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# IoE based Smart Garbage Bin Management System

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**ABSTRACT:** Now-a-days, every village, town and city is producing waste in their own way. Advances in technology has made it possible to manage and get rid of this waste in a safer way. Yet hygiene is still a concern in waste management and lots of people do not know the way of garbage management. Even today, many people do not throw garbage inside garbage bins. Instead they keep it outside. Some people do this to avoid touching garbage bins. Others do it either because the garbage bin is full or because they simply don't care or are in a hurry. Keeping garbage outside creates lots of problems. So to solve this problem, we have implemented an IoE based smart garbage bin management system. With the help of this model, we can detect a person coming from a specified distance. When a person approaches the garbage bin to throw waste, the lid of the bin will automatically open and the person can throw waste inside without touching the bin. When the garbage bin will be full, a notification will be sent to authorities, so that they can come and collect the waste and clear the bin.

**KEYWORDS:**IoE, Waste, Waste management, Garbage bins, Detect, Distance, Notification, Message, Sensors, Arduino Uno, Real-time data.

## I. INTRODUCTION

In today's era, garbage collection and management is a major concern. If waste is not collected on time, then various issues arise. When waste gets accumulated for a longer period of time, it can lead to problems such as water logging, rotten smell and various diseases due to the rise of various insects. To avoid such problems, we have proposed an IoE based smart garbage bin management system. In this system, we have used a breadboard and wires to connect our components. We have used Ultrasonic sensors to measure the distance of an individual from the dustbin. We are using LEDs and resistors to understand the output of our system. To open and close the lid, we are using a servo motor. To make the system smart, we are using a wifi module. Using the Wifi module, we can get real time information of the system and send notifications based on the information. To understand the working of the system, it is important to first learn the basic working of components used in the system.

### A.PROBLEM FORMULATION

Formulation of Problem plays an important role in determining the purpose, requirement, and usage of the project that is made. So the problem statement of this project can be said as, Creation of the IoT based electronic system with the help of Arduino based microcontroller board for garbage monitoring. This system uses different electronic sensors ,LEDs for data accumulation.



## II. LITERATURE SURVEY

### A. SOLID WASTE COLLECTION AS A SERVICE USING IOT-SOLUTION FOR SMART CITIES

In this paper, we are proposing an IoT based solid waste management system which enables garbage bin monitoring, dynamic scheduling and routing of garbage collector trucks in a smart city. In the proposed system, garbage bins equipped with low cost embedded device are located at various places in entire city. Real time status of garbage level along with garbage bin location is sent to cloud. We have designed a cloud based system for organizing solid waste management process and mobile application for waste collection drivers and Municipal Corporation to monitor and control solid waste collection as a service. Mobile application facilitates the waste collection drivers to go to the garbage bins using dynamic and shortest route.[1]

### B. LOCATION BASED GARBAGE MANAGEMENT SYSTEM WITH IOT FOR SMART CITY

One of these solutions is to provide an environmentally friendly, efficient and effective garbage management system. . This paper proposes a cost-effective IOT based system for the government to utilize available resources to efficiently manage the overwhelming amounts of garbage collected each day, while also providing a better solution for the inconvenience of garbage disposal for the citizens. An android app is developed for the workforce and the citizens, which primarily provides the generated routes for the workforce and finds the nearest available smart bin for citizens.[5]

### C.SMART GARBAGE MONITORING SYSTEM USING INTERNET OF THINGS (IOT)

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. 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. This web page also send all information to garbage collection vehicles.[4]

## III. HARDWARE REQUIREMENTS

This section discusses the various components required to make this project.

Sr No.	Sensor Names	Description
1.	HC-SR04	Ultrasonic Distance Sensor
2.	Servo motor	Rotates 90 Degree.
3.	3 LEDs	Calculate the levels of garbage.
4.	Arduino Uno Board	Micro-Controller Board
5.	ESP8266 Wifi	Wi-Fi Module

## 1. Ultrasonic Sensor



Fig 1: Ultrasonic Sensor

An ultrasonic sensor is a sensor that does distance measurement of an object with help of ultrasonic waves. High-frequency sound waves mirror from boundaries to provide distinct echo patterns. The frequency of ultrasonic waves are above the range of the humans. The sensor determines the distance of the object or the target by using the time lapses of the ultrasonic pulse between the sender and receiving signal. The principle of the ultrasonic sensor in our case is manageable, that is it sends ultrasonic waves at 40KHz which travels in the medium or channel that is air and if it discovers any object or any target at a particular distance. It can be simply said that ultrasonic can be used to detect any collision.

## 2. Servo Motor



Fig 2: Servo Motor

The servo engine is a shut circle system that joins positional input to control the rotational or straight speed and position. The engine is controlled with an electric sign, either analog or digital, which decides the measure of development which addresses the last order position for the shaft. Servo motor's main feature is the feedback system which controls the system and the final position of the shaft.

## 3. LED

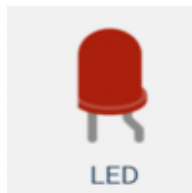


Fig 3: LED

LED stands for light emitting diode and is a semiconductor device. This device is used to emit light whenever electricity is given to it. Many different colours are available in LEDs but green, red and yellow are used widely. We will also use these LEDs in our system.

#### 4. Arduino Uno Board



Fig 4: Arduino UNO Board

Arduino Uno is a type of Arduino board which is used as the main component, that is, an IoT board in our system. We have used this board in interfacing electronic components with coding to make it easy. Arduino Uno R3 is a microcontroller board dependent on a removable, double inline-bundle (DIP) ATmega328 AVR microcontroller. It has 20 computerized input/output pins (of which 6 can be utilized as PWM outputs and 6 can be utilized as simple data sources). Projects can be stacked on to it from the simple to-utilize Arduino PC program.

#### 5. ESP8266 Wifi



Fig 5: Wifi module

To implement the Wifi module, we have used ESP8266 chip. This is a wireless network microcontroller module having system-on-a-chip. The ESP8266 is a low-cost Wi-Fi microchip, with a full TCP/IP stack and microcontroller capability, produced by Espressif Systems in Shanghai, China. ... This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands.

### IV. METHODOLOGY

This section will describe the methodology & approach taken for garbage monitoring system.

#### A. SETUP OF WORKING ENVIRONMENT

We have performed our experiment on the micro-controller board named Arduino Uno. It is based on the Atmega328P microchip having 14 Digital pins and 6 Analog pins. The operating voltage for this board is 5V.



Fig 6: Arduino UNO Board

Arduino provides an integrated environment for programming the microcontroller board. This IDE provides an abstraction from the programming of hardware with assembly-level programming.

**B. STORAGE OF DATA IN CLOUD**

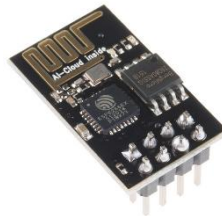


Fig 7: Wifi Module

Storage of data allows us to perform further steps of analysis. To connect the system to the cloud, we need a Wi-Fi module for the system. Arduino Uno doesn't come with the inbuilt Wi-Fi module. So we included an ESP8266 Wifi module externally. So based on the levels we will upload the levels of the garbage in the database.

**C. FLOW DIAGRAM**

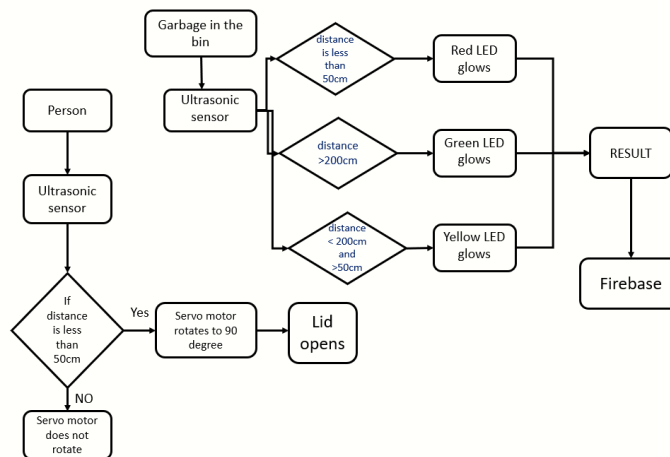


Fig 8: Flow chart of the project

Discusses the flow of data in the system among various components. The data about the garbage is collected by the ultrasonic sensors.. The collected data is about the levels of the garbage.. This data is processed by the microcontroller board and is then forward to the cloud with the help of Wifi module for storage. Storage of data is an important step in this process, as the data then can be fetched and after applying various analysis algorithms can generate conclusive reports.

### E. DATA ANALYSIS

The data collected through the ultrasonic sensors are stored in the cloud can be used to analyze it and induce some conclusive reports. After the process is completed the data is fed into the Machine learning algorithm and is checked against various algorithms and the one with maximum accuracy is selected. Thus this helps to perform the task of forecasting the weather based on the previous data as well as the newly generated data. The graphical charts and diagram can also be generated which helps to generate interactive and easy to interpret reports.

## V. CIRCUIT DIAGRAM

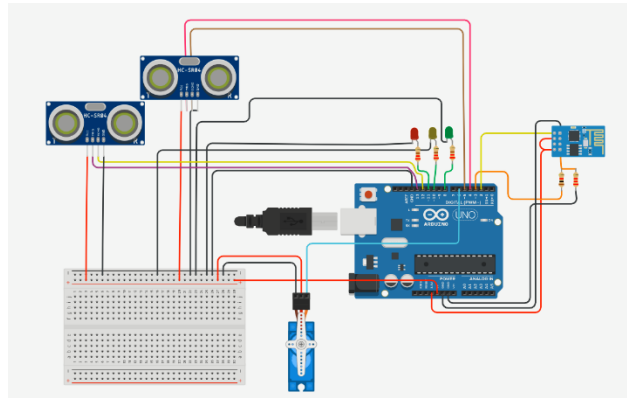


Fig 9: Circuit Diagram

As shown in the circuit diagram the two ultrasonic sensors are used one to detect the distance of the person from the bin and another to rotate the servo motor so that it can open the LED of the bin when a person approaching the bin reaches to a certain distance. The model that we are going to develop will help the people to throw their waste into the dustbin without touching it and will also notify the administrator who is responsible for managing the waste to empty the bin whenever it is reached to its threshold limit. Person can throw the garbage into the bin monitoring system.

## VI. FUTURE SCOPE

More sensors such as humidity sensors and temperature sensors can be added to distinguish between dry and wet waste. We can also add sensors to monitor and report smell that the waste is creating and releasing in the environment. Further updates can be done to improve its performance and efficiency of the system. We can convert this system into a smart garbage collector robot with the help of some modifications and additions.

## VII. CONCLUSION

The system that is proposed will improve the overall management day to day of garbage collection in the rural as well as urban society. The proposed model can be implemented in the multiplex, malls, schools and colleges, in offices and along the roadside as well. Further the model can be updated and can accommodate the changes depending on the place where it will be used.



#### VIII. ACKNOWLEDGEMENT

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