

# IoT based Smart City by Waste Management System

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**Abstract**— As we know the population is increasing day by day, the environment should be clean & hygienic. The problem of the waste management is those dustbins are placed in public place. If the dustbins are full then also people are throwing the dust into the dustbin. To overcome this problem we are proposing the system which contain “IoT”. Based bin which are placed in public places this bin will have sensor. As we know the scope of IoT is being developed day by day this effective method find out quickly. This thing involves a smart city for waste management system idea can be easily implemented. Manual efforts will be reduced. All the data which are going to process in this technology are processed through internet by using ESP module. It will inform to authorized person when the garbage bin is about to send location of bin by using GSM module for android mobile.

**Key words:** Ultrasonic Sensor, ESP8266 Microcontroller, GPS & GSM Module for Android

## I. INTRODUCTION

SMART city is a place where the traditional networks and services are provided more effectively using new digital and telecommunication technologies (IOT). Smart city is nothing but intermediate medium to integrate several techniques along with IOT. There are several cities assets to make a city as a smart city. Which consist of local department information system, libraries, school, hospitals, waste management system, among the above assets in this paper we cover waste management system-with the smart bins. Here we are proposing the smart bins with the touch of IOT.

IOT and its application have becomes an important part of today's life-style. Due to its proper working and high performance, researchers are able to connect large number of devices from environment through internet. We present a waste collection management solution based on the smart bins using an IOT technique.

In existing waste management system there are several issues due to the irregular cleaning of the dustbin work load will be increased, and the shortest of the labour.

Because of the overflow of the garbage problem is occurs such as infectious diseases, hazardous smell to the people placing in that area.

By using a smart bin this issues are the overcome, advantages by using this system are as follows:

- 1) Stop the spread of infectious diseases.
- 2) To clean the dustbin on daily basis.
- 3) To reduce the manpower.
- 4) To avoid the overflow of the dustbin.
- 5) To make city clean and smart.

In our project internet is to be used to connect the devices, sensor and the hardware to the software part or our mobile app. major issue for dustbin management is irregular cleaning of the dustbin. To overcome this issues we used an ultrasonic sensor is to be used to map the level of the

dustbin. In which particular threshold value is to be fixed, if garbage crossed this particular value .this value are setup as follows ,low level , High level.

According to this level updating are done on the map, if garbage is crossed the high level alert Message is given to the municipal office and the garbage collector.

This Ultrasonic sensor interfacing with the android app through the arduino microcontroller. Wi-Fi module is also interfaced with the app through the microcontroller, by using this technology communication are done over the internet.

Android itself contain a GSM, GPS technology.

– GSM

For forwarding message.

– GPS

Is used by the garbage collector, end user for trapping the position of dustbin.

Through API key access the location of the dustbin on map. By using this system transparency will be maintained, garbage collection on regular basis.

## II. LITERATURE SURVEY

We have referred following papers to get an idea about the domain. So, the knowledge we have extracted is:

- 1) In this paper, use a cheap mobile robot for mapping instead of expensive laser sensor. Use cheap ultrasonic Sensor HC-SR04 with range up to 4m. Here ultrasonic sensor used along with Robot with the help of ultrasonic sensor can accept according with rang of signal and echo. They use this hardware for scanning or mapping distance of particular Application. We got an idea is sensor range concept is to be used in our project for the mapping the status of the Dustbin. According with that dustbin is full, empty status is updated. [1]
- 2) In this paper, is use as a machine to machine correspondence it's based on cloud computing and system of information social event sensors and it is portable, virtual and prompt connections. We get an idea that we are going to connect Wi-Fi model to the mobile app directly through the USB device and also we get idea about linked attribute. [2]
- 3) In this paper detailed comparison of the ESP32 to its technique and its function.ESP32 is a Service of low cost, low power system on a chip microcontroller with integrated Wi-Fi and dual mode Bluetooth. In this paper we got an idea of use ESP Wi-Fi module. This is a low cost and low power .Better benefit of the combination of microcontroller and wireless communication module of both in one.[3]
- 4) In this paper the waste collection management solution based on providing intelligence to waste bins, using an IOT prototype with Sensors. It can read, collect, and transmit huge volume of data Over the Internet. The idea of using the IOT prototype is taken from this

paper. Hence the IOT platform is chosen to perform this project.[4]

- 5) In this paper, Smart cities should be equipped with basic infrastructure and technological advancements to provide better ambience and comfort for living. IOT based Garbage Management System for Smart Cities” with the help of Internet of Things (IOT) and cloud computing. In the GMS (Garbage Management System), a robot moves on the overhead rail which is constructed along the locality of the smart city. It carries a bin which collects waste from the people in that particular locality. As our project point of view the concept of the garbage collection by using the robot as future scope. In this idea can be implemented in future. And plus point is that robot can do his work on the regular basis. And there is no delay in the garbage collection.[5]

### III. PROPOSED SYSTEM

#### A. Algorithm

##### 1) K-Means Algorithm

In this system user want to know the nearest dustbin location with position level. Also it want to know nearest another dustbin location when the current dustbin is full.

Usage of this algorithm:

- 1) Number of dustbin grouped in cluster according to the distance measure.
- 2) Find out the minimum distance dustbin location from the mean dustbin.

Initialization:

K: Number of cluster.

N: sample feature vectors (dustbin)  $x_1, x_2, \dots, x_n$ .

M: is the mean of the vector in clustering  $i$ .

Assume  $k$  &  $n$ .

Make initial guesses for the means  $m_1, m_2, \dots, m_k$ .

Until there are no changes in any mean. Use the estimated means to classify the samples into cluster.

For  $i=1$  to  $k$

Replace  $m_i$  with the mean of all the samples (dustbin) for cluster  $i$

End\_for

End\_until

Following steps are repeated until there is no change in cluster elements.

- 1) Find the centroid.
- 2) Find the distance of each object (dustbin) to the centroid (user location).
- 3) Based on the minimum distance group the object (dustbin) into the cluster.

#### B. System Architecture

In proposed system consist of architecture of following component ESP8266 Microcontroller, Ultrasonic sensor, Power Supply etc.

In this architecture ultrasonic sensor is attached to the dustbin. Ultrasonic sensor (HC-SR04) is used to detect the real time level in dustbin on the basis of garbage collection. We are set the levels, and these levels are detected using the ultrasonic sensor. If the dustbin is less than 10% then yellow LED is glow. If the dustbin is greater

than 10% then green LED is glow. If the dustbin is fulfilled with 95% then green LED is glow and the message is automatically send to the server. This message server through collected by the user and garbage collector. If the garbage is collected then updating the level information of dustbin on the server side. When the user refer current dustbin, these dustbin is full then it will also show another nearest dustbin location.

##### 1) Image ESP8266 Wi-Fi Module

It is the low cost Wi-Fi chip with full TCP/IP stack. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connection using Hayes-style command.

##### 2) Ultrasonic Sensor

Ultrasonic sensor (HC-SR04) is used the sonar for measuring distance of a dust. This will give a better measure range from 2cm to 400cm.



Fig. 1:

This ultrasonic sensor will detect so many levels but in our project we consider set the level.

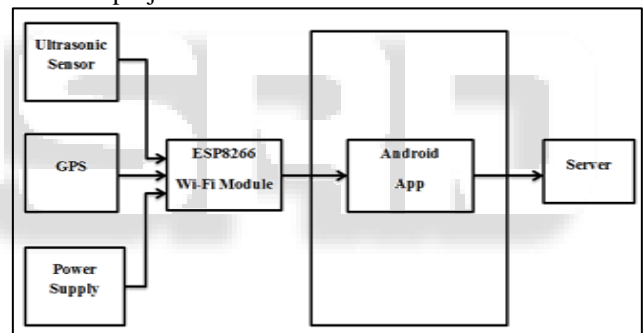


Fig. 2. System Architecture

#### C. Methodology

The working of our system is given below with the help of screenshots of our system and explanation in brief manner:

##### 1) Registration

In the first step for the user provided the username and Password for the registration on android application.

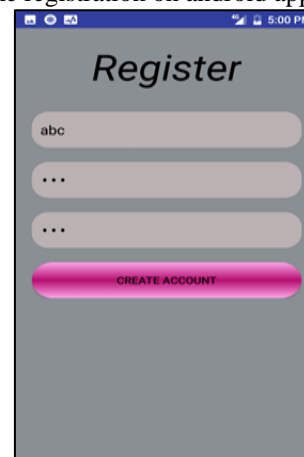


Fig. 3:

### 2) Login

After the registration user have to Login on that application. This software anuthicate the user as per the registration data.

When the user login on that application display screen show the level of the dustbin to the user also if the dustbin is the full it will show the nearest dustbin.



Fig. 4:

### 3) Information Show User

If the dustbin is fulfilled with 95% then green LED is glow and the message is automatically send to the server. This message server through collected by the user and garbage collector. If the garbage is collected then updating the level information of dustbin on the server side. When the user refer current dustbin, these dustbin is full then it.

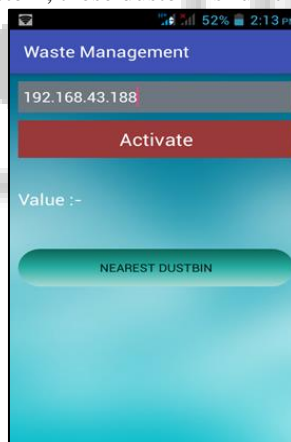


Fig. 5:

### 4) Steps

- 1) User Registration
- 2) User Login:
- 3) Success.
- 4) Information show user and send to the user garbage collector, Municipal office.
- 5) Update the information on the server.
- 6) After the updating the information will be show to user on that application.

### D. System Requirements

#### 1) Frontend

- Java Advance

#### 2) Backend

- MySQL

### 3) Hardware

The hardware used for this system is ESP8266 Wi-Fi Module and Ultrasonic sensor for connect to a Wi-Fi network and detect the real time level.

## IV. CONCLUSION

The waste management system uses arduion microcontroller which works quite nicely. The main thing is that it will clean the dustbin on regular basis which will reduce the long time and hard to maintain. Certainly, it is improved for better results by paying attention in feature or in its process. This will help that system will become more robust. To prevent the overflow of the garbage in the dustbin. The main use of this system will be to remove the garbage on the regular basis. Integration with modern IOT system. Development of application for city, administration, municipal staff. Hence we are going to purpose the intelligent system that will be used for the proper monitoring and maintenance of garbage. This system prevents the irregular cleaning of dustbin by sending an alert.

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