Lab Exercise 2

IT4030 –Internet of Things (IoT) 2024

Lab 2: Controlling the servo motor by using the ultrasonic sensor

Objectives:

- Studying about the ultrasonic sensor and servo motor
- Creating a circuit in Tinkercad to control the servo motor by using the ultrasonic sensor

Background:

An **ultrasonic sensor** is an electronic device that measures the distance to a target object from it by emitting ultrasonic sound waves and then it converts the reflected sound into an electrical signal. **HC-SR04** is a type of an ultrasonic sensor that can measure a distance ranging from 2cm up to 400cm with a ranging accuracy that can reach up to 3mm. There are four pins in this sensor: VCC, Trig (signal output pin), Echo (signal input pin) and GND. The HC-SR04 ultrasonic sensor is shown in Figure 1.

Figure 1: HC-SR04 Ultrasonic sensor

A **servo motor** is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. An object can be rotated to a specific angle by using a servo motor. A servo motor is depicted in Figure 2.

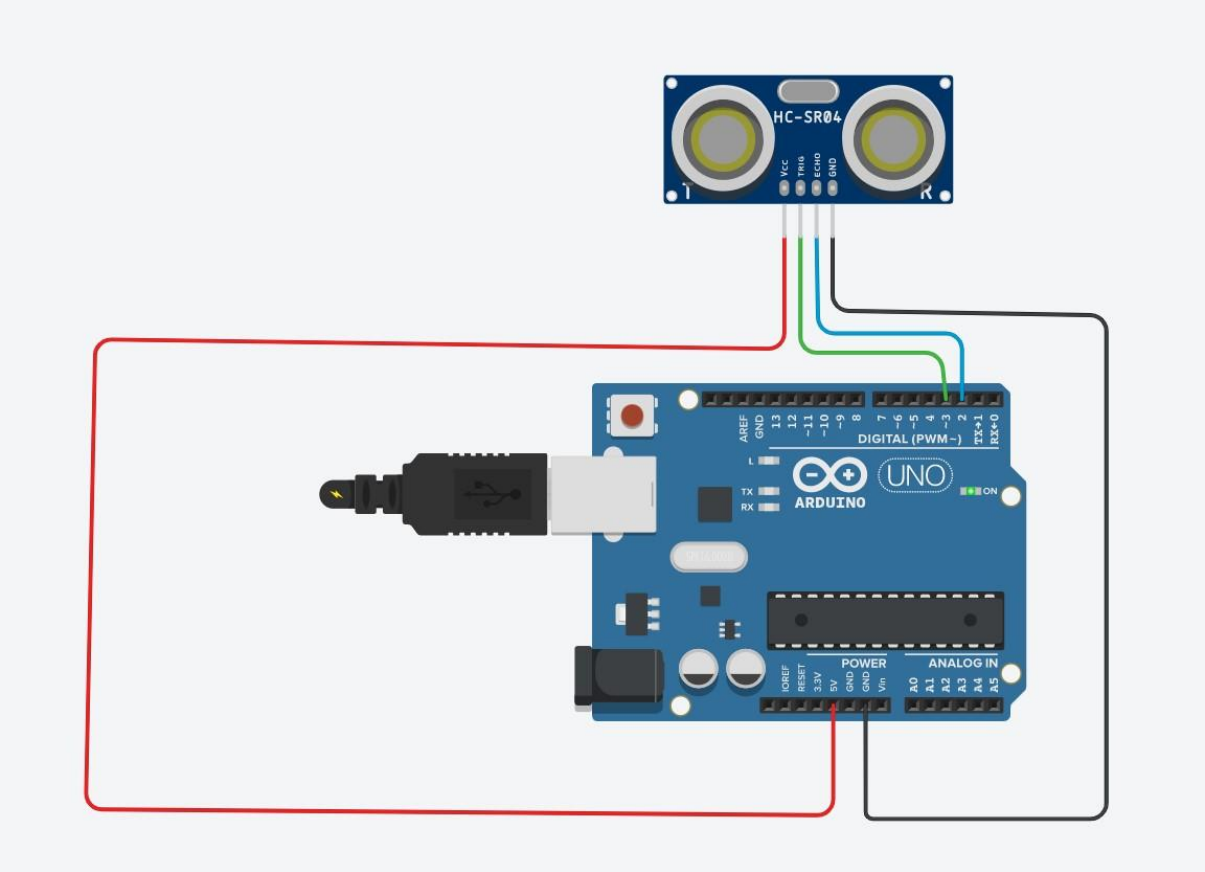
Figure 2 : Servo motor

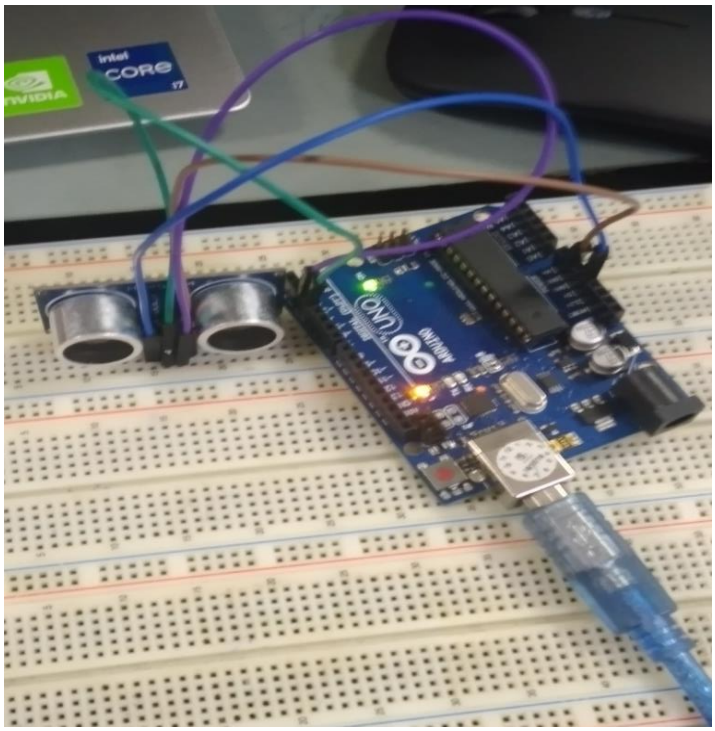
Procedure:

1. Using Tinkercad, create the circuits and use the codes given in each part of the labsheet.

Part 1 : Connecting an ultrasonic sensor to the Arduino

Circuit



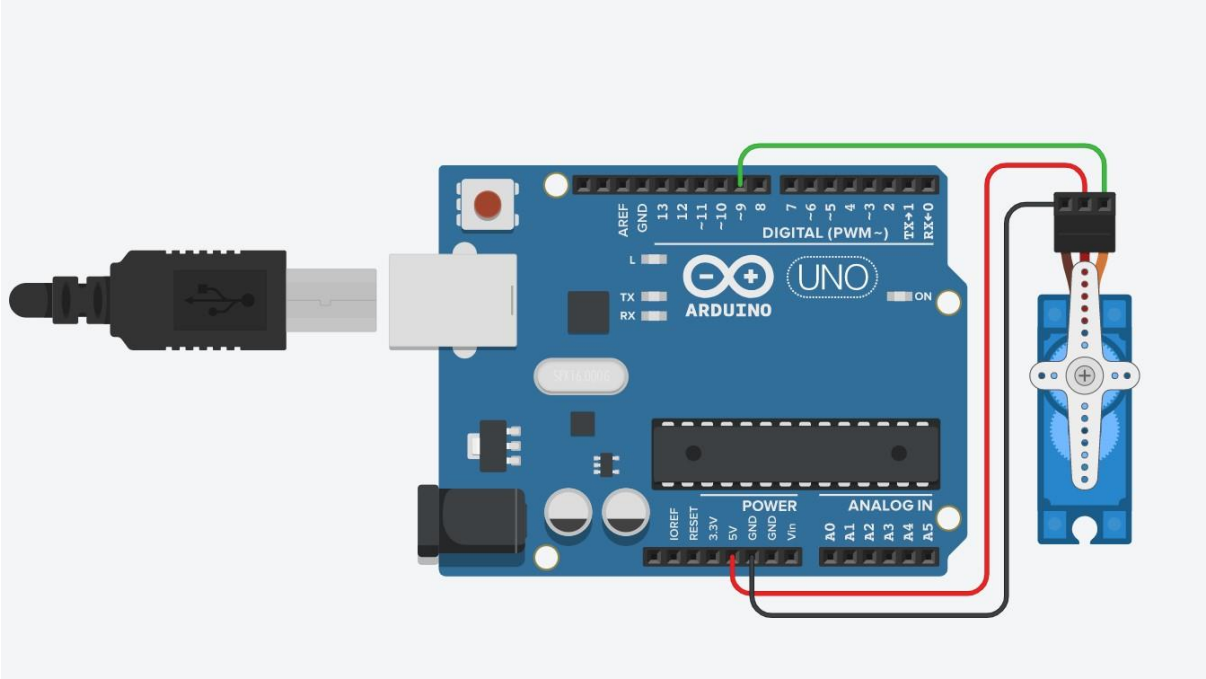


Code

```
int trigger_pin = 3;
int echo_pin = 2;
int time;
int distance;

void setup ( ) {
 Serial.begin (9600);
pinMode (trigger_pin, OUTPUT);
pinMode (echo_pin, INPUT);
}

void loop ( ) {
digitalWrite (trigger_pin, HIGH);
delayMicroseconds (10);
digitalWrite (trigger_pin, LOW);
time = pulseIn (echo_pin, HIGH);
distance = (time * 0.034) / 2;
   Serial.print (" Distance= ");
   Serial.println (distance);
}
```

Part 2 : Connecting a servo motor to the Arduino

Circuit



Video

20240824_131604.mp4

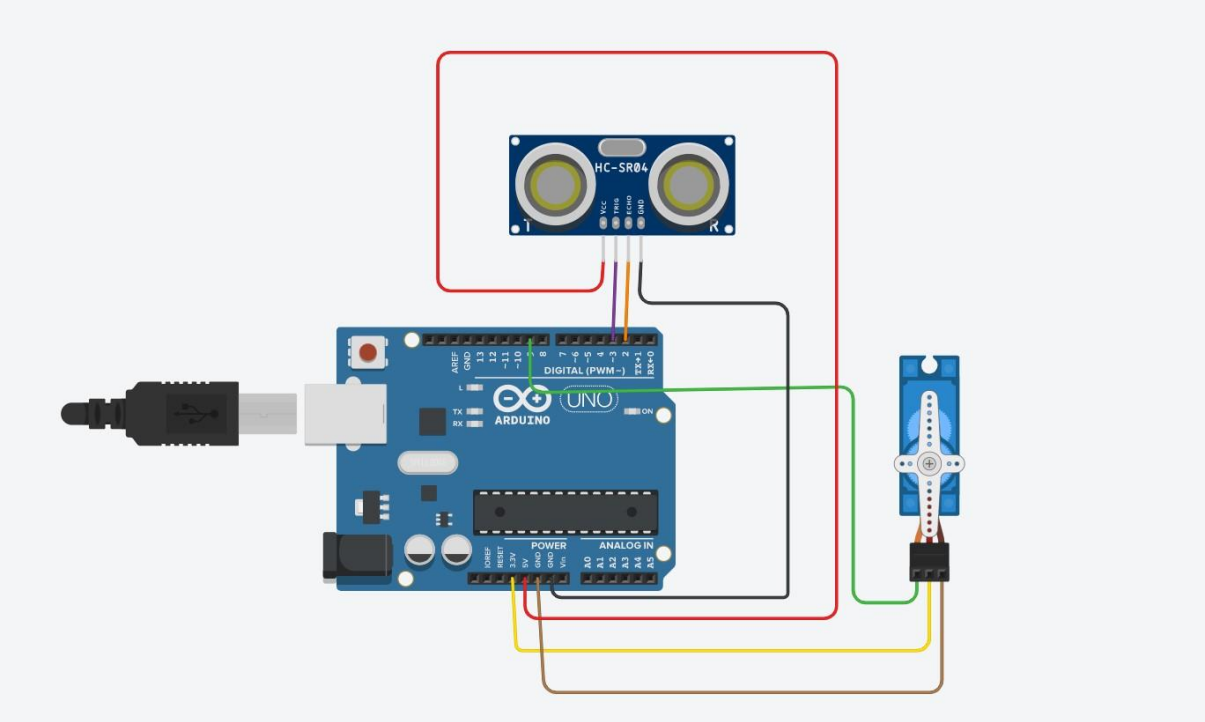
Code

```
#include <Servo.h>

int pos = 0;

Servo servo_9;


void setup()

{

  servo_9.attach(9, 500, 2500);
```

```
}

void loop()
{
 for (pos = 0; pos <= 180; pos += 1) {
servo_9.write(pos);
delay(15); // Wait for 15 millisecond(s)
  }
for (pos = 180; pos >= 0; pos -= 1) {
servo_9.write(pos);
delay(15); // Wait for 15 millisecond(s)
  }
}
```

Part 3 : Controlling the servo motor by using the ultrasonic sensor

Circuit



Video

20240824_153654.mp4

Code

```
#include <Servo.h>

int trigger_pin = 3;

int echo_pin = 2;

int time;

int distance;

Servo servo_9;

int pos;
```

```
void setup ( ) {
Serial.begin (9600);
pinMode (trigger_pin, OUTPUT);
pinMode (echo_pin, INPUT);
servo_9.attach(9);
}
void loop ( ) {
digitalWrite (trigger_pin, HIGH);
delayMicroseconds (10);
digitalWrite (trigger_pin, LOW);
time = pulseIn (echo_pin, HIGH);
distance = (time * 0.034) / 2;

 if (distance <= 100)
{
 Serial.println (" Door Open ");
 Serial.print (" Distance= ");
Serial.println (distance);
delay (500);
servo_9.write(180);
delay(15);
  }
else  {
Serial.println (" Door closed ");
Serial.print (" Distance= ");
Serial.println (distance);
delay (100);
   }
}
```