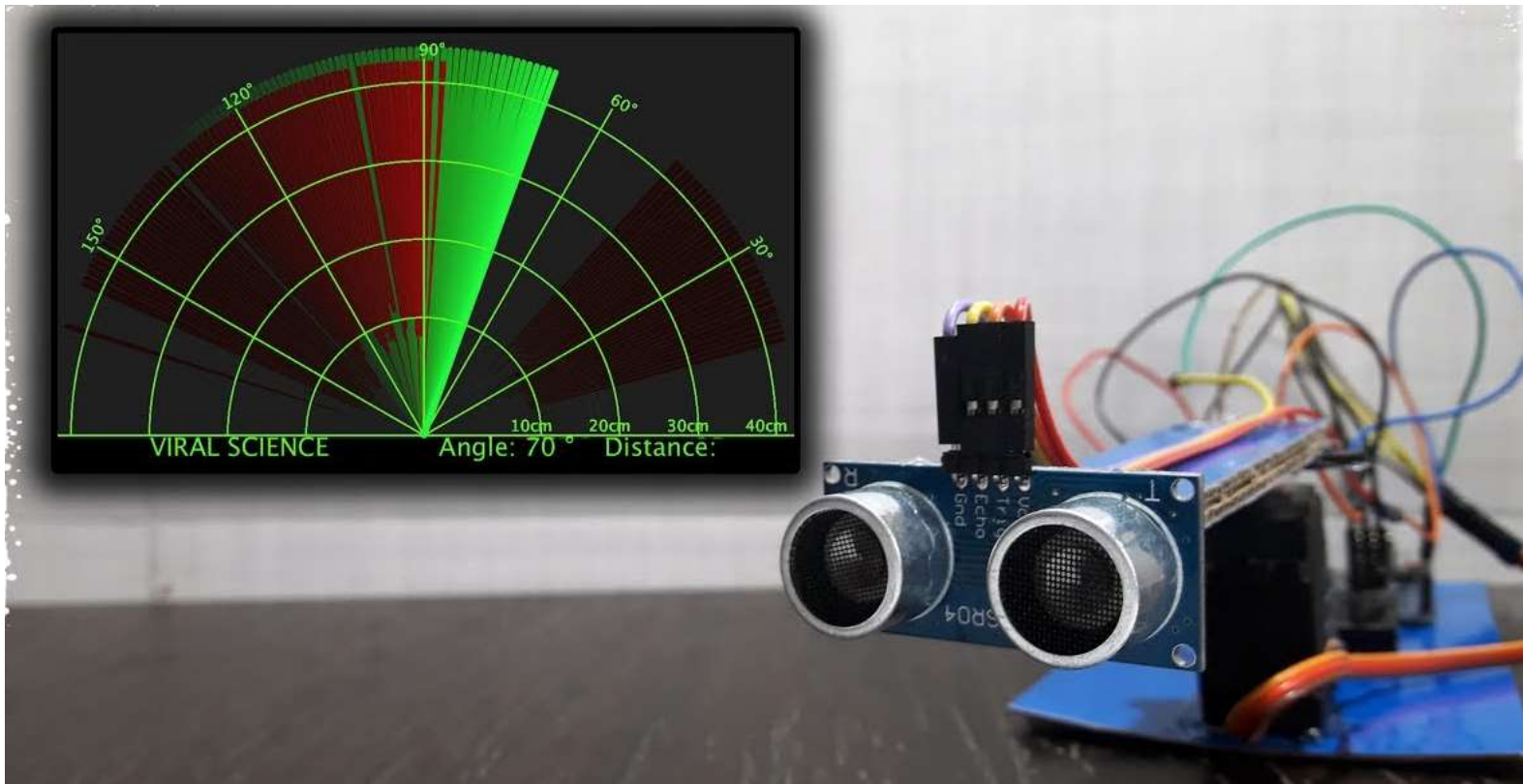
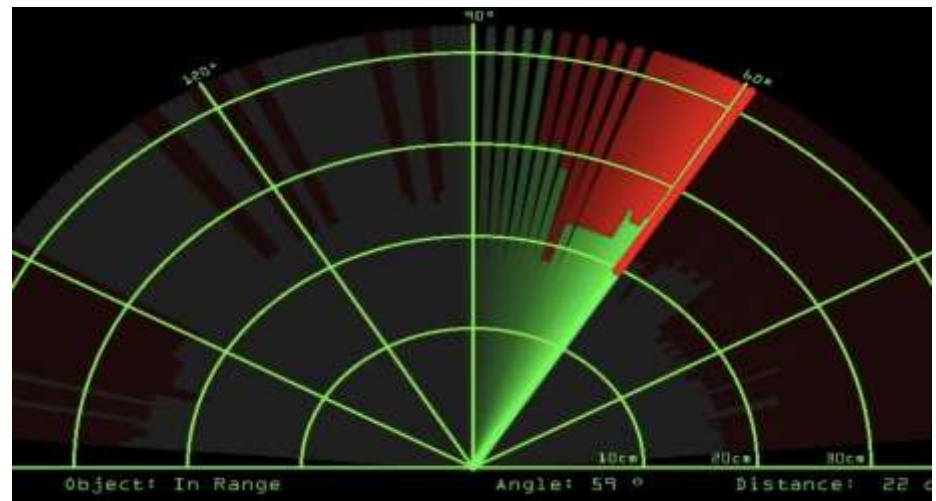


Ultrasonic RADAR System



Introduction of Radar System

Radar is an object detection system. It uses Microwaves to determine the range, altitude, direction, or speed of objects. The radar can transmit radio waves or microwaves which bounce off any object in their path. So, we can easily determine any object in the radar range.



Ultrasonic Sensor HC-SR04

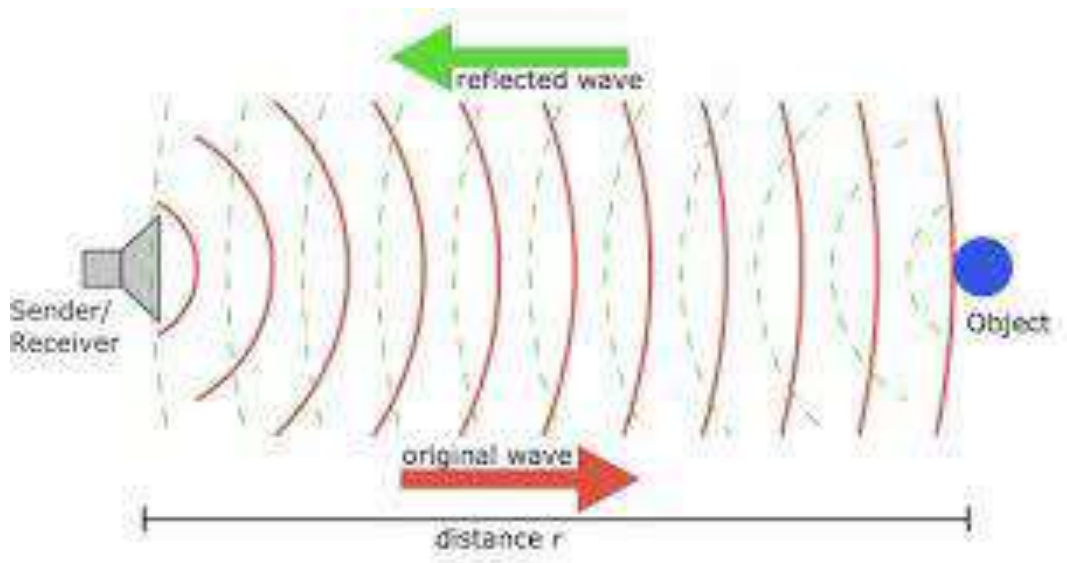
An **ultrasonic sensor** is an instrument that measures the distance to an object using **ultrasonic** sound waves. An **ultrasonic sensor** uses a **transducer** to send and receive **ultrasonic** pulses that relay back information about an object's proximity.



Working principle of Ultrasonic Sensor

- **Ultrasonic sensors work** by emitting sound waves at a frequency too high for humans to hear. Then they wait for the sound to be reflected back, calculating distance based on the time required. This is similar to how radar measures the time it takes a radio wave to return after hitting an object.
- The HC-SR04 offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1" to 13 feet.

Working Diagram



Servo Motor

A **Servo motor** is an electrical device which can push or rotate an object with great precision. If you want to rotate an object at some specific angles or distance, then you use **Servo motor**. It is just made up of simple **motor** which runs through **servo** mechanism.

It consists of three parts:

1. Controlled device
2. Output sensor
3. Feedback system



Working principle of Servo motor

1. A Servo consists of a Motor (DC or AC), a potentiometer, gear assembly and a controlling circuit.
2. First of all we use gear assembly to reduce RPM and to increase torque of motor.
3. Say at initial position of servo motor shaft, the position of the potentiometer knob is such that there is no electrical signal generated at the output port of the potentiometer.
4. Now an electrical signal is given to another input terminal of the error detector amplifier.
5. Now difference between these two signals, one comes from potentiometer and another comes from other source.

Working principle of Servo motor

6. It will be processed in feedback mechanism and output will be provided in term of error signal.
7. This error signal acts as the input for motor and motor starts rotating.
8. Now motor shaft is connected with potentiometer and as motor rotates so the potentiometer and it will generate a signal.
9. So as the potentiometer's angular position changes, its output feedback signal changes. After sometime the position of potentiometer reaches at a position that the output of potentiometer is same as external signal provided.

Working of project

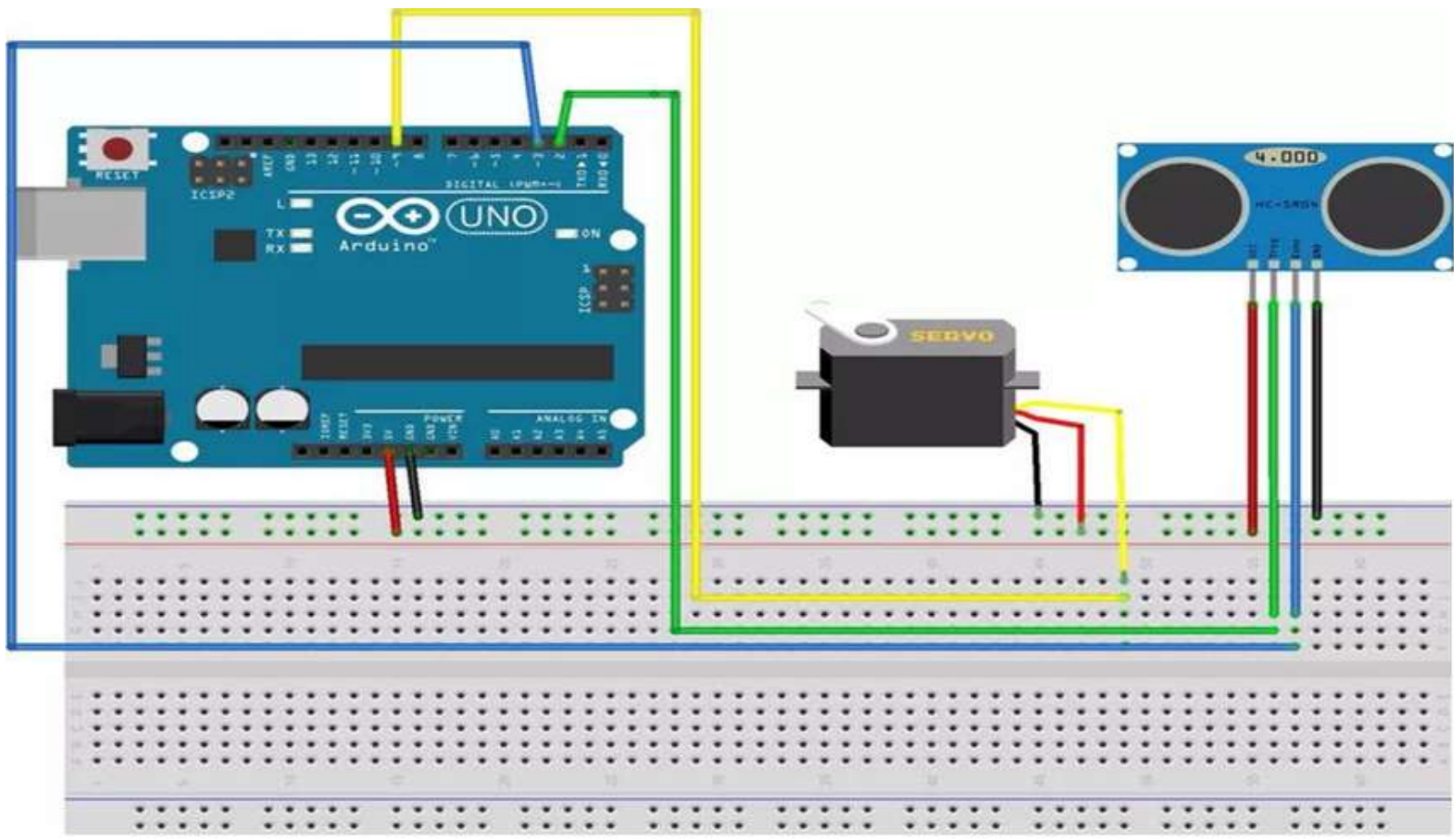
- In this project, the Ultrasonic Sensor collects the object information with the help of Arduino and passes it to Processing Application. In the processing application, there is a simple Graphics application implemented which mimic a radar screen.
- Ultrasonic sensor sends high frequency pulses, these pulses reflects from object and takes as Echo, time between echo and Trig is measured by the microcontroller or Arduino which is directly proportional to distance.
- The speed of sound is 341 meter per second in the air, and the distance between sensor and object is equal to time multiplied by speed of sound divided by two.

$$\text{Distance} = (\text{Time} * \text{Speed Of Sound}) \div 2$$

Components Required

- Arduino UNO
- Ultrasonic Sensor HC-SR04
- Servo Motor SG-90
- Jumper wires

Connection Diagram



Connections for Ultrasonic Sensor & Servo Motor

1. Connect **Trig** pin of Ultrasonic sensor with **2** pin of Arduino.
2. Connect **Echo** pin of Ultrasonic sensor with **3** pin of Arduino.
3. Connect **Vcc** pin of Ultrasonic sensor with **5V** of Arduino.
4. Connect **GND** pin of Ultrasonic sensor with **GND** of Arduino.
5. Connect Red wire of servo with **Vcc(+5V)** of Arduino.
6. Connect Black wire of servo with **GND** of Arduino.
7. Connect signal(orange) wire of servo with **9** pin Arduino.

Steps to be follow :-

1. We need to make a **Arduino code** [given in the folder] and upload it to the Arduino board that will enable the interaction between the arduino and the processing IDE.
2. Install **Processing IDE** : <https://processing.org/download/>
3. Open it, Click on **Get Started**.
4. Paste the code given in the folder **Radar_preprocessing**.
5. Now check your **Arduino “COM port”** [e.g. **COM23**] from **Tools** in Arduino IDE .
6. Enter this COM port in Preprocessing code as follows:

```
17 size (1200, 700); // ***CHANGE THIS TO YOUR SCREEN RESOLUTION***
18 smooth();
19 myPort = new Serial(this, "COM23", 9600); // starts the serial communication
20 myPort.bufferUntil('.'); // reads the data from the serial port up to the character
21 }
```

7. Run Preprocessing code & see the output.

Project Link : <https://youtu.be/Ug0KcpmD3aA>