



# DAYANANDA SAGAR UNIVERSITY

## SCHOOL OF ENGINEERING

### Department of Computer Science Engineering

#### SPECIAL TOPIC REVIEW 1

## SMART GARBAGE MANAGEMENT USING IOT

Under the Supervision  
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# Abstract

- Much garbage is produced daily in homes due to living activities, including cooking and eating. The garbage must be adequately managed for human well-being and environmental protection.
- This study presents a new smart garbage bin system, SGBS, embedded with multiple sensors to solve the problem. We deployed temperature, humidity, and gas sensors to know the condition and identify the garbage content disposed of.
- A GUI is also developed to monitor the desired information related to the garbage for different selected locations. This will help to manage the garbage collection efficiently.

# Problem Statement

## Problem:

- Neglect by individuals and authorities leads to inadequate garbage management, causing overflowing bins, unpleasant odors, and inefficient collection. This neglect results in harmful pollution and significant health risks.
- Proper waste management is crucial for maintaining cleanliness and preserving the environment.

## Solution:

- By equipping garbage bins with sensors that detect fill levels, waste management authorities can receive timely notifications when bins are nearing capacity, ensuring that waste is collected before bins overflow.

# Introduction

- Municipal authorities face challenges with the collection, transportation, and processing of household solid waste. Currently, trash collection is a manual process that requires significant labor and time
- To address this, each garbage bin is assigned a unique identification number. Moreover, when a garbage bin becomes full or starts to overflow, a text message is automatically sent to the central server, which coordinates the dispatch of garbage collection trucks.
- Additionally, each bin is equipped with a weight sensor that monitors the bin's weight. When the weight exceeds a predetermined threshold, a text message is triggered to the garbage collection center. Upon receiving the notification, a garbage disposal vehicle is sent to the specified location.

# Social Impact

- improved Public Health and Hygiene
- Reduction of Environmental Pollution
- Enhanced Quality of Urban Life

# State of the Art-work

Author's Name/ Paper Title	Conference/Jo urnal Name and year	Technology/ Design	Results shared by author	What you infer
Smart IOT Based Dustbin and Waste Monitoring System	2023 International Conference on Advances in Computation, Communication and Information Technology (ICAICCIT)	Smart bin built on Aurdino board platform. It is interfaced with a GSM modem and the bin is equipped with Ultrasonic sensor. there is a buzzer and some LED's for the display of levels	The paper presents a smart dustbin system automating lid operations and real-time garbage monitoring to enhance waste collection efficiency and cleanliness. It demonstrates the system's effectiveness and potential for broader adoption in waste management .	Integration of many bins each with a unique ID can be done by implementing the principles of IOT

Author's Name/ Paper Title	Conference/Jou rnal Name and year	Technology/ Design	Results shared by author	What you infer
smart Dustbin and Garbage Monitoring System using Internet of Things	5th International Conference on Advancements in Computing (ICAC) /2023	The ultrasonic sensors measure the level of the garbage daily. If the dustbin is full then it information and location sends to the municipal department	The smart dustbin system, powered by IoT, is cost-effective and user-friendly, benefiting waste management . It automatically opens, sorts waste, and monitors levels, promoting cleanliness and efficiency.	It help to the municipal government to invest the more amount and it keep the environment clean and fresh.
IOT Based Smart Dustbin With Waste Segregation	2023 International Conference on Power Energy, Environment & Intelligent Control (PEEIC)	This smart dustbin system uses sensors to monitor garbage levels, a servo motor to control the lid, and GSM communication for alerts. It tracks garbage levels in real-time and sends timely notifications for efficient waste collection.	This system can identify and sort garbage into categories like organic and inorganic using sensors and a microprocessor. It can also compress the waste to save space and notify users when the trash can is full or needs emptying.	AUTOMATICALLY LID WILL OPEN WHEN USER SHOW THE OBJECT. WHEN THE DUSTBIN IS FULL IT GIVE THE MESSAGE TO THE RESPECTIVE DEPARTMENT

Author's Name/ Paper Title	Conference/Jou rnal Name and year	Technology/ Desi gn	Results share d by author	What you infer
A Smart-Dustbin and Integration of Waste Management System using IoT	4th International Conference on Inventive Research in Computing Applications (ICIRCA) /2022	Using sensor it check weather the object is wet or dry waste. level monitor done by the ultrasonic device.	A) Bin Checking B) Management of lid C) GPS live location	From the use of the IOT we can use the smart dustbin will ,surrounding area is clean more in the health issues.
SMART DUSTBIN MANAGEMENTUSING IOT AND BLYNK APPLICATION	5th International Conference on Trends in Electronics and Informatics (ICOEI)/2021	ultrasonic sensor to follow the measure of waste. The IR sensor utilized to follow close by individuals.	This project keeps areas clean by monitoring authorities' work, reducing garbage collection trips, and using LED lights to indicate bin status, promoting cleanliness and protecting animals from plastic ingestion.	IoT devices have increased efficiency and accuracy in waste collections.

# FUNCTIONAL REQUIREMENTS

- Automatic Lid Opening.
- Real-time Fill Level Monitoring.
- Alerts for Full Capacity.
- Remote Monitoring and Control.
- Energy Efficient Design.

# NON FUNCTIONAL REQUIREMENTS

- Reliability
- Scalability
- Usability
- Durability
- Performance

# SOFTWARE REQUIREMENTS

- Arduino IDE/Tinker cad

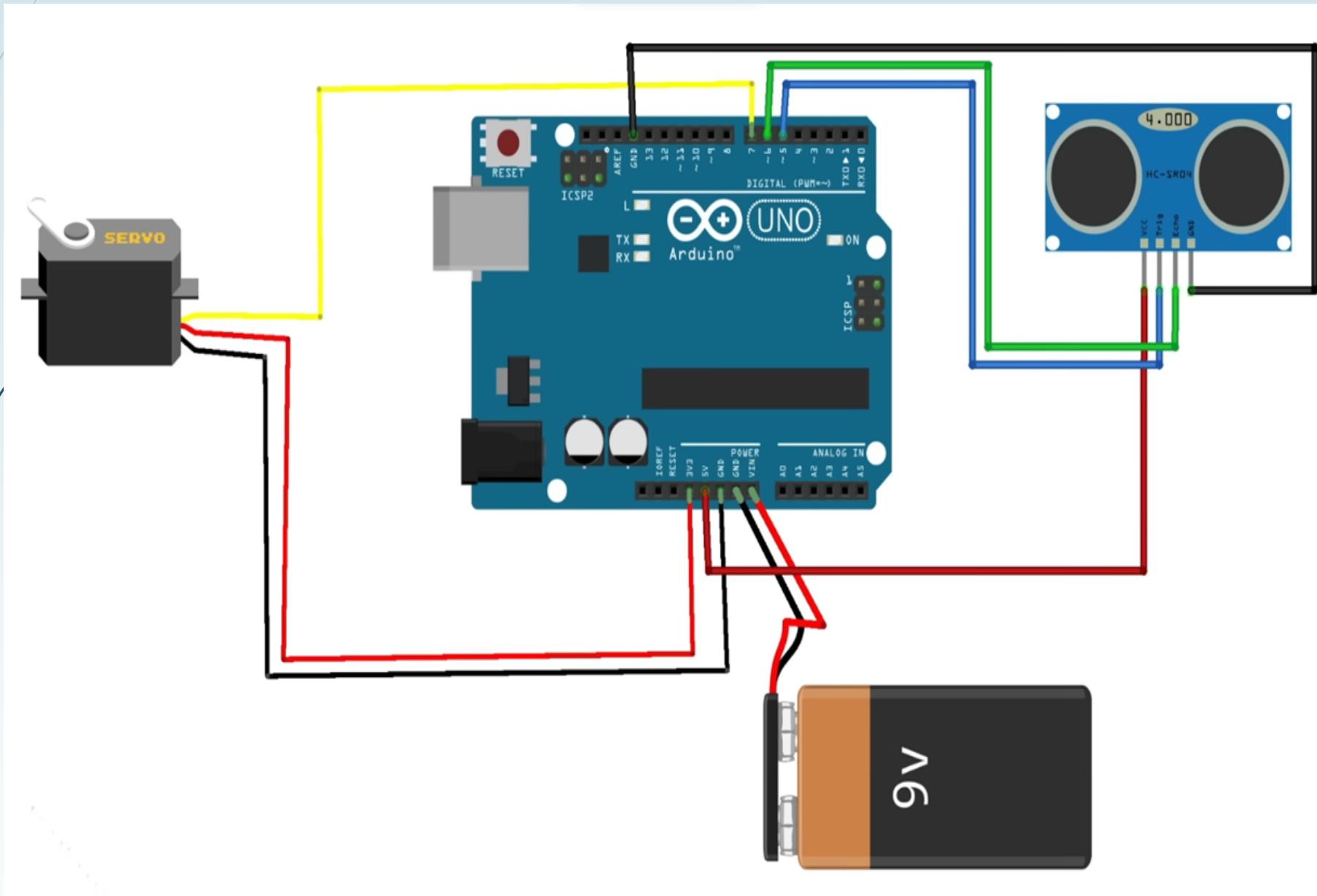
# HARDWARE REQUIREMENTS

- Arduino Uno R3
- Servo motor
- Ultrasonic Distance Sensor
- Led Blub, LCD Screen, Buzzer, Node MCU



# Design

## Hardware Connection



## Description of the connections:

### Servo Motor Connections:

**Yellow wire:** Connected from the signal pin of the servo to pin 9 on the Arduino.

**Red wire:** Connected from the power (VCC) pin of the servo to the 5V pin on the Arduino.

**Black wire:** Connected from the ground (GND) pin of the servo to the GND pin on the Arduino.

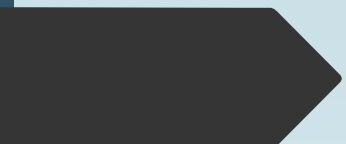
### Ultrasonic Sensor (HC-SR04) Connections:

**VCC (Red wire):** Connected to the 5V pin on the Arduino.

**GND (Black wire):** Connected to the GND pin on the Arduino.

**Trig (Green wire):** Connected to pin 10 on the Arduino.

**Echo (Blue wire):** Connected to pin 11 on the Arduino.

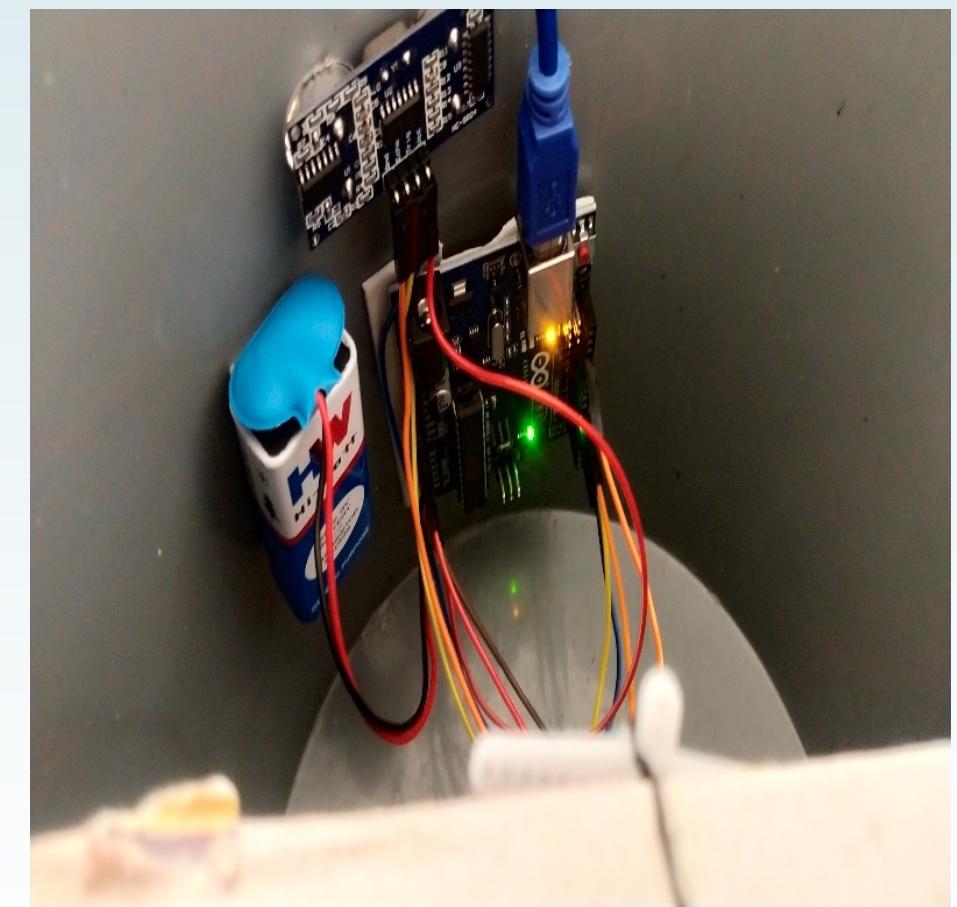


## Arduino Power Connections:

### 9V battery:

**Positive terminal:** Connected to the VIN pin on the Arduino.

**Negative terminal:** Connected to the GND pin on the Arduino.



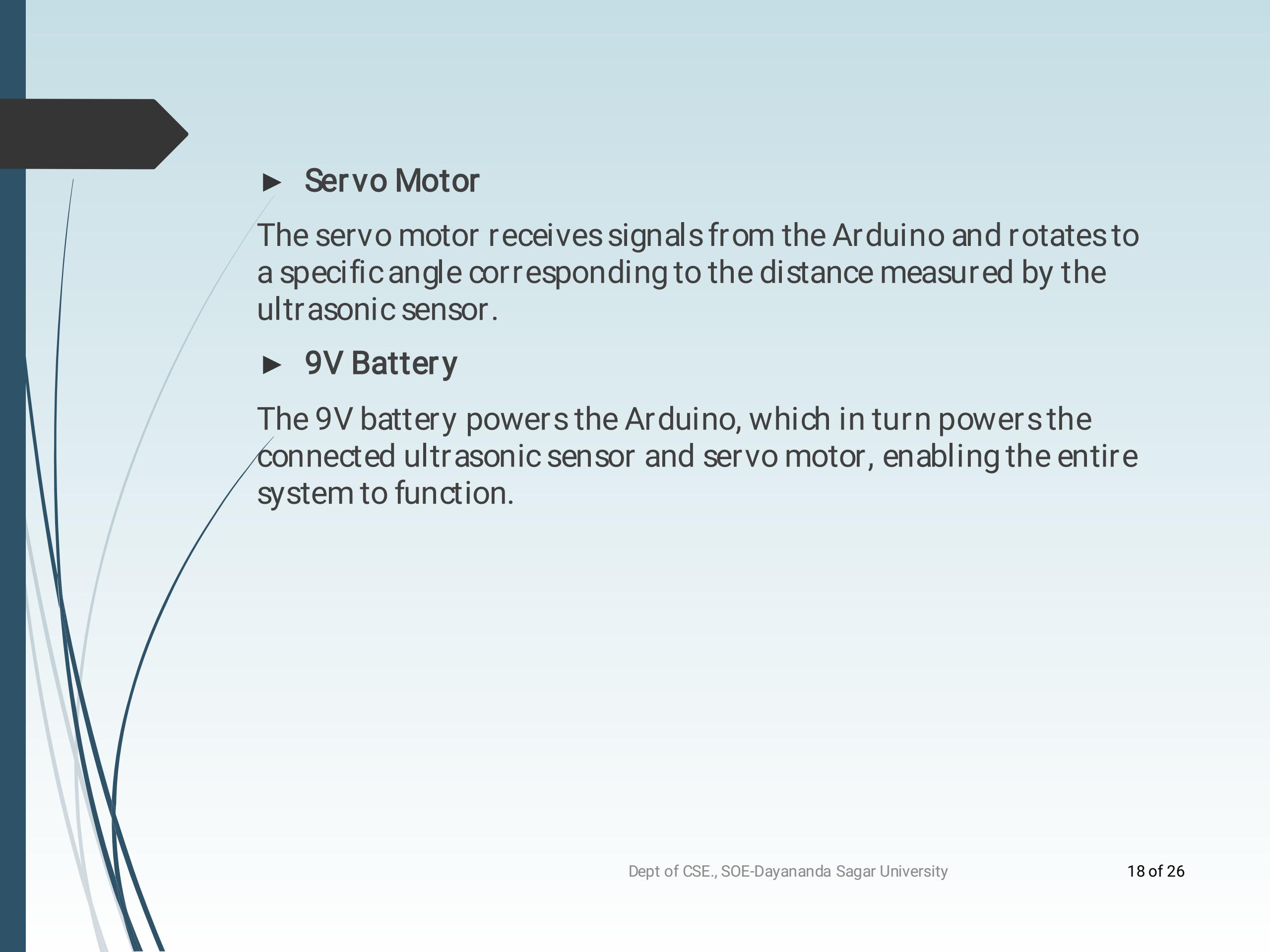
# METHODOLOGY

- **Ultrasonic Sensors**

Used to detect the presence of objects (garbage) in front the dustbin and measure the fill level inside.

- **Arduino Uno**

The Arduino processes the distance data from the ultrasonic sensor and sends appropriate signals to the servo motor to control its position based on the measured distance.



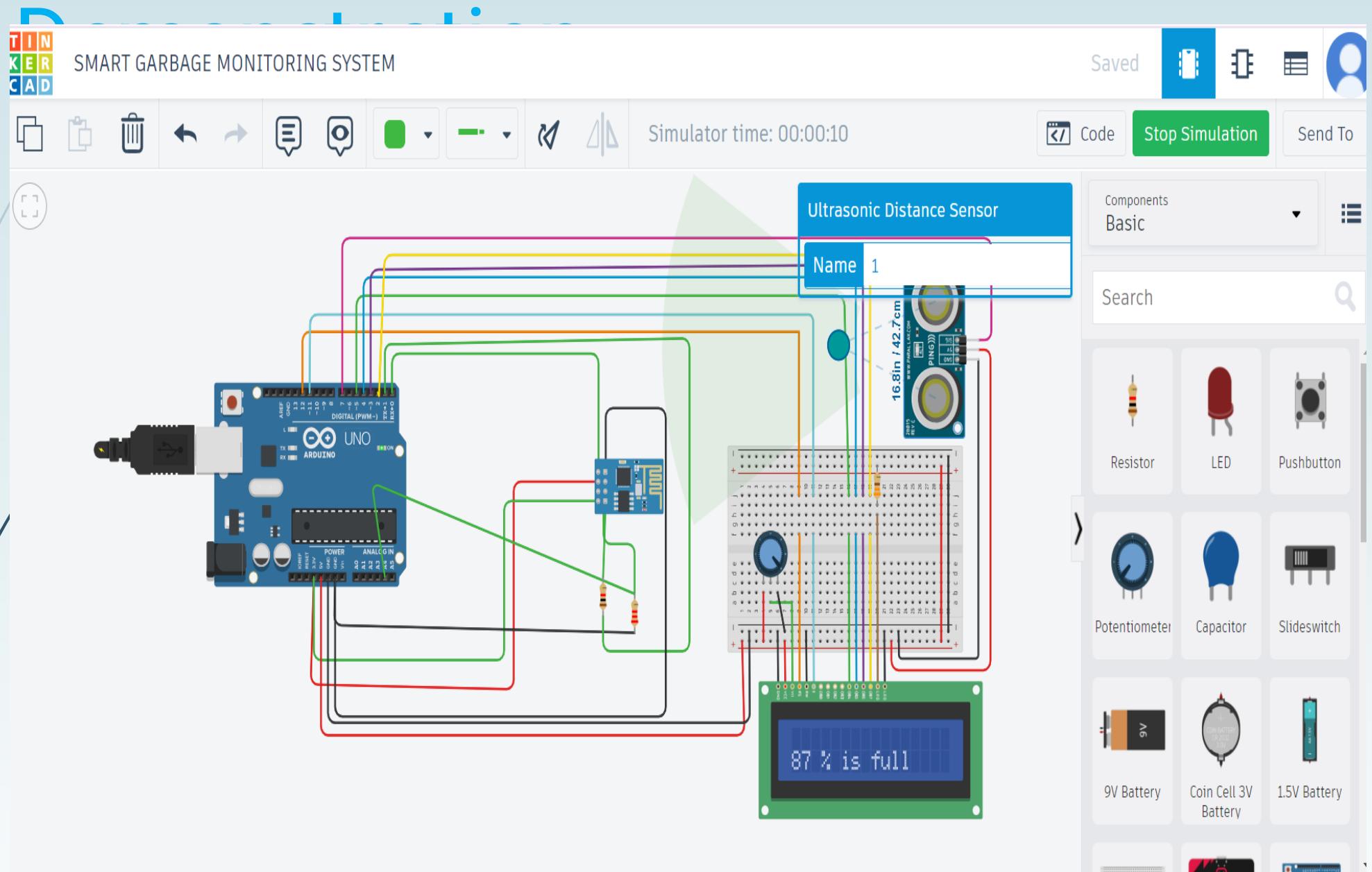
## ► Servo Motor

The servo motor receives signals from the Arduino and rotates to a specific angle corresponding to the distance measured by the ultrasonic sensor.

## ► 9V Battery

The 9V battery powers the Arduino, which in turn powers the connected ultrasonic sensor and servo motor, enabling the entire system to function.

# Implementation and



## Arduino Code

```
#include <Servo.h> // servo library
Servo servo;
int trigPin = 5;
int echoPin = 6;
int servoPin = 7;
int led= 10;
long duration, dist, average;
long aver[3]; // array for average

void setup() {
Serial.begin(9600);
servo.attach(servoPin);
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
```

```
servo.write(0); //close cap on power on delay(100);
servo.detach();
}
void measure()
{
digitalWrite(10,HIGH);
digitalWrite(trigPin, LOW);
delayMicroseconds(5);
digitalWrite(trigPin, HIGH);
delayMicroseconds(15);
digitalWrite(trigPin, LOW);
pinMode(echoPin, INPUT);
duration = pulseIn(echoPin, HIGH);
dist = (duration/2) / 29.1; //obtain distance
}
```

```
void loop() {  
for (int i=0;i<=2;i++) { //average  
distance measure();  
aver[i]=dist; delay(10); //delay between measurements  
}  
dist=(aver[0]+aver[1]+aver[2])/3;  
if ( dist<50 ) { //Change distance as per your need  
servo.attach(servoPin); delay(1);  
servo.write(0);  
delay(3000);  
servo.write(150);  
delay(1000);  
servo.detach();  
}  
Serial.print(dist);  
}
```

# Result Analysis and Testing





samrtbin | Arduino IDE 2.2.1

File Edit Sketch Tools Help

Arduino Uno

samrtbin.ino

```
40
41 if ( dist<50 ) {
42 //Change distance as per your need
43 servo.attach(servoPin);
44 delay(1);
45 servo.write(0);
46 delay(3000);
47 servo.write(150);
48 delay(1000);
49 servo.detach();
50 }
51 Serial.print("distance");
52 Serial.print(dist);
53 }
```

Output Serial Monitor X

Message (Enter to send message to 'Arduino Uno' on 'COM4')

New Line 9600 baud

distance55distance55distance54distance54distance56distance13distance2distance15distance1distance2distance2distance2distance3

# Conclusion

- The implementation of smart garbage management system using IR sensor, microcontroller and GSM module. This system assures the cleaning of dustbins soon when the garbage level reaches its maximum.
- By automating the lid opening/closing mechanism and monitoring the garbage level in real-time, the proposed system aims to enhance waste collection efficiency and promote cleanliness.
- If the dustbin is not cleaned in specific time, then the record is sent to the higher authority who can take appropriate action against the concerned contractor.
- This reduce the total number of trips of garbage collection vehicle and hence reduce the overall expenditure associated with the garbage collection.

# References

- [1]. Palomi Gawali, Swarup Shinde etc."Smart IOT Based Dustbin and Waste Monitoring System".5th International Conference on Advancements in Computing (ICAC) /2023.
- [2]. Mr. Kailash Sharma, Mr. Rahul Singh."IOT Based Smart Dustbin With Waste Segregation". International Conference on Power Energy, Environment & Intelligent Control (PEEIC)/2023.
- [3]. Priyanka Thirumugam, Daminda Herath. "Smart Dustbin and Garbage Monitoring Systemusing Internet of Things".5th International Conference on Advancements in Computing (ICAC) / 2023.
- [4]. G.V.V.S.L. Rupesh, Mopidevi Sai Advytha etc."A Smart-Dustbin and Integration of Waste Management System using IoT ".4th International Conference on Inventive Research in Computing Applications (ICIRCA) /2022.
- [5]. F. Annie Lincy ,Dr. T. Sasikala ."Smart Dustbin Management Using IOT And Blynk Application".5th International Conference on Trends in Electronics and Informatics (ICOEI)/ 2021.