PROJECT REPORT

Waste Management System

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Project Report submitted in partial fulfillment of the requirement of ICTC 3106.3 and Internet of Things of the Degree of BSc in Information Technology

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1. ABSTRACT

In the recent decades, urbanization has increased tremendously. At the same phase there is an increase in waste production. Waste management has been a crucial issue to be considered. This proposal is a way to achieve this good cause. In this project waste management system is built on a microcontroller-based platform Arduino Uno board which is interfaced with the Servo motor and ultrasonic sensor. Ultrasonic sensor is placed at the top of the dustbin which will measure the stature of the dustbin.

The threshold stature is set at a particular level. Arduino will be programmed in such a way that when someone will come in front of dustbin the servo motor will come in action and open the lid for the person to put the waste material into the dustbin. Once these smart bins are implemented on a large scale, by replacing our traditional bins present today, waste can be managed efficiently as it avoids unnecessary lumping of wastes on roadside. Foul smell from these rotten wastes that remain untreated for a long time, due to negligence of authorities and carelessness of public may lead to long term problems. Breeding of insects and mosquitoes can create nuisance around promoting unclean environment. This may even cause dreadful diseases.

2. INTRODUCTION

The rate increasing population in our country has increased rapidly and also, we have an increase in garbage which have increased environmental issue. The dustbin is a container that collects garbage or stores items. The pollution level is also conductive due to the dustbin surroundings. Air pollution due to a dustbin can produce bacteria and viruses which can produce life harmful diseases for humans.

Dustbins (or Garbage bins, Trash Cans, whatever you call them) are small plastic (or metal) containers that are used to store trash (or waste) on a temporary basis. They are often used in homes, offices, streets, parks etc. to collect the waste. In some places, littering is a serious offence and hence public waste containers are the only way to dispose small waste. Usually, it is a common practice to use separate bins for collecting wet or dry, recyclable or non-recyclable waste.
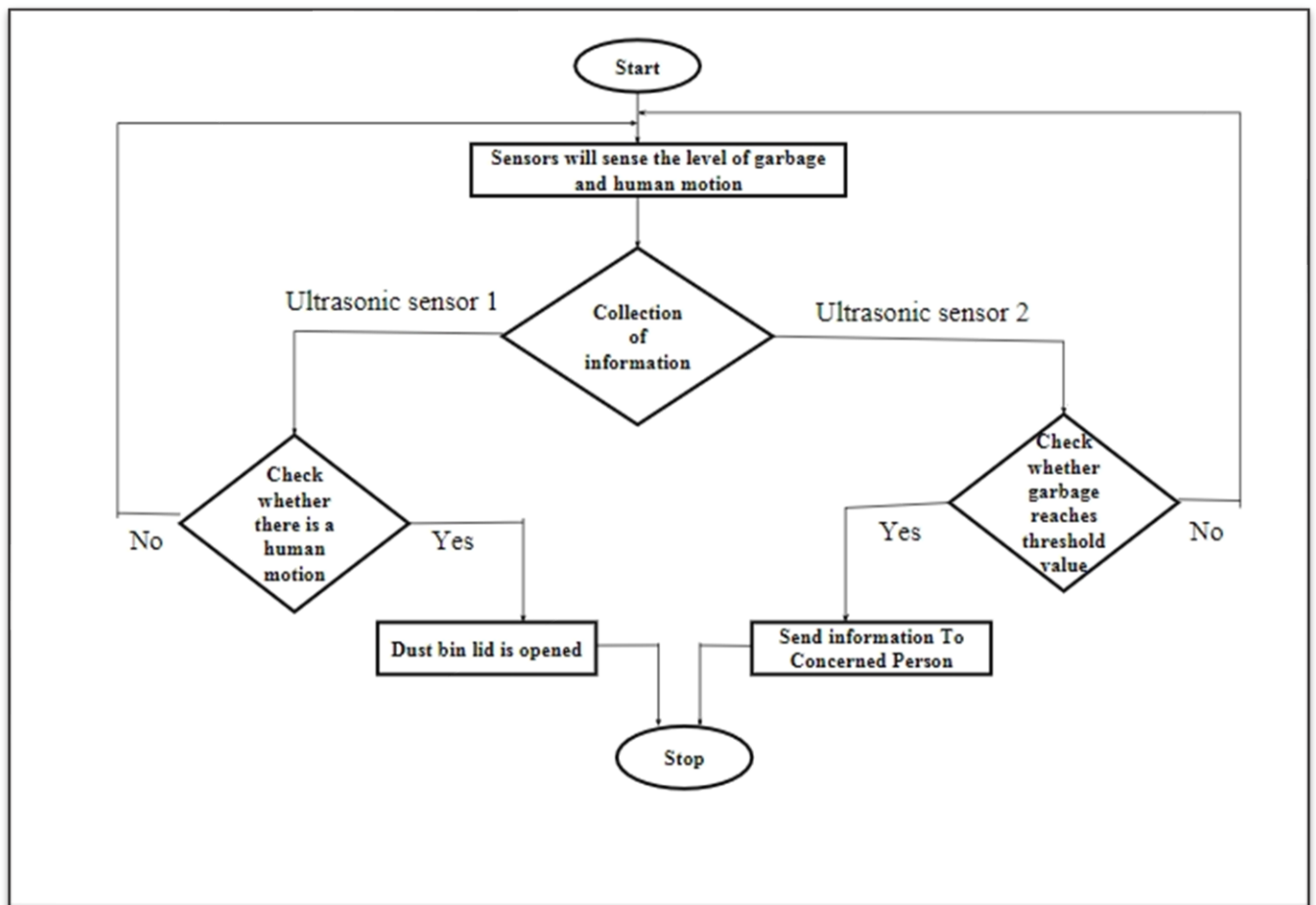
In this project, I have designed a simple system called Smart Dustbin using Arduino, Ultrasonic Sensor, LED, Resister and Servo Motor, where the lid of the dustbin will automatically open itself upon detection of human hand and detect the level of the garbage. The smart dustbin is a carefully designed solution that solves the social issue of waste disposal, the smart dustbin identifies the kind of material being thrown inside it and segregates it into bio or non-biodegradable.

Dustbin will open its lid when someone/object is in range of 10cm to 20cm then it will wait for 10 seconds then it will close automatically. Here lid will close when you don't want to use and it will only open when required.

I create a You Tube Video for my Waste Management System Project.

https://youtu.be/pxNJHbqZumQ

3. FLOW CHART OF WASTE MANAGEMENT SYSTEM

```
                          ┌─────────┐
                          │  Start  │
                          └─────────┘
                               │
         ┌─────────────────────┼─────────────────────────────┐
         │                     │                             │
         │        ┌────────────────────────────────┐         │
         │        │ Sensors will sense the level of │         │
         │        │   garbage and human motion      │         │
         │        └────────────────────────────────┘         │
         │                     │                             │
         │                  ╱──────╲                          │
Ultrasonic sensor 1      ╱ Collection ╲      Ultrasonic sensor 2
         │             ╱     of        ╲        │
         │            ╲  information    ╱        │
         │             ╲──────────────╱          │
         │                                       │
      ╱──────╲                              ╱──────╲
    ╱  Check   ╲                          ╱  Check   ╲
   ╱  whether   ╲      Yes               ╱  whether   ╲
  ╲ there is a  ╱───────┐      Yes      ╲ garbage reaches╱   No
 No╲  human     ╱       │      ┌──────── ╲ threshold value╱───
   ╲  motion   ╱        │      │          ╲──────────────╱
                        │      │
              ┌──────────────┐ ┌──────────────────────┐
              │ Dust bin lid │ │ Send information To  │
              │  is opened   │ │  Concerned Person    │
              └──────────────┘ └──────────────────────┘
                        │      │
                       ┌──────────┐
                       │   Stop   │
                       └──────────┘
```

4. METHODOLOGY

Automatic/contactless dustbin is an project based on Internet Of Things. We will be using Arduino IDE for uploading the code, for detecting the object we will be using ultrasonic sensor(HC-SR04) . It will bring severe changes in tern of cleanliness with the help of technology. Everything is getting smart with technology for the advancement of human being. So this will help in maintaining the environment clean with the help of technology. It is a sensor based dustbin so it is easy to access/use for any age group. Our other aim is to make this cost effective so that number of people can get the benefit from this contactless dustbin. And this should be usable to anyone and helpful for them. Given below is the hardware required to complete this project

SMART DUSTBIN USING ARDUINO is an IOT based project. Here we are using arduino for code execution, for sensing we used ultrasonic sensor which will open lid and wait for few moment. It will bring drastic changes in tern of cleanliness with the help of technology. Everything is getting with smart technology for the betterment of human being. So this help in maintaining the environment clean with the help of technology. It is a sensor based dustbin so it would be easy to access/use for any age group.

4.1. REQUIRED SOFTWARE
      4.1.1. ARDUINO IDE

4.2. REQUIRED HARDWARE
      4.2.1. ARDUINO UNO
      4.2.2. ULTRASONIC SENSOR
      4.2.3. SERVO MOTOR
      4.2.4. 9V BATTERY
      4.2.5. DUSTBIN
      4.2.6. JUMPER WIRES
   4.2.7. RED AND ORANGE LED
      4.2.8. RESISTER

Name	Quantity	Component
U1	1	Arduino Uno R3
DIST1 DIST2	2	Ultrasonic Distance Sensor
B1	1	9V Battery
D1	1	Red LED
D2	1	Orange LED
RI R2	2	220Ω Resistor
SERVO1	1	Positional Micro Servo

Other tools and components

- Digital Multimeter

- Soldering iron kits

- PCB small portable drill machines

4.3. Pictures of the Components used and the Smart Dustbin
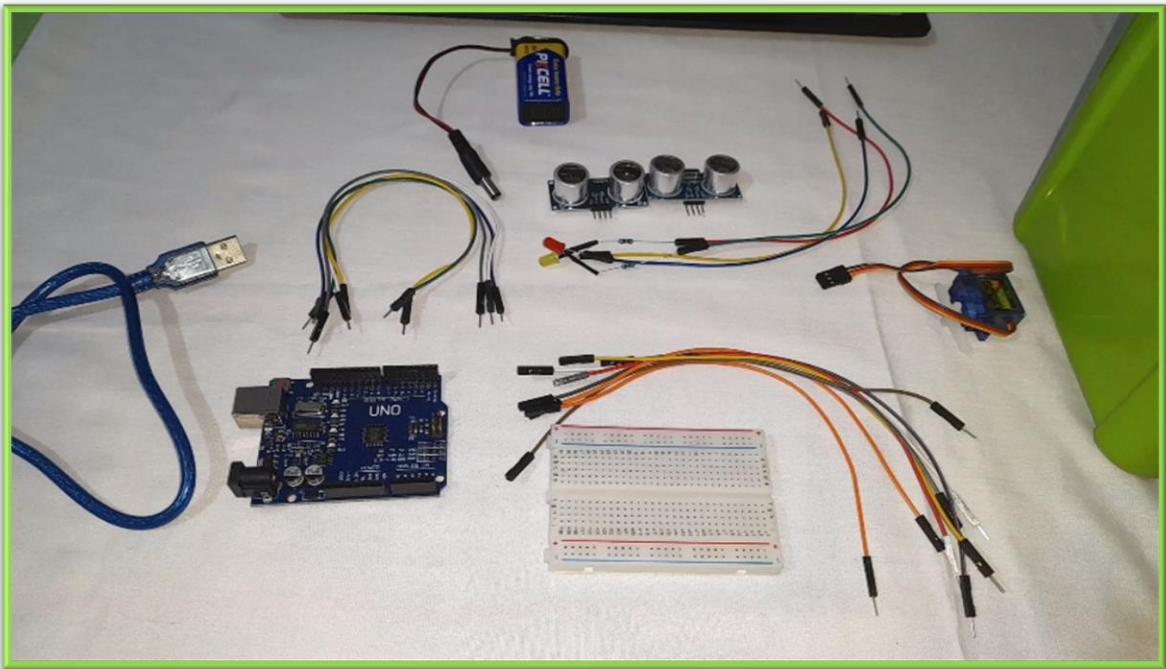
Arduino UNO

     Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

     The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board we can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.
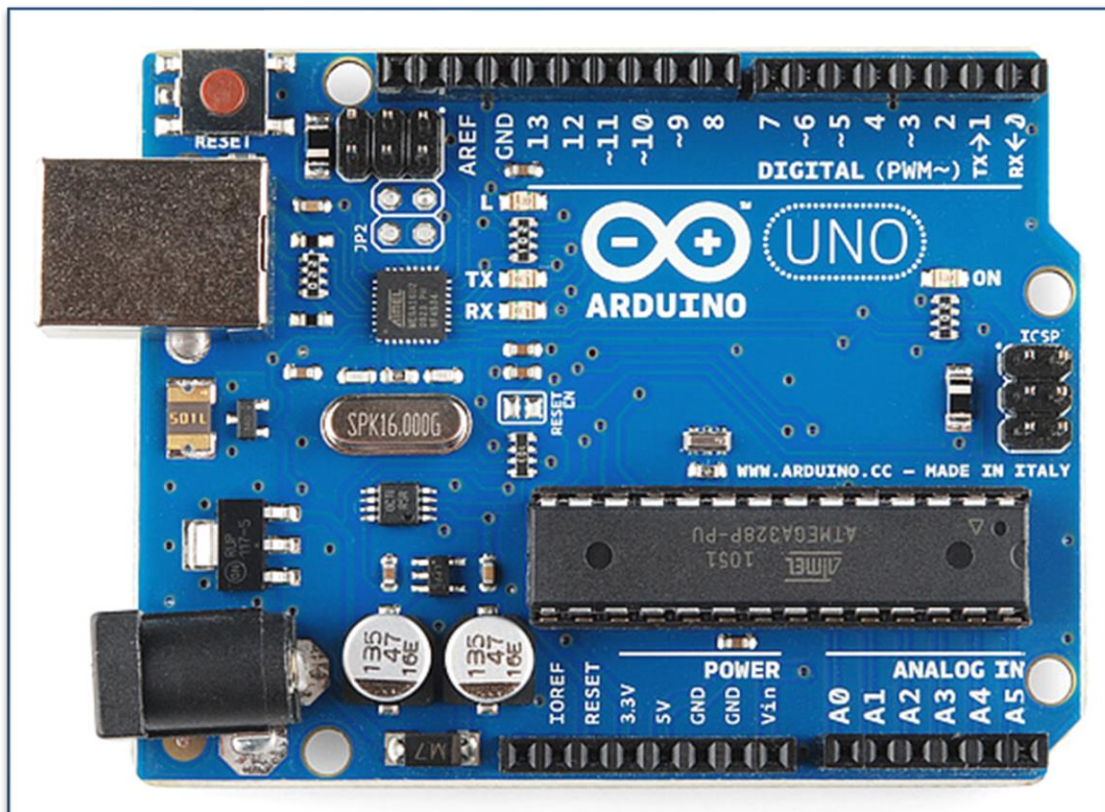
Ultrasonic Sensors

Ultrasonic sensors work by sending out a sound wave at a frequency above the range of human hearing. The transducer of the sensor acts as a microphone to receive and send the ultrasonic sound. Our ultrasonic sensors, like many others, use a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse.

1. Vcc (5 volt Supply)
2. Trigger pin
3. Echo pin
4. Ground

Gnd (0volt)

1. Vcc   2. Trigger   3. Eho   4. Ground
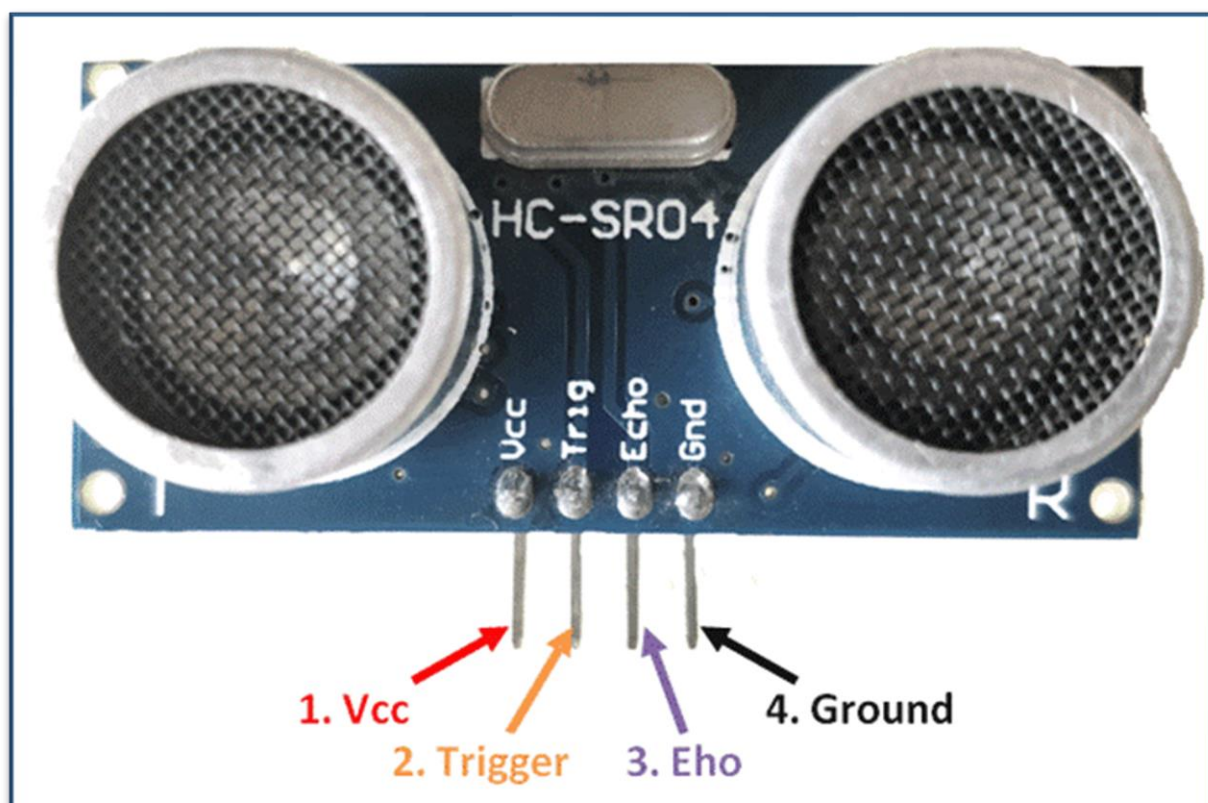
Servo Motor

     A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate an object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages. Due to these features they are being used in many applications like toy cars, RC helicopters and planes, Robotics, Machine etc.
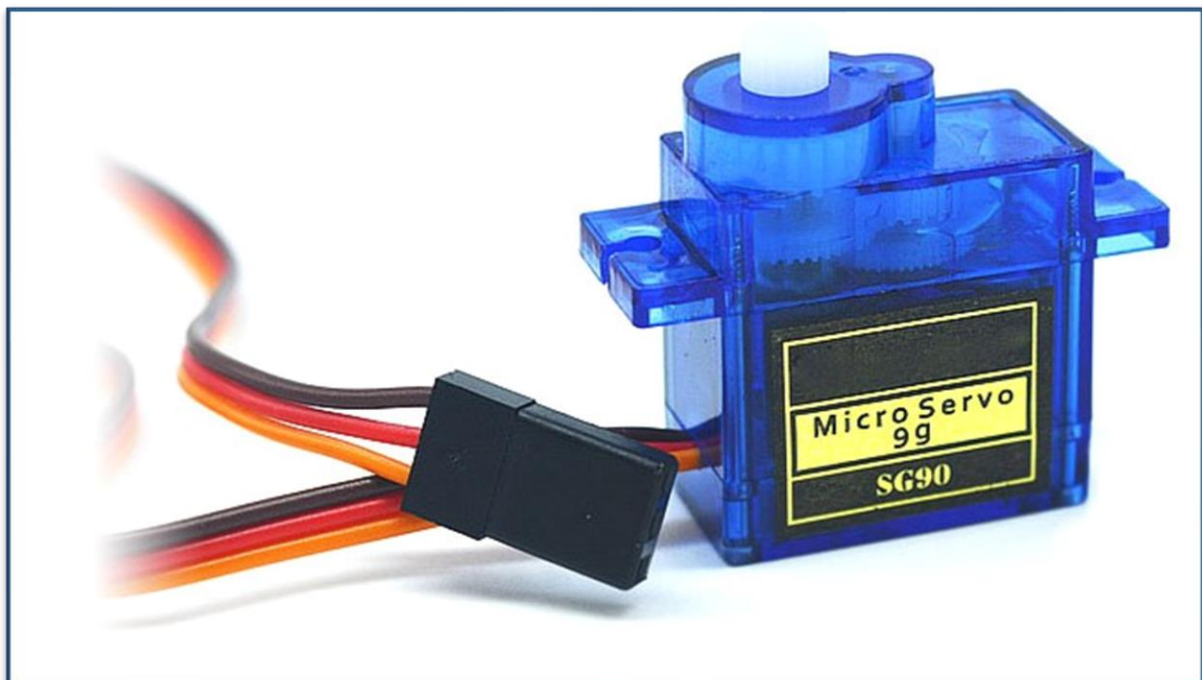
9V BATTERY

9V Hi-Watt Battery With Battery Clip. This battery is a high capacity & low cost solution for many electronic devices. It is used with its specific battery snap, connector or clip. The battery clip can be used to power LEDs or other devices with a 9V battery. rechargeable D batteries use NiMH (nickel-metal hydride) or LiPoly (lithium-polymer) chemistries and have an 8.4V voltage compared to the typical 9V of primary variants. A lower voltage may not affect your electronics' performance, but you should always check with your device's user manual to see if a battery voltage or chemistry is compatible.

DUSTBIN

JUMPER WIRES

I.   Male-Male Jumper Wires

Long jumper wires with male connectors on both ends. Use these to jumper from any female header on any board, to any other female header. Combine these with our female to female jumpers to create a male to female jumper. Multiple jumpers can be connected next to one another on a 0.1" header. Comes in one pack of 20 jumpers (colors shown). Each group of jumpers are connected to each other and can either be pulled apart in any quantity (from 1-20, of course) or kept whole based on you needs.

II.   Male/female Jumper Wires

This 20cm Male to Female Jumper Wire is a group of 10 2.54mm 1P-1P Jumper wires, that are easily detachable according to your requirement. It has 1p male pin at one end and 1p female header at other ends and is well compatible to 2.54 mm header pins. These cables are safe to use and have a protective coating over the wire with plastic plug-in point at both ends. These are mostly used in projects related to Arduino, Raspberry Pi and other PCBs and breadboards without any soldering.

RED AND ORANGE LED

A light-emitting diode is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons.


RESISTER

220 ohm 1/4 watt Resistor - Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. In electronic circuits, resistors are used to limit current flow, to adjust signal levels, bias active elements, and terminate transmission lines among other uses.

5. OBJECTIVES

The main objective of this project is to

- ➢ Design and build a prototype for an automatic open dustbin that can automatically open the lid when it detects the people who want to throw out their trash.

- ➢ It also can detect the level of the trash that inside the dustbin.

- ➢ To get familiar with the Arduino and the respective sensors how to use them for a cause.

- ➢ To analysis the dustbin program and set it up according to the physical distance for best Working.
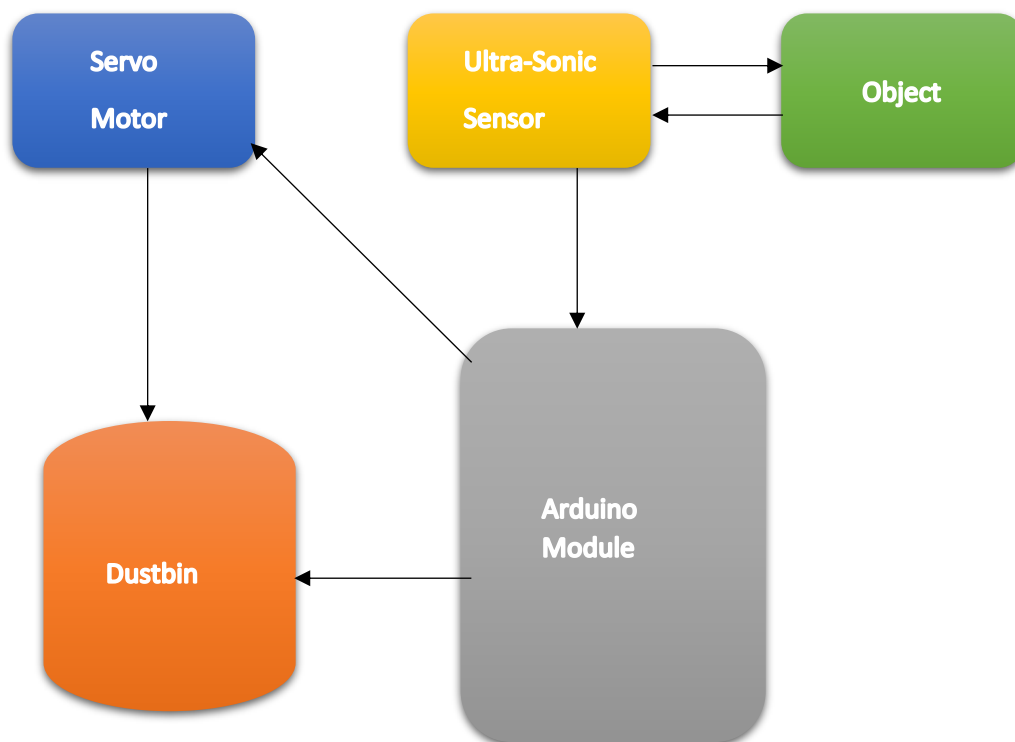
6. SMART DUSTBIN CIRCUIT DIAGRAM
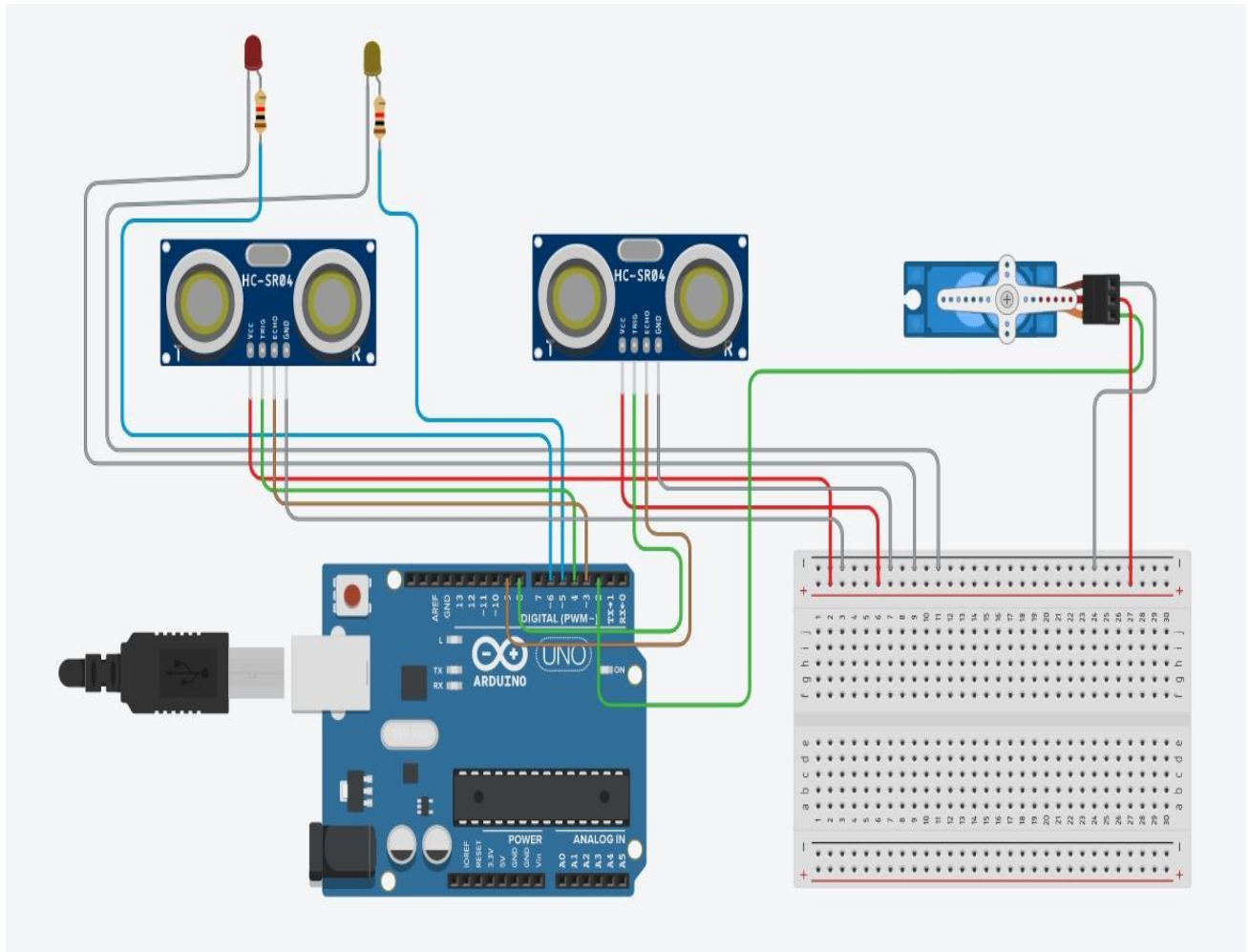
7. PROCEDURE

Now, let me show through the actual setup and build process of the waste management system using Arduino. First, I will start with the mechanism to open the lid. As you might have already guessed, I have used a Servo Motor for this purpose. In order to open the lid, I have fixed a small wire to the servo horn (a single ended horn). For this mechanism to be able to open the lid of the dustbin, it must be placed near the lid. In this the actual setup of dustbin design and build the system by using Arduino. Starting with the mechanism of opening the lid of dustbin, for this purpose Servo motor has been used. This servo motor connected to the in front of the dustbin. And also, I used the two led bulb to find the level of the garbage and it fixed in front of the dustbin and it connect to the senser. The level measurement sensor attached inside the dustbin.

Arduino Uno board consist ATmega328P microcontroller, it is important component of board. In these other components are present like a power supply, ultrasonic module, LED, resister and servo motor etc. Hence, servo motor is used to open the cap of dustbin. For this project and components used, the present level of distance between dustbin and hand is fixed to 50 cm. After connecting all components to the Arduino UNO first upload the code by connecting the USB cable to the Arduino UNO and a pc. First compile the code then upload it using Arduino IDE. When system is powered ON, Arduino keeps checking for any things that come near the sensor at give range using the ultrasonic sensor. When Ultrasonic sensor (HC-SR04) detect any object Arduino determines if it has to give command to servo motor to open the lid or not. If the threshold value is less than that of given during coding then lid will open or else it will not open. Lid will open for 10 seconds which is given in the code and then it will automatically close. And also, another senser measure the level of the garbage. Garbage and sensor distance is on range of 10 to 30 cm and it far to the sensor, the orange led is on. If the garbage and sensor distance is on below the 10cm and it is near to the sensor, the red led is on

8. CONNECTIONS

1. **Servo Motor SG-90**

Red Pin (Servo Motor) with Arduino 3.3v

Black Pin (Servo Motor) with Arduino GND (Ground)

Orange Pin (Servo Motor) with Arduino Pin 2

2. **Ultrasonic Sensor – 01 (servo motor)**

VCC (Sensor) with Arduino 5v

Trig (Sensor) with Arduino Pin 8

Echo (Sensor) with Arduino Pin 9

GND (Sensor) with Arduino GND

3. **Red LED**

Pin 01 with resister and Arduino 6

Pin 02 with Arduino GND

4. **Orange LED**

   Pin 01 with resister and Arduino 5

   Pin 02 with Arduino GND

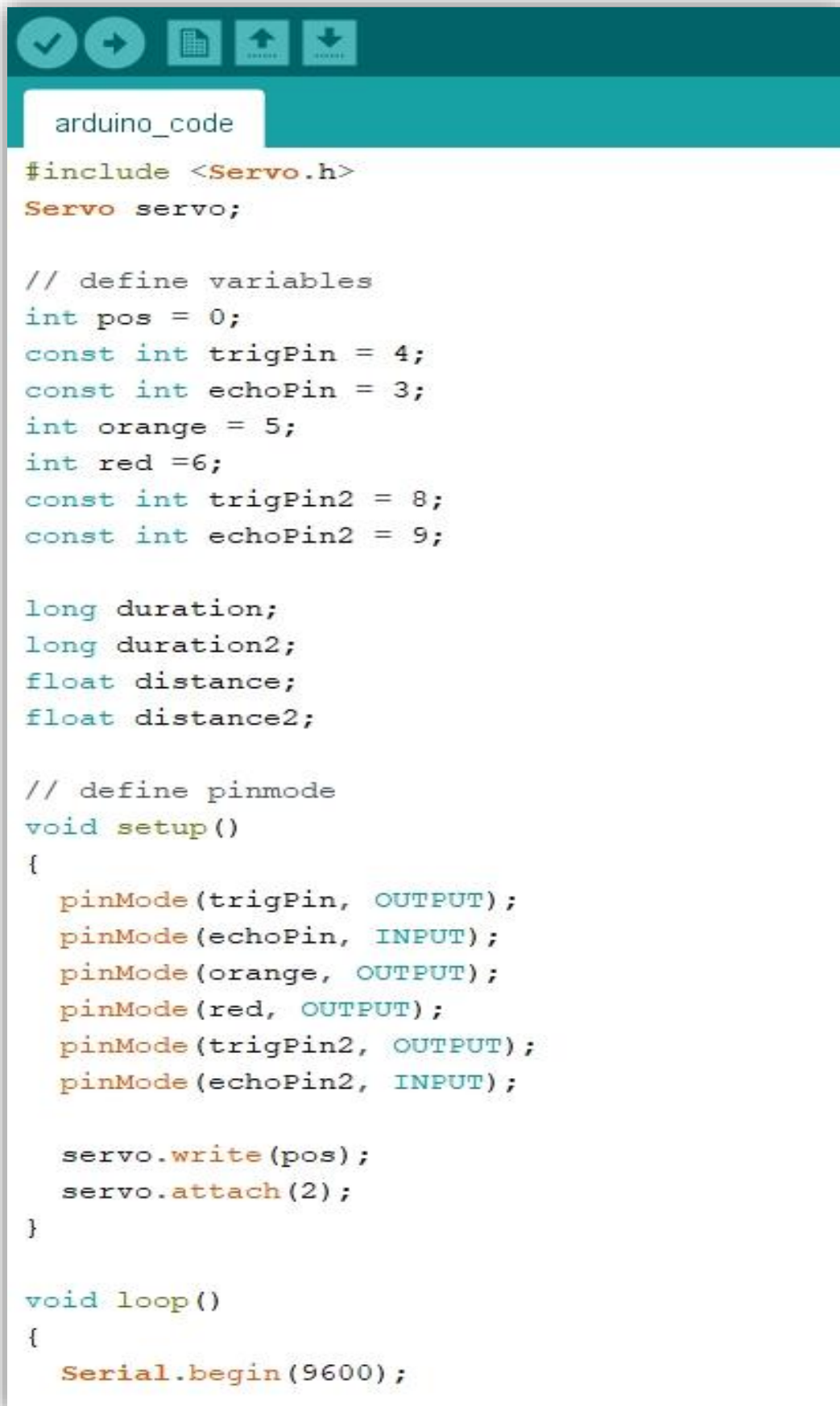
5. **Ultrasonic Sensor – 02**

   VCC (Sensor) with Arduino 5v

   Trig (Sensor) with Arduino Pin 4

   Echo (Sensor) with Arduino Pin 3

   GND (Sensor) with Arduino GND

9. WASTE MANAGEMENT SYSTEM USING ARDUINO CODE EXPLANATION


```
arduino_code
#include <Servo.h>
Servo servo;

// define variables
int pos = 0;
const int trigPin = 4;
const int echoPin = 3;
int orange = 5;
int red =6;
const int trigPin2 = 8;
const int echoPin2 = 9;

long duration;
long duration2;
float distance;
float distance2;

// define pinmode
void setup()
{
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  pinMode(orange, OUTPUT);
  pinMode(red, OUTPUT);
  pinMode(trigPin2, OUTPUT);
  pinMode(echoPin2, INPUT);

  servo.write(pos);
  servo.attach(2);
}

void loop()
{
  Serial.begin(9600);
```

```
//sensor1
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  duration = pulseIn(echoPin, HIGH);
  distance = 0.034*(duration/2);

  digitalWrite(red, LOW);
  digitalWrite(orange, LOW);

// led
  if (distance < 10){
    digitalWrite(red, HIGH);

    digitalWrite(orange, LOW);
  }
  else if ((distance <= 30) && (distance >= 10)){

    digitalWrite(red, LOW);
    digitalWrite(orange, HIGH);
    delay(500);
  }
  else {
    digitalWrite(red, LOW);
    digitalWrite(orange,LOW );
    delay(500);
  }
```

```
//sensor2
  digitalWrite(trigPin2, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin2, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin2, LOW);

  duration2 = pulseIn(echoPin2, HIGH);
  distance2 = 0.034*(duration2/2);
  Serial.println(distance2);

//servo
  if (distance2 < 50)
  {
    servo.write(pos+45);
    delay(2000);
  }
  else
  {
    servo.write(pos);
  }
  delay(60);

//output
  Serial.print ("Space left: ");
  Serial.println(distance);
  Serial.print ("Distabce from trashcan: ");
  Serial.println(distance2);

}
```

Considering Arduino code, first we install the "servo.h" to the code base. After import the install package into the file. Add code for senser01 with including define variables and pin mode. It used to measure the level of the garbage. 0.034*(duration/2) is used to measure the distance between the senser and the hand.

Add code for show the garbage level of the dustbin. So, if the distance is less than to 10, the red led is high and orange is low. If the distance between 10 and 30, the orange led is high and red led is low, else red and orange are low.

Add code for senser02 with including define variables and pin mode. It used to detect the garbage. 0.034*(duration/2) is used to measure the distance between the senser and the garbage.

Add code for servo to open the lid. And also include the variables and pin modes. If the distance less than 50 cm that sensor detected, the servo is run. And also, add code for get the output of the distance of hand and garbage seperately.

10. ADVANTAGES

Following are the advantages of using Smart dustbin:

- ➢ A reduction in the number of waste collections needed by up to 80%, resulting in less manpower, emissions, fuel use and traffic congestion.
- ➢ A reduction in the number of waste bins needed.
- ➢ Maintain environment hygiene
- ➢ It will help in bringing evolution by technology in term of cleanliness.

11. YOU TUBE VIDEO LINK

I create a You Tube Video for my Waste Management System Project.

https://youtu.be/pxNJHbqZumQ

12. SUMMARY

Waste management has been a crucial issue to be considered. This proposal is a way to achieve this good cause. In this project waste management system is built on a microcontroller-based platform Arduino Uno board which is interfaced with the Servo motor and ultrasonic sensor. Ultrasonic sensor is placed at the top of the dustbin which will measure the stature of the dustbin. In this project, I have designed a simple system called Smart Dustbin using Arduino, Ultrasonic Sensor, LED, Resister and Servo Motor, where the lid of the dustbin will automatically open itself upon detection of human hand and detect the level of the garbage.

The main objective of this project is to, design and build a prototype for an automatic open dustbin that can automatically open the lid when it detects the people who want to throw out their trash, it also can detect the level of the trash that inside the dustbin, to get familiar with the Arduino and the respective sensors how to use them for a cause, to analysis the dustbin program and set it up according to the physical distance for best Working. Connecting all components to the Arduino UNO first upload the code by connecting the USB cable to the Arduino UNO and a pc. First compile the code then upload it using Arduino IDE.

It will bring drastic changes in tern of cleanliness with the help of technology. Everything is getting with smart technology for the betterment of human being. So, this help in maintaining the environment clean with the help of technology. It is a sensor-based dustbin so it would be easy to access/use for any age group.

13. REFERENCES

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