INTELLIGENT WASTE SEPARATION SMART DUSTBIN USING IOT TECHNOLOGY

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ABSTRACT

Waste management is a critical challenge in modern society, and efficient waste segregation plays a crucial role in sustainable waste disposal. This proposed system focuses on an automated waste segregation mechanism that classifies waste into biodegradable and non-biodegradable categories. It utilizes an IOT-based transparent bin to differentiate waste levels and integrates sensors for accurate classification. The system employs ultrasonic sensors to detect the fill level of the bins and provide online notifications when they reach capacity. Conductive plate sensors distinguish between wet and dry waste. The two-bin system effectively segregates wet and dry reducing manual intervention. Designed for both indoor and outdoor use, the system ensures minimal time consumption and reduces human effort in waste management. By implementing advanced sensor technologies, this automated waste segregation system enhances efficiency, promotes environmental sustainability, and contributes to smarter waste disposal practices.

KEYWORD: IOT based bin, Sensors ,Wet Waste, Dry Waste

I INTRODUCTION

Waste management is an essential part of keeping our environment clean and healthy. One of the biggest challenges is the proper segregation of waste into biodegradable and non-biodegradable categories. Manual waste sorting is time-consuming, inefficient, and often unhygienic. To address this issue, an automated waste segregation system is proposed to simplify and improve the waste disposal process.

This system uses modern sensor technology to classify waste into two categories: wet and dry. It consists of a transparent IOT-based bin that detects the level of waste and various sensors to identify the type of waste. Ultrasonic sensors help monitor the fill level of the bins and send online notifications when they are full. Conductive plate sensors differentiate between wet and dry waste.

The system is designed for both indoor and outdoor use, making it suitable for homes, offices, and public spaces. By automating the waste segregation process, it reduces the need for manual labor, saves time, and ensures a more efficient and eco-friendly waste disposal system. This technology-driven approach contributes to a cleaner and more sustainable environment.

II LITERATURE SURVEY

2.1 Alam and Dey (2021):

Introduced an IoT-based solid waste management system tailored for smart cities, emphasizing technological innovation and exploration. Additionally, the Central Pollution Control Board in its 2016 annual report.(Reference [2]) highlighted the importance of robust waste management strategies at the governmental level.

2.2 Gharaibehetal. (2020) :

Delved into the concept of smart waste management using IoT, contributing insights from the 2017 IEEE Jordan Conference on Applied Electrical Engineering and Computing Technologies (AEEC T). Kanchan and Sharma (2020) extended this discourse with their study o n IoT-based waste management for smart cities, further emphasizing the r ole of technology in optimizing waste processes.

2.3 A comprehensive review by Kumar et al. (2021) :

Explored various technological options for waste-to-energy, shedding light on effective approaches to managing municipal solid waste. Meanwhile, the Ministry of Environment, Forest, and Climate Change in India provided a regulatory framework through the Solid Waste Management Rules of 2021 (Reference [6]).

2.4 Rana and Goyal (2020):

Contributed to the literature by discussing the challenges and solutions associated with implementing IoT in solid waste management, as published in the International Journal of Computer Applications. Finally, Sharma et al. (2020) addressed the impact of the COVID-19 pandemic on solid waste management, presenting challenges, opportunities, and innovations in the post-pandemic era in their publication in Resources, Conservation, and Recycling.

2.5 Alam and Dey (2021):

Introduced an IoT-based solid waste management system tailored for smart cities, emphasizing technological innovation and 3 exploration. Additionally, the Central Pollution Control Board in its 2021 annual report (Reference [2]) highlighted the importance of robust waste management strategies at the governmental level. Gharaibeh et al. (2021) delved into the concept of smart waste management using IoT, contributing insights from the 2021 IEEE Jordan Conference on Applied Electrical Engineering and Computing Technologies (AEECT). Kanchan and Sharma (2020) extended this discourse with their study on IoT-based waste management for smart cities, further emphasizing the role of technology in optimizing waste processes. A comprehensive review by Kumar et al. (2020) explored various technological options for waste-to-energy, shedding light on effective approaches to managing municipal solid waste. Meanwhile, the Ministry of Environment, Forest, and Climate Change in India provided a regulatory framework through the Solid Waste Management Rules of 2020 (Reference [6]).

III EXISTING SYSTEM

1. The existing waste management system focuses on monitoring garbage levels using IOT technology.

2. It consists of a single-bin setup that detects when the bin is full and sends an alert for disposal. Additionally, it features a line-follower mechanism, making it suitable for indoor use.

3. However, the system has several limitations. It does not separate waste, meaning wet and dry waste are mixed together, leading to inefficient disposal.

4. Moreover, it is designed only for indoor environments, restricting its usability in outdoor spaces. The process is also time-consuming and requires significant human effort for waste disposal.

5. Due to these drawbacks, a more advanced system is needed to automate waste segregation, reduce manual intervention, and improve efficiency in waste management

IV DISADVANTAGES

1. Lack of Waste Segregation :

The system does not separate wet and dry waste, leading to inefficient disposal.

2. Single-Bin Limitation:

All types of waste are collected in one bin, making recycling and proper disposal difficult.

3. Indoor-Only Usability:

Designed primarily for indoor use, restricting its application in outdoor environments.

4. Manual Effort :

Required Waste disposal still requires significant human intervention.

5. Time-Consuming Process:

The system does not optimize waste handling, leading to delays in disposal.

6.Limited Functionality:

The focus is only on garbage level detection rather than smart segregation and management

V PROPOSED SYSTEM

1.The proposed system is an automated waste segregation system designed to classify waste into biodegradable and non-biodegradable categories.

2.It consists of a transparent IOT-based bin that helps in identifying the waste level inside the bins. The system uses different sensors to accurately detect and separate waste.

3.It features a bin setup to segregate waste into wet and dry categories. Ultrasonic sensors are used to monitor the fill level of the bins and send online notifications when they are full.

4.Conductive plate sensors help in distinguishing between wet and dry waste.

5.The system is designed to work both indoors and outdoors, making it suitable for homes, offices, and public places. It automates the waste segregation process, reducing human effort and saving time.

6.By using advanced sensor technology, this system improves efficiency in waste disposal, supports environmental sustainability, and promotes a cleaner and smarter way of managing waste.

VI ADVANTAGES

1.Efficient Waste Segregation:

Automatically classifies waste into wet and dry categories, improving disposal efficiency
IoT-Based Smart Monitoring Transparent IoT-enabled bins monitor fill levels and send online notifications when full, optimizing waste collection.

2.Reduces Manual Effort:

Automates the segregation process, minimizing human intervention and labor requirements. Time-Saving Enhances waste disposal speed by streamlining segregation and collection processes.

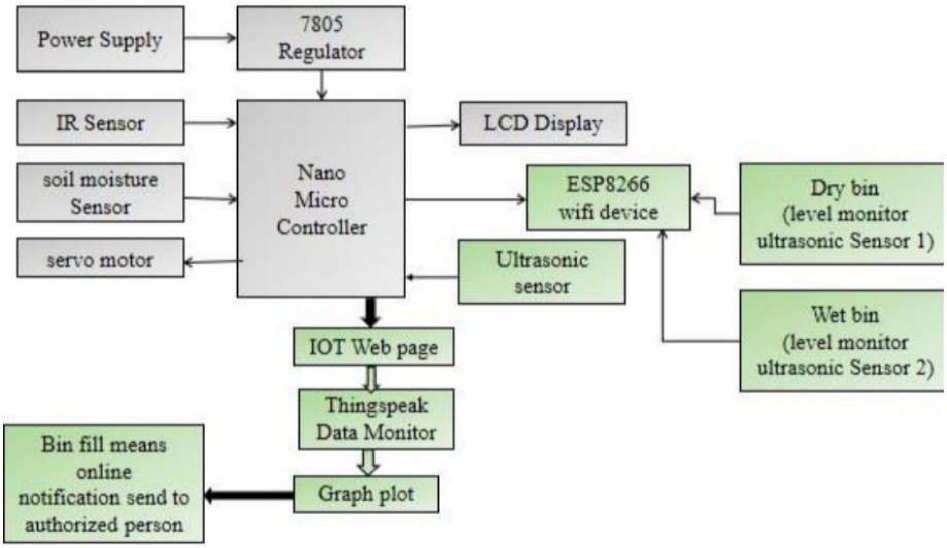
3.Multi-Environment Usability:

Suitable for both indoor and outdoor applications, making it ideal for homes, offices, and public spaces.

4.Advanced Sensor Technology:

Utilizes ultrasonic, conductive plate, and metal proximity sensors for precise waste detection and classification. Promotes Environmental Sustainability Encourages responsible waste disposal and supports recycling efforts, reducing pollution.

VII BLOCK DIAGRAM



The block diagram represents an IoT-based smart waste management system designed to monitor and manage waste bins efficiently. At the core of the system is a Nano microcontroller, which receives input from multiple sensors including IR sensors, soil moisture sensors, and ultrasonic sensors. The ultrasonic sensors are used to detect the waste level in two separate bins—dry and wet—by measuring the distance from the top of the bin to the waste level. The system also includes a servo motor, which can be used for tasks such as opening or closing bin lids. Data from the sensors is processed and displayed on an LCD screen for local monitoring, while an ESP8266 Wi-Fi module enables remote monitoring by uploading real-time data to the IoT platform ThingSpeak. This data is visualized through an IoT web page and graph plotting, allowing authorized personnel to monitor bin status online. When a bin is full, the system sends a notification to the concerned person, ensuring timely waste collection and promoting efficient waste management.

VIII RESULT

The automated waste segregation system enhances waste management efficiency by employing IoT-based smart bins integrated with advanced sensor technologies. It classifies waste into biodegradable and non-biodegradable categories using conductive plate sensors for wet and dry waste . Ultrasonic sensors monitor the fill levels of the bins and trigger online notifications when they reach capacity, optimizing waste collection schedules. The three-bin system minimizes manual effort and improves waste segregation accuracy, making it suitable for both indoor and outdoor environments. By reducing human intervention, the system streamlines waste disposal, promotes environmental sustainability, and supports smarter urban waste management practices.

IX CONCLUSION

Effective waste management is essential for maintaining a clean and sustainable environment. The proposed automated waste segregation system addresses the limitations of existing waste disposal methods by efficiently classifying waste into biodegradable and non-biodegradable categories. By incorporating an IOT-based transparent bin and advanced sensor technology, the system ensures accurate detection and separation of wet and dry waste.With the use of ultrasonic sensors for fill-level monitoring, conductive plate sensors for wet and dry waste detection, and metal proximity sensors for metal waste identification, the system significantly reduces manual effort and enhances efficiency. Additionally, real-time notifications help in timely waste disposal, preventing overflow and improving hygiene.Designed for both indoor and outdoor use, this system minimizes time consumption and promotes an automated, eco- friendly waste management process. By integrating smart

technology, it not only streamlines waste disposal but also contributes to a cleaner and healthier environment. This innovative approach plays a vital role in sustainable waste management, making it a practical solution for modern waste disposal challenges.

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