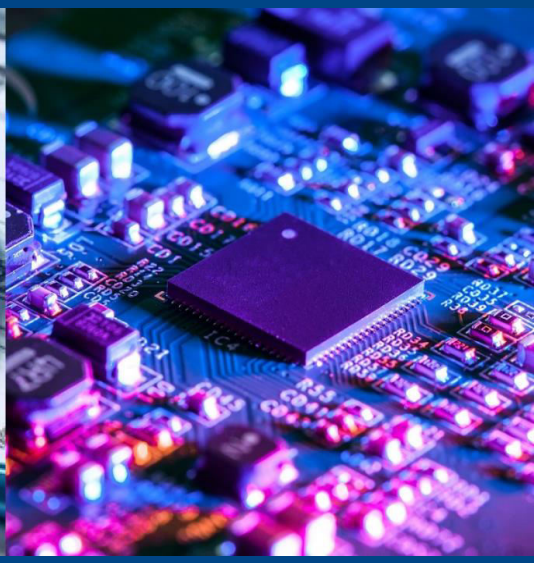
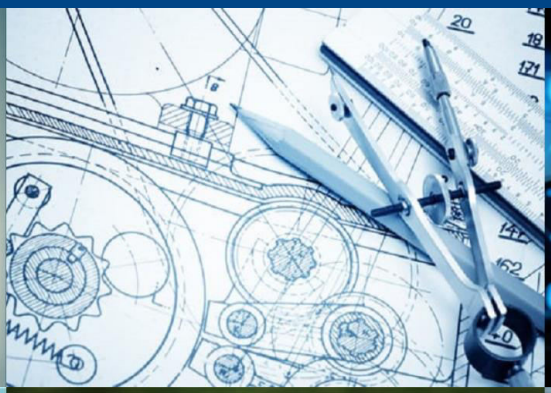
ISSN: 2582-7219

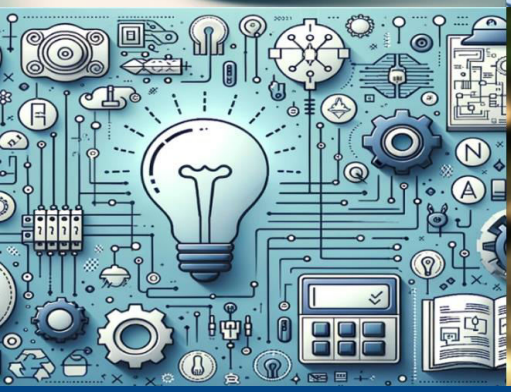




International Journal of Multidisciplinary Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 7.521

Volume 8, Issue 1, January 2025

© 2025 IJMRSET | Volume 8, Issue 1, January 2025| DOI: 10.15680/IJMRSET.2025.0801046

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Smart Dustbin with Waste Level Monitoring and Notification System

Sanjana Joshi[1], Shraddha Kale[2], Shraddha Kamble[3], Janvi Bansode[4], Prof. Appasaheb Nikam[5]

Diploma Student, Department of Electrical Engineering, Zeal Polytechnic, Pune, India[1,2,3,4]

Lecturer, Department of Electrical Engineering, Zeal Polytechnic, Pune, India[5]

ABSTRACT: The Smart Dustbin with Waste Level Monitoring and SMS Notification is an innovative project aimed at improving waste management efficiency through automation and real-time monitoring. This system incorporates sensors to monitor the waste level in the dustbin, providing valuable data on the bin's capacity. Once the waste reaches a predefined level, the system triggers an SMS notification to inform the relevant authorities or maintenance team to empty the bin, preventing overflow and ensuring cleanliness. Additionally, the dustbin features an automatic lid that opens and closes based on proximity sensing, ensuring hygienic waste disposal and reducing human interaction. This project leverages Internet of Things (IoT) technology to create a smart, efficient waste management solution, promoting environmental cleanliness and optimizing waste collection schedules.

I. INTRODUCTION

Effective waste management has always been a key concern for urban development and environmental sustainability. In today's rapidly growing cities, the traditional methods of waste collection are becoming increasingly inefficient due to rising population densities, urbanization, and limited resources. Overflowing trash bins, irregular waste collection schedules, and lack of real-time monitoring are common problems that hinder the cleanliness and hygiene of urban spaces. These challenges call for a modern, automated approach to waste management that is both efficient and sustainable. The Smart Dustbin with Waste Level Monitoring and SMS Notification is a novel solution that leverages technology to address the inefficiencies in the current waste disposal systems. By integrating sensors, automation, and real-time communication, this system aims to optimize the process of waste management while reducing environmental impact and improving urban cleanliness.

The system works by utilizing advanced sensors that continuously monitor the waste levels inside a dustbin. The use of ultrasonic or infrared sensors enables accurate measurement of the bin's fill level, and once the threshold is reached (e.g., 80% capacity), the system triggers an SMS alert to notify waste collection personnel. This proactive approach ensures that bins are emptied before they overflow, minimizing waste spillage and unpleasant odors.

In addition to waste level monitoring, the Smart Dustbin features an automatic lid mechanism. Using proximity or infrared sensors, the system detects the presence of individuals near the bin and opens the lid automatically. This hands-free operation reduces human contact with the bin, promoting hygiene and convenience for users. Once the person moves away, the lid closes automatically, keeping the contents sealed and preventing the spread of odours and contamination. The combination of waste level monitoring, automatic lid operation, and SMS notifications creates a comprehensive, intelligent waste management system. The real-time data collected by the sensors provides valuable insights into waste generation patterns, helping municipalities optimize waste collection schedules and routes. By making the waste collection process more efficient, cities can reduce the time, cost, and environmental impact associated with waste disposal.

This system is particularly beneficial in high-traffic urban areas where waste bins are often underutilized or overflow before the scheduled collection. The ability to monitor and notify authorities when bins are nearing capacity allows for more efficient resource allocation, reducing the occurrence of overflowing bins and unsightly waste piles. Moreover, the automatic opening and closing of the lid promote a more hygienic and user-friendly experience, encouraging proper waste disposal practices among citizens. As cities continue to expand and the need for sustainable waste management becomes more urgent, the Smart Dustbin with Waste Level Monitoring and SMS Notification offers a practical solution

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

that can be easily integrated into existing infrastructure. This system is not only a step forward in creating cleaner, healthier cities but also supports the broader goal of environmental sustainability by optimizing waste collection processes and reducing the overall carbon footprint of waste management. In summary, this project represents a significant advancement in the field of waste management by combining real-time monitoring, automation, and communication. It promises to streamline waste collection, reduce human intervention, promote hygiene, and provide actionable data for urban planning and waste management operations, ultimately contributing to smarter, cleaner, and more sustainable cities.

II. LITERATURE REVIEW

The concept of smart waste management has gained significant attention in recent years due to the growing concerns about urbanization, environmental sustainability, and the limitations of traditional waste collection methods. A number of studies and projects have explored various aspects of intelligent waste management systems, incorporating technologies like the Internet of Things (IoT), sensors, automation, and communication systems. In this literature review, we examine existing research, technologies, and solutions related to smart waste management, with a focus on waste level monitoring, automated lid control, and real-time communication for optimized waste collection.

The integration of IoT in waste management systems has become a prominent area of research. Several studies highlight how IoT-enabled devices, such as sensors and connected devices, can monitor waste levels in real-time and provide timely data for waste collection management. According to Zhang et al. (2017), IoT-based waste management systems enable municipalities to optimize waste collection routes by providing real-time data on bin status, reducing unnecessary waste collection trips, and ensuring that bins are emptied before they overflow. This system helps in preventing unsanitary conditions in urban areas by ensuring timely waste disposal and improving operational efficiency.

The monitoring of waste levels in real-time is a critical component of smart dustbin systems. Ultrasonic sensors and infrared sensors are commonly used to measure the fill level of waste bins. Ultrasonic sensors work by emitting sound waves and measuring the time it takes for the sound waves to bounce back from the surface of the waste. Jain et al. (2016) describe how ultrasonic sensors can effectively measure the distance between the sensor and the surface of the waste to determine the bin's fill level. This technology is cost-effective, non-invasive, and highly accurate in waste level measurement, making it a popular choice for smart waste systems.

In addition to ultrasonic sensors, Rajendra et al. (2018) explored the use of infrared sensors for detecting the presence of waste in dustbins. Infrared sensors use light-based technology to detect the presence of an object. By incorporating such sensors into waste bins, systems can provide continuous monitoring of waste levels and send real-time alerts to waste management personnel.

The integration of these sensors with cloud-based platforms allows for seamless data collection and monitoring from remote locations. Vijay et al. (2020) highlighted how data collected from such sensors can be analyzed to predict waste generation trends and help in decision-making for optimizing collection schedules.

One of the significant issues with traditional waste bins is the need for manual lid operation, which can result in the spread of germs, unpleasant odors, and contamination. The automatic lid control feature is a key element of smart dustbin systems aimed at reducing human interaction with waste bins. Chaudhary et al. (2017) describe a system where proximity sensors trigger the opening and closing of dustbin lids. When a user approaches the bin, the proximity sensor detects the individual and opens the lid automatically. Once the user moves away, the lid closes to seal the waste, reducing the risk of contamination and improving hygiene. Such automation ensures a hands-free operation, making waste disposal more sanitary and convenient for users. This feature also eliminates the need for users to physically touch the lid, reducing exposure to bacteria and viruses. This concept has been adopted in various public spaces, including parks, malls, and hospitals, to maintain cleanliness and hygiene.

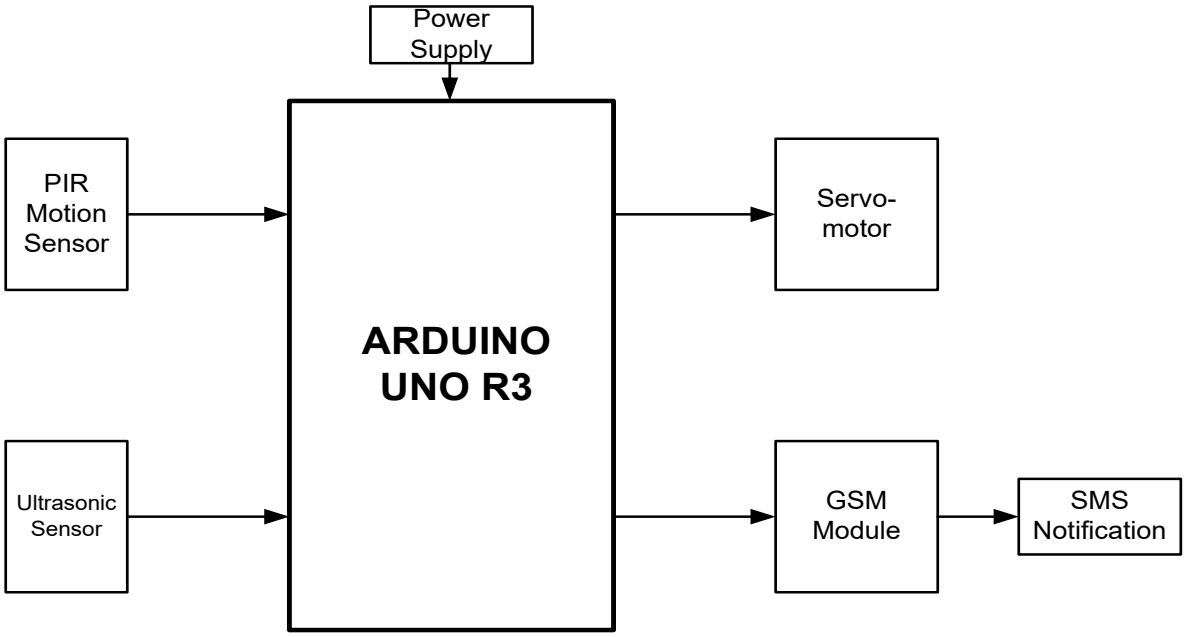
© 2025 IJMRSET | Volume 8, Issue 1, January 2025| DOI: 10.15680/IJMRSET.2025.0801046

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

III. BLOCK DIAGRAM



The Arduino Uno is a popular microcontroller board based on the ATmega328P chip. It operates at 5V and has 14 digital I/O pins, 6 analog inputs, and a 16 MHz clock speed. It can be programmed using the Arduino IDE with C/C++ code and is often used for prototyping, robotics, and IoT projects. It has both USB and external power options and supports PWM, I2C, and SPI communication. The board is easy to use, open-source, and widely supported by a large community.

The SIM800L GSM module is a compact and cost-effective module that allows you to integrate GSM (Global System for Mobile Communications) functionality into various electronic projects. It's widely used for adding SMS, voice, and data communication capabilities to embedded systems.

The HC-SR04 is an ultrasonic sensor used to measure distance. It works by emitting a sound pulse and measuring the time it takes for the echo to return. A PIR (Passive Infrared) sensor is an electronic sensor that detects infrared (IR) radiation, typically emitted by warm objects like humans and animals. PIR sensors are commonly used in motion detection applications, such as security systems, automatic lighting, and other automation systems.

The SG90 is a popular micro servo motor widely used in robotics, electronics projects, and various DIY applications. It is known for its compact size, lightweight design, and affordability. The SG90 operates on a 3-5V power supply and provides a rotation range of approximately 0 to 180 degrees, with a typical rotation time of around 0.1-0.2 seconds per 60 degrees.

IV. METHODOLOGY

The smart dustbin system integrates sensors to monitor the waste level, an automatic lid for hygienic operation, and an SMS notification system to alert for collection when full. These components work together to enhance the waste management process by ensuring timely collection, cleanliness, and optimal use of resources. The waste level monitoring system successfully tracks the amount of waste inside the bin, allowing for real-time assessment of the fullness. The ultrasonic sensors used in the bin provide accurate measurements of the waste height, with minimal margin for error. Helps prevent waste overflow, reduces the chances of pollution or unpleasant odors, and ensures that bins are not emptied unnecessarily when not full.

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

4.1 Hardware Components

Ultrasonic Sensor (for waste level monitoring): This sensor measures the distance from the top of the dustbin to the waste inside. Based on the distance, it can determine the fill level of the dustbin.
PIR Sensor (for motion detection): The Passive Infrared (PIR) sensor will detect a person's presence and trigger the automatic lid opening and closing.
Servo Motor (for lid control): A servo motor will control the opening and closing of the dustbin lid based on the signal from the PIR sensor.
Microcontroller (Arduino/Raspberry Pi): The microcontroller will process input from the sensors and control the components accordingly.
GSM Module (for SMS notification): A GSM module like the SIM900 or SIM800 will send SMS notifications when the dustbin is nearly full, alerting users for disposal.
Power Supply: A power supply unit (battery or adapter) to power the components.

4.2 System Design

Waste Level Monitoring

Ultrasonic Sensor Placement: Mount the ultrasonic sensor at the top of the dustbin, directed towards the waste inside. The sensor will continuously measure the distance to the top of the waste.
Threshold for Fullness: Set a threshold distance that indicates the dustbin is full (e.g., when the waste is at 80% of the dustbin's height). If the sensor detects that the waste has reached this level, it will trigger the system to send an SMS notification.

Motion Sensing (Automatic Lid Opening and Closing)

PIR Sensor Placement: Position the PIR sensor at the top or near the lid of the dustbin to detect the presence of a person.
Lid Control: When the PIR sensor detects motion (i.e., a person approaching), it sends a signal to the microcontroller, which activates the servo motor to open the lid.
Lid Closing: After the person has disposed of the waste and moved away, the PIR sensor will no longer detect motion, and the microcontroller will trigger the servo motor to close the lid.

SMS Notification System

GSM Module Setup: Connect the GSM module to the microcontroller and configure it with the SIM card. When the ultrasonic sensor detects that the waste level has crossed the preset threshold (e.g., 80% or full), the system will send an SMS alert to a preconfigured phone number.
SMS Content: The message might say something like, "Warning: The dustbin is almost full. Please dispose of waste."

Software (Programming the Microcontroller)

Ultrasonic Sensor Data Processing Use the ultrasonic sensor to measure the distance from the waste to the sensor. Compare the measurement with the maximum height to determine the percentage of waste filled.
Set a condition to send an SMS when the waste reaches the desired threshold (e.g., 80%).
PIR Sensor Control Continuously check for motion via the PIR sensor. When motion is detected, trigger the servo motor to open the lid.
After a certain period of inactivity, close the lid automatically to conserve energy.
SMS Sending Logic Integrate the GSM module with the microcontroller. When the waste level crosses the threshold, initiate an SMS alert.
Include a delay mechanism to avoid multiple SMS if the system continuously detects high levels.

V. RESULT

Hygiene Improvement: Reduced direct contact with bins and reduced odors.
Operational Efficiency: Optimized waste collection schedules through accurate waste level monitoring and SMS alerts.
Environmental Benefits: Reduced carbon footprint due to fewer trips for waste collection and energy-efficient lid operation.
Cost Savings: Reduced operational costs due to more efficient use of resources and labor.

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

VI. CONCLUSION

The Smart Dustbin with Waste Level Monitoring, SMS Notifications, and Automatic Lid Opening and Closing represents a significant advancement in waste management technology. By integrating cutting-edge features such as real-time waste level monitoring, automatic lid mechanisms, and SMS alerts, this system provides a comprehensive solution that addresses the challenges faced in traditional waste disposal methods.

This system improves the efficiency and hygiene of waste management in public and private spaces. The automatic lid helps maintain cleanliness by reducing manual contact, preventing odors, and ensuring that waste is disposed of in a sanitary manner. The waste level monitoring feature enhances operational efficiency by notifying the waste collection teams only when the bin is full, thus optimizing collection schedules and reducing unnecessary trips.

Furthermore, the SMS notification system ensures that waste management teams are alerted promptly, helping to prevent overflow, maintain a clean environment, and minimize waste-related issues. As a result, the system not only supports a more hygienic and convenient waste disposal experience but also offers significant cost savings, environmental benefits, and sustainability through optimized resource usage.

In conclusion, the smart dustbin system is a promising innovation for the future of waste management, offering a reliable, efficient, and environmentally friendly solution to the growing concerns of urban waste management. The successful integration of automation, real-time monitoring, and communication makes it a valuable addition to both smart cities and residential setups, contributing to cleaner, more efficient, and more sustainable waste management practices.

REFERENCES

1. **Srinivasan, S., & Agarwal, M.** (2019). *Smart Waste Management using IoT and Wireless Sensor Networks*. International Journal of Advanced Research in Computer Science and Software Engineering, 9(5), 1-6.
2. **Patil, S., & Deshmukh, S.** (2018). *Automatic Waste Collection System Using IoT*. International Journal of Engineering and Technology, 7(4), 110-114.
3. **Jain, R., & Prasad, S.** (2021). *Design and Development of Smart Dustbin with Waste Level Monitoring Using IoT*. International Journal of Innovative Research in Science, Engineering, and Technology, 10(2), 123-128
4. **Sharma, A., & Tripathi, S.** (2022). *Smart Waste Management System Using IoT and Automated Lid Opening*. Procedia Computer Science, 174, 460-467.
5. **Madhuri, S., & Patil, V.** (2021). *A Review of Smart Dustbin Systems with Waste Level Monitoring and Alerts*. Journal of Smart Cities and Smart Homes, 1(1), 35-42.

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING AND TECHNOLOGY

| Mobile No: +91-6381907438 | Whatsapp: +91-6381907438 | ijmrset@gmail.com |

www.ijmrset.com