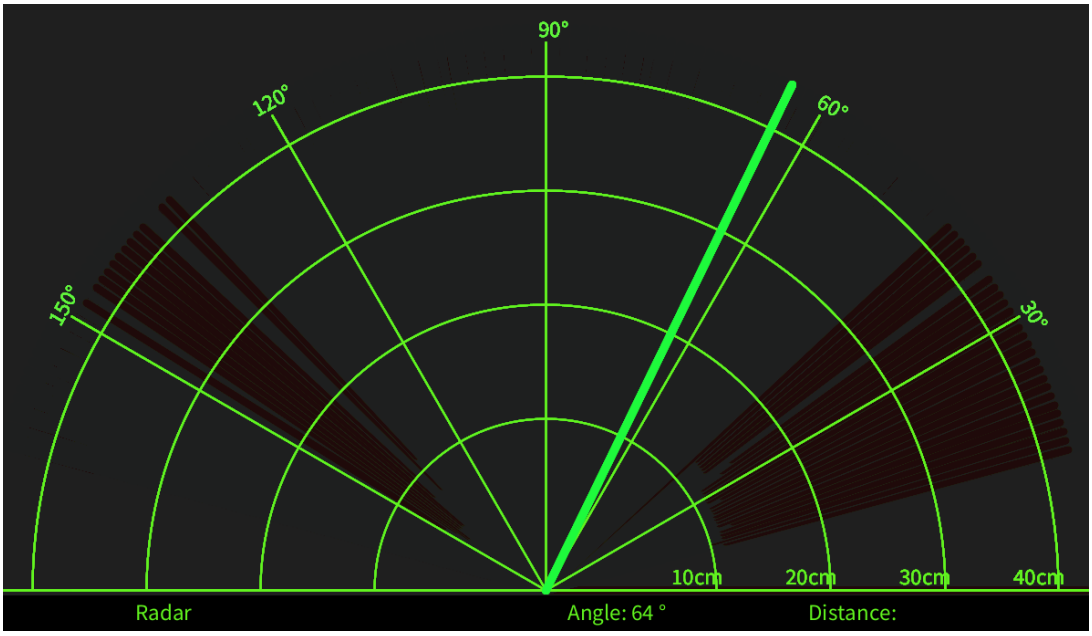
Radar Using Arduino & GUI Using Processing



Group: (1)

- احمد محمد احمد فؤاد المنيلاوي
- احمد سعيد محمد امام زايد
- احمد رضا كامل عبد الغني
- احمد محمد علي محمد
- عزيز عماد عزيز لبيب
- عبد الله محمدي محمدي حفور
- سيف الدين محمد يوسف

إشراف: د/ اماني محمد

Faculty of Engineering

Helwan National University

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Introduction:

This project demonstrates the creation of a radar-like system using an ultrasonic sensor and a display to show the distance and angle of objects in the radar's field of view. The system operates by measuring the distance from the sensor to an object and displaying this information graphically. The radar also shows angles and updates dynamically based on sensor inputs.

Components And Functionality:

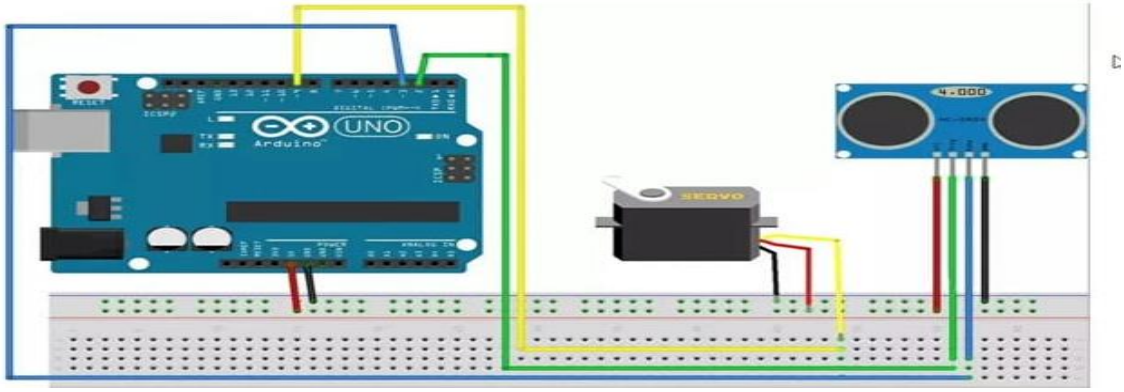
- **Ultrasonic Sensor (HC-SR04):**
  - **This sensor is used to measure the distance from the sensor to any object within its range.**
  - **The trigPin triggers the ultrasonic pulse, and the echoPin listens for the reflected pulse to calculate the distance.**
- **Servo Motor (SG90):**
  - **The servo motor is used to rotate the ultrasonic sensor in a horizontal plane to scan for objects at different angles. It allows the sensor to sweep from 15° to 165° for full coverage.**
- **Arduino:**
  - **The Arduino is responsible for controlling the servo motor and reading data from the ultrasonic sensor.**
  - **It sends the distance and angle data to the connected computer for visualization.**
- **Processing IDE:**
  - **The Processing software displays the radar on a 2D interface, updating in real time based on the sensor data.**

Functionality

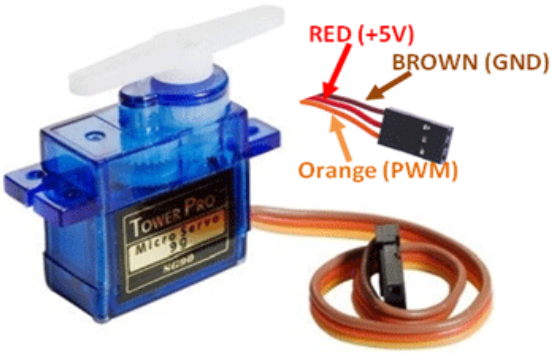
- **Distance Measurement:**

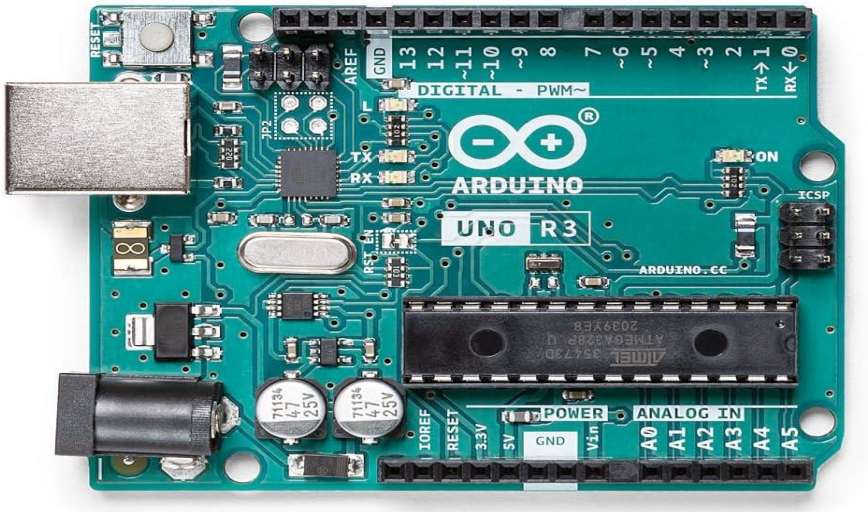
- **The ultrasonic sensor measures the time it takes for a sound pulse to travel to an object and return. This time is used to calculate the distance using the formula:**
  Distance=duration×0.0342\2
- **The sensor sends this distance to the Arduino, which transmits it to the computer.**

- **Servo Motor Rotation:**
  - **The servo motor rotates the ultrasonic sensor at different angles (from 15° to 165°) to scan the area. The system first rotates the sensor to 15°, then to 165°, and repeats this process to sweep the radar continuously.**
- **Radar Display:**
  - **Based on the received angle and distance data, the Processing IDE draws the radar with concentric arcs and lines indicating distances and angles.**
  - **If the detected object is within a specific range, it is displayed on the radar; otherwise, it shows "Out of Range."**
- **Real-Time Update:**
  - **As the sensor moves and new readings are taken, the radar display updates in real time, showing the position of objects within the radar's scanning area.**



Datasheets:





Operation

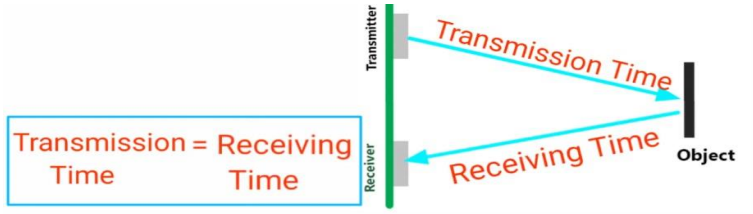
The radar system operates in the following manner:

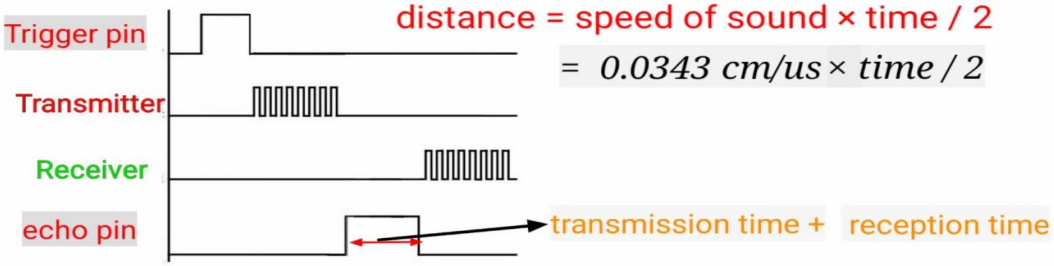
1. **Sensor Setup:**
    - **The trigPin and echoPin are initialized to send and receive signals from the ultrasonic sensor. The servo motor is also attached to a specific pin to control its movement.**
2. **Servo Rotation:**
    - **The servo motor sweeps the sensor from 15° to 165° in steps, sending the corresponding angle to the computer.**
3. **Distance Calculation:**

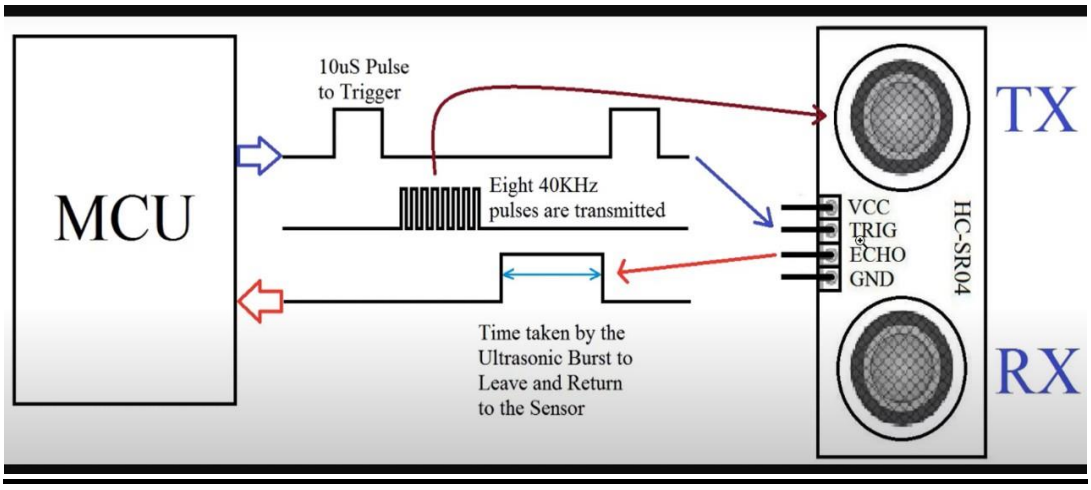
- **For each position of the servo, the ultrasonic sensor sends a pulse and waits for the echo to return. The Arduino calculates the distance based on the pulse duration.**

4. **Data Transmission:**
   - **The Arduino sends the angle and calculated distance to the computer in the format:**
     - **Angle, Distance.**
     - **The data is transmitted serially and can be processed by the Processing software for graphical visualization.**
5. **Radar Visualization:**

   The Processing IDE uses the data to create a 2D radar representation.

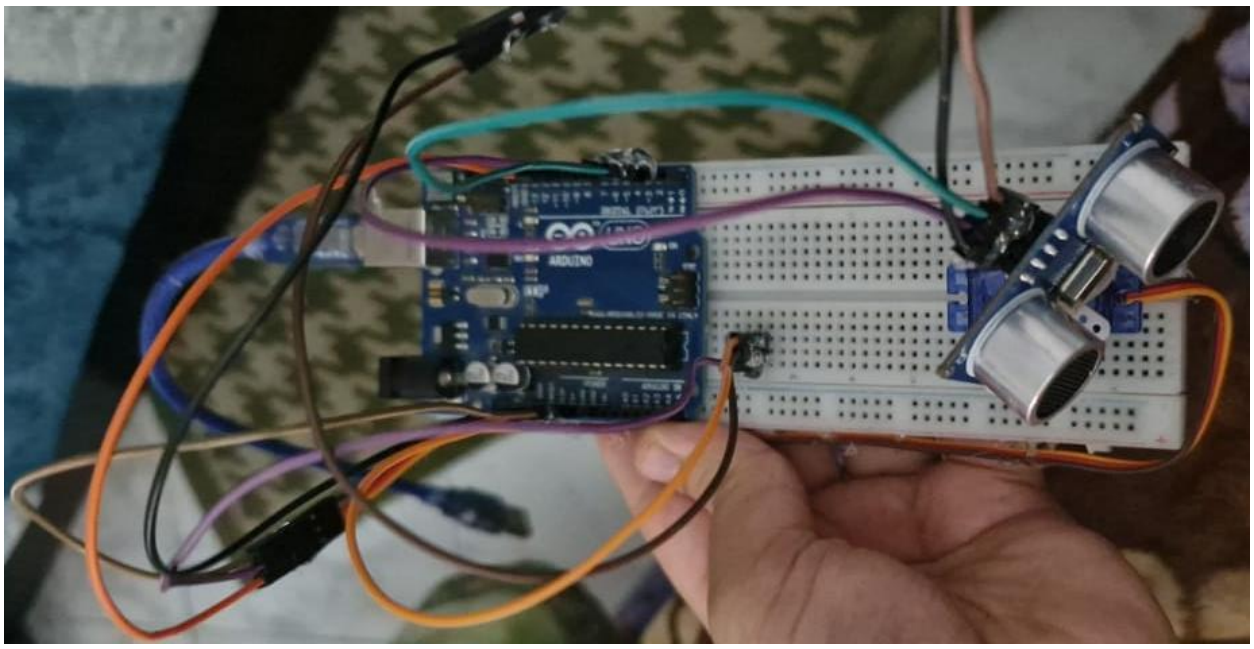






Conclusion:

The project successfully integrates an ultrasonic sensor and a servo motor to create a functioning radar system. The sensor's distance data, combined with the servo motor's ability to rotate the sensor, provides a dynamic and interactive radar display. The system is capable of scanning an area, detecting objects, and updating the radar in real time. The data visualization is shown using the Processing IDE, which provides a clear and informative graphical display of the scanned area.



THANK YOU