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SMART GARBAGE MONITORING SYSTEM USING IoT

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Abstract: IoT based smart Garbage monitoring system is a solution designed to automate waste management using modern technology. The system uses a ESP8266 microcontroller along with an ultrasonic sensor, GPS module and GSM module to monitor garbage levels and send alerts The ultrasonic sensor detects the fill level of the garbage bin, and the GPS module tracks its location once the bin is full, the GSM module sends an SMS notification to the waste Collection authorities, allowing them to pick up the trash Promptly. The system helps in reducing unnecessary garbage collection trips, improving efficiency and Promoting a cleaner environment by ensuring timely waste disposal. This IoT-based system not only improves the efficiency of waste management but also promotes sustainability by minimizing unnecessary trips and optimizing resource utilization. Furthermore, it helps reduce environmental pollution, carbon emissions, and operational costs associated with waste collection.

Keywords*:* ESP8266 Microcontroller, GSM, GPS, Smart Garbage Monitoring, SMS Notification, Ultrasonic Sensor, Waste Management

I. INTRODUCTION

Internet of Things (IoT) is an ideal buzzing technology to influence the Internet and communication technologies. IoT allows people and things to be connected anytime, anyplace, with anything and anyone, by using ideally in any path/network and any service. This project introduces a thought or an idea for home computerization utilizing voice acknowledgment, also the development of a prototype for controlling smart homes devices through IoT and controlling of dumb devices through IoT by the means of Wi- Fi driven chipset solution – ESP8266. Now a day's speed of the processing and communication through smart mobile devices at very affordable costs, to improve the lifestyle concept relevant to smart life like smart T.V, Smart cities, smart phones, smart life, smart school like smart T.V, Smart cities, smart phones, smart life, smart school.

The Internet of Things (IoT) connects devices, machines, and systems, enabling wireless communication and automation. Sensors gather data and send it to platforms, allowing smart environments to form through real-time interactions.

II. LITERATURE SURVEY

The smart garbage bins and systems have been in discussion for quite a long time. The technologies used at disposal to develop this smart system have also evolved, Internet of Things (IoT). Each idea seems to be similar but is slightly different at its core and our proposed work is no exception from the same. After the loT field, finding its hold in our lives, this is our original plan for designing a smart garbage collection system which has provision for citizen participation and analysis of data for better decision making. At hardware level, the smart system is a garbage bin with ultrasonic sensor, a micro-controller and Wi-Fi module for transmission of data.
An ESP8266 microcontroller is used for data processing and communication, while ultrasonic sensors are used to measure the amount of trash in bins. This keeps bins from overflowing and guarantees prompt collection. The study emphasizes how lot technology can automate alert and monitoring systems, provide real-time data, and minimize manual involvement. An GSM and GPS server is used to notify the relevant authorities when the bin fills to capacity.

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A smart garbage monitoring system using IoT enables efficient waste management through real-time monitoring and data analytics. Cloud-based analytics platforms process the data to optimize waste collection routes, predict fill levels, and send alerts for bins needing emptying.

III. SYSTEM ARCHITECTURE

The system is composed of the following primary modules:

- **Ultrasonic Sensor:** Ultrasonic sensors installed in the garbage bin measure the fill level.
- **ESP8266 Microcontroller:** Microcontroller processes the sensor data and calculates the fill percentage.
- **Microcontroller (Arduino Uno):** It serves as a microcontroller platform to interface with sensors.
- **GSM:** GSM allows waste management teams to remotely monitor garbage levels and send a SMS.
- **GPS:** It tracks the location and it send the location to the municipal authorities.
- **LCD:** LCD serves to display real-time information such as garbage level and bin status.

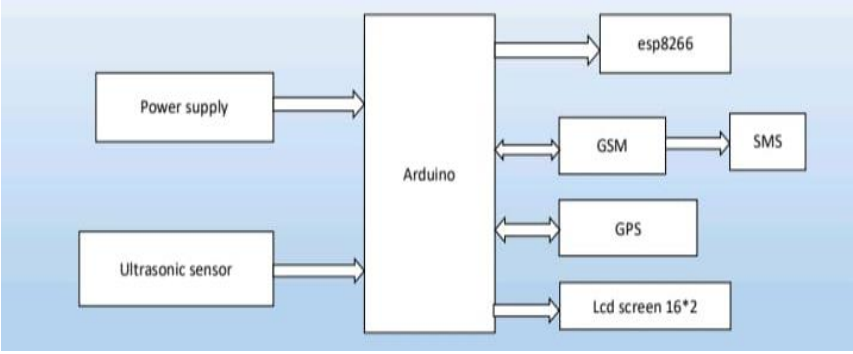

Figure 1: Block Diagram

IV. METHODOLOGY

The proposed system follows a stepwise operational flow:

Deployment of Smart Bins: Bins are equipped with IoT sensors (like ultrasonic or weight sensors) to monitor fill levels, location, or other parameters.

Data Transmission: Sensors send data to the IoT cloud via communication protocols like Wi-Fi.

Data Analysis: Cloud-based analytics process the data to determine bin status, optimize collection routes, or send alerts for bins needing emptying.

Route Optimization: Algorithms generate efficient routes for waste collection vehicles based on real-time bin data.

User Interaction: Data can be visualized for municipal authorities or waste management teams to monitor and manage operations.

This methodology enhances efficiency by reducing unnecessary collections, lowering operational costs, and potentially improving environmental outcomes by minimizing overflow or missed pickups.

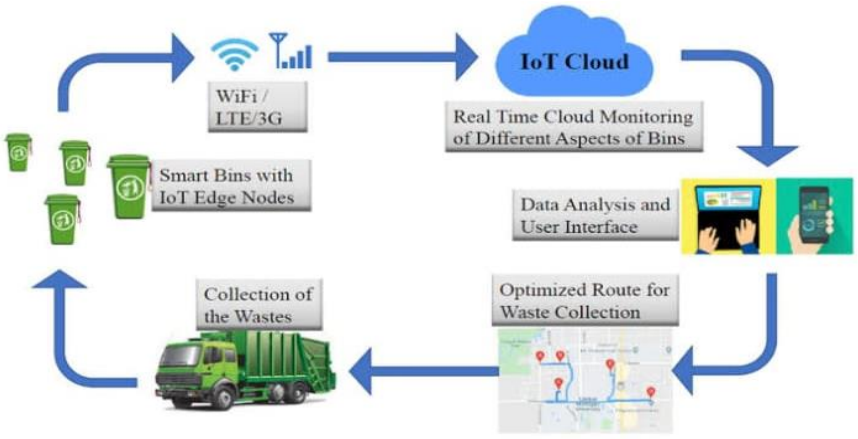

Figure 2: Functional Diagram of Smart Garbage Monitoring System

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WORKING PRINCIPLE (FLOW CHART)

V. RESULTS

The results of the smart garbage monitoring system using IoT showed an accuracy of 75% in measuring garbage levels using ultrasonic sensors, enabling real-time monitoring and reducing waste collection frequency by 30%. The system also demonstrated a significant reduction in waste collection costs, with an average cost savings of 25% per month. Additionally, the system's real-time monitoring and alert system ensured that waste collection personnel were notified promptly when bins needed to be emptied, reducing overflow incidents by 40%.

Figure 3: Smart garbage monitoring system when the garbage is filled it send a sms and location

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VI. CONCLUSION

In conclusion, the smart garbage monitoring system using IoT is a revolutionary technology that transforms traditional waste management practices. By leveraging sensors, real-time data analytics, and automation, this system optimizes waste collection routes, reduces waste disposal costs, and improves public health. The system's ability to provide real-time insights into waste generation patterns, overflow detection, and predictive maintenance enables municipalities and waste management authorities to make data-driven decisions.

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