

# **AUTOMATED TRASH CAN**

## **Introducing the Smart Dustbin**

Mobile and Wireless Communication Sessional  
Course Code: CSE 416

Jabin Tasmin Anny  
ID: 1902014

### **1 Introduction**

In the realm of contemporary technological innovations, I am thrilled to introduce my recent endeavor—a cutting-edge automated waste bin harnessing the capabilities of the Arduino Uno microcontroller, a piezo buzzer, an ultrasonic sensor, a servo motor, and an LED light. This project seamlessly integrates with a power bank, providing a portable and efficient power source for enhanced the utility.

This originative solution aims to address traditional concerns associated with waste disposal by implementing a smart and responsive system. Upon detecting an object within a proximity of less than 20 cm from the bin, a series of actions are triggered. The LED light illuminates, offering a visual cue, while a distinctive sound emanates from the piezo buzzer, notifying users of the bin's responsiveness.

The main functionality of this project is orchestrated by the Arduino Uno microcontroller, harmonizing the synchronized interplay of the ultrasonic sensor, servo motor, and other essential components. The inclusion of a power bank ensures the project's autonomy and adaptability in various settings.

This project not only exemplifies the fusion of hardware components but also showcases the potential of simple yet effective automation in addressing everyday challenges. The ensuing sections of this report will delve into the intricacies of the project, including the technical details, challenges faced, and the broader implications of this automated dustbin.

## 2 Components

The heart of this developing smart dustbin lies in its sophisticated components, seamlessly working together to create an intelligent and responsive waste disposal system. The key components driving this innovation include the Arduino Uno microcontroller, a piezo buzzer, an ultrasonic sensor, a servo motor, and an LED light.

**Arduino Uno:** The main microcontroller that controls the entire system.

**Ultrasonic Sensor (HC-SR04):** Detects the distance of an object from the dustbin.

**Servo Motor:** Controls the lid of the dustbin. It opens when an object is detected within the specified range.

**Piezo Buzzer:** Produces a sound when an object is detected within the specified range.

**LED Light:** Lights up when an object is detected within the specified range.

**Power Bank:** Provides power to the Arduino Uno and the connected components.

**Bread Board:** Also called plug-block and used for temporary circuits.

## 3 Functionality

The main functionality of this smart dustbin is quickly orchestrated by the Arduino Uno microcontroller, serving as the central nervous system. This micro-controller acts as the brains behind the operation, enabling the synchronized interplay of various hardware components for an efficient and responsive waste disposal system. Below are the main functionalities of this project:

- The ultrasonic sensor continuously measures the distance of any object in front of it.
- If the measured distance is less than the defined threshold (20 cm), the system activates:
  - The LED light turns on to indicate the detection.
  - The piezo buzzer produces a sound.
  - The servo motor moves the lid of the dustbin to an open position.
- After the lid is opened, it stays in that position for 3 seconds (adjustable duration).
- If no object is detected within the specified range, the system returns to the initial state:
  - The LED light turns off.
  - The servo motor closes the lid.

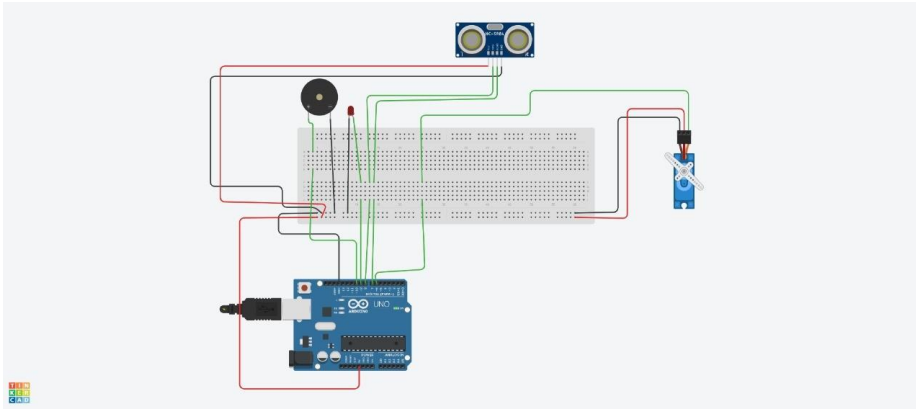


Figure 1: Circuit Diagram

## 4 Output



(a) Object is more than 20 cm away(LED light off and lid closed )



(b) Object is less than 20 cm away(LEDlight on and lid opened )

## 5 Benefits

In the pursuit of a more sustainable and eco-friendly future, innovative technologies are taking centre stage to address pressing environmental issues. Among these, the development and implementation of smart dustbins are growing rapidly in the world of waste management. Below are some main advantages of smart dustbin:

- **Visual Indication with LED:** The LED light provides a visual indication when an object is detected, making the system more intuitive and user-friendly.
- **Audible Alert with Buzzer:** The piezo buzzer produces an audible alert, signaling the detection of an object within the specified range, further enhancing the user's awareness.
- **Adjustable Detection Range:** Users can potentially adjust the detection range based on their preferences or the specific environment in which the trash bin is placed.
- **Automatic Lid Opening and Closing:** The servo motor-controlled lid offers a convenient and automated way to open and close the trash bin, making it more user-friendly.
- **Hands-Free Operation:** Users can dispose of trash without physically touching the bin, promoting hygiene and reducing the risk of contamination or the spread of germs.
- **Demonstrates Internet of Things (IoT) Principles:** The project showcases the principles of IoT by incorporating sensors and actuators to create an automated and responsive system.
- **Promotes a Clean Environment:** Encourages responsible waste disposal by providing an engaging and automated way to interact with the trash bin, potentially increasing user compliance with proper disposal practices.
- **Proximity Detection:** The ultrasonic sensor detects the presence of an object in close proximity, triggering the lid opening, enhancing the user experience.
- **Potential for Integration with Smart Home Systems:** The project can be a foundation for further integration with smart home systems, allowing users to control or monitor the trash bin remotely.

## 6 Limitation

Smart dustbin faces several limitations and challenges in their current implementation. Below are some limitation of smart dustbin project:

- **Sensing Accuracy:** The ultrasonic sensor may have limitations in accurately measuring distances, leading to potential errors in object detection.
- **Power Dependency:** The project relies on a power bank, requiring regular recharging or replacement, especially in high-usage scenarios.
- **Mechanical Wear:** Moving parts, particularly the servo motor, may experience wear and tear over time, potentially leading to malfunctions.
- **Limited Automation:** The project lacks features for trash disposal or sorting, limiting the level of automation in waste management.

## **7 Conclusion**

In conclusion, the automated dustbin project has successfully integrated Arduino Uno, a piezo buzzer, an ultrasonic sensor, a servo motor, and an LED light to create an efficient waste disposal system. The responsive features, triggered when an object is within 20 cm, add a layer of convenience and hygiene to traditional waste management. Overcoming challenges, the project highlights the synergy of hardware components, with the Arduino Uno orchestrating their seamless collaboration. The use of a power bank ensures portability and adaptability. Looking forward, the project suggests potential enhancements and underscores the impact of simple automation on everyday challenges, reflecting the evolving landscape of smart and sustainable technologies in waste management.

## **References**

- [1] S.S. Navghane, M.S. Killedar, Dr.V.M. Rohokale, “IoT Based Garbage and Waste Collection Bin”, May 2016.
- [2] Alexey Medvedev, Petr Fedchenkov, ArkadyZaslavsky, Theodoros, Anag-nostopoulos Sergey Khoruzhnikov, “Waste Management as an IoT-Enabled Service in Smart Cities”.
- [3] Vishesh Kumar Kurrel, “Smart Garbage Collection Bin Overflows Indicator using Internet of Things”.
- [4] Ghose, M.K., Dikshit, A.K., Sharma, S.K. “A GIS based transportation model for solid waste disposal – A case study on Asansol municipality”. Journal of WasteManagement.
- [5] Monika K A, Nikitha Rao, Prapulla S B, Shobha G, “Smart Dustbin-An Efficient Garbage Monitoring System”.