Industrial Applications of Microcontrollers – A Practice Based Approach

Automated Dustbin

BATCH 5

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Problem Statement

- The primary aim of this project is to develop a simple Microcontroller based system that can be worked as an Automated Dustbin.
- Opening the lid automatically when a person approaches near the dustbin.
- Similarly, closing the lid automatically when a person moves away from the dustbin.
- Designing an Arduino UNO circuit by developing a proper Arduino IDE code for the Automated dustbin.

Scope of Solution

The objectives of this project can be summarized as follows:

1. Designing and building a prototype for automatically opening the lid of the dustbin when a person is detected and closing the lid after a delay of time.
2. Connecting the sensors to detect the person and to open the lid.
3. To develop a circuit using Arduino Uno and design a code using Arduino IDE.

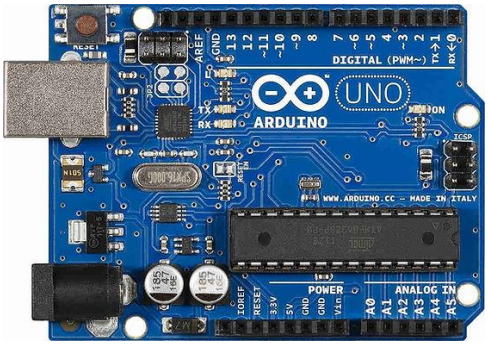
By achieving these objectives, we can be able to create an automatic dustbin that can open its lid automatically when a person is detected near its range.

Components Description

S.no	Hardware Component
1	Arduino Uno R3
2	Ultrasonic Sensor
3	Servo Motor
4	Jumper wires
5	Cardboard Lid
6	Dustbin
7	Power Supply (USB A – B cable)

S.no	Software Components
1	Arduino IDE
2	Embedded C

1. Arduino Uno R3:



Hardware pictures of Arduino Uno R3

The Arduino UNO R3 is an open-source microcontroller board based on the processor ATmega328P. It has 14 digital input/output pins, 6 analog inputs, a USB connection, a power jack, an ICSP header and a reset button. It serves as the central processing unit of the system. It is a microcontroller that is responsible for collecting data from various sensors, processing the data, and executing programmed logic. It is relatively inexpensive, and it has cross-platform compatibility which means a wide range of users can make use of it either in Windows, Linux and macOS. In this project it is used as the main controlling device which on detecting the person with the help of the ultrasonic sensor and opens the lid of the dustbin with the help of a servo motor.

2. Ultrasonic Sensor:

Ultrasonic Sensor

An Ultrasonic Sensor (HC-SR04) is an electronic device that calculates the distance of an object or a target by emitting ultrasonic sound waves and converting those waves into electrical signals. These are widely used in various applications due to their specifications, affordability, and flexibility. It has four pins namely Vcc, Trig, Echo and Gnd. Vcc is nothing but the power supply connected to the 5V pin in the Arduino UNO board, Trig pin is connected to the 5^{th} position, Echo pin is connected with the 6^{th} position of the Digital pins and

Gnd is connected to the ground of the Arduino board, In this project, the ultrasonic sensor detects the person when he/she approaches less than the range mentioned in the code.

3. Servo Motor:

SG90 Servo Motor

A Servo Motor is an electric motor that provides precise control of angular or linear position, speed, and torque using a feedback loop system. It consists of a suitable motor coupled to a sensor for position feedback and a controller that regulates the motor's movement according to a desired setpoint. It has three wires orange is for the control signal, red is for the Vcc and brown is for the ground. When the ultrasonic sensor detects the person then the servo motor runs and make the lid to open and closes after a certain delay automatically.

4. Jumper Wire:

Hardware pictures of Jumper wire

Jumper wires are electrical wires with connector pins at each end, used to connect two points in a circuit without soldering. They are commonly used with breadboards and other prototyping tools to facilitate easy circuit modifications. They are used to connect the sensors to the Arduino board.

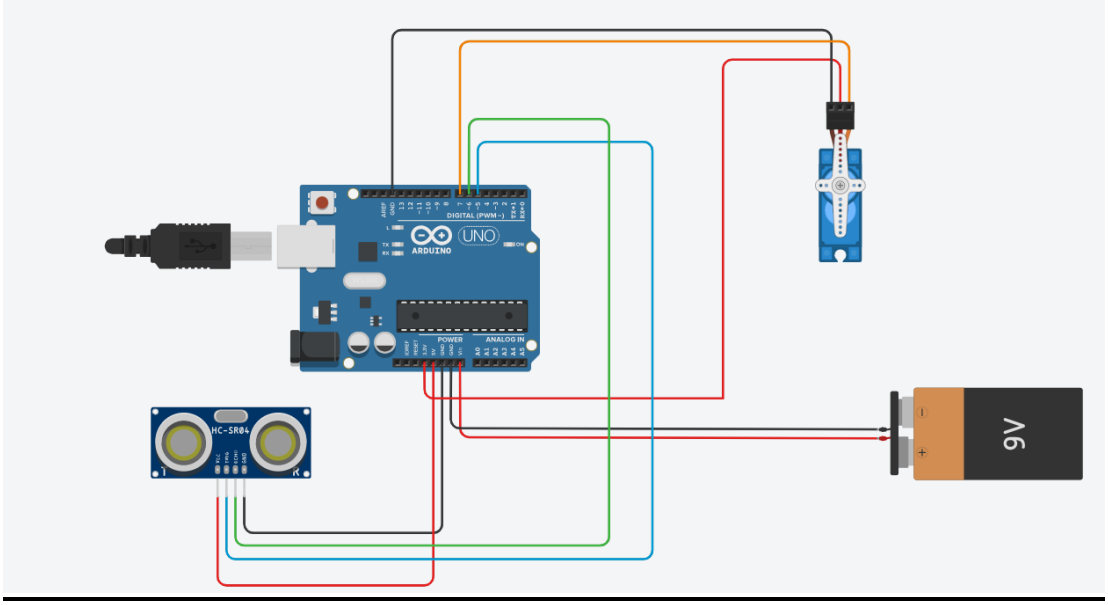
5. Power Supply (USB A-B cable):

Hardware pictures of USB A – B cable

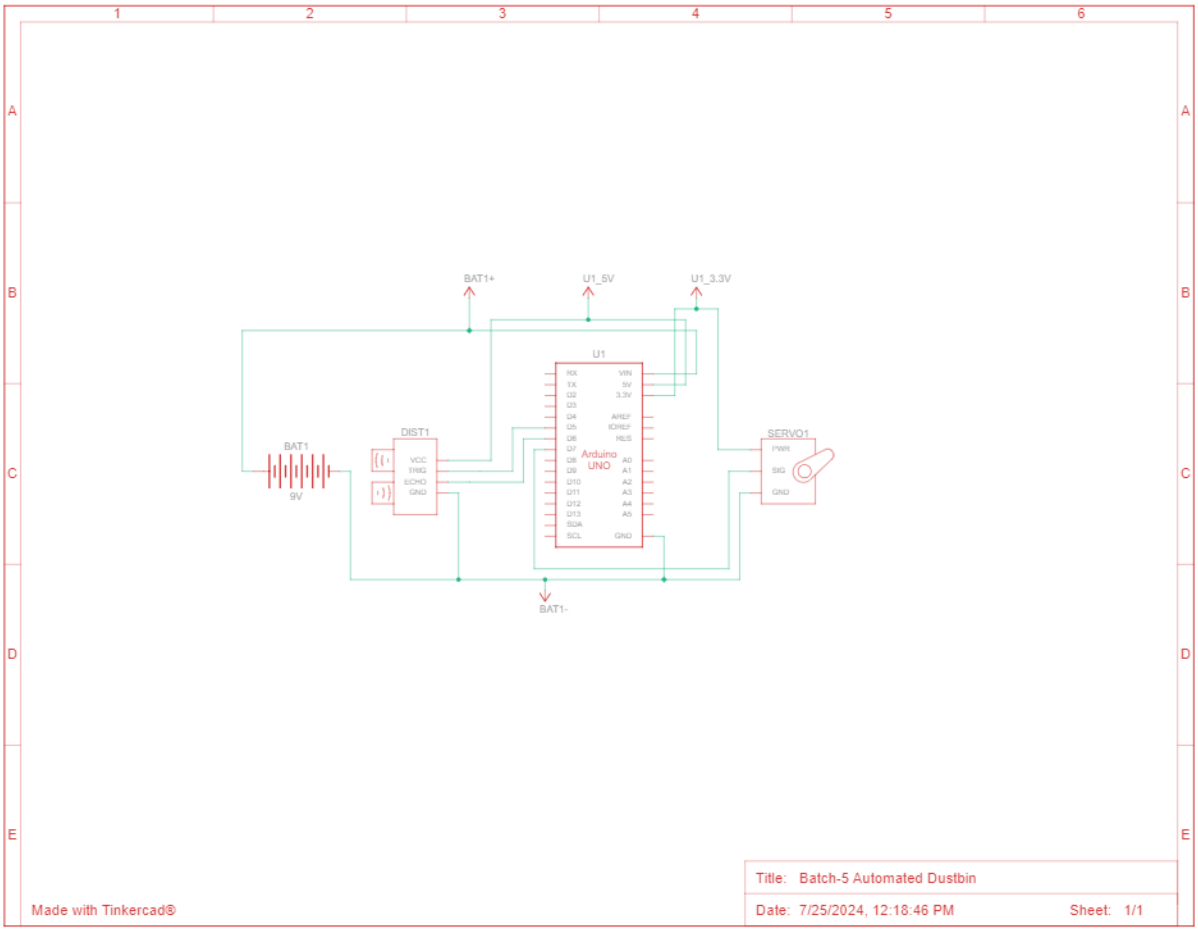
The USB A – B cable is used to provide serial communication between the Arduino uno board, with the help of this cable the embedded C code is uploaded to the Arduino uno board from the Arduino IDE software. It is also used as a power supply to power the Arduino uno microcontroller.

Simulated Circuit / Circuit Diagram

Circuit Diagram:



Schematic View:



Circuit Connections:

1. Ultrasonic sensor:

   i) Vcc – 5V power supply pin of Arduino
   ii) Trig – 5th pin of Arduino
   iii) Echo – 6th Digital Pin of Arduino
   iv) GND – ground to the Arduino Board

2. Servo Motor:

   i) Servo Pin - 7th Digital Pin of Arduino
   ii) Power – 3.3V of the Arduino
   iii) GND – Gnd to the Arduino

Video Of Demo

The video of the demo for this project has been shared in the google drive link given below:

GOOGLE DRIVE LINK:

https://drive.google.com/file/d/1Om_hVwbmqFtTUmAZQbDAdQSu7eboIRo0/view?usp=sharing

Gerber File

A Gerber file is not applicable in this project.

Code for the Solution

```
#include <Servo.h>  //servo library
Servo servo;
int trigPin = 5;
int echoPin = 6;
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(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);
}
```

References

Tinkercad Simulation link:

https://www.tinkercad.com/things/cqqJyP6wN8Z-batch-5-automated-dustbin?sharecode=vG_Ou5v_rlsrGCAkpXdLqG0JhPZrzhGuIR8boRbG9Ks

Google drive link (project presentation):

https://drive.google.com/file/d/1Om_hVwbmqFtTUmAZQbDAdQSu7eboIRo0/view?usp=sharing

Video Link for TinkerCad Simulation:

https://drive.google.com/file/d/17lY-fE0hxKQlk4NYjay18sjsk2bLFcEX/view?usp=sharing

https://screenrec.com/share/DZsMFpt5oS