Research Paper

Ultrasonic Radar System using Arduino

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Abstract
The aim of our project is to help users to get useful andsystematic Guidance of Obstacles open to them in theirrespective field . Radar is an electronic device whichutilizeselectromagneticwavestodeterminethealtitude, range, direction, or speed of both moving andimmovableobjects
The main purpose of developing this project is to helpusersthroughradarGuidanceandmakedecisionsabout their field. In contrast, ultrasonic waves are usedinsteadofelectromagneticwavesinultrasonicradar.In this paper, we designed a radar system that uses anultrasonic sensor to detect objects. In this paper, theultrasonic is used to measure the distance between theradarandanyobject-basednon-contacttechnologyThe effectiveness of the proposed design is measuredusingastatisticalanalysisofthedistanceerrorbetweentheradarandtheobstacles. Thesignalreceivedfromsensorwouldbeprocessedusing "Processing Development EnvironmentSoftware," then the result would be shown on a PCscreen.
Keywords

- *Servomotor*
- *Radar*
- *Ultrasonic Sensor*
- *Arduino Uno*
- *Processing IDE*

I.   Introduction

Radar is an informationprovider ofan objectsthatcannotreacheddirectly.Itisamethodofobjectdetection using radio waves to determine objects' size,height,direction.Theprincipleofoperation ofradars isunique;sendingandreceivingwavesthroughaspecific medium that allow such waves to pass throughat a low level of attenuation. However, the distance ofthemeasurementsdoes not exceed 50cm

New uses of the radar include a wide range of air trafficcontrolsystems including,radar, air defensesystems,AIcars,seasurveillancesystems,outerspacemonitoring,andHomeSecurity.Theexperimentalresults show that the erroris decreased by increasingthe distance between the object and the sensor. Both theeffective area of the object and its shape were taken intheaccountforprecisemeasurement.However,thesystemmustincludeaGSMmodemthataddcomplexity to the design.Developmentof HardwareSystem which may help to users to Find Obstacles onSpecifiedArea.
Ultrasonic detectors have several positive features suchas, cheapness, higher sensing range, better robustnessduring environmental changes rather than other types.Eventhoughoursolutionisbasedonthetypicalcombination of an ultrasonic sensor with the Arduinoplatform, we provide an important improvement in thehardwareandsoftwaredesignofthesystem.Asamatter of fact, our solution provides a compact, low-cost and versatile hardware device that allows. obtainedthroughthesmartphone'saccelerometer sensor.
This paper aims at providing a new low-cost, versatilesystem based on ultrasonic technology and the ArduinoNano platform [10] to blindly map indoor environmentswith the aid of anAndroid-based mobile device. Asamatter of fact, ultrasonic sensors have become a popularmeasurementtoolbecauseofboththeirsimplicityandaffordability.More recently, several applications based onultrasonic technology have been developed to improve themappingandlocalizationofarobotmodulefortheexplorationofunknownand/ordangerousspacesthatcannotbeacce

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ssedby humans.

This Work aim to Design and Implement An ultrasonicSystem for distance Measurement using Arduino boardfordistanceup to 10cm to 50cm Approx.

II. Objectives

The main objective of this System is to monitor anObstacles in particular range an show it on the laptoporcomputerScreenin theformofRadar

Thisprojectwillservethefollowingobjectives:

- Userscan Seethedirectionoftheobjectin180degreeformat.
- UserscanMonitortheobjectintheredlineformatinthe radarsystem.
- Itwill display therangeofthe objectinfrontofthesensor.
- ItcanMonitortheobjectinthespecifiedrangeupto50cm.
- ThemainobjectiveofthissystemistonavigatetheAIand automaticcars.

Purpose

The aim of this projectis to calculate the distanceposition and speed of the object placed at some distancefrom the sensor. Ultrasonic sensor sends the ultrasonicwave in different directions by rotating with help ofservo motor. This wave travels in air and gets reflectedbackafterstrikingsomeobject.Thiswaveisagainsensed by the sensor and its characteristics is analyzedand output is displayed in screen showing parameterssuchas distanceandpositionofobject.

Arduino IDE is used to write code and upload coding inArduino and helps us to sense position of servo motorand posting it to the serial port along with the distanceof the nearest object in its path. The output of sensor isdisplayed with the help of processing software to givefinaloutput indisplay screen.

Project Modules

- Ultrasonic Sensor(HC SR04): An ultrasonic sensorworks similar as of sonar. It can measure distance ofobject by sending sound waves. Sound waves aresend at a specific frequency at a specific directionand listen for sound wave tocomeback

- Servo Motor (SG90):A servomotor is a rotaryactuator that allows for precise control of angularposition, velocity and acceleration. It consists of asuitable motor coupled to a sensor for positionfeedback, it will receive the input of 5v and throughtheoutput of1.5v.

- Arduino UNO Board:Aduino The Arduino is anopen source electronics platform based on easy touse hardware and software. . In most applications,theArduinoboardisusedas acontroller.Initially,the device requires a direct connection to acomputerat the first setting steps. .

Submodulesare:
- USBconnector
- Powerport
- DigitalPins
- CrystalOscillator
- TXRXLEDs
- ResetSwitch

- Bread Board: Breadboardsare one of themostfundamental pieces when learning how to buildcircuits. They are used to built the connectionswithout Isolation.

- ProcessingSoftware:Processing(Figure4)isanIntegrated Development Environment (IDE)designed for several purposes such as electronicarts and visualizing the fundamentals ofprogramming. In this software the Radar will bediaplayed

- JumperCables:-Jumperwiresareelectricalwireswith connector pins at each end. They are used toconnect two points in a circuit without soldering.Submodulesare:
- MaletoMalecable.
- FemaletoFemalecable.

Scope

- "Ultra Sonic Radar system " is a hardwaresystemthatisusedtomonitoranddetecttheobjectinthespecifiedrange.
- The System is designed to create an Onlinebased guidance tool for Robots or AI and automotiveservices
- ItCanbeusedinautomaticcarsorAIbasednavigation system.
- As the system is built in cheaper andeffective price users can buy it easily forsecuritypurposeratherthenCCTVcameras.
- Effectiveformonitoringlargeandmiddlelevelobjects.
- Thistypeofsystemprovestoaneffectivetoolformonitoring theprohibited area
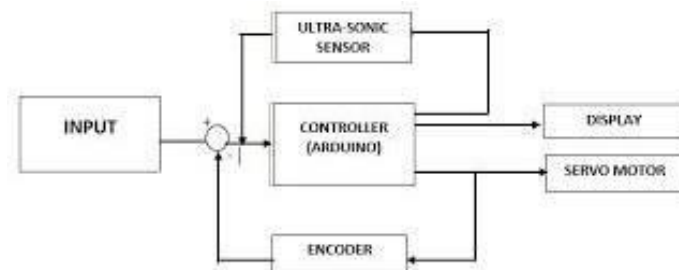

Fig.1.1ArchitectureUltraSonicradarsensorusingArduino

Features

- UserscaneasilySeetheobjectinthe radarsystem in Red format.
- Userscanaccess iteasily,nologinoranything.
- Thesystemisverycheap,andcaneasilyperformtask.
- Wecanseetheradarsystemwithinourhouseoranywherethroughlaptop.
- Itcanbewirelessandtherangecangoupto150cm infeature.

Design Concept

- ProcessingModule:

This module will manages all details regardingto the radar system and the distance angel andcommunicatewith thesensor.

- ArduinoUno:

It is a hardware board that is used to communicatewith the software of Arduino IDE and processingsoftware and will provide the guidance to the servomotorandthentheprocessingsoftwarewilldisplaytheoutput

- CircuitDesign:

Itshowstheconnectionofdifferentelectronicscomponents. In the figure triggering pins of ultrasonicsensor is connected to D8 pin of Arduino, control lineof servo motor is connected to D6 pin of Arduino andD7 pin of Arduino is connected to echo pin. VCC pinsof servo motor and ultrasonic sensor isconnected to5V pin of Arduino while ground pin of Arduino isconnected to ground pin of both servo motor and ultra-sonicsensor
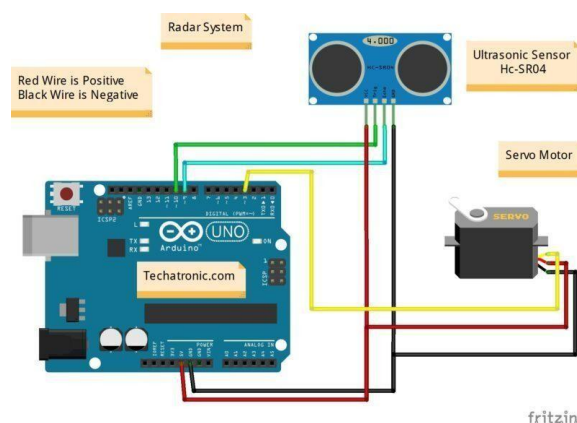

Fig.1.2.Circuit Diagram of ultrasonicRadarsystem usingArduino

HardwareRequirementforDevelopmentofProject
1. Operatingsystem:WindowsXP
2. Harddisk: 40GBharddisk
3. RAM:1 GBRAM
4. ArduinoUnoBoard
5. UltrasonicSensor(HCSR04)
6. Servomotor(SG90)
7. Breadboard
8. Jumpercables
9. Processor:IntelPentiumorabove

Software Requirement for Development of Project

1. Designinterface:Arduinolanguage,C++
2. BackEnd:processing,java
3. ProcessingSoftware
4. IDE:ArduinoIDE

Advantages of this Project

- The systempriceisverylowsoeachusercanaffordit.
- Thesystemislightinweightandsmallsoitiseasilyportable
- Workingandmaintenancevale is verylow
- AnydarkenvironmentshavenoeffectonthisArduino radar sensor's detection procedure. So, itcanalsouseatnight.
- It has high frequency, high sensitivity, therefore, itcaneasilydetecttheexternalordeepobjects.
- Thisradarsensorisnotaffectedbydust,rain,snow,andmanymore.
- TheUltrasonicsensorcaneasilyinterfacewithanytypesofthemicrocontroller.

Disadvantages of this Project

- TheArduinoRadarSensorconductsoundtocontinuethework.So,itisnotworkinginavacuum as there is no air for the sound to travelthrough.CausesComplacencyinNetworking
- Anotherlimitationisthedetectionrange.Therangeisupto50cm
- Itishardtodetectobjectswhicharecoveredwithsoftfabric.

III. Conclusion

Inthiswork,anultrasonicradarsystemwasdesignedandimplementedexperimentallyfordistancemeasurementspurpos estobeusedinvariousapplications.Threetypesofmaterials(wood, sponge and aluminum) were used in thedesign as obstacles.

The software results have been verified by usingrubber and paper with a drawn angle. Hence, thedevicecalculatesthedistancewithsuitableaccuracy and resolution. The data converted intovisualinformation.AnArduinoUnodevicewasusedasacontrollerinthedesignbesideotherrequirements such as servomotor, ultrasonic sensorand computer for distance calculation of objects orobstaclesplacedatdifferent angles(from0to180 degrees)within therange upto50cms.

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