Experiment No.: 02

Experiment Name: Experimental study on Sonar Sensor interfacing with Arduino.

Objective:

Theory:

Required Hardwares with Quantity:

Required Software:

Working Procedure:

Hardware Arrangement Diagram:

Sketch:

Result and Output:

Conclusion:

Basic Knowledge:

Ultrasonic sensors are proximity sensors. They are used in perking technologies and anti-collision safety systems. Compared to IR sensors in proximity sensing applications, ultrasonic sensors are less susceptible to interference from smoke, gases, and other airborne particles.

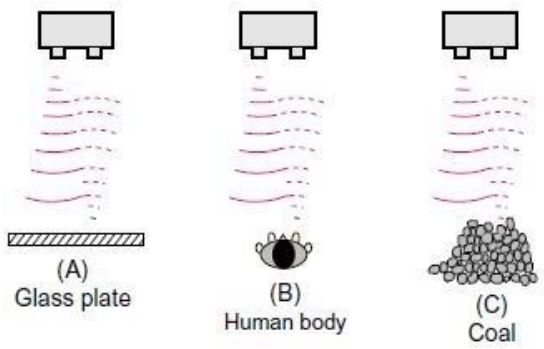
Ultrasonic refers to sound waves that are at a frequency higher than what humans can hear, typically above 20 kHz. These waves are part of the broader category of ultrasound and are used in many practical applications, such as sensing, communication, and cleaning.

A **sonar sensor** (Sound Navigation and Ranging sensor) is a device that uses sound waves to detect and locate objects in its environment. Sonar sensors are commonly used in various fields, including underwater exploration, robotics, detecting underwater objects and obstacle detection. The basic principle behind sonar is the emission of sound waves and the measurement of the time it takes for the echo (reflected sound waves) to return after hitting an object.

It can measure object from upto 2-400cm.

Working Principle:

1. **Emission**: The sonar sensor emits sound waves (usually ultrasonic waves) into the environment.
2. **Reflection**: These waves travel through the medium (air or water) and reflect off objects.
3. **Detection**: The sensor detects the reflected sound waves (echo).



4. **Calculation**: By calculating the time difference between emitting the sound and receiving the echo, the distance to the object can be determined using the formula:

Distance=(Speed of Sound×Time)/2

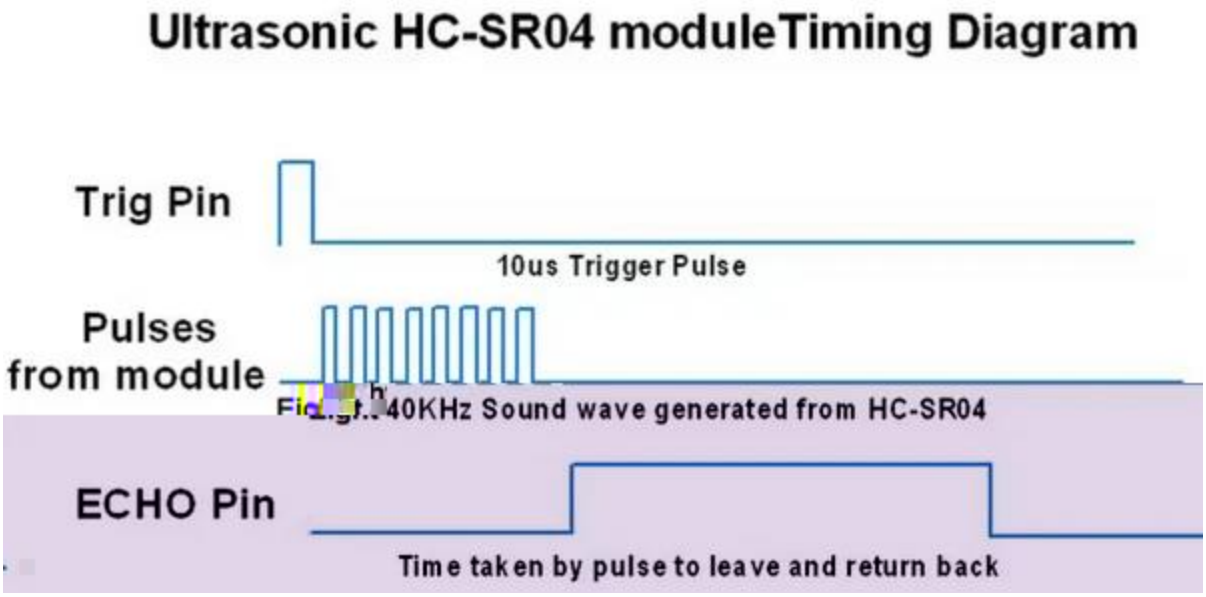
The division by 2 is necessary because the sound wave travels to the object and back.

Working Principle in Detail:

An ultrasonic sensor is a type of electronic sensor that uses ultrasonic waves to determine the distance between two objects and converts the reflected sound into electrical signals. The working principle of an ultrasonic sensor is to measure distance using ultrasound, which travels faster than sound that is audible. This sensor consists of two major components a transmitter that generates sound waves via a piezoelectric crystal and a receiver that detects the reflected ultrasonic waves.

The transmitter of the module transmits an ultrasonic sound. This sound will be reflected if an object is present in front of the ultrasonic sensor. The reflected sound is received by the receiver present in the same module.

To generate the ultrasonic sound, need to trigger the trigger pin as high for a minimum of 10us. Then the module will start sending 8 sonic burst ultrasounds from the module at 40 Khz. It will receive by the receiver called Echo pin and it will calculate the output time to measure the distance.



Typical Pin Configuration for an HC-SR04:

- **VCC**: 5V
- **GND**: Ground
- **Trig**: Connected to a digital output pin (Arduino pin 7 in code).
- **Echo**: Connected to a digital input pin (Arduino pin 6 in code).

Here's an explanation of each pin:

1. VCC (Voltage Common Collector) Pin:

- **Function**: Supplies power to the sonar sensor.
- **Typical Voltage**: It usually requires a **5V** power supply from the Arduino or another microcontroller.
- **Connection**: This pin should be connected to the 5V output pin on the microcontroller.

2. GND (Ground) Pin:

- **Function**: Provides the ground connection.
- **Connection**: This pin should be connected to the ground (GND) pin on the Arduino or microcontroller to complete the circuit.

3. Trig (Trigger) Pin:

- **Function**: This pin is used to send a trigger signal (ultrasonic pulse) from the sensor.
- **Working**:

    - To generate an ultrasonic pulse, the **Trig Pin** must receive a **HIGH signal for 10 microseconds**.
    - This action causes the sensor to emit a **40 kHz ultrasonic burst** (usually 8 cycles of sound waves).
- **Connection**: This pin is connected to a digital output pin on the microcontroller (e.g., pin 7 in your Arduino code) to control when to send the pulse.

4. Echo Pin:

- **Function**: Receives the reflected ultrasonic wave (echo) and outputs a signal.
- **Working**:
    - The **Echo Pin** outputs a pulse proportional to the time it took for the ultrasonic burst to travel to the object and reflect back.
    - The duration of this pulse (in microseconds) is used to calculate the distance to the object.
- **Connection**: This pin is connected to a digital input pin on the microcontroller (e.g., pin 6 in your code). The **pulseIn()** function is typically used to measure the length of this pulse.

Sketch:

```
#define echoPin 6
#define trigPin 7
long duration;
int distance;
void setup()
{
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  Serial.begin(9600);
}
void loop()
{
  digitalWrite(trigPin, LOW);
```

```
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance = duration * 0.034 / 2;
  Serial.print("Distance: ");
  Serial.print(distance);
  Serial.println(" cm");
}
```

TASK 3: Sonar Sensor interfacing with Arduino and display the output to LCD.