

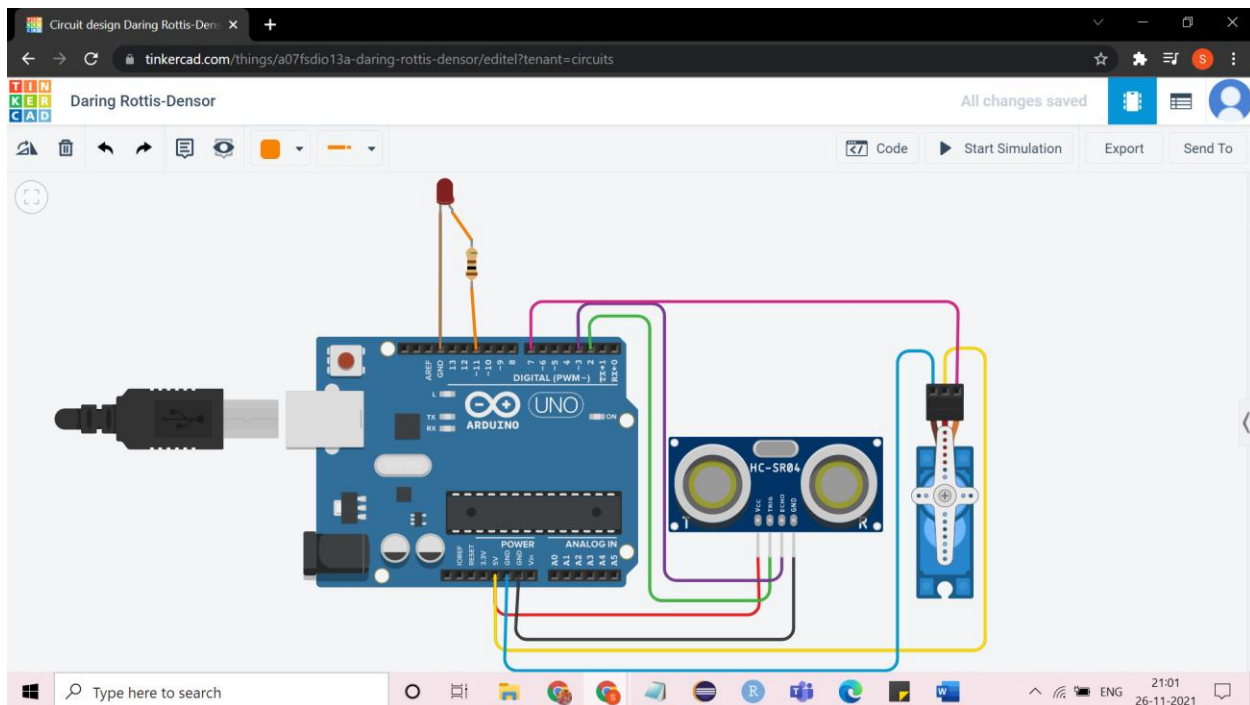
## Assignment 2

*Q. Develop an "Automatic garage door opening system". Use an Ultrasonic sensor to detect if there is a vehicle in front of the garage. if any vehicle is detected open the garage door (rotate the servo motor) for some time and close it. Understand the Working of Ultrasonic Sensor.*

### How the HC-SR04 Ultrasonic Sensor Works

It emits an ultrasound at 40,000 Hz which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance. The HC-SR04 Ultrasonic Module has 4 pins, Ground, VCC, Trig and Echo. The Ground and the VCC pins of the module needs to be connected to the Ground and the 5 volts pins on the Arduino Board respectively and the trig and echo pins to any Digital I/O pin on the Arduino Board.

### Arduino Board with HC-SR04 Ultrasonic Sensor, Micro Servo & LED



## Arduino and HC-SR04 Ultrasonic Sensor with Micro Servo Motor & LED Code

Circuit design Daring Rottis-Den

tinkercad.com/things/a07fsdio13a-daring-rottis-densor/edit?tenant=circuits

All changes saved

Code Start Simulation Export Send To

Text 1 (Arduino Uno R3)

```
1 #include<Servo.h>
2 Servo servol;
3
4 void setup(){
5   servol.attach(7);
6
7   pinMode(2,OUTPUT);
8   pinMode(3, INPUT);
9
10  pinMode(11, OUTPUT);
11  Serial.begin(9600);
12 }
13
14 void loop(){
15
16   digitalWrite(2, LOW);
17
18   digitalWrite(2, HIGH);
19   delayMicroseconds(10);
20   digitalWrite(2, LOW);
21
22   float dur = pulseIn(3, HIGH);
23
24   float dis = (dur*0.0343)/2;
```

Serial Monitor

Type here to search

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Circuit design Daring Rottis-Den

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All changes saved

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Text 1 (Arduino Uno R3)

```
21 delayMicroseconds(10);
22 digitalWrite(2, LOW);
23
24 float dur = pulseIn(3, HIGH);
25
26 float dis = (dur*0.0343)/2;
27
28 Serial.print("Distance in cm: ");
29 Serial.println(dis);
30
31 if(dis<=100)
32 {
33   servol.write(90);
34   delay(100);
35
36   digitalWrite(11, HIGH);
37   delay(1000);
38   digitalWrite(11, LOW);
39   delay(1000);
40 }
41 else
42 {
43   delay(100);
44   servol.write(0);
45 }
46 }
47 }
```

Serial Monitor

Type here to search

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## Code

```
#include<Servo.h> //for servo motor

Servo servo1;

void setup(){

    servo1.attach(7); //signal pin of servo motor connected

    pinMode(2,OUTPUT); //sets TRIG pin as output
    pinMode(3, INPUT); //sets ECHO pin as input

    pinMode(11, OUTPUT); //for LED

    Serial.begin(9600); //start the serial communication for showing the results on the serial monitor
}

void loop(){

    digitalWrite(2, LOW); // Clears the TRIG pin

    digitalWrite(2, HIGH); //Sets the TRIG pin on HIGH state for 10 micro seconds
    delayMicroseconds(10);
    digitalWrite(2, LOW);

    float dur = pulseIn(3, HIGH); //Reads the ECHO pin, returns the sound wave travel time in microseconds

    float dis = (dur*0.0343)/2; //Calculating the distance
```

```
Serial.print("Distance in cm: "); //Prints the distance on the Serial Monitor
```

```
Serial.println(dis);
```

```
if(dis<=100) //if object(car) is detected within the given distance
```

```
{
```

```
    servo1.write(90); //open the garage by rotating the servo motor
```

```
    delay(100);
```

```
    digitalWrite(11, HIGH); //also blink LED to indicate the garage door is open
```

```
        delay(1000);
```

```
        digitalWrite(11, LOW);
```

```
        delay(1000);
```

```
}
```

```
//if object is not detected within the specified distance, close the garage door by rotating the servo motor and the LED stops blinking
```

```
else
```

```
{
```

```
    delay(100);
```

```
    servo1.write(0);
```

```
}
```

```
}
```

## Output

***At distance 90.1 cm - Garage door open(servo motor rotated) with blinking LED***

The screenshot shows the Tinkercad simulation environment. The circuit includes an Arduino Uno R3, an Ultrasonic Distance Sensor (HC-SR04), a servo motor, and a red LED. The sensor is labeled "Name 1" and shows a distance of 35.5in / 90.1cm. The code in the right panel is as follows:

```
19  
20 digitalWrite(2, HIGH);  
21 delayMicroseconds(10);  
22 digitalWrite(2, LOW);  
23  
24 float dur = pulseIn(3, HIGH);  
25  
26 float dis = (dur*0.0343)/2;  
27  
28 Serial.print("Distance in cm: ");  
29 Serial.println(dis);
```

The Serial Monitor shows the following output:

```
Distance in cm: 132.38  
Distance in cm: 140.01  
Distance in cm: 127.48  
Distance in cm: 118.99  
Distance in cm: 113.89  
Distance in cm: 110.48  
Distance in cm: 104.39  
Distance in cm: 105.80  
Distance in cm: 105.95  
Distance in cm: 101.34  
Distance in cm: 97.86  
Distance in cm: 88.39  
Distance in cm: 89.80  
Distance in cm: 89.81  
Distance in cm: 89.09
```

***At distance 278.2cm - Garage door closed(servo motor rotated) with LED off***

The screenshot shows the Tinkercad simulation environment. The circuit is the same as the previous one, but the servo motor is now closed. The sensor shows a distance of 109.5in / 278.2cm. The code in the right panel is the same as the previous one:

```
19  
20 digitalWrite(2, HIGH);  
21 delayMicroseconds(10);  
22 digitalWrite(2, LOW);  
23  
24 float dur = pulseIn(3, HIGH);  
25  
26 float dis = (dur*0.0343)/2;  
27  
28 Serial.print("Distance in cm: ");  
29 Serial.println(dis);
```

The Serial Monitor shows the following output:

```
Distance in cm: 272.03  
Distance in cm: 275.62  
Distance in cm: 277.08  
Distance in cm: 277.08  
Distance in cm: 275.65  
Distance in cm: 275.62  
Distance in cm: 275.62  
Distance in cm: 275.65  
Distance in cm: 275.62  
Distance in cm: 275.62  
Distance in cm: 275.65  
Distance in cm: 275.62  
Distance in cm: 277.08  
Distance in cm: 275.62  
Distance in cm: 275.62
```

Applications Involving Ultrasonic Detection is Ultrasonic Distance Measuring where distance measurement is based on the measurement of time-of-flight. The time between sending and receiving the reflected sound signal is calculated by the sensor. Distance measurement would be applied in a **garage parking application**, sensing when a vehicle is in front of the garage and if detected the garage door is opened and closed accordingly with the help of rotating a micro servo motor. A blinking LED also indicates that the garage door is open.