



## A Review: Garbage Bin Tracking Using IoT

*Prof. A. D. Thorat<sup>1</sup>, Ms. Shruti Khot<sup>2</sup>, Ms. Sakshi Patil<sup>3</sup>, Ms. Shravani Patole<sup>4</sup>, Ms. Pradnya Tandale<sup>5</sup>*

<sup>1</sup>Assistant Professor, Dr. Daulatrao Aher College of Engineering, Karad, Maharashtra, India/Computer Science and Engineering Email: [adthorat.cse@dacoee.ac.in](mailto:adthorat.cse@dacoee.ac.in)

<sup>2</sup>Dr. Daulatrao Aher College of Engineering, Karad, Maharashtra, India/Computer Science and Engineering

Email: [khotshruti149@gmail.com](mailto:khotshruti149@gmail.com)<sup>2</sup>, [sakshipatil13032003@gmail.com](mailto:sakshipatil13032003@gmail.com)<sup>3</sup>, [patoleshravani13@gmail.com](mailto:patoleshravani13@gmail.com)<sup>4</sup>, [Pradnyatandale2003@gmail.com](mailto:Pradnyatandale2003@gmail.com)<sup>5</sup>

### ABSTRACT:

This system presents IoT innovation project of a smart waste bin with real time monitoring system which integrates multiple technologies such as solar system, sensors and wireless communication technologies. The aim of this project is to provide an efficient and cost-effective waste collection management system hence providing clean, healthy and green environment. This study proposed a new framework that enables remote monitoring of solid waste bin in real-time via Wi-Fi connection, to assist the waste management activity. The system framework is based on wireless sensor network [WSN] contains three segments: renewable energy source, WSN and control station. Within this framework there are four developed subsystems: solar power system, smart waste bin, short messaging service [SMS] notification system and real-time monitoring system that are interrelated to each other to perform as an efficient, cost-effective waste management system that yield to a green and healthy living environment.

**Index Terms:** Garbage bin tracking system, IoT components, Garbage level detection, Android App

### 1. Introduction

Things (Embedded devices) which are connected to Internet and sometimes these devices can be controlled from the internet is called as Internet of Things. In our system, the Smart dust bins are connected to the internet to get the real time information of the smart dustbins. A proper waste management system is required to keep the city clean and hygienic. There are multiple dustbins situated across the city or the Campus (Educational Institutions, Companies, and Hospitals etc.). These dustbins are connected with micro controller, Ultrasonic Sensors and GSM modules where the Ultrasonic sensor will detect the level of the dustbin and will send the signals to micro controller. The data received will be analyzed and processed and accordingly the dustbin level can be found out on weekly basis. K-means clustering Algorithm will provide with the analysis to figure out on which days the dustbin is been filled more. All this activities can be tracked out through the Android Application. Authorized personnel will have the Android Application which will show the current level of dustbin. This will help in regularly monitoring the current status of dustbin and clean the dustbins at right times so unnecessary bad smell will be reduced .

### 2. Literature Review

The proposed paper by Pranja Alva [1] a Smart waste collecting system and waste management system are based on IoT is proposed in this study to help the local government. This aids in the resolution of issues related to trash management and IoT-based waste collection for the smart city. The developed solution is extremely efficient in collecting waste, monitor the amount of waste deposited, and to indicate the odor and toxic smell produced by the waste and to normalize the environment. The system's main benefit is that it collects waste on time, avoiding bin overflow, which would aid in waste collection.

Sunny Kanade [2] The system is implemented using two ultrasonic sensors which is being controlled by node MCU .One of the ultrasonic sensors 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 app. The proposed system is reliable, cost effective and can be easily implemented.

Ritaf Zabin [3] Checking system utilizing Arduino or Raspberry pi board and an open IoT stage is presented in this report. The proposed framework includes an Arduino microcontroller, ultrasonic sensor, Wi-Fi module and a heap battery. Information from the ultrasonic sensor and burden cell is obtained by using the Arduino microcontroller. By utilizing an ultrasonic sensor, the profundity of the trash in the compartment is resolved and the

heaviness of the waste receptacle from the heap cell is also estimated. For indicating the information, the LCD screen is utilized. The Wi-Fi module sends to the web the information portrayed previously.

Satish kumar N[4] This paper proposes an IoT based efficient waste collection system with smart bins. It does real-time monitoring of the waste bins and determines which bins are to be emptied in every cycle of waste collection. The system also presents an enhanced navigation system that shows the best route to collect wastes from the selected bins. Four waste bins are assumed in the city of Mount Pleasant, Michigan at random location. The proposed system decreases the travel distance by 30.76% on an average in the assumed scenario, compared to the traditional waste collection system. Thus it reduces the fuel cost and human labor making the system optimized and efficient by enabling real-time monitoring and enhanced navigation.

### 3. Problem Statement

To develop an IoT based solution for garbage bin tracking.

### 4. Proposed System

To create a reliable, cost effective and portable „IoT Based Garbage Monitoring System“ which have to monitor the garbage bins or dustbins. It will inform the current status of respective dustbin to the concern authorities, which will help them to maintain the cleanliness in the city, and make the city a smarter one.

A System Description ESP32 is an open source software which helps to interface the Ultrasonic Sensors and GSM Module. It is a Micro-controller having the potential to monitor the level of garbage bins.

The code has been written in editor and then deployed on board using upload option in editor. The code contains workers phone numbers which will be useful for sending message to them. One can edit the number and location name from the code .

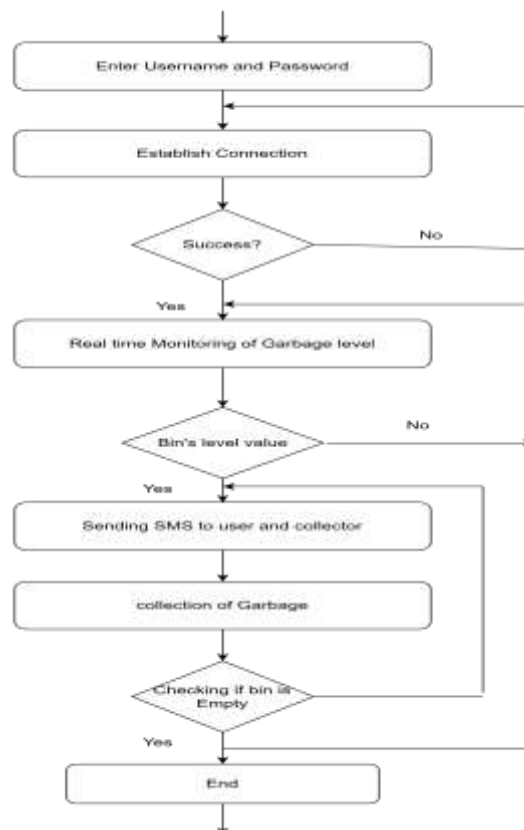


Figure : Proposed System

The components to be used in proposed system are:

- **ESP32:**

In module ESP 32 is used. It is low cost. It is better than Arduino. It provides the advance features for processing, it is suitable for complex application. Esp32 can be used on 3 to 5 voltages. In ESP module Wi-Fi is inbuilt in Arduino the Wi-Fi module can be attach separately that's why it is more convenient.

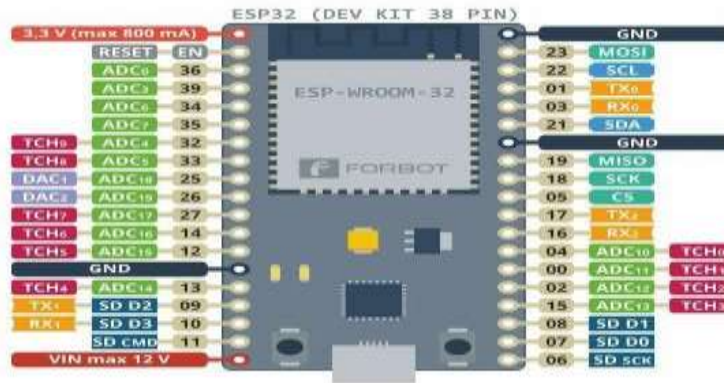


Figure 1. ESP32

- **Ultrasonic Sensor:**

Ultrasonic sensor placed over the bins to detect the garbage level and compare it with the garbage bins depth. Ultrasonic sensor is used to find the object while giving information about the bin is full or empty. ultrasonic sensors can measure distance and detect the presence of an object without making physical contact.

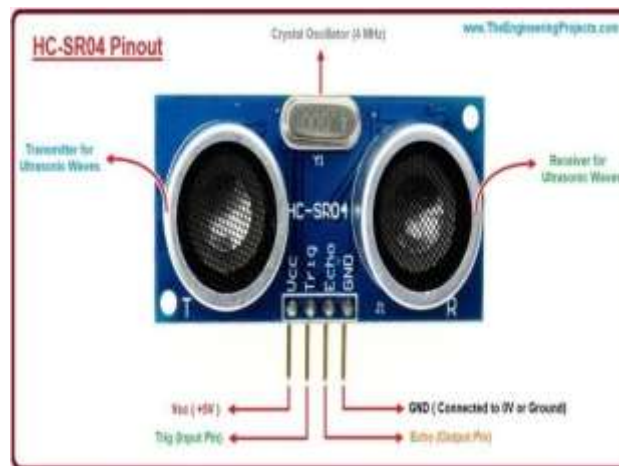
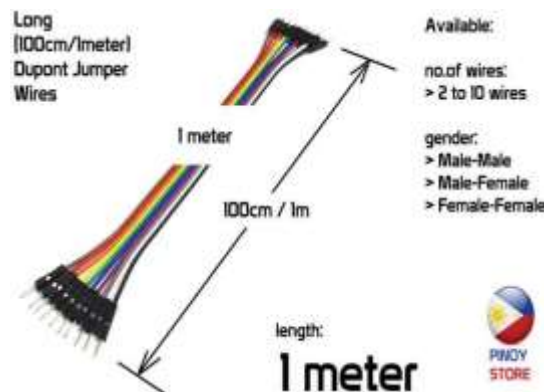


Figure 2: Ultrasonic sensor

- **Jumper Wires:**

The jumper wire is used as a connecting medium. By placing the jumper wire on the circuit it becomes possible to control the electricity. It carries the signal up to 12 to 13.8v.



**Figure 3: Jumper wires**

- **Buzzer:**

The buzzer is attached to the ultrasonic sensor it will enable after filling the garbage bin at a particular level. It will continuously beep until dustbin is empty. The buzzer is used to as an alert. It requires voltage from 1.5v to 5v.

**Figure 4: buzzer****5. Result**

- A. Waste Level detection inside the dustbin Using this project the garbage level can be detected on the a SMS is been sent once the threshold level is reached. Similarly, mobile application facilitates to monitor the waste level.

**Fig A. detection of waste level**

- B. Transmit the information wirelessly to concerned :

In the mobile application we have a separate login for the administrator who can monitor all the garbage bins and their status through the application. The worker has a separate login which helps him to locate the garbage bin through maps and once the garbage is collected he can change the status of bin from full to empty.



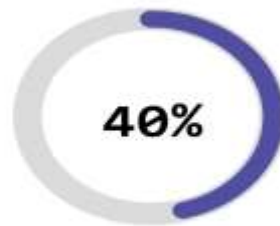
Fig B1: Home page





SmartBin connects you to your nearby dustbin via HC05, So that you don't have to reach to every dustbin each time.

NEXT



After connecting to near by dustbin app communicates with dustbin using iot device and shows the percentage of how much the dustbin is filled with garbage.

GET STARTED



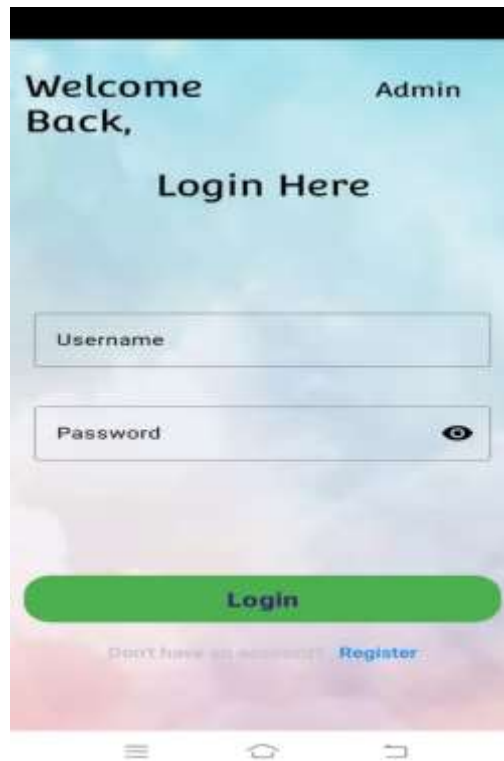


Fig B2: Mobile app for admin

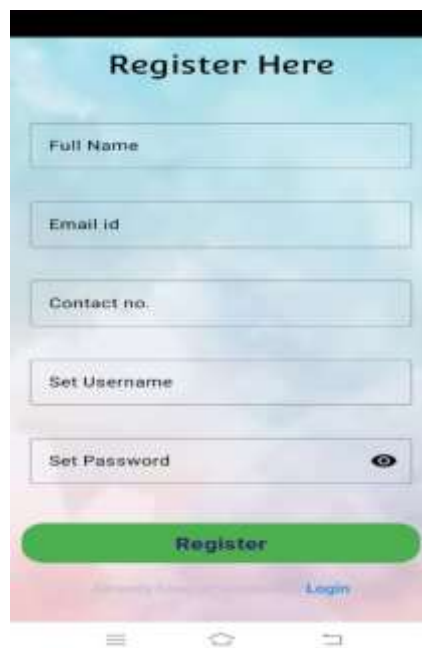


Fig B3 :Registration For Workers



Fig B4 : Registered Workers

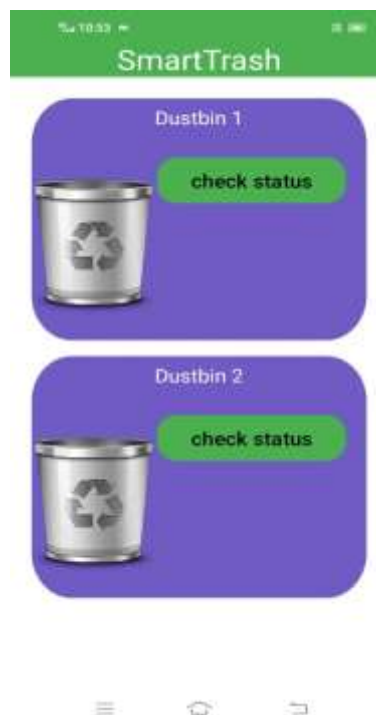


Fig B5 : Checking Bin Status

C. The data can be accessed anytime and from anywhere :

As we are using the mobile application for accessing the status of garbage bins it becomes easier for the worker as well as the admin to monitor the bins and access becomes easy as we can have the status of the bins from anywhere. We just need to have the application installed. Along with the installation of application we need internet connection which ensures the real time status of dustbins.



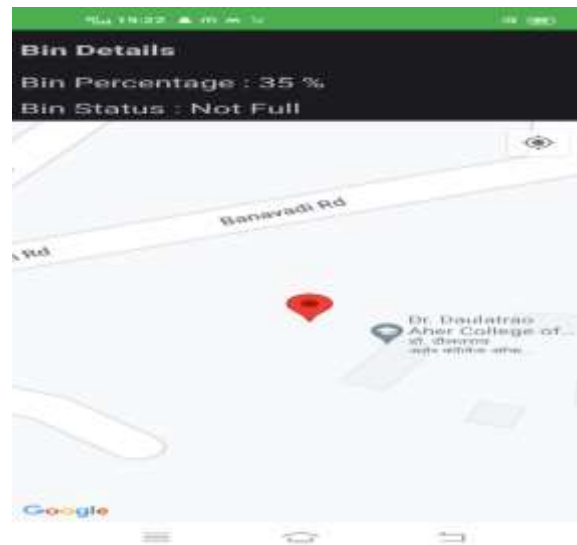


Fig C : Location of dustbin on Google map

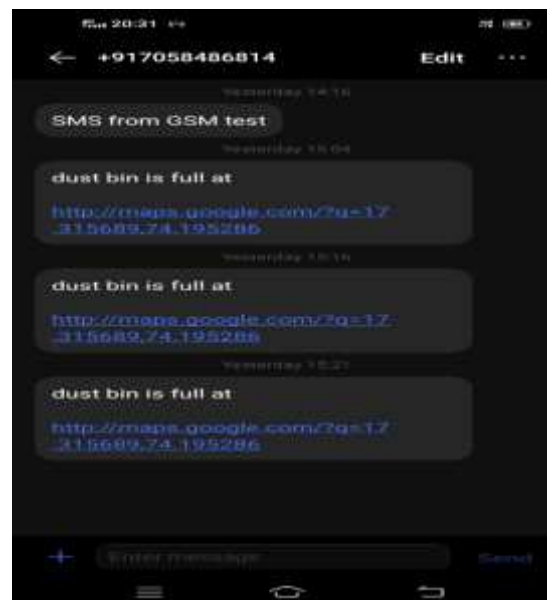


Fig C 1: Dustbin full msg to user

## 6. Mathematical Model

Now let us look at the mathematical calculation of the garbage level detection system.

wavelength = sound / frequency

$$= \frac{343}{40000}$$

$$= 0.008575 \text{ m}$$

Let us assume that the ultrasonic sensor sends out sound waves . The area covered by the beam at a distance of 200 cm is:

$$\text{area} = \pi * (\tan(15/2) * 200)^2$$

$$= 0.2618 * 40000$$

$$= 10472 \text{ sq. cm}$$

Therefore, the resolution of the sensor at a distance of 200 cm is: resolution = area / (200<sup>2</sup> \* pi)

$$= \frac{10472}{(40000 * \pi)}$$

$$= 0.0264 \text{ sq. cm}$$

This means that the sensor can detect level of garbage with a size of 0.0264 sq. cm at a distance of 0.20 cm.

---

## 7. Conclusion

The main objective is to maintain the level of cleanliness in the surrounding and form an environment which is better for living. By using this, the system can constantly check the level of the garbage in the dustbins which are placed in various places. If a particular dustbin has reached the maximum level then the worker can be informed and they can immediately take certain act to empty it as soon as possible. The worker can check the status of these bins anytime on their mobile phones.

---

## 8. Future Enhancement

This system provides us with the real time information and status of garbage bins located in different areas. With the help of this real time information we can monitor the bins and once the bins are full the workers can collect the garbage and set them to empty again. This system is cost effective and can be accessed from anywhere. Traffic can be controlled as the workers collect the garbage only when the bin is full whereas in traditional way workers collect the garbage daily whether the bin is filled or not. This system has a future scope where this system can be used with time stamp where real-time clock will be made available to the authority stating at what time Garbage bins was full and at what time did the garbage is collected from the smart Garbage Bins.

## 9. Acknowledgement

We would like to express our sincere gratitude to Prof. A. D. Thorat for her insightful recommendations. We also want to thank our friends especially for helping us with our study.

---

## 10. References

1. Sathishkumar N; Pravinkumar M .“IOT based Dustbin Monitoring with Dumpster Alert System,” IEEE international conference on advance computing and communication systems. [2022]
2. Anagha Gopi; Jeslin Anna Jacob; Riya M “IoT based smart waste management system”, IEEE international conference on web research [2021]
3. Prajna Alva; Jai Prakash Prasad Sunay Kanade “Smart garbage monitoring system using IOT,” IEEE international conference on computing methodologies and communication (ICCCMP)
4. Khandaker Foysal Haque; Rifat Zabin “An IoT Based Efficient Waste Collection System with Smart Bins”, institute of electrical and electronics engineers (IEEE) [2022]
5. Sudharani Ashok ghadage, Neeta Anilkumar Doshi “International conference on intelligent sustainable systems (ICISS),
6. Dr.N.SathishKumar, B.Vijayalakshmi, R. Jenifer prathana, A .Shankar “IOT Based Smart Garbage alert system using Arduino UNO”.
7. Shobana G, Sureshkumar R (2018)“AUTOMATED GARBAGE COLLECTION USING GPS AND GSM ” International Journal of Pure and Applied Mathematics 118 (20), 751-755.
8. Sonal Chakole, Priya Khadse, Shruti Shinganjude, Prajakta Pimple, Snehal Shahane, Shweta Mokhale (2017)“Real Time Smart City Garbage Collection and Monitoring System Using GSM and GPS ” International Research Journal of Engineering and Technology (IRJET) Volume: 04
9. Shubham , R.Narayanamoorthi, (2015)“Smart and Wireless Waste Management” IEEE Sponsored 2nd International Conference on Innovations in Information Embedded and Communication Systems,.
10. Theodoros Anagnostopoulos , Arkady Zaslavsky , Alexey Medvedev (2015)“Robust Waste Collection exploiting Cost Efficiency of IoT potentiality in Smart Cities”, International Conference on Recent Advances in Internet of Things (RioT) Singapore