



Title: “Smart Garbage Management System”

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I. ABSTRACT

The advancement in technology has provided numerous benefits in various fields of life. One such application is the use of GSM AND IOT BASED SMART GARBAGE MANAGEMENT SYSTEM, which have gained significant attention in recent years. The proposed project aims introduce efficiency and automation into urban waste management, addressing issues related to manual labor, resource consumption, and organizational shortcomings.

Proper management of waste is getting tougher because of increasing population, urbanization, and industrialization. In this modern era of technology, we need to apply technology-based solutions to handle large amounts of waste for overpopulated urban areas. We have reviewed several recent research articles related to the smart waste management system, and almost all of them have some major limitations as well as progress. To ensure environmental hygiene and sustainable urban life, we have presented a smart IoT based integrated system consists of an The system will consist of three main components: the dustbin monitoring system and automated lid system and a communication system, using IOT and GSM module. The dustbin monitoring system will be used to identify dustbin level, and ESP32 is used as a microcontroller to synchronize all of the three systems.

I. INTRODUCTION

One such groundbreaking solution is the implementation of Smart Waste Management, where intelligent sensors are strategically placed within waste receptacles to monitor fill levels and revolutionize the efficiency of waste collection processes. This cutting-edge approach not only addresses the pressing need for more sustainable waste management but also presents a promising avenue for cities to reduce operational costs and optimize resource utilization.

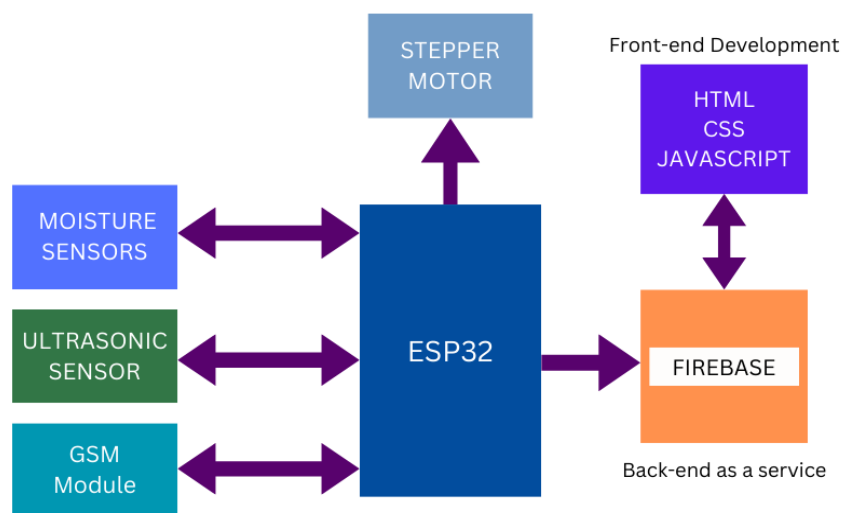


Fig 1: Block Diagram of SMART WASTE MANAGEMENT

Gsm and Iot based smart garbage Management system is a garbage management solution that uses sensors to monitor dustbin fill-ness and replicate that data on the website with dustbin location, also send message to the garbage collector vehicle or user with the help of gsm module so that the garbage collector can efficiently collect the garbage before overflow of dustbin. It is linked to a firebase with using hardware to software implementation code called as 'Embedded C'. The same firebase (Backend as a service) is linked with the Web application and set perform accordingly and send alerts to a specific user.

II. LITERATURE SURVEY

[1] Anagha Gopi , Jeslin Anna Jacob, Riya Mary Puthumana, Rizwana A K, Krishnapriya S, "IoT based smart waste management system", 8th International Conference on Smart Computing and Communications (ICSCC), September 2021, DOI: [10.1109/ICSCC51209.2021.9528293](https://doi.org/10.1109/ICSCC51209.2021.9528293) :

Urban India generates tonnes of wastes annually. Our country faces major challenges associated with waste management. Conventional garbage collection is not efficient since the authorities are not notified until the waste bin is full, and this leads to overflow of waste material. Efficient way of waste disposal and collection of disposed garbage is essential for a sustainable and clean India. This paper presents smart waste management using IoT based waste bin for collection and monitoring the level of waste inside bin. The system is implemented using two ultrasonic sensors which is being controlled by Node MCU. One of the ultrasonic sensor 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 Blynk app. The proposed system is reliable, cost effective and can be easily implemented.

[2] Minhaz Uddin Sohag, Amit Kumer Podder , " Smart garbage management system for a sustainable urban life: An IoT based application",Volume 11, September 2020, DOI:10.1016/j.iot.2020.100255.:

Proper waste management is one of the major problems for densely populated urban areas. It is getting difficult day by day to lead a healthy, sustainable living in urban areas because of environmental contamination. Due to the lack of proper waste management approach, problems like an overflow of waste occurs that badly harm our environment. Polluted surroundings result in the spread of various kinds of diseases in an epidemic form. For developed and developing countries, waste management is a challenge to long-term development. Proper management of waste is getting tougher because of increasing population, urbanization, and industrialization. In this modern era of technology, we need to apply technology-based solutions to handle large amounts of waste for overpopulated urban areas. We have reviewed several recent research articles related to the smart waste management system, and almost all of them have some major limitations as well as progress. To ensure environmental hygiene and sustainable urban life, we have presented a smart IoT based integrated system consists of an identification system, an automated lid system, a display system, and a communication system. Arduino Uno is used as a microcontroller to synchronize all of the four systems. Sensors are used for identification and measuring the garbage level. The system provides the facility of continuous monitoring of the status of waste inside the garbage bin and shows the percentage filled up on liquid crystal display (LCD). The communication system uses a global system for mobile communications (GSM) module that will inform the corresponding authority to collect the waste when the garbage bin is filled up. The proposed waste management system is much more efficient than any other conventional waste management system as it reduces the use of manpower, avoids spillover of waste, saves time, more economical, and most importantly it is a completely automated system.

[3] Mustafa M , and Ku Azir K.N , " Smart Bin: Internet-of-Things Garbage Monitoring System " , MATEC Web of Conferences 140, 01030 (2017) ICEESI 2017,

The proposed system consisted the ultrasonic sensors which measure the garbage level, an ARM microcontroller which controls system operation whereas everything will be connected to ThingSpeak. This work demonstrates a system that allows the waste management to monitor based on the level of the garbage depth inside the dustbin. The system shows the status of different four types of garbage; domestic waste, paper, glass and plastic through LCD and ThingSpeak in a real time to store the data for future use and analysis, such as prediction of peak level of garbage bin fullness. It is expected that this system can create greener environment by monitoring and controlling the collection of garbage smartly through Internet-of-Things.

III. METHODOLOGY

System workflow:



When an garbage dustbin filling up the wave to the dustbin and sends data to data and send dustbin level as a module get command from Esp32 board and send message to user using 3G network. At the same time, moisture sensor detect the moisture from the garbage and send data to the Esp32 board and it process the data, send command to the stepper motor and it moves to segregate garbage.

ultrasonic sensor sending out a sound the Esp32 board. Esp32 board process message through GSM module gsm

Software implementation:

The software for the ESP32 board can be written in Arduino IDE using C++ programming language. The program includes the following functions:

- Initialization of the GSM (Global System for Mobile communication) module, Ultrasonic sensor and Moisture sensor.
- Data acquisition from the Ultrasonic sensor and Moisture sensor.
- Triggering of the stepper motor and data based on the comparison results.
- Sending alert messages via Wi-Fi or GSM module (optional).
- Replicating data on the website.

IV. COMPONENT SPECIFICATION.

1. Micro Controller NODEMCU ESP-32:

The NodeMCU ESP-32 is a versatile microcontroller featuring built-in Wi-Fi and Bluetooth capabilities. It is based on the ESP32 chip, offering a compact and powerful solution for IoT projects, sensor applications, and wireless communication tasks.

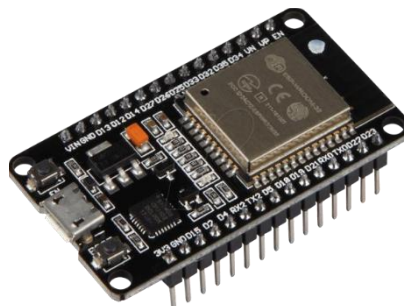


FIG 1: Micro Controller NODEMCU ESP-32.

2. Ultrasonic Sensor:

A gadget known as an ultrasonic sensor uses high-frequency sound waves to monitor how long it takes for the waves to return after colliding with an item. This data is used to calculate distance, detect obstacles, and enable proximity sensing in various applications.

FIG 2: Ultrasonic Sensor

SIM 900A GSM MODULE:

SIM900A is a dependable and incredibly small wireless module. With its SMT design and very potent single-chip CPU that integrates the AMR926EJ-S core, this complete GSM/GPRS module offers you cost-effective options and modest dimensions.



FIG 3: SIM 900A MODULE.

II. RESULTS

- **Smart Cities Management:** Implementing garbage monitoring and alert systems in urban areas can significantly improve waste management efficiency. Municipal authorities can use real-time data to optimize garbage collection routes, allocate resources more effectively, and reduce operational costs.
- **Industrial Facilities:** Manufacturing plants, warehouses, and industrial complexes produce large amounts of waste. Monitoring systems can help these facilities track waste generation, schedule timely pickups, and ensure compliance with environmental regulations.
- **Commercial Establishments:** Restaurants, hotels, shopping malls, and other commercial buildings can benefit from garbage monitoring to maintain cleanliness and hygiene standards. Timely waste collection can also improve the overall customer experience.

V. CONCLUSION

In conclusion, the Monitoring the fullness of bins through the use of sensors, it is possible to achieve a more efficient system than the current existing. Our idea of “Smart waste management system”, mainly concentrates on Monitoring the waste management, providing a smart technology for waste system, avoiding human environment . The system is designed to collect data and to deliver the data through wireless mesh

network . The system also employs duty cycle technique to reduce power consumption and to maximize operational time . The Smart bin system was tested in out outdoor environment .

In our system , the Smart dustbin are connected to the internet to get the real time information of the smart dustbin. This project implementing real time waste management system by using sensors to check the level of garbage in the dustbin. In this system, the information of the dustbin can have accessed from anywhere and anytime. This system will help inform the status of each dustbins in real time. So, waste management can send the garbage collector to pick up the garbage when the dustbin is full. The range of ultrasonic sensor can detect distance is between 2cm until 400cm. This sensor will compare the depth of the dustbin to show the level of garbage in the bin.

The system's benefits include enhanced cost effectiveness, improved efficiency, and reduced human error. It eliminates the need for traditional identification methods such as manual checks, which can be time-consuming and error-prone. The GSM and IOT Based Garbage Management System provides a reliable and accurate way to monitor and collect garbage waste from an area or city.

VII. REFERENCES:

- [1] Anagha Gopi , Jeslin Anna Jacob, Riya Mary Puthumana, Rizwana A K, Krishnapriya S, "IoT based smart waste management system", 8th International Conference on Smart Computing and Communications (ICSCC), September 2021, DOI: [10.1109/ICSCC51209.2021.9528293](https://doi.org/10.1109/ICSCC51209.2021.9528293).
- [2] Minhaz Uddin Sohag, Amit Kumer Podder , " Smart garbage management system for a sustainable urban life: An IoT based application", Volume 11, September 2020, DOI: [10.1016/j.iot.2020.100255](https://doi.org/10.1016/j.iot.2020.100255).
- [3] Mustafa M , and Ku Azir K.N , " Smart Bin: Internet-of-Things Garbage Monitoring System ", MATEC Web of Conferences 140, 01030 (2017) ICEESI 2017, DOI: [10.1051/mateconf/2017140010](https://doi.org/10.1051/mateconf/2017140010).
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