

# Garbage Monitoring System using IoT

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**Abstract:** The Internet of Things (IOT) is that the internetworking of physical devices, vehicles and other different objects that consists of an embedded system with sensors and network connectivity that enable to collect and exchange data. In the present scenario, we come across various places where the garbage bins placed along the roadside are overflowed due to increase of trash in day to day life. The unhealthy status of the dustbin leads to poor wellbeing of the people and impairment to the society which causes some deadly diseases and human illness. To address the above issue, we developed a Garbage Monitoring System which monitors the dustbin and send notifications to the cleaner. The smart dustbin monitors the capacity level of the dustbin and indicate the user in LED. Once the capacity reaches the threshold level, an alert message is sent to the corporation vehicle who in turn will clear the bin. The shortest path to reach the dustbin from the cleaner is detected using TSP algorithm. The main motto of the project is to prevent the lumping of garbage in the roadside dustbins which causes foul smell and illness to the people.

**Keywords:** smart dustbin, ultrasonic, waste management, IOT.

## 1. Introduction

IOT - Internet of Things is a new uprising of the internet. The aim of the IOT is, that enables the things to be connected anytime, anyplace with anything and anyone ideally using network. The significant part of the IOT is Smart Connectivity using existing networks and Context Aware computation using network resources. The availability of living space, utilization of natural resources, education and employment is caused due to the rise in population. The amount of waste generated by individual for each minute is also another serious problem.

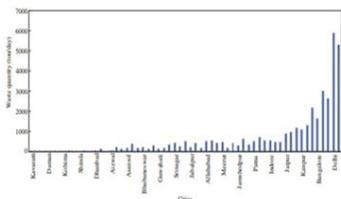


Fig.1. Waste quantity generation rate(tons/day) vs. city

The garbage bin is a basic and common need everywhere. It is observed that many times the garbage bins are overflowed and spilled out from the bins which leads to various health issues. The waste material is polluted due to majority of the public environment. The solid waste management is the big challenge in the urban cities. To eliminate this problem, the

smart garbage monitoring system is developed. “Swachh Bharat Abhiyan” is introduced by Sri Narendra Modi to ensure a clean environment. Dustbin modernization is needed for imparting the smart technology.

## 2. Literature survey

Although there are large number of researches that have been done earlier on waste management schemes, a few are done on bin monitoring which really has a very good scope in eliminating these problems.

In paper Smart E-Dustbin by authors Chinmay Kolhatkar, Prachi Choudhari, Bhavesh Joshi, Dhruvin Bhuva have developed a smart dustbin which will monitor the capacity level of the dustbin using ultrasonic sensor and send the email notification about the status level to the municipality officials. LCD display has been done to show the current status of the dustbin to the user. The major drawback here is that only the location of the filled dustbin is found but the route to reach the dustbin swiftly is not detected, which leads to improper clearing of that particular dustbin [1]. In IoT based Garbage Monitoring and Clearance Alert System by authors Himadri Nath Saha, Sourav Gon, Annesha Nayak, Samabrita Kundu, Sumandrita Moitra have proposed a system in which RGB led lights will be attached with the bins that indicates the level of the garbage inside the dustbin to the user. Once the garbage that has been disposed in the bin reaches the threshold level, an alert is sent to the municipality. If the dustbin is being cleared for more than two times before it crosses the threshold level then also a clearance alert is sent using an android app. The main disadvantage is that the path to reach the dustbin is not tracked [2]. In GSM based Garbage Monitoring System by authors S. Kale, P. Alane, K. Gaikwad have proposed a system that provides unique ID for each dustbins located throughout the area and continuously monitors the capacity of the dustbin. If the dustbin capacity is full, the unique ID is send to the concern authorities using GSM. The generation of Unique ID for a large metropolitan city becomes unmanageable which leads to inefficiency of the system [3]. In Automation of Smart waste management using IoT by authors Bharadwaj B,M Kumudha, Gowri Chandra N,Chaithra G have implemented a system which separate the garbage wastes into dry and wet waste using conveyor belt. The information of waste is sent to the particular organisation using mobile app. Implementation cost is very high [4]. In Smart Dustbin for economic growth by authors

Nagaraju Urlagunta, Ritu Mishra, Chaitanya Kumar, Rajkumar have developed a system in which the ultrasonic sensor is placed at the top to measure the status of the dustbin. Then the GSM is triggered by ultrasonic sensor to send the alert message continuously until the dustbin is cleaned. In this system the message can be sent directly to the cleaner instead of sending it to organization [5].

### 3. Proposed work

The Proposed Garbage Monitoring System using IOT is working with GSM sim900a and GPS. It develops a Smart dustbin which monitors the capacity level of the dustbin regularly and sends the notification and also it displays the status level of the dustbin in LCD. Although the existing system explains the same working, there occurs some delay in clearing the bin. It is because the official who receives alert message has to communicate with the cleaner and order them to clear the bin which increases his/her workload. To address these issues this project deals directly with the cleaner. Once the dustbin reaches the threshold level, the system tracks the nearby corporation vehicles and sends an alert message to the vehicles and municipality officials. The shortest path to reach the dustbin from the vehicle is tracked using Travelling Salesman Algorithm. In order to reduce the human work, the dustbin lid gets automatically open if it senses any person nearer to the dustbin with the help of ultrasonic sensor.

#### A. Flow chart

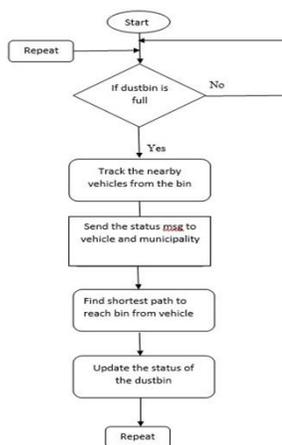


Fig. 2. Working model

#### B. Architecture diagram

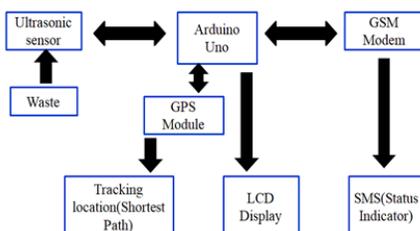


Fig. 3. Block diagram of the system

#### C. Implementation

Smart dustbin is built on Arduino Uno that is interfaced with GSM sim900a and is equipped with Ultrasonic sensor. Component Used: Arduino Uno, Ultrasonic Sensor, GSM SIM900A, 9g servo, GPS.

#### D. Arduino UNO



Fig. 4. Arduino UNO

Arduino Uno is an open source microcontroller board on the ATmega328. It consists of fourteen digital input/output pins within which six will be used as PWM outputs, 16 Megahertz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, on power jack and a reset button. Arduino Uno Board varies from all other boards and they will not use the FTDI USB-to-serial driver chip to them. It is featured by the ATmega16U2 programmed as a USB-to-serial converter.

#### E. Ultrasonic sensor



Fig. 5. Ultrasonic Sensor

Ultrasonic sensor is the sensor is used to measure the distance of an object from itself by emitting ultrasonic waves. It emits an ultrasonic waves and receives the waves which is reflected back from target. It measures the distance by evaluating the time between emission and reception of ultrasonic sensor.

The distance can be calculated by:

$$\text{Distance}(L) = 1/2 * T * C.$$

L=distance of the object from the sensor.

T=Time between emission and reception

C=speed of Ultrasonic waves.

#### F. Global system for mobile



Fig. 6. GSM Sim 900A

A GSM is a specialized type of modem which accepts a SIM card and operates over a subscription to a mobile operator. It is

more effective for full duplex voice telephony. Wireless technology was incorporated in GSM to work with kind of application like DTMF decoder, network protocols and ECM detection. GSM module is power-efficient and value economical. GSM module is connected simply with GSM network to report, control and program. The GSM module, Subscriber identity module(SIM)can be moved from one another.

**G. Global positioning system**



Fig. 7. GPS

A GPS tracking device is attached with each dustbin so as to track the location of the dustbins and also the nearby corporation vehicles. The route to reach the dustbin is also being traced using this GPS device.

**H. TSP algorithm**

The smart dustbin is embedded with Travelling Salesman Algorithm which provides the shortest route to reach the dustbin in an effective manner. The Algorithm analyses all the possible alternative paths and find out the shortest path which requires minimum time to reach the location and clear it.

**I. LCD display**

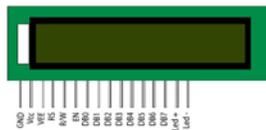


Fig. 8. LCD

LCD (Liquid Crystal Display) screen is an electronic module. A 16x2 LCD display may be a basic module and is usually used in various devices and circuits. These modules are most well-liked over seven phases and different multi segment LEDs and it will display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 picture element matrix. This LCD has two registers, namely, Command and Data. LCD module is used in this system to display the capacity level of the dustbin whether the bin is full or medium or empty.

**J. Servo motor**



Fig. 9. 9g Servo motor

A Servomotor is a rotary actuator that allows for precise control of angular position, velocity and acceleration. The Arduino triggers the servo motor when the sensor sense any object.

**4. Result**

Waste management is a serious issue in today’s situation due to drastic increase in population. To overcome such problems, the Garbage Monitoring System has been developed which will monitor the dustbin and alert to the concerned cleaner to clean the dustbin.



Fig. 10. Automatic Lid opening



Fig. 11. Sample output

**5. Conclusion**

In each corner of the world the garbage clearance has become a huge problem to the developed countries with greater amount of population. To solve these kind of issues the approach of Garbage monitoring system using IoT is developed. In this approach the dustbin will send the notification to the vehicle and municipality officials. The human involvement will be very less and most of the process is automatic. This system is used to reduce the amount of human labor and the cost of petrol by identifying the shortest route to the vehicle drivers while collecting the garbage.

**6. Future enhancement**

This proposed system can be used to keep the city clean and hygienic. This system is one of the initiative to manage waste. The work of the system can be further extended by segregating the type of waste and disposing thereafter.

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