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Radar using Ultrasonic Sensor

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Abstract: *Radar is an object detection system which uses radio waves to determine the range, direction of objects. The radar dish or antenna transmits pulses of radio waves or microwaves which bounce off any object in their path. Arduino is a single-board microcontroller to make using electronics in multidisciplinary projects more accessible. This project aims at making a Radar that is efficient, cheaper and reflects all the possible techniques that a radar consists of. The proposed system "ultrasonic radar for the object detection distance and the speed measurement" employs an ultrasonic module that includes an ultrasonic transmitter and receiver. It operated by transmitting 40 kHz frequency pulse which is not audible to the human ear. Module rotate with step angle of the stepper motor with specific angle for a specific time interval and the distance between the object and system is measured by calculating time interval taken by the signal to transmit and the echo reception Whereas the detected signal is shifted toward the module or away from the module which give the information about the speed of that detected object which is shown on PPI Display.*

Keywords: Radar, Ultrasonic Sensor, Arduino, Servo Motor

I. INTRODUCTION

Radar is an object detection system which uses radio waves to determine the range OR direction of objects. Radar systems come in a variety of sizes and have different performance specifications. Some radar systems are used for air-traffic control at airports and others are used for long range surveillance and early-warning systems. A radar system is the heart of a missile guidance system. Small portable radar systems that can be maintained and operated by one person are available as well as systems that occupy several large rooms.

Radar was secretly developed by several nations before and during World War II. The term Radar itself, not the actual development, was coined in 1940 by the United States Navy as anacronym for radio Detection and Ranging. The term radar has since entered English and other languages as the common noun radar, losing all capitalization.

The modern uses of radar are highly diverse, including air traffic control, astronomy, air, 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 systems; guided missile target locating systems; and ground-penetrating radar for geological observations. High tech radar systems are associated with digital signal processing and are capable of extracting useful information from very high noise levels.

1.1 Aim & Objective

The goal of this project is to create a working Ultrasonic radar system that is capable of monitoring a particular area. the ultra- sonic sensing technology since its emergence and some of these include home security systems, robotics applications, distance measurement, tank level measurement, in production lines, and proximity detection applications. These innumerable applications have made it possible to solve technical problems faster and cheaper without compromising safety, quality and stability.

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II. SYSTEM REQUIREMENTS

A brief description of the components that are used in the implementation of radar using ultrasonic sensor project are states below:

Software requirements

- Arduino IDE
- Processing Application

Hardware Requirements

Ultrasonic Sensor

An ultrasonic sensor works similar as of sonar. It can measure distance of object by sending sound waves. Sound waves are send at a specific frequency at a specific direction and listen for sound wave to come back. time taken by sound wave to come back helps us to determine distance of object.

Servo Motor

A servo motor is a rotary actuator that allows for precise control of angular position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servo motors. Servomotors are not a different class of motor, on the basis of fundamental operating principle, but uses servomechanism to achieve closed loop control with a generic open loop motor. Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing

Arduino

The Arduino is an open source electronics platform based on easy to use hardware and software. The open source Arduino software makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X and Linux. The environment is written in java and based on processing and other open source software. This software can be used with any Arduino board. The Arduino software IDE contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common function. It connects to Arduino and Genuino hardware t+o upload programs and communicate with them. Program written using Arduino software are called sketches

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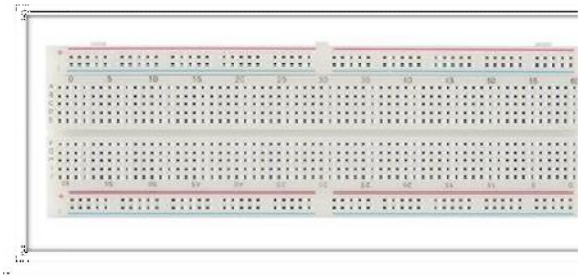
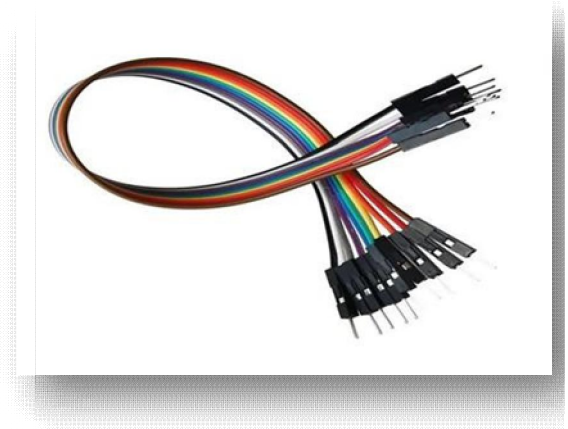
Bread Board

Breadboards are one of the most fundamental pieces when learning how to build circuits. In this tutorial, you will learn a little bit about what breadboards are, why they are called breadboards, and how to use one. Once you are done you should have a basic understanding of how breadboards work and be able to build a basic circuit on a breadboard



Jumpers Wires

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed.



III. DESIGN AND IMPLEMENTATION

In this chapter we will discuss about the connection of all components.

For this Project we need a 5v power supply. We use Computer as A supply by a USB cable which will directly connected to the jumper wire from 5v pin of Arduino to positive pin of breadboard Then, we take another Wire that is connected to GND pin of Arduino to negative pin of breadboard.

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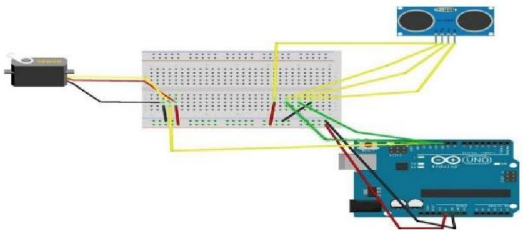
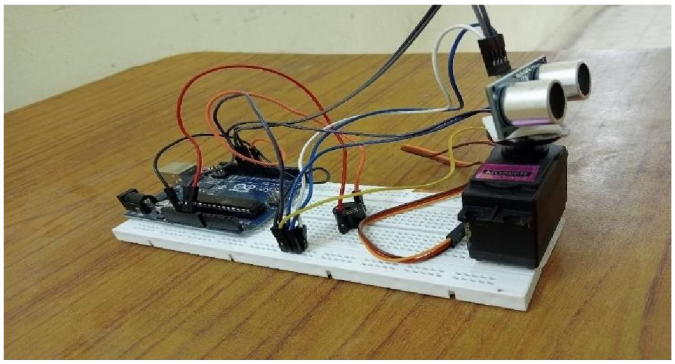


Connection Diagram of Arduino Radar

Now we will Connect the servo motor to the Arduino. Servo motor has 3 Wire. We have to give 5v supply to motor by Red Wire. We used brown wire as a ground that is connected to the negative pin of breadboard. The last wire that is yellow we will connect it to the Arduino digital pin 12.

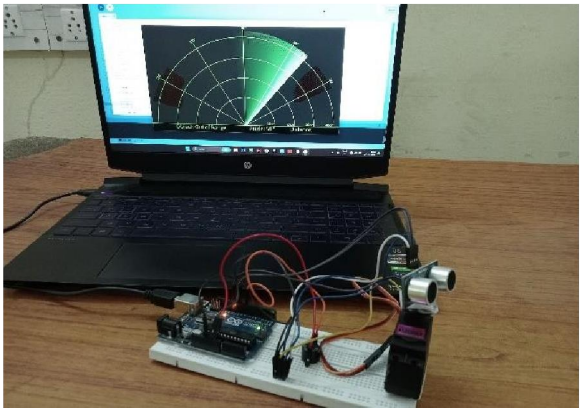
Ultrasonic Sensor has 4 pins. Vcc pin connected to the 5v suppy by jumper wire. GND of breadboard. Trig and Echo pin connected to the 10 &11 no pin of Arduino. Trig pin sends a sound wave to the air and Echo pin receive the return wave So, we can say that Trig pin is the output pin of sensor.



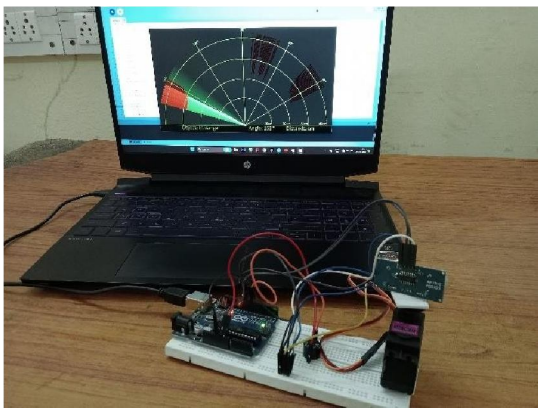
Ultrasonic is a non-contact level measurement method that uses sound waves to determine the process material being measured. Ultrasonic transmitters operate by sending a sound waves, generated from a piezo electric transducer, to the media being measured, The device measures the length of time it takes for the reflected sound wave to return to the transducer. A successful measurement depends on reflection from the process material in a straight line back to the transducer.

However there are various influences that effect the return Signal. factors such as Dust heavy vapours, tank obstructions, surface turbulence, foam and even surface angles can affect the return signal. That is why the conditions the determines the characteristics of sound must be considered when using ultrasonic measurements.

IV. EXPECTED OUTPUT



Before Object Detection



After Object Detection

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V. APPLICATIONS

Military Applications In air defense it is used for target detection, target recognition and weapon control (directing the weapon to the tracked targets). In missile system to guide the weapon. Identifying enemy locations in map.

Air Traffic Control To control air traffic near airports. The Air Surveillance RADAR is used to detect and display the aircraft's position in the airport terminals. To guide the aircraft to land in bad weather using Precision Approach RADAR. To scan the airport surface for aircraft and ground vehicle positions.

Space To guide the space vehicle for safe landing on moon to observe the planetary systems to detect and track satellites to monitor the meteors.

VI. FUTURE SCOPE

We have represented a project on ultrasonic radar for security system for human or object interference in a short range. The system has been successfully implemented and the aim is achieved without any derivation. There is a lot of future scope of this project because of its security capacity. It can be used in many applications. This project can also be developed or modified according to the rising needs and demand.

VII. CONCLUSION

A lab scaled radar system was designed and implemented using a Arduino, a servomotor and an ultrasonic sensor. The developed system is able to read the distance of obstacles and the angle of incident and convert this data into visually represented information. The system performance measure up with other system at its level as it adequately reports any obstacle. A very handy application for this system would be in the area of object detection and avoidance system for robotics or maybe in instrusion detection systems for location sizes where it may not be economical to use multiple units to provide adequate coverage. The systems range is dependent on the range of the ultrasonic sensor that is used. In this system the HCSR04 ultrasonics Sensor was used which has a range between 2cm and 40cm

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