Project Report: Radar System using Ultrasonic Sensor and Servo Motor

1. Introduction

A radar system based on an ultrasonic sensor and a servo motor is designed to detect objects within a specified range. This system operates by emitting ultrasonic waves and analyzing the echoes to determine the presence and distance of objects. The servo motor enables a sweeping motion, allowing a 180-degree rotation for efficient object detection.

2. Components Used

- **Arduino Uno**
- **Ultrasonic sensor (HC-SR04)**
- **Servo motor**
- **Jumper wires**
- **Breadboard**
- **Power supply**
- **Processing software**

3. Circuit Diagram
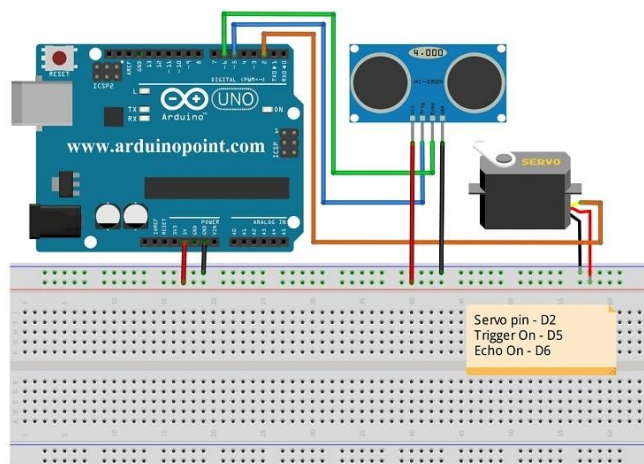
4. Code

```
#include <Servo.h>.

const int trigPin = 10;
const int echoPin = 11;

long duration;
int distance;
Servo myServo;

void setup() {
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin, INPUT);
  Serial.begin(9600);
  myServo.attach(12);
}
void loop() {

  for(int i=0;i<=180;i++){
  myServo.write(i);
  delay(30);
  distance = calculateDistance();

  Serial.print(i); // Sends the current degree into the Serial Port
  Serial.print(","); // Sends addition character right next to the previous value needed
later in the Processing IDE for indexing
  Serial.print(distance); // Sends the distance value into the Serial Port
  Serial.print("."); // Sends addition character right next to the previous value needed
later in the Processing IDE for indexing
  }
  for(int i=180;i>0;i--){
  myServo.write(i);
  delay(30);
  distance = calculateDistance();
  Serial.print(i);
  Serial.print(",");
  Serial.print(distance);
  Serial.print(".");
  }
}
// Function for calculating the distance measured by the Ultrasonic sensor
int calculateDistance(){

  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
```

```
  // Sets the trigPin on HIGH state for 10 micro seconds
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH); // Reads the echoPin, returns the sound wave
travel time in microseconds
  distance= duration*0.034/2;
  return distance;

}
```

5. Processing software

Processing software is often used in radar systems to display visual representations of the data collected by the Ultrasonic sensor.
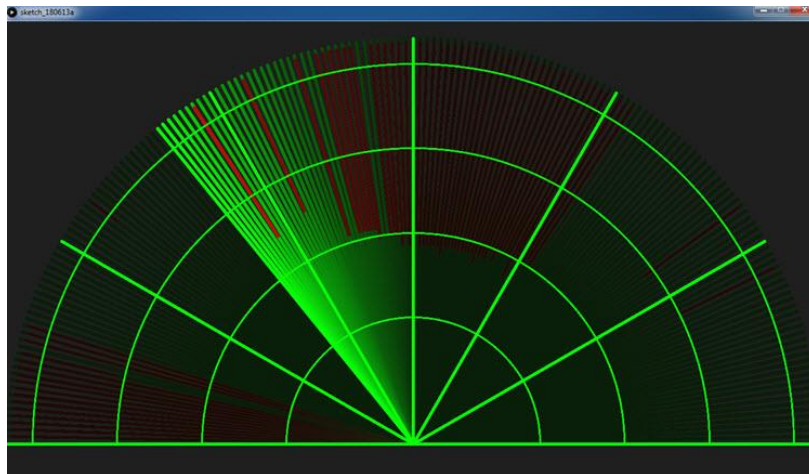
6. Result

The radar system successfully rotates the servo motor, scanning in a 180-degree range. It detects objects within a 40 cm range and displays the angle of detected objects via the serial monitor and with the processing software we can display on graph.

7. Advantages and Disadvantages

Advantages

- Efficient object detection within a specified range.

- **Adjustable range and rotation for diverse applications.**
- **Cost-effective and simple implementation.**

Disadvantages

- **Limited accuracy and resolution in object detection.**
- **Susceptible to interference from reflective surfaces or certain materials.**

8. Future Scope and Applications

Future Scope

- **Integration with IoT platforms for remote monitoring and control.**
- **Implementing multiple sensors for enhanced coverage and accuracy.**
- **Utilization in autonomous vehicles, security systems, or robotics for object detection and avoidance.**

Applications

- **Security systems to detect intruders within a specified area.**
- **Robotics for obstacle avoidance and navigation.**
- **Industrial applications for monitoring and controlling machinery movements.**