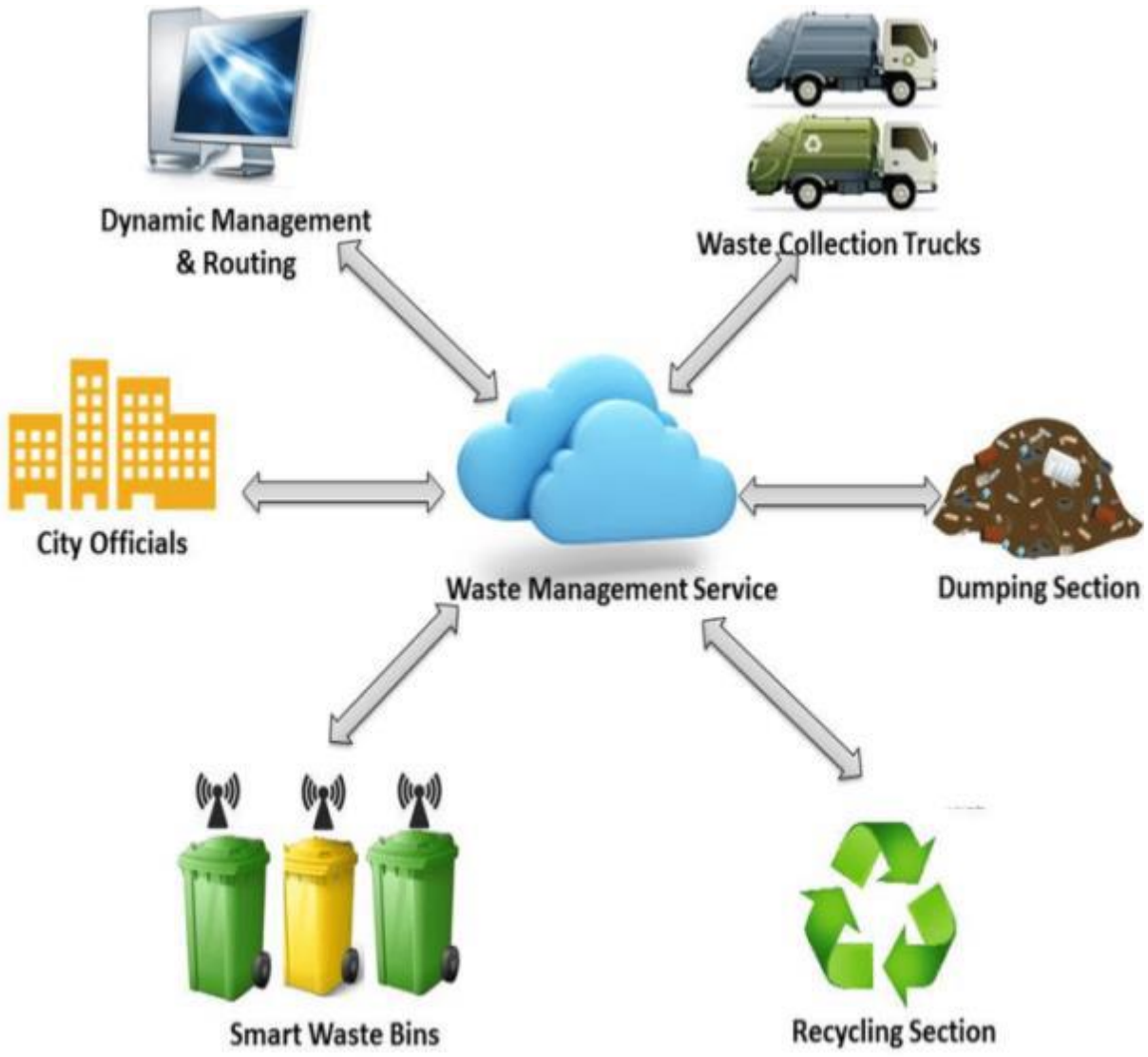
2. System can be accessed anytime and from anywhere

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



3.1 Empathy Map Canvas

An empathy map canvas **helps brands provide a better experience for users by helping teams understand the perspectives and mindset of their customers**. Using a template to create an empathy map canvas reduces the preparation time and standardizes the process so you create empathy map canvases of similar quality.

3.2 Ideation & Brainstorming

As you can see, ideation is not just a one-time idea generation or a brainstorming session. In fact, we can divide ideation in these three stages: **generation, selection, and development**.

3.3 Proposed solution

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. The proposed plan has many advantages, it is also cogent enough to be implemented in every street of a developing nation. the advantages lie in its easy and valuable functioning.This will not only improve the streets we live in, but also provide a pavement for better working system.

- Efficient and effective Functioning.
- Cleaner Environs
- Better health issues.
- Pollution free and stinking free environs

3.4 Problem solution fit

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem.

4.REQUIRMENT ANALYSIS

Many of the existing solutions provide partial solutions to the issues mentioned above. In addition to the core requirement- being able to monitor trash levels in individual bins- we have identified the following three major requirements:

Low cost sensor: Replacing the existing trash bins with the smart ones is not a viable option for most of the public entities, therefore an add-on sensor solution is required. The sensor node needs to be cheap enough so that if it is damaged or lost it won't be a big economic issue to replace it. Based on our interviews, 500DKK,or roughly $100 per bin is identified to be appropriate for the price of the sensor node. It is clear that the most important obstacle to widespread implementation of smart collection systems is the high capital investment cost. Current add-on smart sensors available on the market cost as much as the bins themselves.Though most market solutions promise that the sensors will have an economic life of up to 10 years, the interviews conducted showed that every single manager in both the private and public trash collections sector is fully aware that this would not be the case. Bins are often set on fire or blown up with fireworks. They are treated really harshly and the threat of theft of mounted sensors is high.

Simplicity: High tech solutions are rather disadvantageous. Having a very advanced and expensive device in a bin brings no value to the client (municipalities)nor the user of public areas. Therefore a simple solution is required seeing how the value does not come from the sensor itself, but from using the trash level data. Related to this, using off the shelf components can help to maintain simplicity as well as keeping the costs down.

Open/transparent system: There is a lot of focus on open data, open source and compatibility. Municipalities are looking for solutions that can work together and where they have the freedom to switch between different systems without major difficulties.This could for example mean that a municipality might choose to implement other sensors, or use the sensors on another platform, or even further develop the systems themselves.

4.1 Functional Requirement

The functional elements of waste management are: onsite handling, storage and processing; collection; transfer and transport; resource recovery and processing; and disposal.

4.2 Non-Functional Requirements

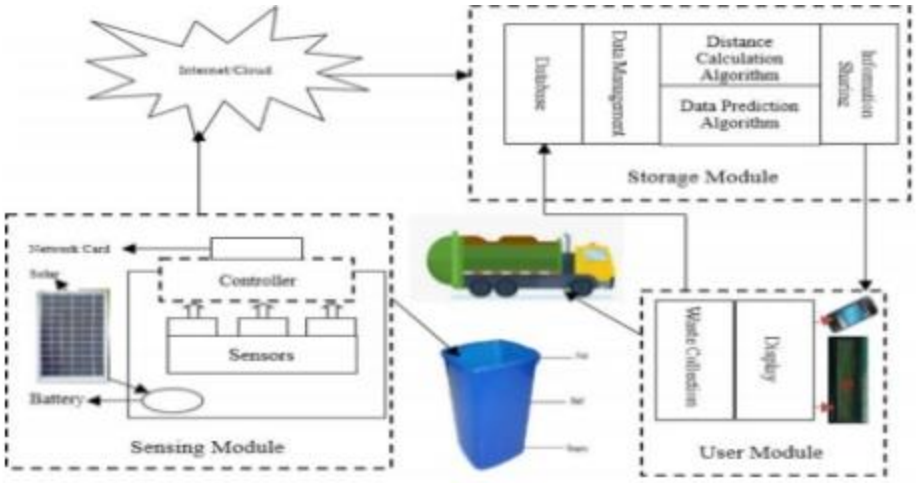
The project requires a user interface for monitoring and manually intervening (if required) in the efficient and timely collection of garbage from the selected Garbage bins.

Non-functional requirements arise through the user needs, because of budget constraints, organizational policies, the need for interoperability with other.

5. PROJECT DESIGN

Based on these requirements, we have developed an addon sensor system, that is simple to install, inexpensive and based on open standards. The system consists of sensor nodes, gateways, a cloud based backend for data collection and a front-end for visualisation for analytics.

5.1 Data Flow Diagram



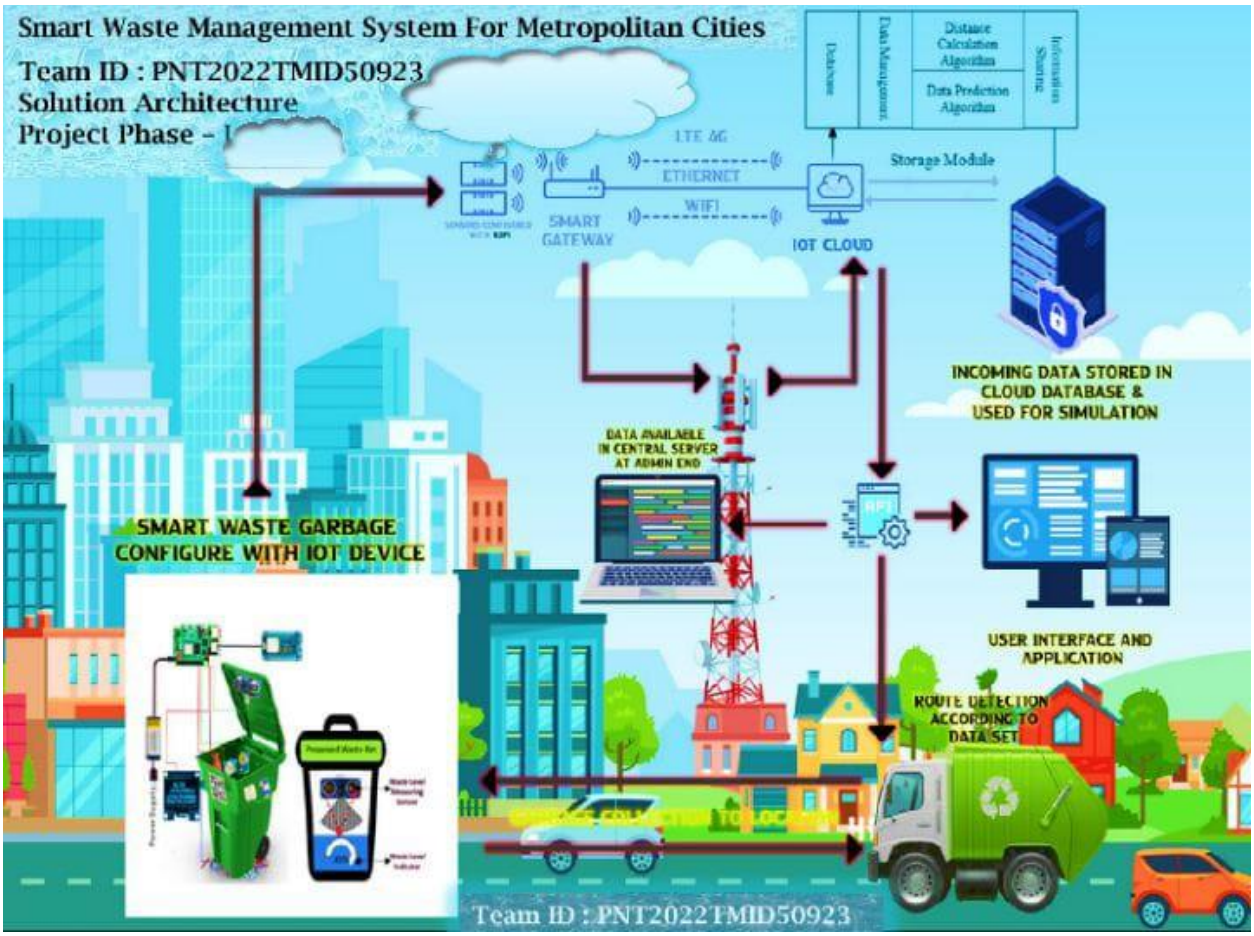
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored. • It shows how data enters and leaves the system, what changes the information, and where data is stored. • A smart waste management platform uses analytics to translate the data gather in your bins into actionable insights to help you improve your waste services. You can receive data on metric such as:

The first test conducted is the situation where the garbage bin is empty or its garbage level is very low.

Then, the bin is filled with more garbage until its level has surpassed the first threshold value, which is set to 80% then the first warning SMS is being sent, as depicted. The first notification SMS sent by the system, once the waste reaches the level of 85% full. The second notification SMS sent by the system, indicating that bin is at least 95% full and the garbage needs to be collected immediately. Locations prone to overflow.

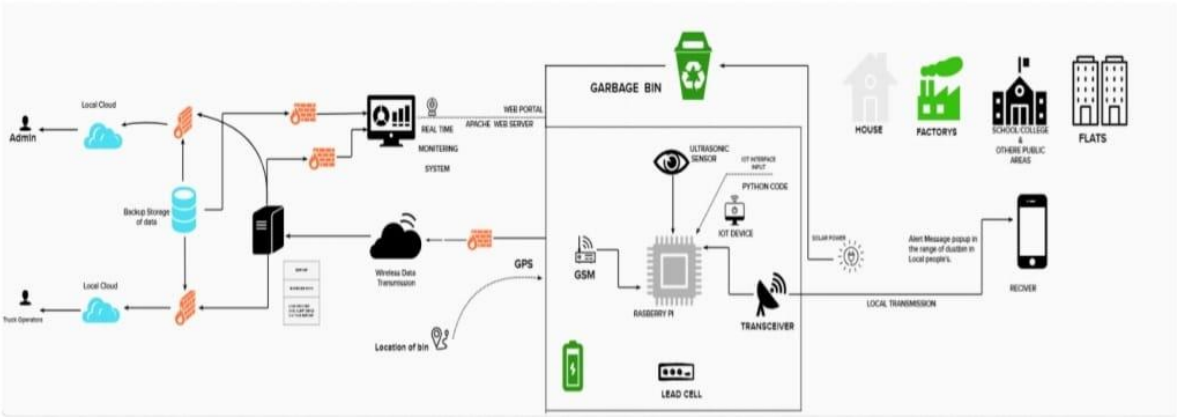
5.2 Solution & Technical Architecture

The internet nowadays has the world under its spell.Not a single person lives without internet, phone, tab or laptop.It is believed without connectivity u cannot move ahead in today's world but sometimes due to heavy plans or connectivity issues we can't access to the internet, and thus attracting people towards free Wi-Fi. providing free Wi-Fi facility for dumping waste into the dustbin would solve the issue of waste and the internet facility plus availability of free service would help people go crazy and would act as reward for maintain cleanliness in the locality.



It is very salient issue to deal and discover the proper remedies for it some of them are like government should enact stringent laws against the people throwing trash, against the industries for not using biodegradable material, more use of recycle items, reduce the use of non-degradable stuff, reuse the items, thus implementing this can reduce the waste up to some extent. Along with this use of technology for proper dumping of trash an diminising its hazardous effects is the concept put forward.

Technical Architecture:



5.3 User Stories

An example of a modern smart waste management system would include; **a sensor attached to the trash bin that measures fill level; and a communication system that transfers this data to Cloud**. Data is processed in the Cloud, thus, the route of collection trucks is optimized.

At the core of smart bin technology is **a series of wireless ultrasonic sensors that detect fill levels**. The IoT devices communicate waste data to sanitation department workers in real-time.

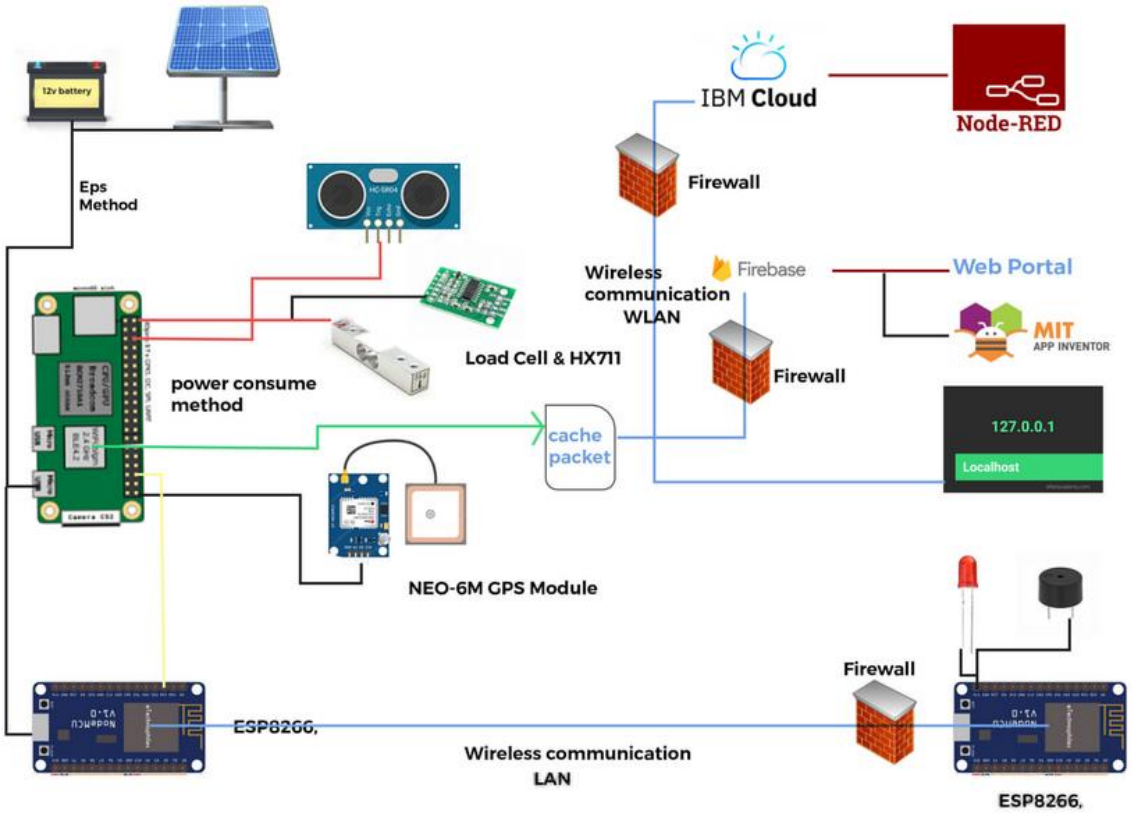
The various processes of solid waste treatment are **composting, vermin composting, incineration, power generation, fuel pelletization and biomethanation**. These processes ensure that the waste is stabilized and made inert before it is disposed.

6. PROJECT PLANNING &SCHEDULING

6.1 Sprint Planning&Estimation

Garbage, garbage, and litter are all over the television these days, with disturbing statistics of debris filling the world. Despite the grim news, a number of people and policymakers are trying to change the trend by creative waste management practices. These five forward-thinking countries are taking a novel approach to waste management in order to make the environment a safer, healthier place. Germany is first, followed by Austria, South Korea, Wales, and Indonesia. Clean Harbors, Stericycle Inc., Covanta Holding, and others are among the best waste management firms inthe world. The Government of India has encouraged city-based schemes and public-private collaboration projectsto improve waste management systems, but these have proven to be troublesome. The lack of financial resources, appropriate skills, and technological competencies with the public sector are the main obstacles to improving solid waste management services in India. Governments have begun to look at PPPs as a possible solution. The amount of change and development made was minimal. Some serious problems have been discovered as a result of this research, and some significant proposals have been made.

The proposed plan has many advantages, it is also cogent enough to be implemented in every street of a developing nation. the advantages lie in its easy and valuable functioning.This will n ot only improve the streets we live in, but also provide a pavement for better working system.



7.CODING &SOLUTIONING

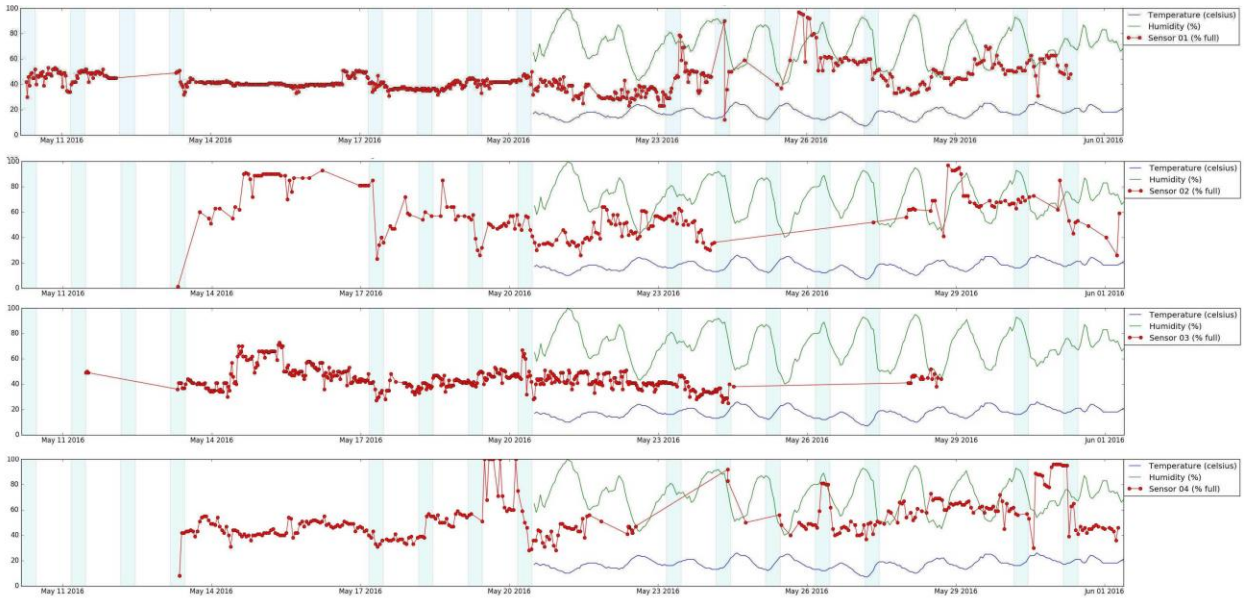
A reduction in the number of waste collections needed by up to 80%, resulting in less manpower , emissions, fuel use and traffic congestion. A reduction in the number of waste bins needed. Analytics data to manage collection routes and the placement of bins more effectively.

```python
import pyrebase
import wiotp.sdk
import time
import random
d = 0

w = 0
def database(d,w,m,load,distance,lat = 10.939091,long= 78.135731):
#Initialize Firebase
  firebaseConfig={
  "apiKey": "AIzaSyB9ysbnaWc3IyeCioh-aJQT_UCMd5CBFeU",
    "authDomain": "fir-test-923b4.firebaseapp.com",
    "databaseURL": "https://fir-test-923b4-default-rtdb.firebaseio.com",
    "projectId": "fir-test-923b4",
    "storageBucket": "fir-test-923b4.appspot.com",
    "messagingSenderId": "943542145393",
    "appId": "1:943542145393:web:9b5ec7593e6a3cbd7966d0",
    "measurementId": "G-BN7JNX1Q7B"
  }

  firebase=pyrebase.initialize_app(firebaseConfig)

  db=firebase.database()

  # #Push Data
  data={"level":str(d)+"cm",
        "alert":m,
        "weight":str(w)+"g",
        "latitude":lat,
        "longitude":long,
        "distance_status":distance,
        "load_status":load}
  # print(db.push(data))


  # update data base

  db.child("-NEkRRkKsX7yVcqy_rK4").update(data)

  myConfig = {
      "identity": {
          "orgId": "4yi0vc",
          "typeId": "smartwaste123",
          "deviceId":"70103"
      },
      "auth": {
          "token": "123456789"
      }
  }

  def myCommandCallback(cmd):
      print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
      m=cmd.data['command']

  client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
  client.connect()
  client.publishEvent(eventId="status", msgFormat="json", data=data, qos=0, onPublish=None)
```

9.RESULTS

The data was analysed in accordance to the observations during the pilot test (see Figure).Bins 01, 03 and 04 are located in an area where it is common for smokers to stand. Bin 02 was filled very quickly during the weekends, from visual observation it was clear that this was due to being located at an entry point to the building where students work all seven days of the week. This meant that the bin usually needed to be emptied on Monday mornings.

Bin 04 was the closest to an outdoor sitting space that is frequented for lunch by cafeteria workers. Therefore it was quickly filled after the lunch hours during work days(Monday-Friday).Bins 01 and 03, though very close to the other two, were used far less. This is interesting, as it shows that users are not willing to walk a few meters towards a bin even though it is empty. Instead they prefer the closest bin, despite its state. From observation it was clear that the bins were subjected to a lot of physical abuse (being kicked around, tipped over) and very efficiently, but violently, emptied by removing the lid where the sensor was mounted. In addition, the biggest worry of the collectors was the sensors ability to withstand rain and humidity. The sensors survived both the physical abuse and a number of rainy and humid days during the 19 day period.



Bins 01, 02, 03 and 04. Axes: Measure/Time. Bin 01: Emptied at the beginning of the data gathering process and 2weeks later . Bin 02: Emptied after long weekend. Bin 03: Bin that observed the least activity, in spite of its proximity to bin 04. Bin 04: The bin that experienced the most activity, due to its proximity to outdoors eating area. Was emptied onceper week .

9.1 Peformance Metrics

However, this **smart garbage** monitoring **system** can **measure** the garbage level in real time .The absence of efficient waste **management** has caused serious environmental problems and cost issues.

10.ADVANTAGES&DISADVANTAGES

Advantages

- Real time information on the fill level of the dustbin.

- Deployment of dustbin based on the actual needs.
- Cost Reduction and resource optimization.
- Improves Environment quality -Fewer smells -Cleaner cities
- Intelligent management of the services in the city.
- Effective usage of dustbins.
- As mentioned above, waste management involves the collection and disposal of both hazardous and non-hazardous wastes from all the sectors of society. We shall now look in detail the advantages of waste management or the benefits of proper garbage disposal.
- A reduction in the number of waste collections needed by up to 80%, resulting in less manpower, emissions, fuel use and traffic congestion. A reduction in the number of waste bins needed. Analytics data to manage collection routes and the placement of bins more effectively.

Disadvantages:

- expensive.
- some wastes cannot be recycled.
- technological push needed.
- separation of useful material from waste difficult.

11.CONCLUTION

They have displayed an IoT based waste management and monitoring system. The system is based on the IoT recognizing model responsible for continuous monitoring of the

waste levels in the dustbin and later send this information through the internet to a server that is the concern authorities responsible for disposal of the waste. This information helps in the timely collection and disposal of waste without creating any failures. In the future, we should need to focus on and improve the waste disposal of liquid and fluid waste. We should also focus on improving the automation in waste segregation techniques. By understanding this task we can maintain a level of pollution and toxic gases released by the rotating of waste in the dustbin. Moreover, the shocking smell can be decreased or avoided in light of social events the hardship before its rot. They set up the framework with devices embedded in the dustbin to check the level of dustbin constantly. In this framework when garbage is full the data is sent to the concerned authorities. The data will be sent in the form of a message on devices with the location of the dustbin. In this case, the message will be sent on the phone using (GSM SIM module) attached with Google map location using (GPS VK16E Module). By executing this purposed framework we can build up the smart cities at a reduced cost. By the productive utilization of smart dustbin, we can be technologically advanced.This framework can diminish the dirty and untidy picture of a waste bin in the Awe-inspiring cities and can make the environment clean and healthy.

12.FUTURE SCOPE

During the pilot test it was clear that users are unwilling to walk towards another empty bin when a bin is overfilled,even if it is within their sight. Gamification and nudging has been already

used in traditional waste collection settings, and we believe that their utilization should be further explored in smart waste management.

In regards to the sensor nodes, an integrated board can be designed to reduce the manufacturing costs and significantly decrease the physical footprint. Finally, the system can greatly benefit from adding a volatile organic compound or gas sensors; which can provide an estimation of the odours concentrated in the trash bin and provide a dimension in analytics.

Smart dustbin helps us to reduce the pollution. Many times garbage dustbin is overflow and many animals like dog or rat enters inside or near the dustbin. This creates a bad scene. Also some birds are also trying to take out garbage from dustbin. This project can avoid such situations. And the message can be sent directly to the cleaning vehicle instead of the contractor's office.

13.APPENDIX

Source code

```
#IBM Watson IOT Platform
#pip install wiotp-sdk
import wiotp.sdk.device
import time
import random
myConfig = {
    "identity": {
        "orgId": "oonztp",
        "typeId": "Smart_Waste",
        "deviceId":"12345"
    },
    "auth": {
        "token": "rZgABoZEoxK!U3cWJg"
        }
}
```

```
def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
    m=cmd.data['command']

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

while True:
    ult_sen=random.randint(0,200)
    weight=random.randint(0,100)
    myData={'Detected value is':ult_sen, 'Weight Percentage in bin is':weight}
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0,
onPublish=None)
    print("Published data Successfully: %s", myData)
    client.commandCallback = myCommandCallback
    time.sleep(2)
client.disconnect()
```

```
while True:
    distance= random.randint(10,70)
    loadcell= random.randint(5,15)
    data= {'dist':distance,'load':loadcell}

    if loadcell < 13 and loadcell > 15:
        load = "90 %"

    elif loadcell < 8 and loadcell > 12:
          load = "60 %"

    elif loadcell < 4 and loadcell > 7:
          load = "40 %"
    else:
          load = "0 %"

    if distance < 15:
          dist = 'Risk warning:' 'Dumpster poundage getting high, Time to collect :) 90
%'



    elif distance < 40 and distance >16:
          dist = 'Risk warning:' 'dumpster is above 60%'

    elif distance < 60 and distance > 41:
          dist = 'Risk warning:' '40 %'
    else:
          dist = 'Risk warning:' '17 %'



    if load == "90 %" or distance == "90 %":
          warn  = 'alert :' ' Dumpster poundage getting high, Time to collect :)'

    elif load == "60 %" or distance == "60 %":
```

```
            warn = 'alert :' 'dumpster is above 60%'
        else :
            warn = 'alert :' 'No need to collect right now '
        def myOnPublishCallback(lat=10.678991,long=78.177731):
            print("Gandigramam, Karur")
            print("published distance = %s " %distance,"loadcell:%s " %loadcell,"lon = %s "
    %long,"lat = %s" %lat)
            print(load)
            print(dist)
            print(warn)

        time.sleep(10)


        success=deviceCli.publishEvent ("IoTSensor","json",warn,qos=0,on_publish=
    myOnPublishCallback)

        success=deviceCli.publishEvent ("IoTSensor","json",data,qos=0,on_publish=
    myOnPublishCallback)


        if not success:
            print("not connected to ibmiot")
        time.sleep(30)



        deviceCli.commandCallback=myCommandCallback
    #disconnect the device
    deviceCli.disconnect()
```

GitHub&Project Demo Link

https://drive.google.com/file/d/1HQmS2W_eU6C2NeLBzqMPOH5eao8OKqnv/view?usp=drivesdk