MINI PROJECT

# SMART TRASH BIN SYSTEM USING ARDUINO – REPORT


## ABSTRACT:

The Smart Trash Bin System is an automatic waste disposal solution designed to promote hygiene and convenience in public and household environments. The system uses an Arduino UNO, ultrasonic sensor, IR sensor, and servo motors to detect human presence and automatically open and close the bin lid. Additionally, indicator LEDs and ambient LEDs give visual feedback, while the system runs on a battery pack with a DC-DC converter for stable power. This smart bin minimizes contact, improves sanitation, and provides an energy-efficient waste management method.


## INTRODUCTION:

Traditional waste bins require manual operation, which can lead to the spread of germs and reduce hygiene levels. Smart waste bins overcome this issue by using sensors to detect the user's hand or object and automatically open the lid. The proposed Smart Trash Bin System uses an Arduino UNO as the controller, ultrasonic sensor for distance detection, IR sensor for object confirmation, and servo motors to drive the bin lid. LEDs are used to indicate system activity. The system operates efficiently from a rechargeable battery pack, making it suitable for homes, offices, hospitals, and public places.

## COMPONENTS REQUIRED:

- Arduino UNO
  Main microcontroller used to process sensor inputs and control servos.
- HC-SR04 Ultrasonic Sensor
  Detects distance of objects (hand/obstacle).
- IR Sensor Module
  Detects close-range presence for additional confirmation.
- MG996R Servo Motors (2 Nos.)
  Used to open and close the trash bin lid.
- Ambient LED (Warm White)
  Shows bin lid status or illuminates the area.
- Indicator LED (Blue)

Indicates detection of an object.

- 18650 Li-ion Battery Pack (7.4V)
  Power supply for system.
- DC-DC Converter
  Steps down battery voltage to 5V for Arduino and sensors.
- 1N4007 Diode & ON/OFF Switch
  Provides protection and power control.
- Connecting wires
  Electrical connections.

**OBJECTIVES:**

- To design a contactless waste bin for better hygiene.
- To automatically open and close the lid using sensors.
- To reduce the spread of germs and maintain cleanliness.
- To provide a low-cost, energy-efficient smart waste management system.
- To use LEDs for user feedback and system status.

**METHODOLOGY:**

- The ultrasonic sensor continuously measures distance.
- When an object (like a hand) is detected within a set range, the Arduino activates the servos.
- Servos rotate to open the trash bin lid.
- The IR sensor is used to confirm object presence for reliable operation.
- LEDs glow to indicate lid opening and system activity.
- After a delay, if no object is detected, the servos close the lid.
- The power system (battery + DC-DC converter) ensures stable 5V supply to components.

**ALGORITHM:**

1. Start the system.
2. Initialize sensors, LEDs, and servo motors.
3. Read distance from ultrasonic sensor.
4. If distance < threshold (e.g., < 20 cm):

5. Turn ON indicator LED
6. Open lid using servos
7. Check IR sensor for confirmation
8. Keep lid open while object is present.
9. When object is removed
10. Close lid using servos
11. Turn OFF LED
12. Repeat the loop continuously.

**ARDUINO CODE :**

```
#include <Servo.h>

Servo leftServo;

Servo rightServo;

#define TRIG 9

#define ECHO 8

#define IR_PIN 7

#define INDICATOR_LED 6

#define AMBIENT_LED 5

Int threshold = 20;

Void setup() {

 Serial.begin(9600);

 leftServo.attach(3);

 rightServo.attach(4);

 pinMode(TRIG, OUTPUT);

 pinMode(ECHO, INPUT);

 pinMode(IR_PIN, INPUT);

 pinMode(INDICATOR_LED, OUTPUT);

 pinMode(AMBIENT_LED, OUTPUT);
```

```
 digitalWrite(INDICATOR_LED, LOW);
  digitalWrite(AMBIENT_LED, LOW);
  closeLid();
}
Long getDistance() {
  digitalWrite(TRIG, LOW);
  delayMicroseconds(2);

  digitalWrite(TRIG, HIGH);
  delayMicroseconds(10);
  digitalWrite(TRIG, LOW);
 long duration = pulseIn(ECHO, HIGH);
  long distance = duration * 0.034 / 2; // Convert to cm
  return distance;
}
Void openLid() {
  leftServo.write(0);
  rightServo.write(180);
}
Void closeLid() {
  leftServo.write(90);
  rightServo.write(90);
}
Void loop() {
  Long distance = getDistance();
  Int ir = digitalRead(IR_PIN);
```

```
  If (distance < threshold && ir == 0) {
    digitalWrite(INDICATOR_LED, HIGH);
    digitalWrite(AMBIENT_LED, HIGH);
    openLid();
    delay(3000);  // Keep lid open for 3 sec
  }
  Else {
    digitalWrite(INDICATOR_LED, LOW);
    digitalWrite(AMBIENT_LED, LOW);
    closeLid();
  } Delay(200);
}
```

**CIRCUIT DIAGRAM:**