Smart Dustbin Using Arduino

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Introduction

A Smart Dustbin is an automatic trash bin that opens its lid when someone approaches and closes it after a few seconds.

This system helps maintain hygiene by eliminating the need for direct contact with the bin. It is simple, cost-effective, and easy to build using an Arduino Uno, an ultrasonic sensor, and a servo motor.

How It Works

The ultrasonic sensor detects motion when a person comes close (within 15 cm). The Arduino processes this signal and sends a command to the servo motor, which then opens the dustbin lid. After 3 seconds, the lid closes automatically.

Step-by-Step Process:

1. The ultrasonic sensor constantly checks the distance of nearby objects.
2. When a person is detected within 15 cm, the sensor sends a signal to the Arduino.
3. The Arduino activates the servo motor, which opens the lid.
4. After 3 seconds, the lid closes automatically.
5. The process repeats for the next user.

Components Required

| Component	Quantity	Description
Arduino Uno	1	Controls the system
HC-SR04 Ultrasonic Sensor	1	Detects approaching objects
Servo Motor (SG90)	1	Moves the lid
Jumper Wires	As needed	For wiring connections
9V Battery & Holder	1	Power supply
Plastic Dustbin	1	Used as the smart bin

Circuit Connections :

Ultrasonic Sensor Connections

- VCC → Connect to **5V** on Arduino
- GND → Connect to **GND** on Arduino
- Trig → Connect to **Pin 9**
- Echo → Connect to **Pin 10**

Servo Motor Connections

- VCC → Connect to **5V** on Arduino
- GND → Connect to **GND** on Arduino
- Signal → Connect to **Pin 6**

Circuit Diagram

Below is the project circuit flow:
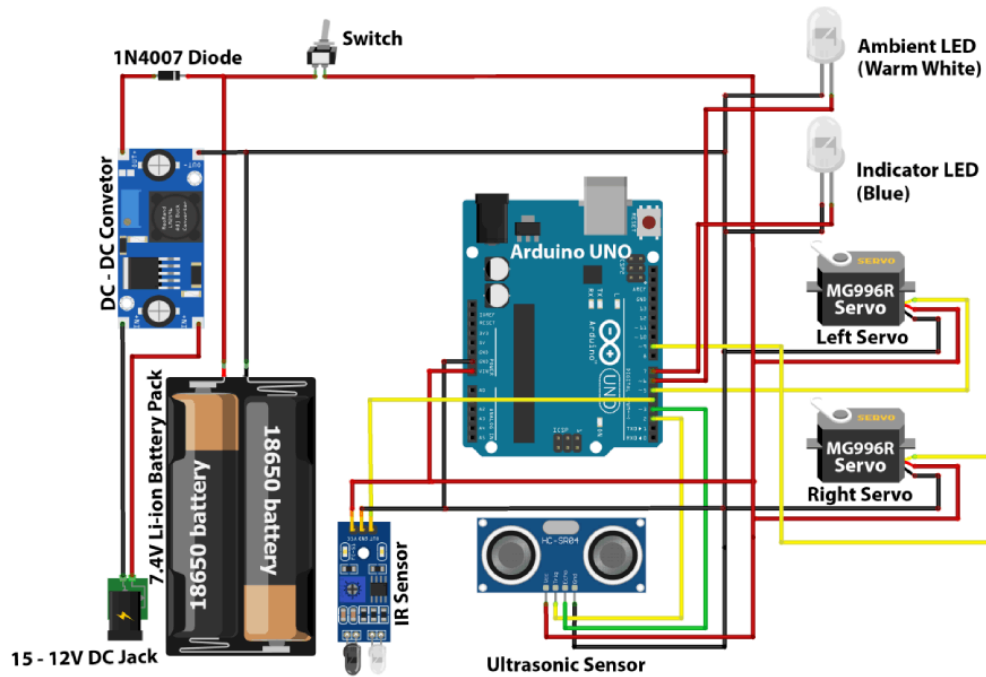
Arduino Code

This code reads data from the ultrasonic sensor and controls the servo motor to open and close the lid.

```cpp
#include <Servo.h>

// Pin configuration
const int trigPin = 9;     // Trigger pin for ultrasonic sensor
const int echoPin = 10;    // Echo pin for ultrasonic sensor
const int servoPin = 6;    // Servo motor control pin

Servo servoMotor;          // Servo object for controlling the lid

// Function to calculate distance from ultrasonic sensor
long getDistance() {
  digitalWrite(trigPin, LOW);  // Ensure trigPin is LOW
  delayMicroseconds(2);        // Short delay

  digitalWrite(trigPin, HIGH); // Send a pulse to trigger sensor
  delayMicroseconds(10);       // Pulse duration
  digitalWrite(trigPin, LOW);  // End pulse

  long duration = pulseIn(echoPin, HIGH);  // Measure the pulse duration
  long distance = duration * 0.0344 / 2;  // Calculate distance in cm
  return distance;
}

void setup() {
  // Initialize pins
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);

  // Initialize servo motor
  servoMotor.attach(servoPin);
  servoMotor.write(0);  // Start with lid closed

  // Start serial communication for debugging
  Serial.begin(9600);
}

void loop() {
  long distance = getDistance();  // Get distance from ultrasonic sensor

  // Print the distance to serial monitor (for debugging)
  Serial.print("Distance: ");
  Serial.print(distance);
```

```
  Serial.println(" cm");

  // If object is detected within 15 cm, open the lid
  if (distance > 0 && distance < 15) {
    servoMotor.write(90);  // Open the lid (90 degrees)
    delay(3000);           // Keep lid open for 3 seconds
    servoMotor.write(0);   // Close the lid (0 degrees)
  }

  delay(500);  // Wait for a short time before next sensor reading
}
```

Working Model & Implementation

1. Build the circuit as per the wiring diagram.
2. Attach the servo motor to the dustbin lid.
3. Upload the code to the Arduino using the Arduino IDE.
4. Power the circuit using a 9V battery or USB cable.
5. Test the system by bringing your hand near the sensor.

Advantages of Smart Dustbin

✔️ Hygienic – No need to touch the dustbin.

✔️ Automated – Reduces human effort.

✔️ Energy Efficient – Uses minimal power.

✔️ Cost-Effective – Uses inexpensive components.

✔️ Simple & Easy to Build – No complex hardware required.

Applications

✔️ **Homes & Offices** – Reduces direct contact with waste.
✔️ **Hospitals** – Prevents infections from waste.
✔️ **Public Places** – Encourages proper waste disposal.

Future Improvements

🚀 **IoT Integration** – Monitor waste levels via a mobile app.
🚀 **Solar-Powered Version** – Make it energy-efficient.
🚀 **Smart Sorting** – Classify waste into biodegradable and non-biodegradable categories.