Semester Project Report
Digital Logic Design

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Project Title

Smart Dustbin

1. Introduction

The rate of increasing population in our country has increased rapidly and also, we have an increase in garbage which have increased environmental issue. A dustbin is a container which collects garbage or stores items which recyclable or non-recyclable, decompose and non-decompose. They are usually used in homes, offices etc., but in case they are full no one is there to clean emit and the garbage is respited out. The surrounding of a dustbin is also a conductor increasing the pollution level. Air pollution due to a dustbin can produce bacteria and viruses which can produce life-threatening diseases for humans. Therefore, we have designed a smart dustbin using ARDUINO UNO, an ultrasonic sensor which will sense the item to be thrown in the dustbin and open the lid with the help of the motor. It is an IOT-based project that will bring a new and smart way of cleanliness. It is a decent gadget to make your home clean, due to practically all offspring of home consistently make it grimy and spread litter to a great extent by electronics, rappers and various other things. Since the smart dustbin is also intriguing and children make fun with it, it will help maintain cleanliness in the home. It will be applied to various types of waste. Dustbin will open its lid when someone/object is near at some range then it will wait for a given time period then it will close automatically. The lid will close when you don't want to use it and only open when required.

2. Hardware Components

Required Hardware:

1. Arduino UNO

Arduino Uno is an open-source microcontroller board based on the processor ATmega328P. It has 14 digital input/output pins, 6 analogue inputs, a USB connection, and a power jack. It contains everything needed to support the microcontroller. Just plug it into a computer with a USB cable or power it with an adapter to get started.

2. Ultrasonic Sensor HC-SR04

HC-SR04 is an ultrasonic distance sensor used for measuring the distance at which an object is located. The principle used by this sensor is called SONAR. It is perfect for small robotics projects such as obstacle-avoiding robots, distance-measuring devices etc. It has two parts, one emits the ultrasound sonar to measure the distance to an object. The other part is the receiver which listens for the echo. As soon as the ultrasound hits the object it bounces back and is detected by the receiver. The time taken for the wave to come back decides the distance of the object being measured.

3. Servo Motor

The micro servo 9G is a light, good quality and very fast servo motor. This servo is designed to work with most radio control systems. It is perfect for small robotics projects. The SG90 mini servo with accessories is perfect for remote-controlled helicopters, planes, cars, boats and trucks.

4. Power Bank / 9 Volt Battery

A 9-volt battery or power bank is basically used for the power supply to the circuit.

5. Dustbin

A dustbin is a container which is generally used for throwing rubbish.

6. Jumper Wires

Jumper wires are basically used to connect different devices/circuits on the chip.

These are used for a connection.

3. Software Components

Arduino IDE and Library which we used is **Servo.**

This library allows an Arduino board to control servo motors. Servos have integrated gears and a shaft that can be precisely controlled. Standard servos allow the shaft to be positioned at various angles, usually between 0 and 180 degrees. Continuous rotation servos allow the rotation of the shaft to be set to various speeds.

To use this library:

#include <Servo.h>

4. Code and Configuration

__Code__

Here's the code of our project

```
#include <Servo.h>   //servo library
Servo servo;
int trigPin = 5;      //This pin is used for the motion sensor to transmit the sound pulses
(input)
int echoPin = 6;     //This pin is used for the motion sensor to catch the sound pulses
when hit with the object (output)
int servoPin = 7;
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(200);        //Delay between measurements


}


dist=(aver[0]+aver[1]+aver[2])/3;


if(dist<50){


 servo.attach(servoPin);

 servo.write(0);   //Motor bar is at normal position (starting position 0 degrees)

 delay(3000);        //After 3 seconds

 servo.write(90);     //Move the motor bar to 90 degree

 }


Serial.print(dist);

}
```
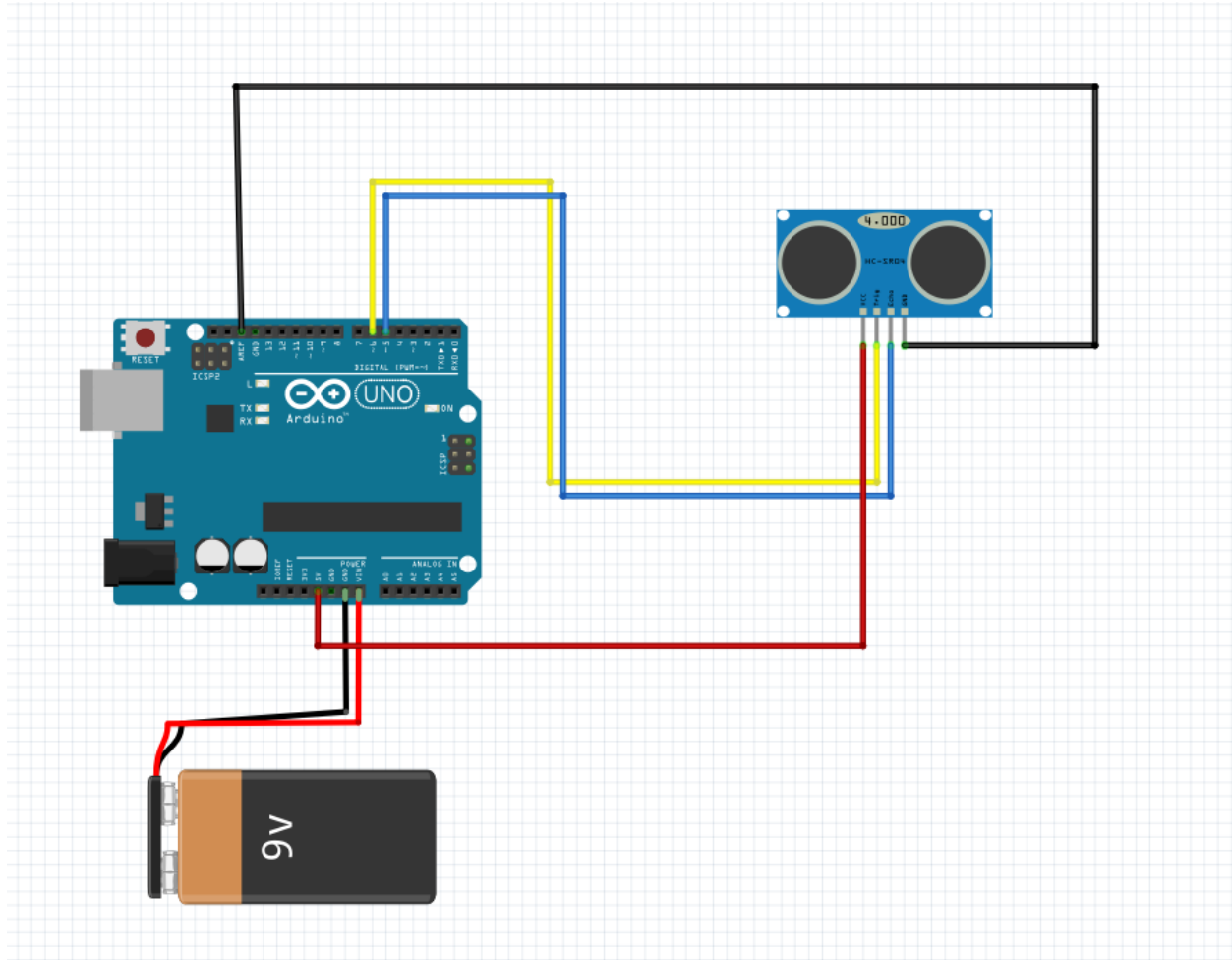
Circuit Diagram

- The circuit diagram for the smart dustbin contains three main components: Arduino **UNO**, a Power supply and an ultrasonic sensor.

- The Ultrasonic sensor HC-SR04 pins echo and trig are connected to Arduino Uno pins 6 and 5 respectively. The VCC pin is connected to 5V on Arduino **UNO** and the grounds are connected. The Servo motor pin is connected to Arduino Uno pin 7.

5. Working

- After setting up the Smart Dustbin and making all the necessary connections (by following the circuit diagram), upload the code to **Arduino** (code given above) and provide a power supply (in the form of a **power bank** of 2500 mAh) to the circuit.
- Once the system is powered ON, **Arduino** keeps monitoring for any object near the Ultrasonic Sensor.
- If the Ultrasonic Sensor detects any object like a hand **for example**, Arduino calculates its distance and if it is less than a certain predefined value (which is 50 cm), Arduino will activate the **Servo Motor** and with the support of the thread, it will list the lid open.
- After a certain time (3 seconds), the lid is automatically closed.

6. Summary

The project titled *"Smart Dustbin"* tends to minimize the risk of contamination to the cleanliness staff of schools, colleges, universities, offices, hospitals etc. from diseases. It is a simple but very useful concept, where a dustbin cap will move upwards after detecting an object (hand or garbage) and closes after some seconds. This will prevent further contamination through bugs and flies.