A.3.1 Learning activity

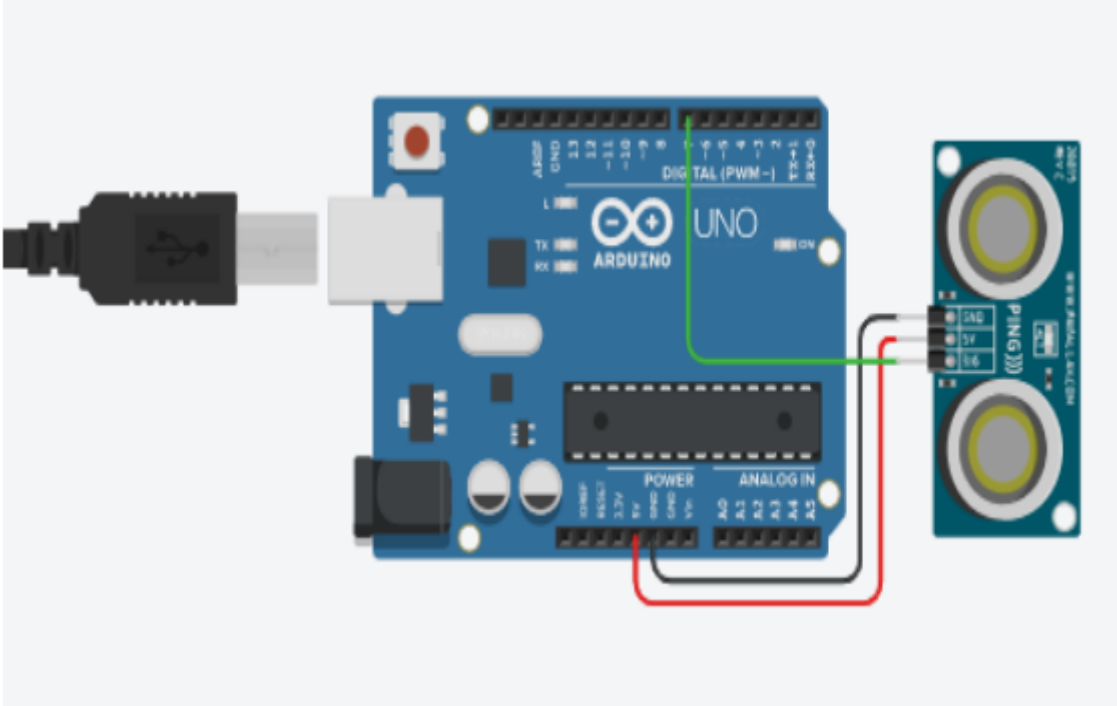
Object detection sensor circuit, using an Arduino, an ultrasonic sensor and a 16x2 LCD I2C Display.

Development

1. Use the following list of materials for the development of the activity

Quantity	Description
1	Ultrasonico sensor HC-SR04
1	Display LCD of 16x2
1	Power supply of 5v
1	1 Potenciometer 10k
1	Arduino UNO

2. Based in the show image, assembly inside the simulator, the electronic circuit indicated in the **Figure 1**.



3. Make the program that allows through one of the inputs of the Arduino, receive the value registered by the **Ultrasonic Sensor** when approaching an object at different distances.

```
const int Trigger = 12;   //Pin digital 2 para el Trigger del sensor
const int Echo = 13;   //Pin digital 3 para el echo del sensor
```

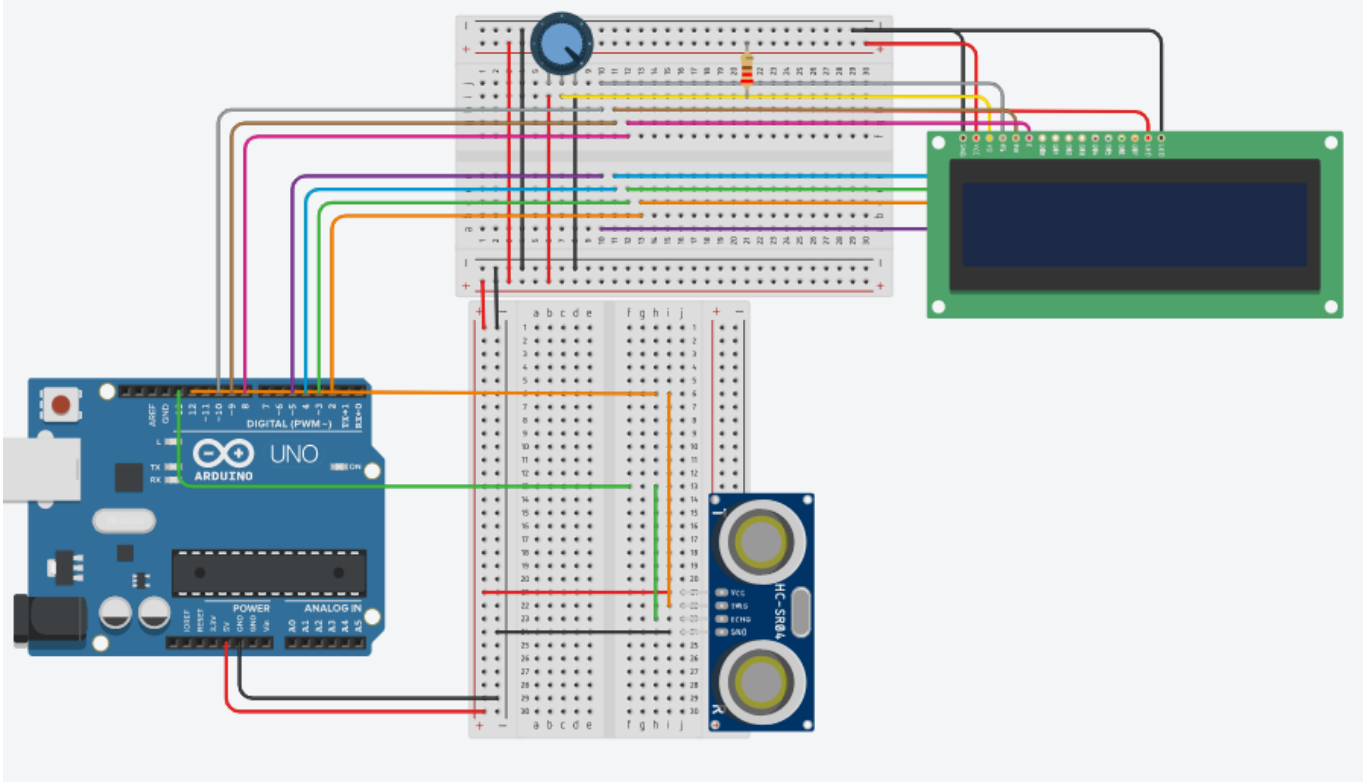
```
void setup() {
    Serial.begin(9600);//iniciailzamos la comunicación
    pinMode(Trigger, OUTPUT); //pin como salida
    pinMode(Echo, INPUT);  //pin como entrada
    digitalWrite(Trigger, LOW);//Inicializamos el pin con 0
}

void loop() {

   long t; //timepo que demora en llegar el eco
   long d; //distancia en centimetros

    digitalWrite(Trigger, HIGH);
    delayMicroseconds(10);          //Enviamos un pulso de 10us
    digitalWrite(Trigger, LOW);

    t = pulseIn(Echo, HIGH); //obtenemos el ancho del pulso
    d = (t * 0.034)/2;             //escalamos el tiempo a una distancia en cm
    //d = t/58;

    Serial.print("Distancia: ");
    Serial.print(d);
    serial.println("cm");
    delay(100);          //Hacemos una pausa de 100ms
}
```

---

4. Considering that the ultrasonic sensor has a minimum and maximum detection range based on the return time of the sonic signal, what values are obtained in the simulation under the **following conditions:**

Number	Condition 1	Condition 2	The object is detected?
1	5 cm of distance to the sensor	0 degrees to the perpendicular axis of the sensor	Yes
2	50 cm of distance to the sensor	35 degrees to the perpendicular axis of the sensor	Yes
3	100 cm of distance to the sensor	-35 degrees to the perpendicular axis of the sensor	Yes
4	5 cm of distance to the sensor	90 degrees to the perpendicular axis of the sensor	No
5	50 cm of distance to the sensor	-60 degrees to the perpendicular axis of the sensor	No
6	350 cm of distance to the sensor	0 degrees to the perpendicular axis of the sensor	No

5. Once completed the previous points, add to the figure 1, **a Display I2C 16x2 LCD**, and place the image of the completed circuit up to this section.



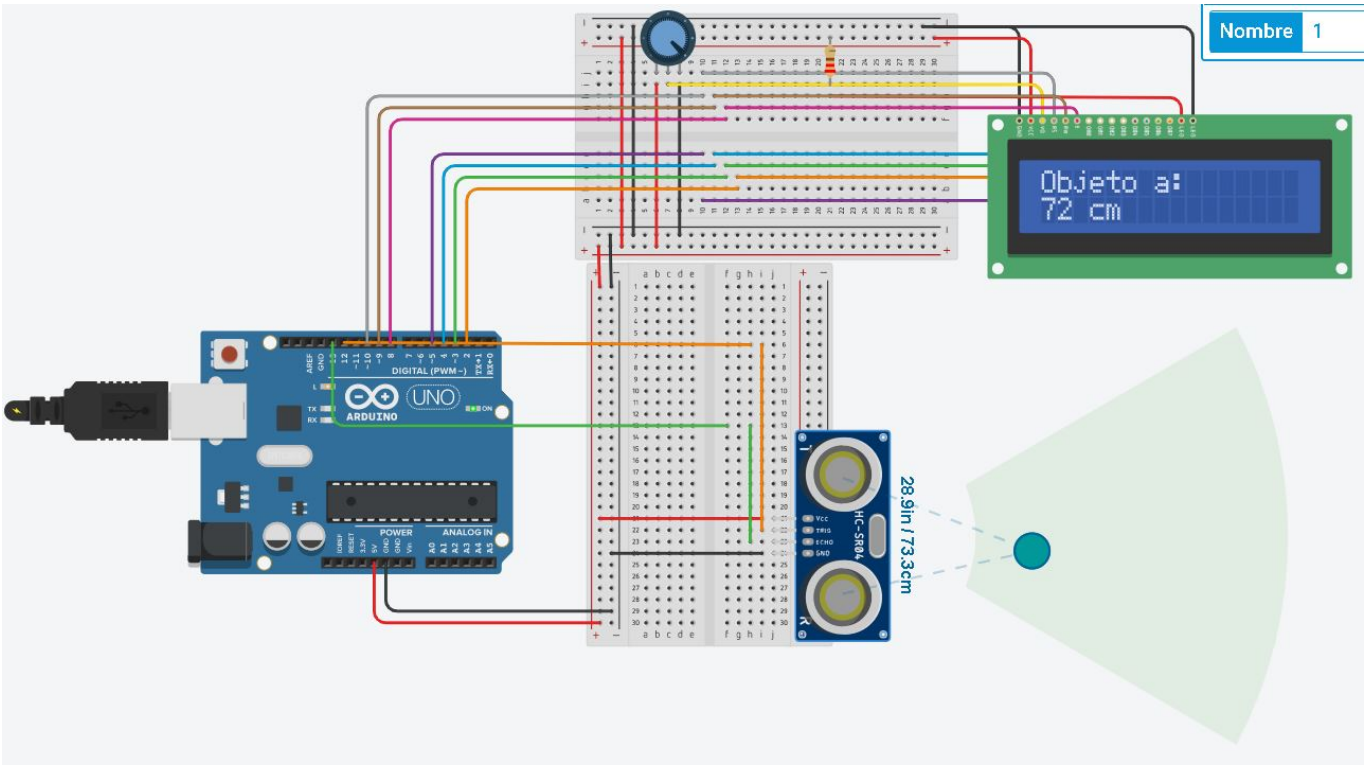
6. Having completed the integration of the I2C Display, set the program that allows the display to show the following message, **"Objective detected at ? cm** , and in case of not achieving detection, indicate the message **"Target out of range"**

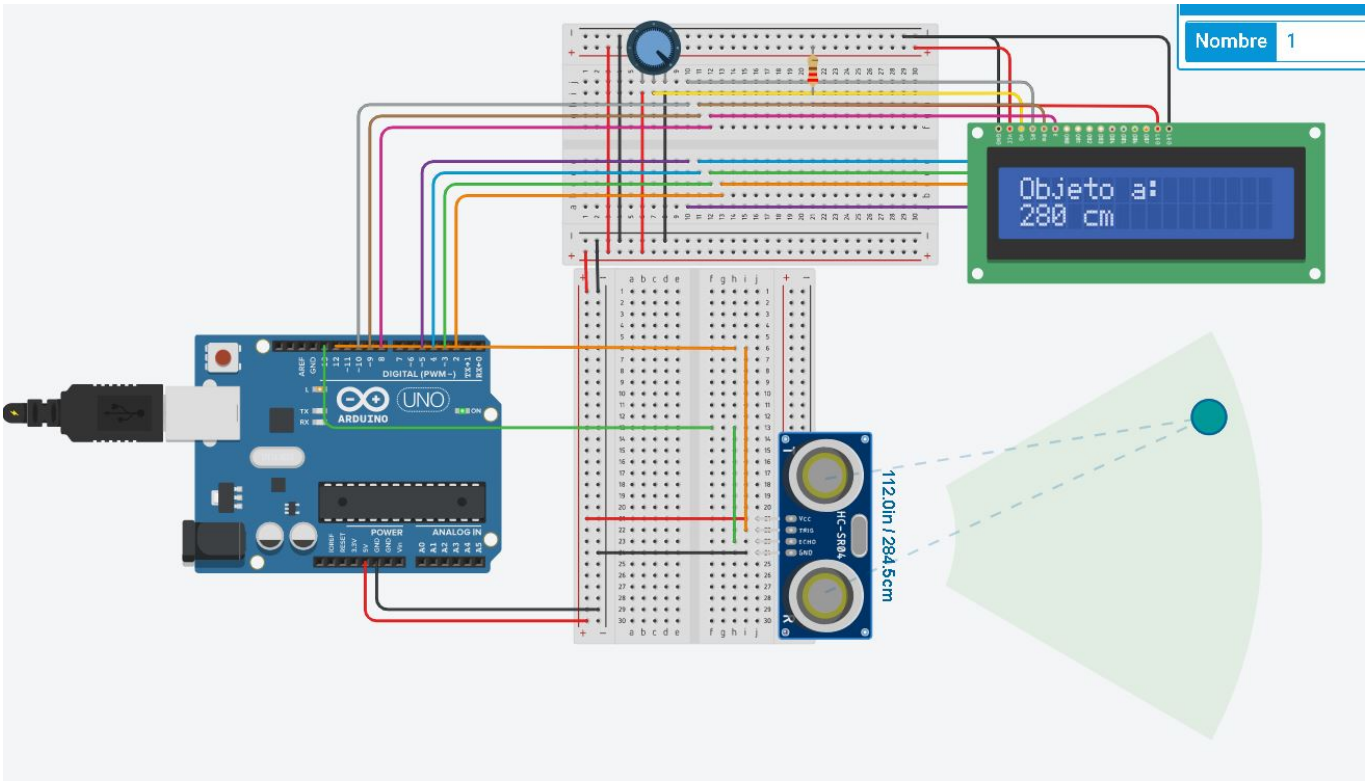
```
#include <LiquidCrystal.h>
LiquidCrystal lcd(10, 9, 8, 5, 4, 3, 2);
const int Trigger = 12;   //Pin digital 2 para el Trigger del sensor
const int Echo = 13;   //Pin digital 3 para el echo del sensor

void setup() {
    pinMode(Trigger, OUTPUT); //pin como salida
    pinMode(Echo, INPUT);  //pin como entrada
    digitalWrite(Trigger, LOW);//Inicializamos el pin con 0

    lcd.begin(16, 2);            // Inicia el LCD 16x02 (columnas, filas)
}


void loop(){

  long t; //timepo que demora en llegar el eco
  long d; //distancia en centimetros

  digitalWrite(Trigger, HIGH);
  delayMicroseconds(10);          //Enviamos un pulso de 10us
```

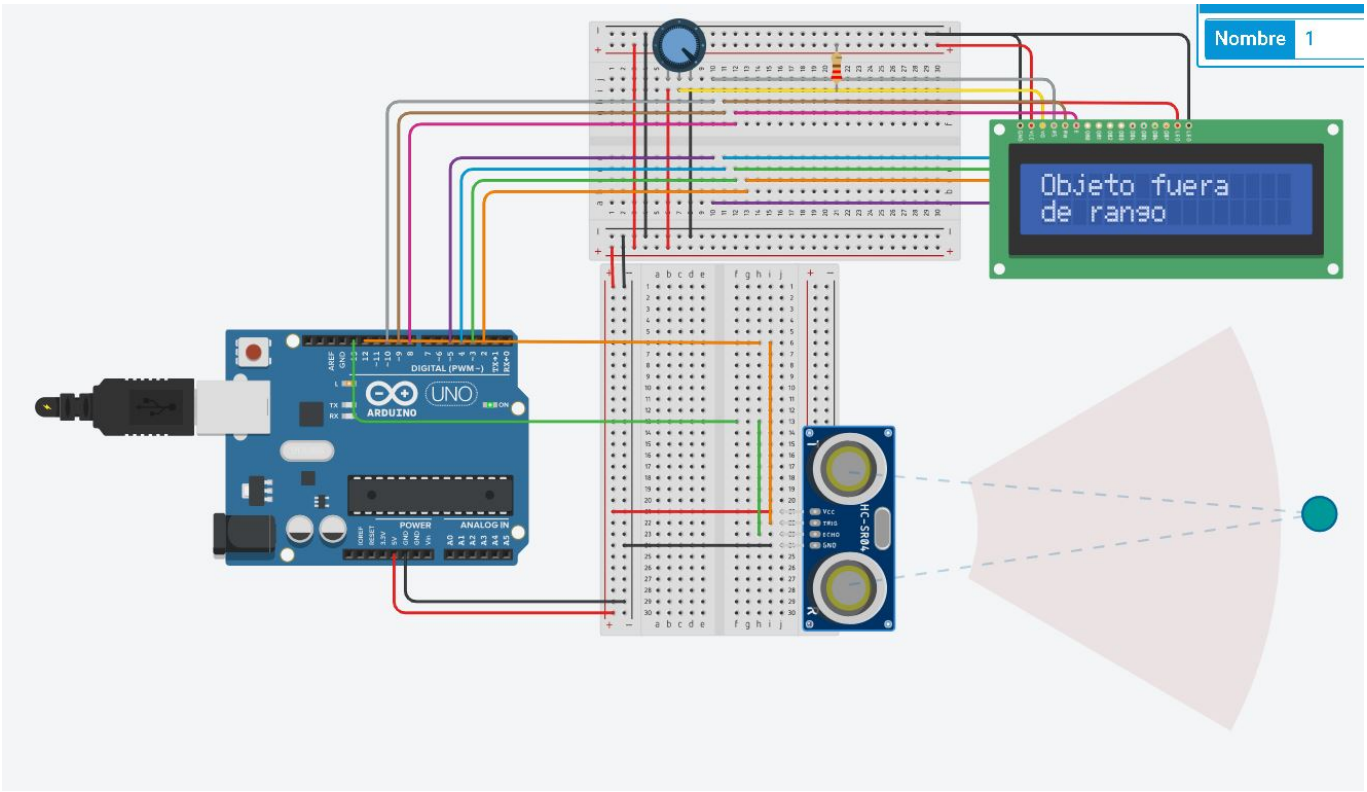
```
  digitalWrite(Trigger, LOW);

  t = pulseIn(Echo, HIGH); //obtenemos el ancho del pulso
  d = (t * 0.034)/2;             //escalamos el tiempo a una distancia en cm
  //d = t/58;
  lcd.clear();

 if(t>19530)
{
  lcd.print("Objeto fuera");
  lcd.setCursor(0,1);
  lcd.print("de rango");
}
else
{
  lcd.print("Objeto a: ");
  lcd.setCursor(0,1);
  lcd.print(d);
  lcd.print(" cm");
}


  delay(100);          //Hacemos una pausa de 100ms
}
```

---

7. Place here evidence that you consider important during the development of the activity.







8. Conclusions

Axel: To conclude I can say that the HC-SR04 sensor is an ultrasonic object sensor, which works with trigger that sends a signal that when it hits an object is returned and is captured by its other part that is the echo, that to calculate the distance at which the object detected is, it is done from the time in which the signal is emitted by the trigger and captured by echo.

David: For what we could observe about the implementation of the ultrasonic sensor it was no that difficult once we had the proper information about it and the same goes for the program to make it work. As for the results they were pretty interesting to see how it reacts to the distance and the way to calculate it.

Emmanuel: In conclusion. The HC-SR04 sensor is a sensor that measures the distance between the sensor and an object by means of sound, in this case by means of the echo emitted by the object in a space and this is verified with the practice carried out where the sensor detected the object and even when he was out of range.

Oscar: The HC-SR04 sensor works with ultrasonic waves to detect how far the object its from it, with this one you need to send a high signal to the trigger pin and then measure how many time it takes to go from high to low in the echo pin, and then you can manipulate that data to transform that microseconds into how far the object is from the sensor.

Repositories

Axel Go to my repository

David Go to my repository

Emmanuel Go to my repository

Oscar Rojas Got to my repository