



Smart Dustbin for Dry and Wet Waste Integrated with Android Application

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Abstract : The main goal of this project is to create an innovative dustbin that promotes cleanliness and eco-friendliness in line with the "Swaach Bharat Mission". Taking advantage of advancing technologies, we are designing a smart dustbin using Arduino, a microcontroller-based system equipped with ultrasonic sensors, alarms, gas sensors, and other features. Proper maintenance of dustbins is crucial to prevent pollution and maintain a healthy environment. Our proposed technology includes the use of NodeMCU, ultrasonic sensors, servo motors, and battery jumper wires to create a smart dustbin. Once the hardware and software are connected, the Smart Dustbin program will run, allowing the lid to open when someone approaches within a certain range, wait for the user to dispose of the garbage, and then close. Our aim is to make this technology affordable and accessible to all, benefiting both individuals and businesses by promoting health, hygiene, and environmental sustainability.

IndexTerms – Smartdustbin, Ultrasonic Sensor, NodeMCU, Alarm System.

I. INTRODUCTION

In today's world, garbage and diseases are major problems that are prevalent in our society. As individuals, we all strive for clean and tidy surroundings, yet the issue of environmental pollution caused by the large amount of garbage that is scattered on our streets often goes unnoticed. Despite the efforts of government facilities to provide dustbins for public use, these bins are often dirty and unattractive due to the lack of maintenance. This, in turn, creates a disincentive for people to dispose of their garbage in the dustbins provided, as the process of opening and closing the lid can often be cumbersome and time-consuming. As the population of our country continues to grow at an exponential rate, the issue of garbage disposal has become a pressing environmental concern. Dustbins are containers that are designed to collect and store both recyclable and non-recyclable items, as well as decomposable and non-decomposable waste. They are commonly used in homes, offices, and other public spaces, but when these bins become full, there is often no one there to clean them, resulting in garbage being spilled out onto the streets.

The consequences of this are manifold. Garbage not only creates an unsightly and unpleasant environment, but it also serves as a breeding ground for pests and diseases. In addition, garbage can pollute the air, water, and soil, causing harm to both human health and the environment. Thus, the proper disposal of garbage is of utmost importance, not just for aesthetic reasons, but also for the sake of our own health and well-being. To address this issue, it is important to come up with innovative solutions that can help to make the process of garbage disposal more efficient and effective. This is where the concept of a smart dustbin comes in. By leveraging the power of modern technology, a smart dustbin can help to keep our surroundings clean and tidy in a more eco-friendly manner. Such a system would be equipped with features such as ultrasonic sensors, alarms, and gas sensors, which would help to manage the disposal of garbage in a more automated and efficient manner.

Moreover, a smart dustbin can help to address the issue of maintenance, as it would be designed to be more attractive and user-friendly, making it more likely that people would be willing to use it. By making the process of garbage disposal more convenient and accessible, a smart dustbin can go a long way in promoting a cleaner and healthier environment for all. Ultimately, it is important for us to take the issue of garbage disposal seriously, and to come up with innovative solutions that can help to address this pressing environmental concern. Garbage disposal has become an increasingly pressing environmental concern in recent years. Not only does it create an unsightly and unpleasant environment, but it can also lead to the production of harmful bacteria and viruses that can cause life-threatening diseases for humans. Moreover, the surrounding of a dustbin can contribute to the pollution levels in the air, which can have serious health implications.

To address this issue, we have designed a smart dustbin that can help to keep our environment clean and free of pollution. The smart dustbin will have two compartments - one for dry waste and the other for wet waste. It will be equipped with ARDUINO UNO and ultrasonic sensors that will sense the level of waste in the compartments and indicate when it needs to be emptied. One of the key advantages of a smart dustbin is that it is a user-friendly gadget that can make garbage disposal more convenient and accessible for everyone. Children, in particular, are often fascinated by new technology, and the smart dustbin's interactive features can help to encourage them to dispose of their garbage properly. This, in turn, can help to promote a culture of cleanliness in our society and reduce the amount of litter that is spread around by electronics, wrappers, and other such items.

In addition to its user-friendly features, the smart dustbin will also be equipped with several advanced functions to ensure that it is safe and efficient. It will have waste level indicators that will show when it is time to empty the compartments, harmful gas protection with an alarm system that will sound when harmful gases are detected, and automatic LED lights that will make the dustbin visible from a distance. Overall, the smart dustbin is an innovative solution that can help to promote a cleaner and healthier environment for all. By making garbage disposal more convenient and accessible, it can encourage individuals to take responsibility for their waste and ensure that it is disposed of in a safe and efficient manner. With its advanced features and user-friendly design, the smart dustbin is an important step towards building a more sustainable and environmentally friendly society.

II. LITERATURE REVIEW

2.1 IOT Based Smart Garbage Monitoring and Alert System Using Arduino UNO (February 2018) K.Harika, Muneerunnisa, V.Rajasekhar,P.Venkateswara Rao, L.J.N SreeLakshmi

The purpose of this project is to create a smart alert system for efficient garbage clearance by using an ultrasonic sensor to detect the level of garbage filled in a trash bin. The system is designed to send alerts to the municipal net server once the bin is full, which will enable the municipal authority to quickly schedule a clean-up of the bin. This will help maintain cleanliness in the area and reduce the risk of diseases caused by uncollected waste. To support the system, an embedded module integrated with GSM and GPS with IoT facilitation is used. This allows for real-time monitoring of waste collection by the municipal authority, which can help tailor remedial measures. Additionally, a mobile application is developed to notify the urban office about the garbage bin's status and to perform remote monitoring of the clean-up process, thereby reducing the manual process of observation and verification. Notifications are sent to the mobile application using a Wi-Fi module. The main module used in this project is the Arduino UNO, which is interfaced with the ultrasonic sensor to determine the garbage level in the trash bin. The GSM/GPRS module is used to establish communication between a user's computer and a GSM-GPRS system, allowing for SMS notifications from the trash bin. The GPS module is a navigation device that indicates the location of the garbage bin, and the Wi-Fi module provides a unique IP address for SMS and allows the Municipal Officer to see the garbage bin status on the "All Things Talk" website. This project aims to provide an effective and efficient solution for garbage clearance in the community using smart technology. It helps reduce pollution and the risk of diseases caused by uncollected waste, and the use of a mobile application and real-time monitoring ensures that the system is up to date and running smoothly.

2.2 IoT Based Smart Trash Bins – A Step Toward Smart City (December 2017) Chaitanya Jambotkar, Shamlee Rashinkar, Sneha Ghatole, Swati Kadapatti, Varsha Yadave

Garbage management is a crucial aspect of maintaining a clean and healthy environment. With the increase in urbanization and population, there is a corresponding increase in the amount of waste generated, which poses a significant challenge for municipal authorities. In this context, a smart intelligent garbage alert system can be a valuable tool in efficient garbage management. The objective of the proposed work is to develop a smart alert system that can accurately monitor the level of garbage in a bin and provide an alert signal to the municipal internet server for immediate garbage clearance. The system is assisted by an inaudible device that is interfaced with Arduino UNO to measure the amount of garbage in the bin. The data is transmitted via IoT to the municipal internet server, which takes necessary actions for garbage clearance.

The proposed system has several advantages. Firstly, it reduces the need for manual monitoring and intervention. This eliminates the need for personnel to physically inspect each bin to check its status, which can be time-consuming and inefficient. Instead, the smart alert system can provide real-time information about the status of the bin, enabling authorities to take immediate action. Secondly, the system provides accurate and reliable data about the status of the bin. The inaudible device can measure the level of garbage precisely, providing an accurate estimate of when the bin needs to be cleared. This eliminates the need for arbitrary schedules for garbage clearance, which can lead to inefficient utilization of resources. The system uses IoT, which is a technology that allows devices to connect and communicate with each other over the internet. IoT has revolutionized the way we interact with our environment, and its application in garbage management can lead to significant improvements in efficiency and cost-effectiveness. The hardware components of the proposed system include an inaudible device, a microcontroller, and a Wi-Fi module for transmission of data. The system also uses IoT for data transfer, which is an innovative way of leveraging technology for garbage management. The proposed smart intelligent garbage alert system is an innovative and efficient way of managing garbage in urban areas. The system's ability to provide real-time data about the status of the bin, coupled with its IoT-based communication, can lead to significant improvements in garbage management. The system's implementation can lead to a cleaner and healthier environment for urban dwellers while reducing the burden on municipal authorities.

2.3. Eco - friendly Environment with RFIDCommunication Imparted Waste Collecting Robot(July 2015) K. Vidyasagar, M. Sumalatha,K. Swathi, M.Rambabu

The main objective of this paper is to present a smart waste collecting system for restaurants that enables the collection of waste material in a clean and efficient way. This system utilizes an RFID communication system to connect the table occupier with a mobile robot that collects the waste material. An RFID tag is assigned to each table, and an RFID reader is integrated with the guided robot. The system works by sending a command signal from the table occupier to the central control room using an RF transmitter. The RF receiver at the control room receives the signal and sends it as input to the microcontroller ARM7. The microcontroller then outputs the necessary commands to the robot to collect the waste material from the specific table. To navigate the robot to the required table, a path finding mechanism has been adopted using an optimum path algorithm. An IR sensor assembly is equipped with the robot to follow the specified optimal path. The status of the task is communicated back to the control room using an IEEE 802.15.4 communication device. The experimental results of this system have been encouraging, which has encouraged the implementation of this system for real-time applications. By implementing this system, restaurants can keep their premises clean and green while minimizing the manual work of cleaning up waste material.

This system not only ensures efficient waste management but also helps to reduce the amount of time and effort required for waste collection. Additionally, it provides an opportunity for restaurants to reduce their environmental impact by ensuring that waste is managed in a sustainable and responsible manner.

4. Smart Garbage Management System Using Internet of Things (IOT) For Urban Areas (May2018) Ms. Nisha Bhagchandani, Ms. Rupa, Ms. Rajni Kumari,

The aim of this project is to manage the collection of garbage done by Municipal Corporation through the use of an IoT-based embedded device that is attached to the dustbin of each area. The device continuously updates the status of the dustbins in every space to a website designed for garbage management. This system ensures that the garbage collection process is efficient and timely. The device is equipped with an ultrasonic sensor that continuously detects the level of garbage inside the bin. Once the bin is full, it will update its status on the website designed for garbage management along with the date and time. It will then go into a waiting state until the dustbin is emptied. A timer is set simultaneously in this waiting state for a fixed duration within which the dustbin must be cleaned by the Municipal Corporation. If the timer gets expired and the dustbin is not cleaned by the employees on the given time, then the device will send a message to the higher authority that the dustbin has not been cleaned on time. The timer will then be set for the same duration, and the device will remain in the waiting state. Once the dustbin is cleaned by the employees, the device will come out of the waiting state and will update its status of being cleaned on the website along with the date and time. a record is maintained regarding the status of the dustbin for each area in the website in tabular form using IoT technology along with the embedded system, which will efficiently manage the garbage collection process. This system will help to resolve the most significant issue of inefficient garbage collection, which results in an unclean and unhealthy environment.

The use of an embedded device and IoT technology in this project ensures that the garbage collection process is efficient, timely, and automated. It also reduces the chances of errors or delays in the process. The data collected by the device and the website can be used by the Municipal Corporation to improve the garbage collection process and make it more efficient. Additionally, the system can help to create awareness among the people about the importance of keeping the environment clean and encourage them to dispose of their waste in a responsible manner.

III. RESEARCH METHODOLOGY

3.1 Block Diagram:

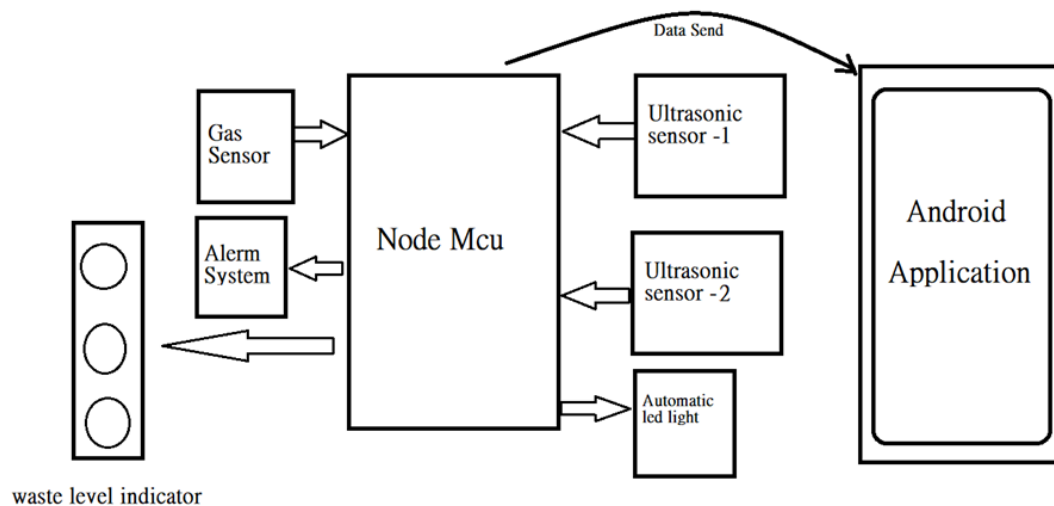


Fig 1.0 Block Diagram of the Project

3.2 Working of Project:

Smart dustbins have become an essential part of modern waste management systems, as they help in keeping the environment clean and healthy. The traditional waste management methods have become ineffective, and therefore, the need for innovative approaches has increased. Smart dustbins are one such innovation, which has the potential to change the way we manage waste. In this context, the use of NodeMCU for the execution of codes, along with the integration of ultrasonic and gas sensors, has proved to be an effective solution. The Smart Dustbin using NodeMCU is a project that aims to automate waste management by using sensors and NodeMCU microcontroller boards.

The ultrasonic sensor is used in this project to detect the level of waste in the dustbin. The sensor emits sound waves and measures the time taken for the sound waves to bounce back from the surface of the waste. Based on the time taken, the distance of the waste from the sensor is calculated, which gives the level of waste in the dustbin. This information is then used to trigger a motor that moves the lid of the dustbin to open or close it. The gas sensor used in this project detects harmful gases in the environment, which can be generated due to the decomposition of organic waste. The gas sensor is also connected to the NodeMCU board, which helps in monitoring the levels of harmful gases in the dustbin. If the level of harmful gases exceeds a certain threshold, an alert is triggered to inform the user to empty the dustbin.

To ensure better visibility, an automatic LED light is also incorporated into the Smart Dustbin. The LED light is connected to an LDR (Light Dependent Resistor) sensor, which helps in detecting the ambient light levels. The LED light turns on automatically when the ambient light levels are low, such as during the night, and turns off when the ambient light levels are high, such as during the day. The use of NodeMCU microcontroller boards in the Smart Dustbin project makes it highly customizable and flexible. The NodeMCU board can be programmed to control various other components, such as motors, displays, and sensors, which makes it an ideal solution for developing smart systems.

Overall, the Smart Dustbin using NodeMCU is an innovative project that provides an efficient and automated solution for waste management. With the integration of sensors and NodeMCU boards, the project offers a customizable and flexible approach, which can be adapted to suit various waste management requirements.

3.3 Methodology:

Innovations in the field of Internet of Things (IoT) have enabled the development of smart systems that can automate various aspects of our lives. One such application is the Garbage Monitoring System, which uses IoT technology to monitor the level of garbage in a bin and notify the user when it needs to be emptied. The Garbage Monitoring System uses an Ultrasonic Sensor to detect the level of garbage in the bin. The Ultrasonic Sensor is installed at the top of the bin, on both the dry and wet chamber, and measures the distance of the garbage from the top of the bin. A threshold value is set according to the size of the bin, and if the distance is less than this threshold value, the system will print the message "Basket is Full" on the webpage. Conversely, if the distance is greater than the threshold value, the message "Basket is Empty" will be displayed. In the program code, a threshold value of 5cm has been set.

The Garbage Monitoring System uses an ESP8266 Wi-Fi module to connect the Arduino board to a web server. A local web server is used to demonstrate the working of the system. When the garbage level reaches a particular height, the system will immediately process the information to the Android application, including the message that the garbage is being filled. This is achieved by using a Wi-Fi module in NodeMCU. To provide better visibility of the dustbin, the Garbage Monitoring System uses an LED light. The LED light indicates the level of the dustbin using three different colors: red, orange, and green. A Light Dependent Resistor (LDR) Sensor Module is used to detect the presence of light and measure its intensity. The output of the module goes high in the presence of light, and the LED will turn off. Conversely, it becomes low in the absence of light, and the LED will turn on, providing better visibility of the dustbin at night. Additionally, the Garbage Monitoring System also includes a gas sensor that is able to detect foul smells inside the bin and identify the presence of harmful gases. If harmful gases are detected, an alarm will get triggered, and the information will also be sent to the Android application.

The Garbage Monitoring System is an innovative application of IoT technology that provides an automated and efficient solution for monitoring the level of garbage in a bin. By using ultrasonic and gas sensors, an ESP8266 Wi-Fi module, an LDR Sensor Module, and an LED light, the system can detect the level of garbage in the bin and provide real-time information to the user. With its customizable and flexible approach, the Garbage Monitoring System can be adapted to suit various waste management requirements and help in keeping our environment clean and healthy.

3.5 List of Component used:

REQUIRED SOFTWARE:

- ARDUINO IDE

REQUIRED HARDWARES:

- Node MCU
- ULTRASONIC SENSOR
- LDR RESISTORS
- MQ6 GAS SENSORS
- 9V BATTERY
- LED LIGHT
- DUSTBIN
- JUMPER WIRES

3.6 Advantages:

The Smart Dustbin is a revolutionary technology that offers many advantages over traditional waste management systems. Here are some of the benefits of using a Smart Dustbin:

1. Reduction in waste collections: Smart Dustbins use sensors and IoT technology to detect the level of waste in the bin. This allows waste management companies to optimize their collection routes and schedules, resulting in a reduction in the number of waste collections needed. This can lead to up to an 80% reduction in waste collections, which translates into less manpower, lower emissions, less fuel use, and less traffic congestion.

2. Reduction in waste bins needed: With traditional waste management systems, it is common to have multiple waste bins located throughout a given area. This can result in cluttered and unsightly surroundings, as well as higher costs associated with the management of multiple bins. By using a Smart Dustbin, waste management companies can reduce the number of bins needed, leading to a more streamlined and efficient system.

3. Environment hygiene: Smart Dustbins can prevent overflowing of waste and reduce unpleasant odors. By using sensors to detect the level of waste in the bin, the system can alert waste management companies when the bin is nearing capacity. This allows for timely waste collection and prevents the overflow of waste, which can be unsightly and unhygienic. In addition, Smart Dustbins are equipped with odor-reducing technology that helps to eliminate unpleasant odors.

4. Evolution by technology: The use of Smart Dustbins represents a major step forward in waste management technology. By using IoT technology and sensors, Smart Dustbins can provide real-time data on the level of waste in the bin, allowing waste management companies to optimize their operations and reduce costs. This technology also provides an opportunity to engage with the community and raise awareness about the importance of waste management.

The advantages of using Smart Dustbins are numerous. They offer a more efficient and streamlined waste management system, reduce the number of waste collections needed, prevent overflowing of waste, reduce unpleasant odors, and bring about evolution by technology in terms of cleanliness. The use of Smart Dustbins represents a significant step forward in waste management technology, and has the potential to transform the way we manage waste and protect the environment.

3.7 Application of the Project:

The Smart Dustbin system is not just an innovative technology, but also a powerful tool to help cities become cleaner and more livable. Here are some of the ways in which the system can be used to improve the cleanliness of cities:

1. Smart City development: With the growing trend towards smart cities, the Smart Dustbin system can play a significant role in creating a cleaner and more efficient urban environment. By using sensors and IoT technology, waste management companies can monitor the level of waste in the bins and optimize their collection schedules. This can lead to reduced congestion, lower emissions, and a cleaner city overall.

2. Swachh Bharat Abhiyan: The Swachh Bharat Abhiyan, launched by the Indian government in 2014, aims to make India cleaner and more hygienic. The Smart Dustbin system can be a valuable tool in achieving this goal. By providing real-time data on the level of waste in the bins, the system can help waste management companies to be more efficient in their operations and reduce the amount of waste that ends up on the streets.

3. Constant monitoring of garbage levels: The Smart Dustbin system can constantly monitor the level of garbage in the bins located throughout the city. This can help to prevent overflowing of waste, which can lead to unsightly and unhygienic conditions. By using sensors to detect the level of waste in the bin, the system can alert waste management companies when the bin is nearing capacity, allowing for timely collection.

4. Standard reference for cleanliness: By using the Smart Dustbin system as a standard reference, people can take one step further in increasing cleanliness in their respective areas. The system can serve as a benchmark for cleanliness and help to motivate individuals and organizations to take action to improve the cleanliness of their surroundings.

The Smart Dustbin system is an innovative technology that can contribute significantly to maintaining the level of cleanliness in the city. By using sensors and IoT technology, the system can help waste management companies to optimize their operations, prevent overflowing of waste, and create a cleaner and more hygienic environment. The system can also serve as a standard reference for cleanliness and inspire individuals and organizations to take action to improve the cleanliness of their surroundings.

IV. CONCLUSION

The aim of our project is to revolutionize the way we approach cleanliness by introducing smart dustbins. These dustbins are a significant upgrade from the traditional garbage bins and incorporate intelligent waste monitoring and trash compaction technologies. They are equipped with smart devices such as sensor and NodeMCU. The lid of the dustbin will automatically open when an object comes near to the dustbin and close after a certain time period. Our goal is to make this technology affordable for everyone so that it can benefit all, from normal people to the rich. We believe that this innovation will not only improve hygiene and health standards in our society but also contribute to the development of smart cities. Furthermore, it can serve as a standard reference for individuals who wish to take responsibility for cleanliness in their areas. We are confident that this project will bring about a positive change in both cleanliness and technology.

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