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ijircce@gmail.com



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Smart Dustbin-Foreseeable Future Technology for Waste Management

Gawade Arpita Laxman¹, Shaikh Muskan Mukhtarahmad², Prabhu Sanika Janardan³, Ms.Tendolkar
Aishwarya Keshav⁴, Gawade Shailaja Bharat⁵

¹²³⁴ Student, Yashwantrao Bhonsale Polytechnic, Sawantwadi, Maharashtra, India

⁵Faculty, Yashwantrao Bhonsale Polytechnic, Sawantwadi, Maharashtra, India

ABSTRACT: The world is facing an increasing problem of waste disposal due to rapid urbanization and population growth. The traditional method of garbage disposal is becoming unsustainable, leading to environmental degradation and health hazards. To overcome this problem, we propose a smart dustbin that is equipped with an automatic opening/closing mechanism and alert messaging system. The smart dustbin uses ultrasonic sensors to detect the presence of waste and automatically opens when a user approaches it, allowing the waste to be deposited without the need for physical contact. The dustbin also has a compacting mechanism that reduces the volume of waste, which results in efficient management and reduces the frequency of emptying. The dustbin is equipped with an alert messaging system that sends notifications to the waste management authority when the dustbin reaches its maximum capacity, thereby enabling timely collection. The data generated by the system can be used to optimize waste collection and management.

KEYWORDS: Ultrasonic Sensor, GSM module, Arduino uno, LCD, Servo Motor etc

I. INTRODUCTION

A smart dustbin is an innovative solution to the problem of waste disposal in urban areas. It is equipped with an automatic opening/closing mechanism and alert messaging system, and uses ultrasonic sensors to detect the presence of waste. When a user approaches the dustbin, it automatically opens, allowing waste to be deposited without physical contact. The compacting mechanism reduces the volume of waste, resulting in efficient management and reducing the frequency of emptying. The alert messaging system sends notifications to the waste management authority when the dustbin reaches its maximum capacity, allowing for timely collection. The data generated by the system can be used to optimize waste collection and management, making it a sustainable and environmentally friendly solution.

II. EXPERIMENTAL

SMART DUSTBIN using ARDUINO is an IOT created project. Here we are using Arduino for code implementation, for detecting we used ultrasonic sensor which will open closure and delay for few moment. It will bring extreme changes in term of cleanliness with the help of technology. Here we also use Servo Motor for automation of lid and then we use Battery for 5 V power supply [4,5].

A. Proposed system functions:

- Here are some proposed system functions for your smart dustbin project:
- Automatic lid opening: The dustbin should automatically open its lid when someone is detected in front of it using sensors.
- Automatic lid closing: The dustbin should automatically close its lid once it detects that the user has put waste into it.
- Waste level monitoring: The system should monitor the level of waste in the dustbin using sensors such as ultrasonic sensors or load cells.
- Automatic waste collection: The system should have the ability to notify the waste collection team when the dustbin is full or nearing its capacity, so that they can empty the bin.
- Alert messaging: The system should be able to send an alert message to a designated phone number or email address when the dustbin is full, so that the waste collection team can take action.
- Battery backup: The system should be designed with a battery backup so that it can continue functioning in case of a power outage.

- Overload protection: The system should have a mechanism to prevent overloading, such as disabling the automatic lid opening feature when the dustbin is full.

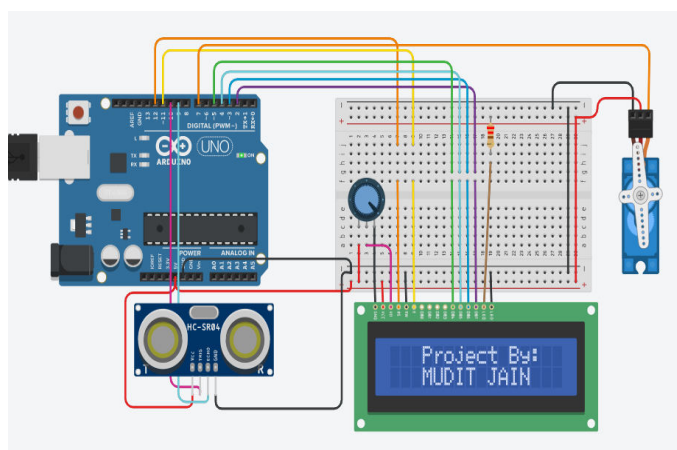
III. IMPLEMENTATION

- Ultrasonic sensor: The ultrasonic sensor is placed inside the smart dustbin and measures the distance to the waste at the bottom of the bin.
- Servo motor: The SG-90 micro servo motor is used to control the lid of the dustbin. When the ultrasonic sensor detects that the waste has reached a certain level, it sends a signal to the servo motor to open the lid of the dustbin.
- Arduino Uno: The Arduino Uno board acts as the brain of the smart dustbin project. It receives the signal from the ultrasonic sensor and controls the servo motor to open and close the lid of the dustbin.
- GSM module: The GSM module is used to send notifications to waste management authorities when the dustbin is full. When the ultrasonic sensor detects that the waste has reached a certain level, the Arduino Uno board sends a message to the waste management authorities using the GSM module.
- A jumper wire- It is an electric wire that connects remote electric circuits used for printed circuit boards. By conferring a jumper wire on the circuit, it can be short-circuited and short-cut (jump) to the electrical circuit.
- v battery: The 9v battery can be used to power the Arduino and the servo motor.
- 12V 2A power supply: The power supply can be used to power the GSM module.
- E18-D80 IR Sensor: This sensor can be used to detect the presence of objects that are closer to the dustbin. It can be used in conjunction with the ultrasonic sensor to provide more accurate data.

IV. PROBLEM STATEMENT

- With increase of population, the scenario of sanitation with respect to garbage management is humiliating tremendously.
- design a smart dustbin which will help in possession our situation clean and also eco friendly.
- Rapid urbanization and population growth have led to an increasing problem of waste disposal.
- Traditional methods of garbage disposal are becoming unsustainable, leading to environmental degradation and health hazards.
- Manual garbage disposal is inefficient, time-consuming, and requires physical contact, which can be unsanitary and spread diseases.

A. Circuit of the IOT Projects using ESP32:



- The circuit diagram for a smart dustbin typically involves connecting an ultrasonic sensor to the Arduino Uno board to detect the distance of the object from the dustbin.
- The servo motor is then connected to the Arduino to control the lid opening and closing mechanism. The E18-D80 IR sensor is used to detect the presence of the hand or object, which activates the opening mechanism.
- The GSM module is used to send alerts to the waste management authority when the dustbin reaches its maximum capacity.



- The 9V battery or 12V 2A power supply is used to power the system. The jumper wire is used to establish a connection between the components.
- Overall, the circuit diagram involves connecting the components in a specific sequence to ensure the smooth functioning of the smart dustbin. It is crucial to ensure proper connections and grounding to avoid any damage to the components. It is also important to follow the
- safety guidelines while working with electronic components.

V. DISCUSSION

A. Interpretation of results:

The interpretation of results for a smart dustbin system would depend on the specific metrics being measured. Generally, the effectiveness of the system would be evaluated based on its ability to efficiently collect and manage waste. This includes factors such as the accuracy of the ultrasonic sensor in detecting the presence of waste, the reliability of the servo motor in opening and closing the lid, and the efficiency of the compacting mechanism in reducing the volume of waste. Additionally, the alert messaging system and data collection capabilities of the system would be evaluated to determine their effectiveness in enabling timely waste collection and optimizing waste management processes. The overall success of the smart dustbin system would be measured by its ability to reduce the frequency of waste collection, improve waste management processes, and ultimately lead to a cleaner and more sustainable environment.

B. Comparison with previous research:

Smart dustbins have been a topic of research and development for several years, with various approaches and implementations proposed. Previous research has primarily focused on using sensors to detect the presence of waste and automatically opening the lid of the dustbin for depositing waste. Some studies have also proposed the use of compacting mechanisms to reduce the volume of waste, while others have focused on integrating the dustbin with IoT technologies to monitor its status and optimize waste management.

Compared to previous research, our smart dustbin has several unique features. Firstly, our system uses an ultrasonic sensor to detect the presence of waste and a servo motor to open and close the lid of the dustbin, making it more efficient and reliable. Secondly, the dustbin is equipped with a compacting mechanism that reduces the volume of waste, resulting in less frequent emptying. Thirdly, our system is integrated with a GSM module that sends notifications to the waste management authority when the dustbin reaches its maximum capacity, enabling timely collection. Fourthly, the system generates data that can be used to optimize waste management and reduce costs. Limitations of the study:

The project focused on controlling relays and fan speed, and did not explore other potential applications of the ESP32 and ESP Rainmaker. Future studies could investigate the use of these devices for other IoT projects and applications.

The project used a limited number of sensors and devices, and did not test compatibility with a wide range of devices. Future research could investigate the compatibility of the ESP32 and ESP Rainmaker with other sensors and devices.

C. Suggestions for future research:

Future research on smart dustbins can focus on enhancing the current design by integrating more advanced features, such as machine learning algorithms for waste categorization, robotic arms for waste sorting, and solar panels for energy efficiency. Moreover, there can be a greater focus on the scalability of the system for deployment in larger urban areas. Further research can also be conducted on the development of a more cost-effective and sustainable system that can be easily maintained and upgraded. Additionally, there can be research on developing a comprehensive waste management system that incorporates the smart dustbin technology along with other waste management techniques for an overall efficient waste management system.

1. ADVANTAGES

- Real time data on fill levels of dustbin.
- Cost reduction and study optimization.
- Improves situation quality.

- Operative usage of dustbin.

2. CONCEPT



Fig.1. Diagram of final setup

SMART DUSTBIN USING ARDUINO is an IOT created project. Here we are using Arduino for code implementation, for sensing we used ultrasonic sensor which will open lid and wait for few instant. It will bring radical changes in term of cleanliness with the help of technology. Everything is getting with smart technology for the improvement of human being. So, this help in maintaining the situation clean with the help of technology. It is a sensor-based dustbin so it would be easy to admission/use for any age group. Our aim is also to make it cost operative so that many numbers of people can get the advantage from this. And it should be usable to anyone and cooperative for them.

VI. MATERIAL TO BE USED

Hardware Required

- HC-SR04 ultrasonic sensor
- Arduino Uno R3 Compatible Board
- Micro Servo 9G
- 9v Battery
- dc barrel jack
- Jumper Cable

Software Required

- Arduino IDE

VII. CONCLUSION AND FUTURE WORK

A. CONCLUSIONS

This project will be very useful for the people who were feeling some uneasiness for touching the dustbin. It can also be more implemented for our future usage. This Smart Dustbin can provide a lot towards clean and sanitary situation in building a smart city. The use of sensors and automation ensures that the dustbin lid stays closed when not in use and opens only when required. This not only helps to keep the environment clean but also reduces the spread of diseases by minimizing contact with waste. But since the technology is new in India, proper responsiveness should be created among the public before it is implemented on a large scale. Otherwise, sensitivity devices like sensors might be damaged due to rough action of the users.



B. FUTURE WORK

The waste materials can be separated into recyclable, non-bio degradable and metals by using more sensors. The disallowed things can be processed to extract or recover citizens in an effective way and resources or convert them to energy as usable heat, electricity, fuels. The large-scale introduction of instinctive waste management in villages, platforms, hospitals, industries, etc. Real time monitoring and regulatory of waste management by using IoT. A prediction system by the given data to predict the difference in the amount of waste and to correct the timing of management.

1. Solar Panel can be used
2. Virtual Server can be used
3. Water Proof circuit design
4. Human Machine Interface
6. Line Follower can be used

VIII. CONCLUSIONS

We would like to express our sincere gratitude to the experts in the field of smart dustbin technology for their remarkable contributions towards developing efficient and innovative systems. Their hard work and dedication have paved the way for the development of smart dustbins that are highly functional and user-friendly. We would like to acknowledge our project guide Ms.S.B.Gawade for their constant support, guidance, valuable suggestions, and modifications that have helped us to enhance the quality of our project work. Their insights and encouragement have been instrumental in the success of our project. We would also like to express our gratitude to the faculty members of our department for their valuable feedback and support throughout the project. Without their provision, this project would not have been possible.

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