A Short-Range Radar System Using Arduino

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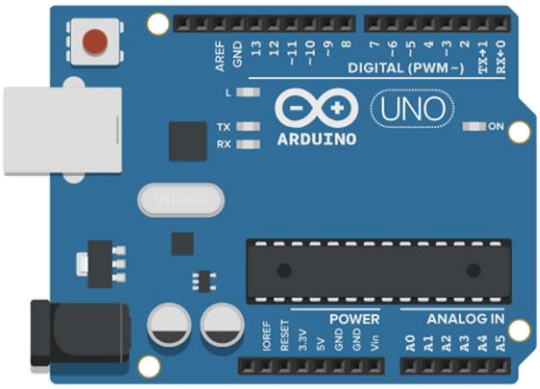
Introduction:

RADAR is a detection system that uses radio waves to determine the characteristics of the detected objects such as: range, height, direction, or the speed of objects. In this paper, we designed a radar system that uses an ultrasonic sensor to detect objects. In this paper, the ultrasonic is used to measure the distance between the radar and any object-based non-contact technology. Whereas, the movement of the sensor is controlled by using a small servo motor. This radar-controlled using the Arduino Uno board as a microcontroller. The signal received from the sensor would be processed using “Processing Development Environment Software," then the result would be shown on a PC screen.

Components Required:

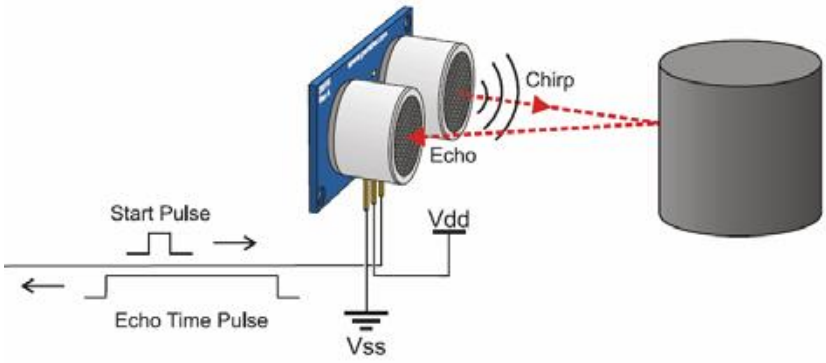
- **Arduino Board UNO Model:**

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.



- **Ultrasonic Sensor:**

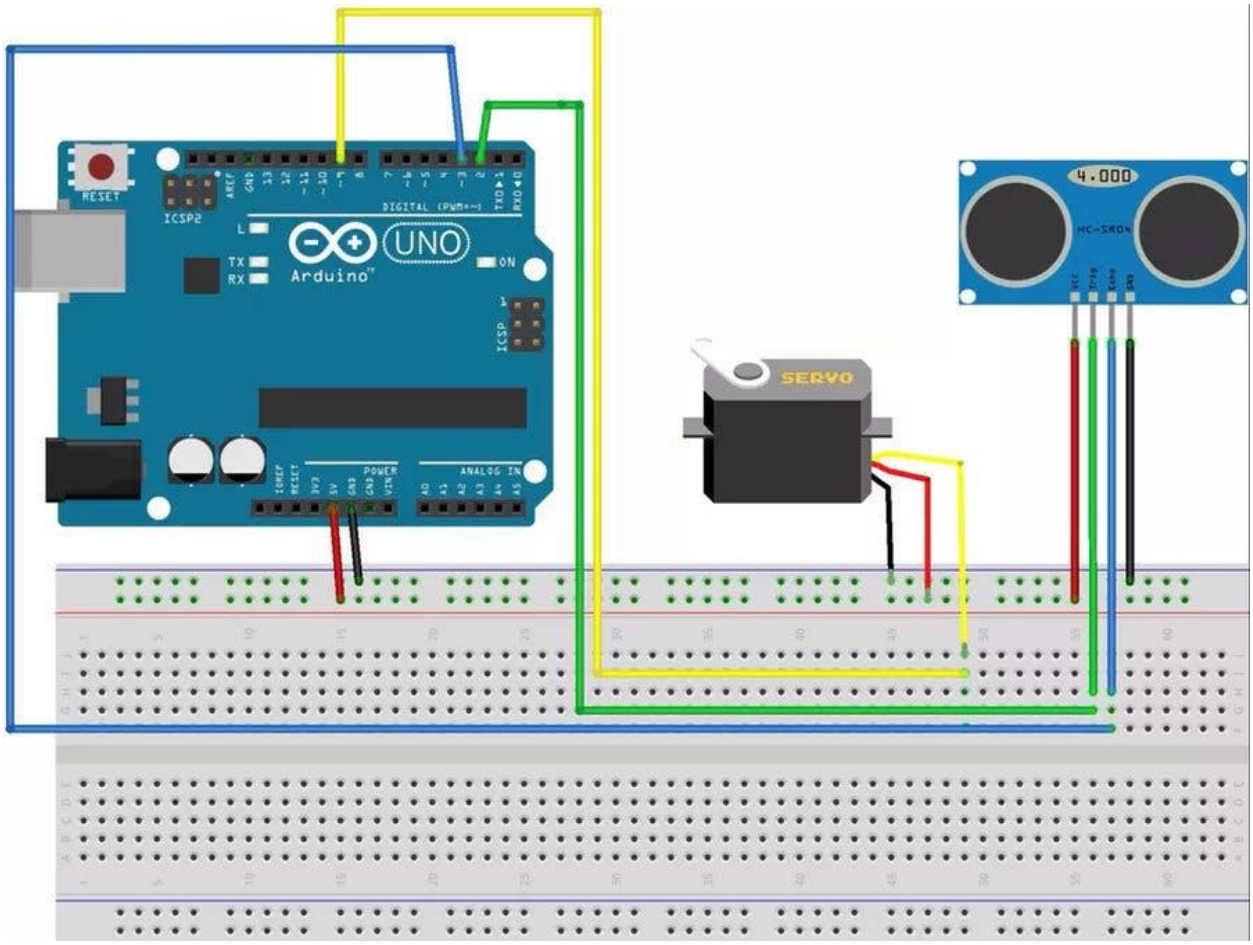
The ultrasonic sensor emits ultrasound at 40 000 hz, which passes through the air, while it bounces back into the module if there is an object or obstacle in its way. The distance can be determined based on the travel time and the speed of the sound.



- **Servo Motor:**

Tiny and lightweight with high output power. The servo will rotate about 180 degrees (90 in each direction) and operate just as small as the regular types. To monitor these services, you can use any servo code, hardware].

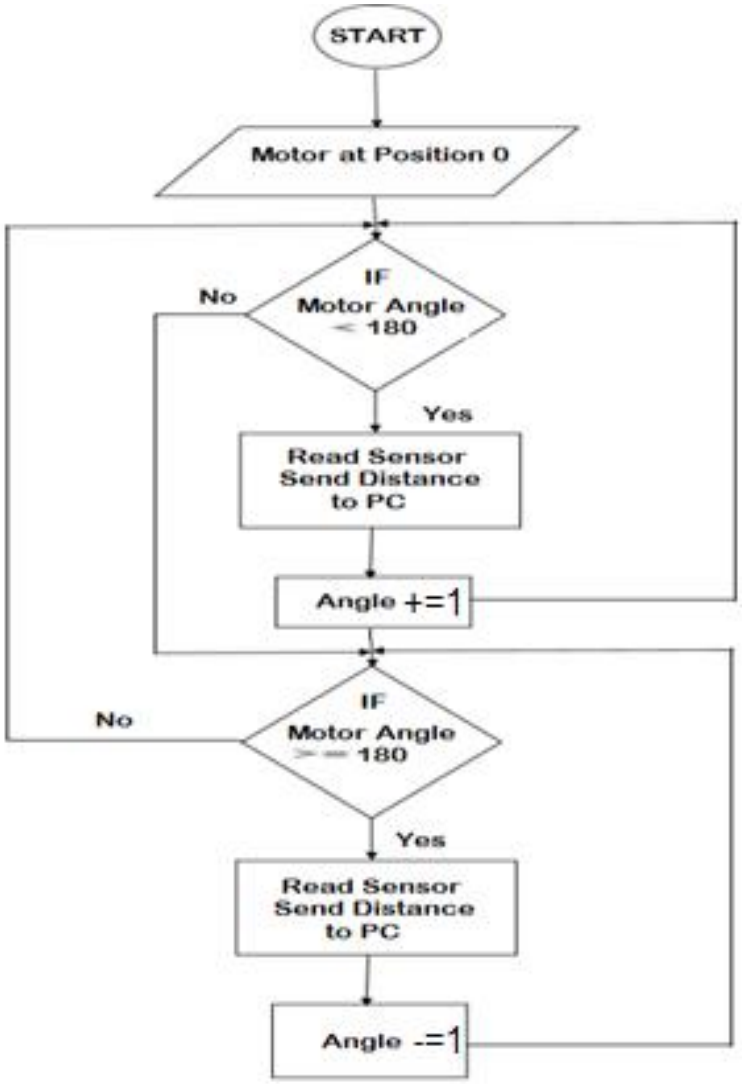
HARDWARE SYSTEM DESIGN:



SOFTWARE:

FLOWCHART:

The flowchart shows the overall operation of the system following software to control the servo motor.



THE CODE:

```
// Includes the Servo library
#include <Servo.h>.

// Defines Tirg and Echo pins of the Ultrasonic Sensor
const int trigPin = 2;
const int echoPin = 3;
// Variables for the duration and the distance
long duration;
int distance;

Servo myServo; // Creates a servo object for controlling the servo motor

void setup() {
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin, INPUT); // Sets the echoPin as an Input
  Serial.begin(9600);
  myServo.attach(9); // Defines on which pin is the servo motor attached}
void loop() {
  // rotates the servo motor from 15 to 165 degrees
  for(int i=0;i<=180;i++){
  myServo.write(i);
  delay(30);
  distance = calculateDistance();// Calls a function for calculating the distance measured by the Ultrasonic sensor for each degree
  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
  }
  // Repeats the previous lines from 165 to 15 degrees
  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;
}
```

Figure 11 shows object radar information on radar workspace where the distance between object and radar is 11cm, and angle is 160.

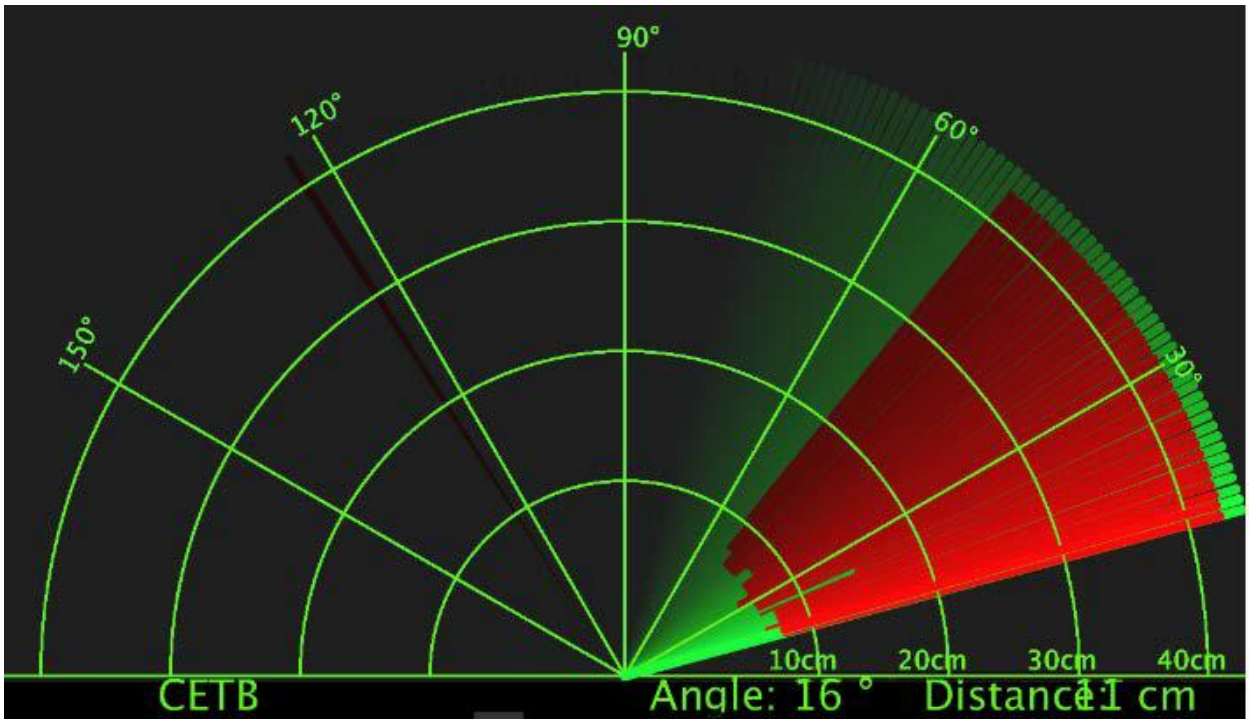


Fig. 11 Radar information