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Smart Enemy Tracking Radar Using Arduino Project

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ABSTRACT

This paper is about Radar System controlled via Arduino. This RADAR system is made up of an ultrasonic sensor and a servo motor, which are the system's main components. The system's basic function is to detect things within a certain range. The servo motor is coupled to an ultrasonic sensor, which rotates 180 degrees and displays a visual depiction on the software called Processing IDE. The Processing IDE displays a graphical depiction of the item, as well as its angle or location and distance.

Arduino is used to control this system. To control an ultrasonic sensor and interface it with a display device, an Arduino UNO board is sufficient. During our investigation, we learned about existing navigation and obstacle detection advances, as well as several systems that employ ultrasonic sensors effectively. This RADAR system's main application is in the fields of navigation, positioning, object identification, mapping, spying or tracking, and other applications. Indoor applications are also possible with these low-cost systems.

Keywords : Ultrasonic, radar, location, surveillance, and obstacle detection

1. Introduction

RADAR is a radio-wave-based object detecting technology that determines the range, altitude, direction, and speed of objects. Radar systems are available in a variety of sizes and performance levels.

At airports, some radar systems are utilised for air traffic control, while others are employed for long-range surveillance and early-warning systems. A missile guiding system's heart is a radar system. Small portable radar systems that can be maintained and managed by a single person, as well as systems that take up multiple big rooms, are available. Several countries developed radar in secret before and during World War II.

Air-defense systems,Air traffic control, radar, astronomy, antimissile systems, marine radars to locate landmarks and other ships; aircraft anti-collision systems; ocean surveillance systems, outer space surveillance and rendezvous systems; meteorological precipitation monitoring; altimetry and flight control precipitation are just a few of the modern uses of radar.

Digital signal processing is used in high-tech radar systems, which can extract meaningful information from very high noise levels. The following components are linked to the working principle of our proposed system: an ultrasonic sensor coupled to the microcontroller (we choose Arduino) digital input and output pins. The servo motor is connected to digital output and input pins as well. Our ultrasonic sensor and servo motor are both connected at the same time, so that when our servo motor spins from 0 to 180 degrees from extreme right to extreme left, the motor will rotate near its axis.We utilize Computer screen to demonstrate the data (distance and angle) throughsoftware called “Processing development Environment”

2. Literature survey

[1] Raut Sanket Sanjay et al. Radar's evolution and research efforts have been immensely successful, and they have had a significant impact on computing. Finally, researchers working on radar will be able to design, develop, and upgrade security and user interfaces that are capable of meeting the specified performance criteria in various environments. Radar is an object detection system that uses electromagnetic waves to determine the range, altitude, direction, or speed of both moving and fixed objects such as aircraft, ships, motor vehicles, weather formations, and terrain. Ultrasonic radar is an object detection system that uses ultrasonic waves instead of electromagnetic waves to determine the range, altitude, direction, or speed of both moving and fixed objects such as aircraft, ships, motor vehicles, weather formations, and terrain.

The Ultrasonic Sensors are the most important parts of any Ultrasonic radar. Ultrasonic sensors work on the same concept as radar or sonar, evaluating a target's properties by reading radio or sound wave reflections. This project intends to use an Ultrasonic Sensor attached to a Raspberry Pi board, with the data from the sensor being sent to a laptop screen to measure the presence of any obstacle in front of the sensor, as well as determine the range and angle at which the obstacle is detected. The apparent shift in frequency or pitch when a sound source moves toward or away from the listener, or when the listener moves toward or away from the sound source, was discovered in 1842 by Christian Doppler.

[2] Milenko S. Andri c, Boban, P. Bondzuli c, and Bojan M. Zrnic described a database of radar echoes from numerous targets in a work published in 2010. The database can be downloaded by anyone. In this study, spectral analysis is utilised to extract extremely basic information that can be used for categorization.In a paper published in 2012, Alexander Angelov, Andrew Robertson, Roderick Murray-Smith, and Francesco Fio showed solutions for classification issues in the context of automobile radar utilising several neural network architectures.

3. Scope of Project

- A GSM can be used to send SMS to concerned person about detectedobject, distance.
- A camera can also be used to view the live video.
- We can use this radar system to detect objects in Real time.
- Also, we can mount camera-based system to capture the imageand send it over the cloud.
- We can fix this system on the rooftop of vehicle and we canintegrate this to control the speed of the vehicle.

4. Methodology

After designing, building, and programming the system, we placed a few objects in front of the ultrasonic sensor to verify its functionality.

Our monitor began to display the output through processing IDE as soon as the motor began to revolve. As a result, when the sensor passed over the object, it displayed a red segment indicating the object's distance and angle.

The first object was placed at a distance of 30.5cm, which was measured with a ruler, and the system calculated the distance to be 32cm.

The second object was placed at a distance of 20 cm and measured at 21 cm by the system. As a result, the calculated efficiency was 95 percent.

5. System Overview

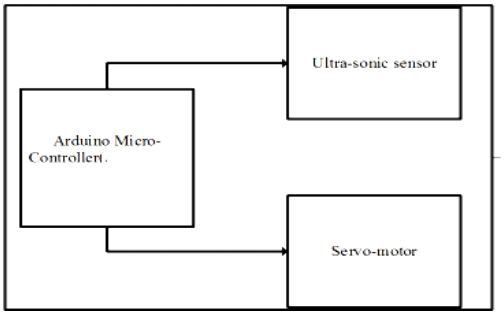


Figure1. System hardware description

This diagram depicts a high-level overview of the radar system. The controller we're utilising here is Arduino, with an Ultrasonic sensor as the

input and a servo motor that rotates 180 degrees as the output. All of the system's functions are controlled by the microcontroller, from motor rotation to ultrasonic obstacle detection and display of the results on the screen.

6.System Block Diagram

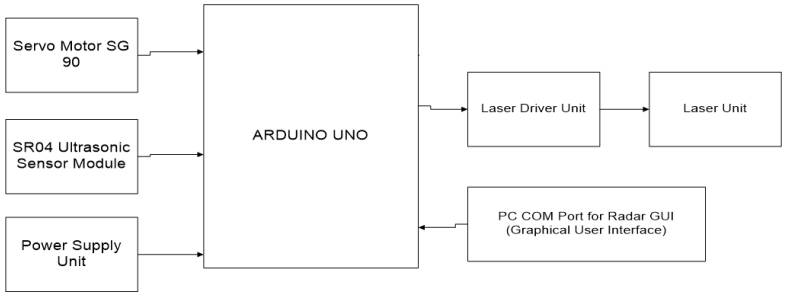
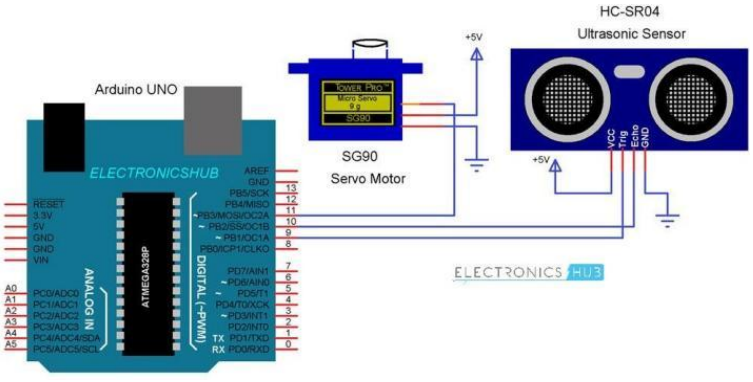


Figure2. Block Diagram of Radar System.

- In this above block Diagram Ultrasonic sensor emits ultrasound wave with 40khz frequency.it has transmitter & receiver module. When transmitter emits the wave & obstacle is present in front oftransmitter the echo received at the receiver side.
- The time required to travel this wave divide by two will give the distance. When obstacle is within the limit then it will show red mark on processing software. Theprocessing software is connected serially with UNO &which used to display nice graphical user interface.
- The servo motor SG90 is used to rotate the ultrasonic sensor to cover full area.
- Laser pointer is attached on to the ultrasonic sensor to point out the object orenemy.
- Arduino uno is main device of the project & it is brain of the project. The Arduino uno is an open-source microcontroller board based on the microchipATmega328p microcontroller. Arduino is programming device to program the device based on Arduino ide software is used.
- Then the power supply unit is giving the supply of 5v dc with simply connected tocomputer with usb cable or power if with a AC to DC adapter or battery to get started.

7. Circuit Diagram

- The circuit diagram of this Radar Project is very simple as it involves very little hardware.



8.Software details

1.Arduino IDE (Integrated development Environments)

2. Processing 3 (GUI Graphical user interface)

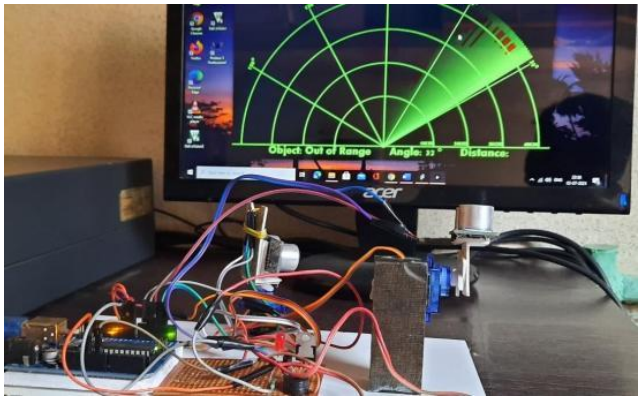
9.Hardware Used

- ArduinoUNO[BuyHere]
- HC-SR04UltrasonicSensor
- SG90ServoMotor
- MountingBracketforUltrasonicSensor(optional)
- ConnectingWires
- JumperCables
- 5VPowerSupply
- USBCable(forArduino)

10.Working & Result

After creating the connections, upload the code to Arduino. The servo can be seen sweeping from 00 to 1800 and then back to 00. The Ultrasonic Sensor will participate in the sweeping movement because it is positioned over the Servo.
Now, launch the Processing programme and paste the above-mentioned sketch into it. Make the necessary changes to the COM Port selection in the Processing Sketch, and replace it with the COM Port number to which your Arduino is attached.
If you look at the Processing Sketch, you'll notice that I set the output display size to 1280720 (considering that practically all PCs today have a minimum resolution of 1366768) and calculated with that resolution in mind.
In the future, I'll post a new Processing sketch where you may specify the desired resolution (for example, 1920x1080) and all computations will be changed automatically to this resolution.
Now run the sketch in Processing, and if all goes properly, a new Processing window will appear, similar to the one below.

11.Result of project



12 Radar Screen

A Graphical representation of the data from the Ultrasonic Sensor is represented in a Radar type display. If the Ultrasonic Sensor detects any object within its range, the samewill be displayed graphically on the screen

13 Conclusion

Radar is typically used to determine an object's velocity, range, and position. We read the distance and angles of detected objects in this technical endeavour in order to turn the data into visual information. Our project is performing exceptionally well. It detects items inside the specified range with ease. The information is displayed clearly on the screen with enough delay for the user to read it. This project could be useful for object recognition and avoidance applications.

This project could easily be extended and could be used in any systems may need

- Ultrasonic Radar Using Micro-Controller Was Successfully Implemented and executed
- Designedprojectcanabletodetecttheobjectandalsogivesaudiosignalingifanyobjectis detectedwithinthe30cm range.
- Therangecanbeadjustableup-tothe400cmrange

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