

# Smart Waste Management System

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## ABSTRACT

In this paper, we present a cost-effective and efficient smart waste management system that acts as an easy link between the user and the authority by providing a mobile application to monitor the bin interfaced with appropriate sensors.

**KEYWORDS:** Smart waste management system, nodeMCU, Ultrasonic Sensor, Servo Motor, Mobile application.

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## I. INTRODUCTION

Waste management is one of the main problems faced by our nation. It includes the collection of waste, transportation, treatment and disposal of waste. Here in this project, we are implementing a smart waste management system. Cities are becoming smarter so has to be our waste management. This is more overachieved by deploying dedicated municipal access networks to support city management and maintenance services through a data connection. This project practically demonstrates a solution for many of the problems related to the waste management system in our country. Here we present a smart waste management system using appropriate sensors, that detects the waste level, collects the data and send them over a data network to a mobile application hence allowing user and authority to monitor the bin. This data is then put into a server and the information is collected by the user with the help of a mobile application.

## II. LITERATURE SURVEY

Improper waste management can easily result in air pollution, soil contamination and other related health issues. They will adversely affect human health. [1].According to recent research conducted in South Delhi, it was found that 12.16 percent of the waste produced was plastic. In Delhi, the quantity of plastic waste was 10.14 percent of the city's total waste by the Central Pollution Control Board in 2015. Delhi produces 10,000 metric tonnes of garbage every day and also the area to dump this garbage could be a major

problem.[2].In this paper, waste management involves various waste bins that exhibit significant filling variations. The detection of the waste level of the urban solid-waste-bins introduces many problems due to the irregular shape and the variety of the included materials [3]. Issues connected to waste collection are: (i) when the bin will be filled and (ii) devoid the bin before it gets overflowed [4]. The main theme of the work was to create a smart intelligent garbage alert system for waste management. This paper proposes an alert system for waste collection by giving an alert signal to the municipal net server for immediate cleaning of a dustbin with proper verification according to the level of garbage filling. This process is done by the ultrasonic sensor which is interfaced with Node MCU to check the level of garbage filled in the dustbin and sends the data to a mobile application handled by the user or the authority [5].

## III. EXISTING SYSTEM

In existing systems garbage is collected by the municipalities weekly once or twice a week. Through this, the waste gets accumulated and overflows the waste bin and spread over the roads and thus it will pollute the environment. The smell produced from this will be heavy and it contaminates the air and the surroundings and causes many diseases. The stray dogs and animals eat the waste food and the waste spreads over the area and creates a dirty environment. In order to

avoid such a situation, we are designing smart waste management system for smart cities.

Plastic pollution causes immense damage to humans, wildlife, and aquatic creatures. The widespread use of such waste is harmful as it is non-biodegradable. This interferes with the food chain and causes indigestion to wildlife and marine creatures sometimes resulting in fatal situations.

**Disadvantages of the existing system**

- Consumes time and less effective: trucks go and empty containers even if they are filled or not.
- High implementation costs.
- Unhygienic bins will affect the look of the city.
- Foul smell and toxic chemicals cause adverse effects on living beings.
- Waste collection vehicles are nuisance causing noise and traffic.
- Plastic waste is not being managed properly



Fig:- Current situation in cities. PROPOSED WORK

**IV. PROPOSED WORK**

There are effective waste management systems that consist of smart alert system for waste clearance by giving an alert to the municipality for fast removal of garbage in waste bin based on the information about the level of garbage filling. Here we propose a project that makes use of sensors and controllers that manage the waste in a locality and also segregate the waste by the user with the help of a mobile application.

**Hardware**

**A. NodeMCU**

NodeMCU includes firmware that runs on the ESP8266 Wi-Fi SoC, which is an open source IoT platform and hardware which is based on the ESP-12 module. The waste level is detected and this level is transferred to the mobile application by using this controller.

**B. Ultrasonic Sensor**

The ultrasonic sensor transmits sound waves and if an object is present this wave is reflected back as echo which is received by the sensor present in the module, the distance can be calculated by measuring the travel time and the speed of sound. With all the received information the ultrasonic sensor detects the waste level to check whether the bin is full or not.

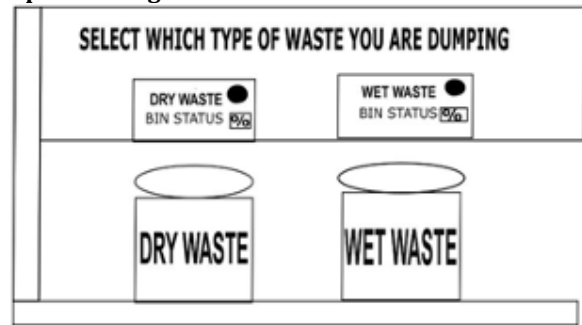
**C. Servo Motor**

The servo can rotate 90 degrees in each direction and therefore it can rotate 180 degrees in total. We can use any servo code, hardware or library to control the servos. When the user selects which type of waste he is dumping then the corresponding bin will automatically open up with the aid of a servo motor.

**D. Mobile Application**

The waste level is detected and the level is transferred over the wifi module (nodeMCU) to the mobile and the level is displayed. Two buttons are provided in the app such that the user can select either wet waste or dry waste.

**Proposed design**



**Software**

The software used to program NodeMCU is Arduino IDE. The flowchart for the software part is given below.

**Flowchart**

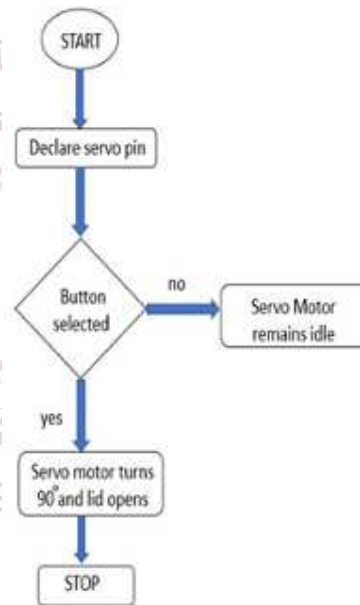


Fig: Flow Chart of waste level detection

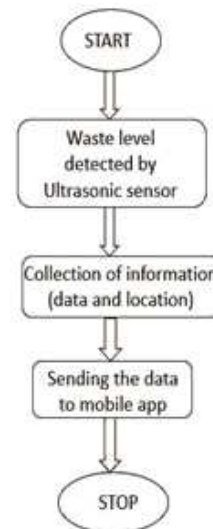


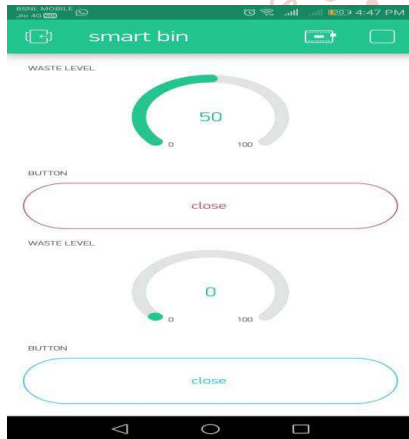
Fig: Flow Chart of automatic lid opening

**Advantages**

- Easy to implement.
- Maintains hygiene.
- Unwanted trips can be avoided.
- Reduces waste overflow.
- The waste level can be monitored by the user as well as the authority.
- Low cost.

**V. RESULTS**

In this project, smart waste management can be done by monitoring the waste level with the help of the ultrasonic sensor. The waste level information is transferred to the mobile app with the help of NodeMCU. The user, as well as the authority, can view the level of waste in his/her mobile phone and act accordingly. Also, the user can select which type of waste he is dumping (dry or wet waste) with the help of the app. The lid opens automatically as soon as the user selects the button and hence this will provide hygiene to the user without interfering with the waste bin. Manual switches are also provided in the control panel even if the user doesn't take his phone. Led lights are also interfaced which is used to indicate whether the bin is filled or not.

**VI. FUTURE SCOPE**

- Automatic waste segregation can be incorporated to separate dry and wet waste.
- On spot, decomposition can be implemented so that wet waste can be converted into biowaste.
- Compactors can be provided.
- Solar panels help to provide the power supply.
- Location mapping can be incorporated.
- Common remote application can be implemented to control bins in different localities.

**VII. CONCLUSION**

Smart waste management system involves sensor and mobile application to monitor the waste overflow. Waste overflow is eliminated with the help of two methods of automatic lid opening and waste level detection. Servo motor is used to open the lid so as to provide the users with hygienic bins hence avoiding direct contact with bin. It also allows the user to be informed about the waste level before leaving their home to dump the waste. This information is collected with the help of a mobile application which is interfaced with Node MCU and ultrasonic sensor. This system is efficient as it helps to keep the environment clean by allowing timely collection of waste from bins.

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