A

Report On

Smart Trash Can

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Abstract

The Smart Trash Can project introduces an automated, contactless solution for waste disposal, prioritizing hygiene and convenience. Utilizing an ESP8266 microcontroller, ultrasonic sensor, and servo motor, the system detects user proximity and opens the lid automatically, ensuring an efficient and germ-free experience. This report provides a comprehensive analysis of the project's design, implementation, results, and potential future enhancements.

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1. Introduction

In an era where technology intersects with daily life, the Smart Trash Can project serves as a step toward automation and hygiene. The system eliminates the need for physical contact with trash can lids, promoting cleanliness and ease of use. It is ideal for applications in smart homes, public spaces, healthcare facilities, and more. This report outlines the project's objectives, technical components, implementation, and results.

2. Background Study

The idea of a contactless trash can stems from the increasing demand for hygienic waste disposal methods, especially in public and medical environments. Traditional systems often require manual operation, posing risks of contamination. Existing smart solutions leverage sensors and actuators, but many lack scalability or affordability. The Smart Trash Can bridges these gaps by combining simplicity, cost-effectiveness, and functionality.

3. Objectives

The primary objectives of this project are:

- To enhance hygiene by eliminating the need for manual contact with trash can lids.
- To develop a cost-effective and efficient automated solution.
- To demonstrate practical applications of IoT and microcontroller-based systems.
- To explore potential upgrades for smarter waste management solutions.

4. Components:

- **ESP8266 Microcontroller**: Processes sensor input and controls the servo motor.

- **Ultrasonic Sensor (HC-SR04)**: Detects user proximity by measuring the distance using ultrasonic waves.

- **Servo Motor (SG90)**: Controls the lid's opening and closing mechanisms.

- **Power Supply**: Provides necessary power to the components.
- **Connecting Wires**: Connect the components for seamless communication.
- **Trash Can Structure**: Acts as the base for the smart system.

5. Design and Working Principle

The system operates on a simple yet effective design principle:

7. Results

The Smart Trash Can was tested in various scenarios, demonstrating:

- **Reliable Detection**: Accurate proximity detection within 20 cm.
- **Efficient Operation**: Smooth opening and closing of the lid.
- **Power Efficiency**: Minimal power usage due to automated standby mode.

8. Applications

- **Smart Homes**: Enhances convenience and hygiene for residents.
- **Public Spaces**: Encourages hygienic waste disposal in parks, malls, and streets.
- **Healthcare Facilities**: Ensures contactless waste disposal, reducing contamination risks.
- **Restaurants and Cafes**: Improves cleanliness and ease of use for customers.

9. Advantages

- **Hygiene**: Contactless operation minimizes germ spread.
- **Convenience**: Automated functionality for seamless waste disposal.
- **Cost-Effective**: Simple and affordable components.
- **Scalability**: Expandable design for advanced features.

10. Future Enhancements

- **Smart Connectivity**: Adding Wi-Fi for remote monitoring and control.
- **Trash Level Monitoring**: Sensors to detect and notify when the trash can is full.
- **Improved Detection**: Integrating infrared sensors for better accuracy.
- **Portable Power**: Including rechargeable batteries for mobility.

11. Conclusion

The Smart Trash Can project highlights the practical applications of microcontroller technology in addressing real-world problems. Its successful implementation demonstrates the potential of IoT-based solutions in creating smarter environments. This project provides a foundation for future innovations in automated waste management systems.

- ***Software:***

```
#include <Servo.h>

#define TRIG_PIN D1 // Define the TRIG pin for the ultrasonic sensor
#define ECHO_PIN D2 // Define the ECHO pin for the ultrasonic sensor
#define SERVO_PIN D3 // Define the servo pin

Servo trashLid; // Create a Servo object

const int openAngle = 160;   // Angle to open the trash can lid
const int closeAngle = 0;   // Angle to close the trash can lid
const int detectionDistance = 20; // Distance in cm to detect a person

void setup() {
  pinMode(TRIG_PIN, OUTPUT);
  pinMode(ECHO_PIN, INPUT);
  trashLid.attach(SERVO_PIN);
  trashLid.write(closeAngle); // Start with the lid closed
  Serial.begin(9600);         // Start serial communication for debugging
}

void loop() {
  long duration, distance;

  // Send a 10us pulse to trigger the ultrasonic sensor
  digitalWrite(TRIG_PIN, LOW);
  delayMicroseconds(2);
  digitalWrite(TRIG_PIN, HIGH);
  delayMicroseconds(10);
  digitalWrite(TRIG_PIN, LOW);

  // Measure the time for the echo to return
  duration = pulseIn(ECHO_PIN, HIGH);

  // Calculate the distance in cm
  distance = duration * 0.034 / 2;

  Serial.print("Distance: ");
  Serial.print(distance);
  Serial.println(" cm");

  // Open the lid if a person is detected within the detection distance
  if (distance > 0 && distance <= detectionDistance) {
    trashLid.write(openAngle);
  } else {
    trashLid.write(closeAngle);
  }

  delay(200); // Add a small delay to avoid rapid triggering
}

```

- ***Hardware:***

References:

1. M. Banzi and M. Shiloh, *Getting Started with Arduino*. Maker Media, Inc., 2014.

2. S. Monk, *Programming Arduino: Getting Started with Sketches*. McGraw Hill Professional, 2016.