A Short-Range Radar System Using Arduino

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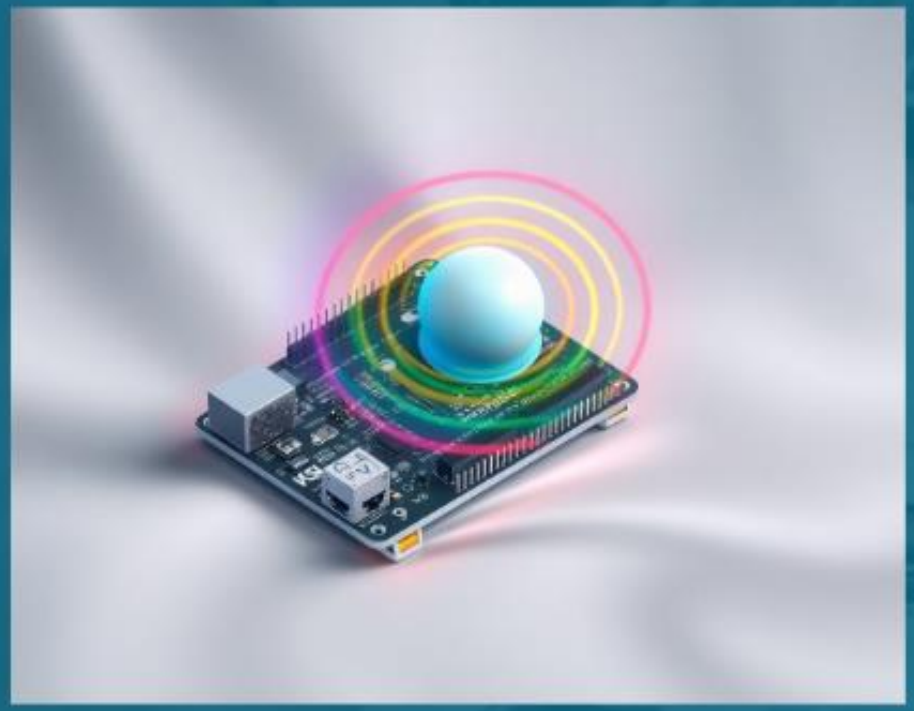
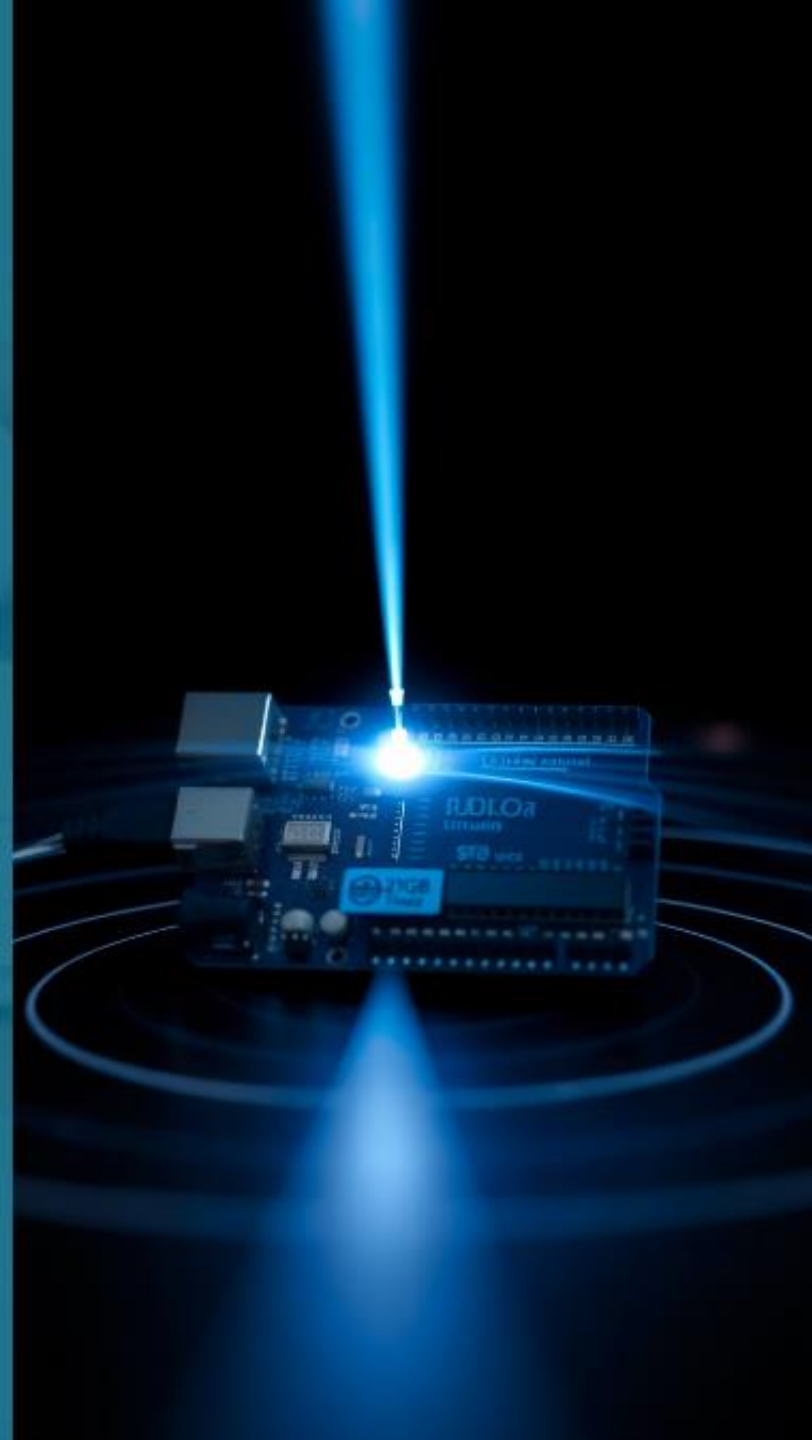
Introduction



RADAR is a method of object detection using radio waves to determine objects' size, height, direction or speed. Radar systems come in various forms, from compact units to large installations. They are used in different applications such as air traffic control, long-distance surveillance, missile guidance, and weather monitoring. Modern radar systems integrate digital signal processing for enhanced performance.

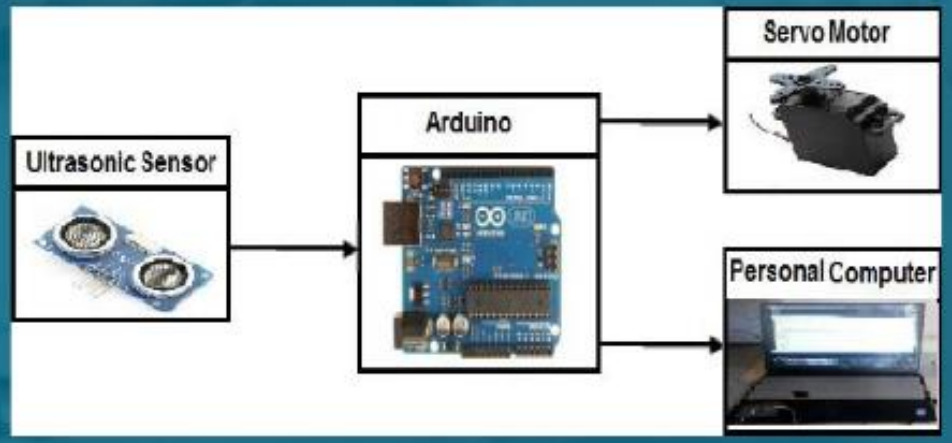
Project Overview

This project involves designing a short-range radar system using an ultrasonic sensor to measure the distance between the radar and objects. The sensor is mounted on a servo motor to scan across a 180-degree range. An Arduino Uno board controls the sensor and processes the data, which is then displayed on a PC using the Processing Development Environment Software.



System Block Diagram

The system consists of an ultrasonic distance sensor connected to a signal conditioning unit, processed by an Arduino microcontroller, and displayed on a personal computer.The sensor moves with the help of a servo motor to cover a 180-degree range.



Components Required

Key Components

Arduino Uno

An open-source microcontroller board used for building digital devices and interactive objects that can sense and control physical devices. It has digital and analog I/O pins and supports serial communication interfaces.

Processing Software

An open-source programming language and environment to teach the fundamentals of computer programming in a visual context. It supports 2D, 3D, and PDF outputs, and is compatible with GNU/Linux, Mac OS X, and Windows.

Fig. 5 Ultrasonic Sensor

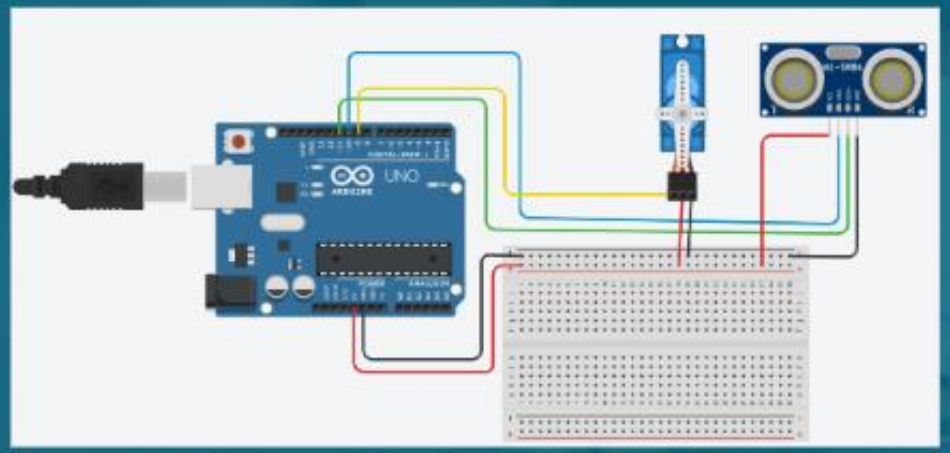
Ultrasonic Sensor HC- SR04

Emits ultrasound at 40kHz to measure distance based on the travel time of sound waves. The speed of sound (341 meters per second) and the time difference between emission and reception are used to calculate distance.

Servo Motor

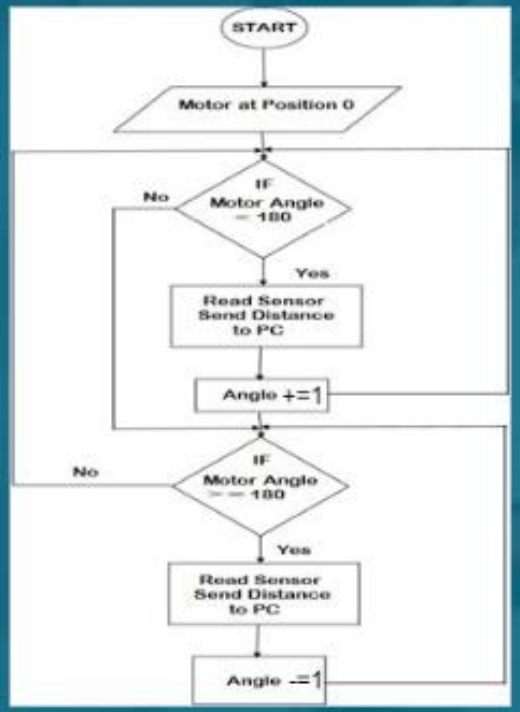
A motor capable of rotating 180 degrees, used to position the ultrasonic sensor. It is lightweight, has high output power, and can be controlled using various servo codes or libraries.

Hardware System Design



The design of hardware that was designed with a scraper environment. The connection of different electronic components is displayed.

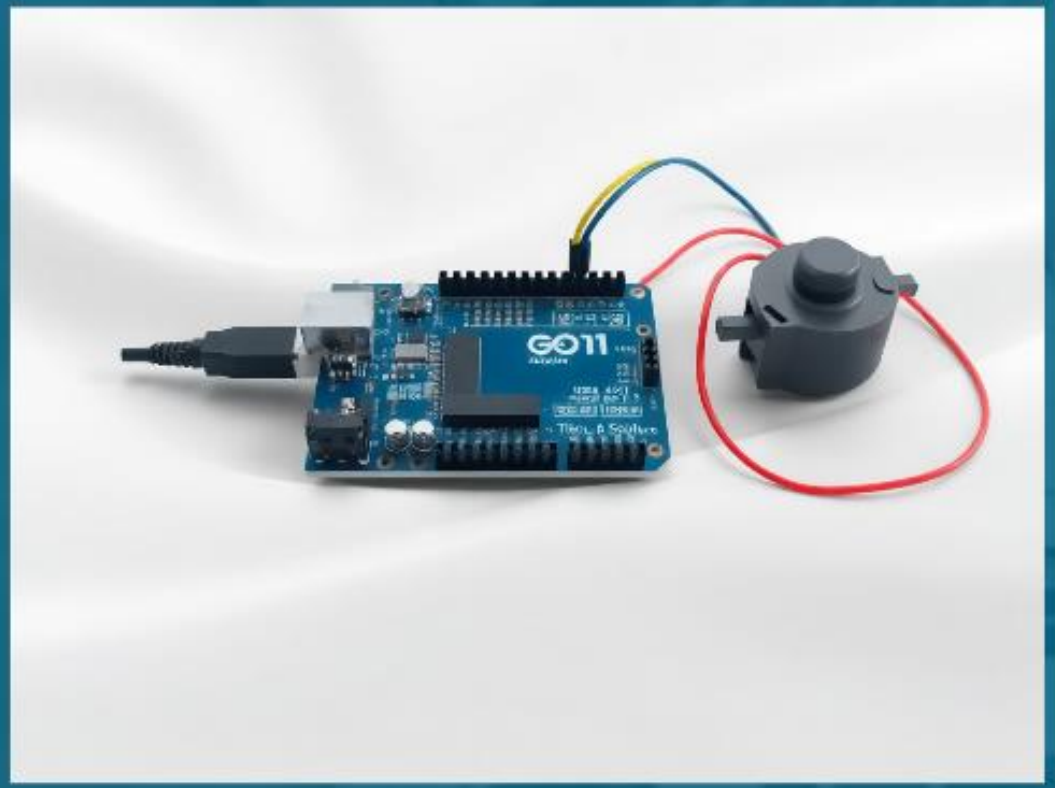
Flowchart and Operation



The flowchart outlines the system's operation, showing how the Arduino software controls the servo motor. Data from the ultrasonic sensor is processed by the Arduino to calculate object distance and angle, which are then sent to the Processing software for display.

Results

Project Outcome

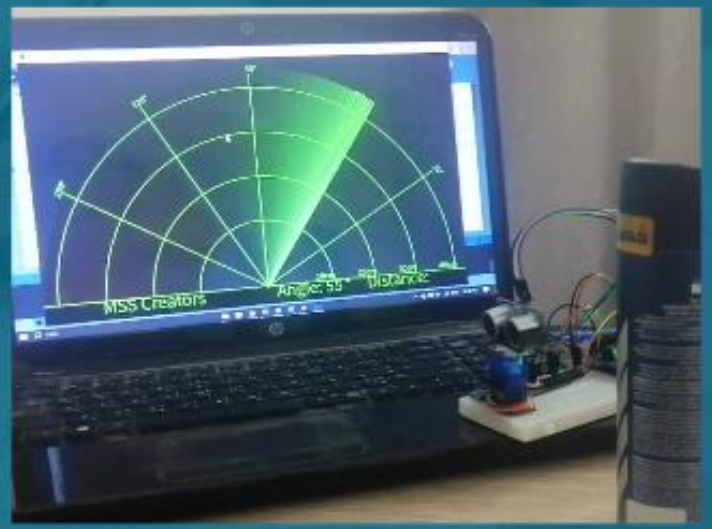


Hardware Model

The project's hardware model includes an Arduino, ultrasonic sensor, servo motor, and the processing setup.

Results

Project Outcome

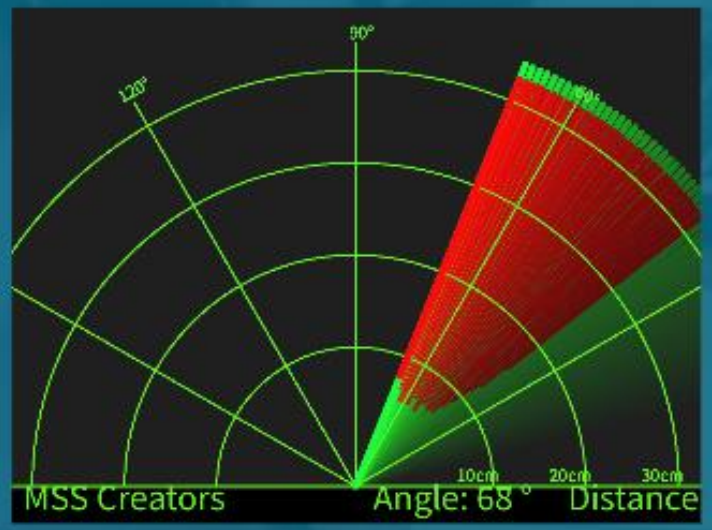


Radar Workspace

Displays the radar in operation, showing detection and distance measurement capabilities.

Results

Project Outcome



Object Detection

The radar system accurately measures the distance and angle of detected objects, providing suitable accuracy and resolution.

Applications

Application in Air Force

Application in Marine

Application In Meteorology

Conclusion

The project successfully designed and implemented a simple, low-cost short-range radar system using Arduino. It effectively detects objects and measures distance with accuracy, providing valuable data in a visual format. The system has numerous potential applications, from aviation to marine and meteorology.

References

[1] Anuj Dutt, Arduino Based RADAR System. United States: GRIN Verlag, June 25, 2014.

[2] Praveen Tamhankar, Piyush Mittal, Ashutosh Singh, Ultrasonic RADAR/Electronic Design Lab (EE-318), Guide: Prof. Jayanta Mukherjee.

[3] Arduino official website: http://www.arduino.cc.

[4] Servo motor datasheet.

[5] How to Mechatronics, Arduino Radar Project, available at: https://howtomechatronics.com/projects/arduino-radar-project.

Thank You!

We appreciate your time and attention! 🚀

🔗 For more details and access to the project data, please click here

If you'd like to connect or have any questions, feel free to reach out on

🔗 LinkedIn: click here