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Radar Tracking Using Arduino

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***Abstract*: A Object Radar is a device (Tool) that is used to measure the distance from the object to the device Which is used for the purposes of surveying, determining focus in photography, or getting the information about the location and angle of the object. In this technical project, we had made simple object radar using the Ultrasonic Sensor (HC-SR04). This Radar Device works by calculating a distance range from 4 cm to 40 cm with angle range between 15° to 165°.In this device Servo Motor is used for the rotation of the ultrasonic sensor between the angles. "Processing Development Environment" software is used to demonstrate the result on a PC Screen after processing the information received by the Ultrasonic Sensor.**

***Keywords*: Radar System, Imitation, Microcontroller Arduino Board, Ultra-Sonic Sensors Module, Servo Motor.**

1. Introduction

Contactless distance measurement can be done by many different methods, according to the selected principle. In various applications, transmitters and receivers use infrared light, the distance being measured by the method of optical triangulation. Other systems for distance measurement are based on laser, a method providing increased accuracy and precision. Motion detection of objects or living beings might be interesting in many domains, such as security devices, radars, the positioning of industrial robots, liquid levels in tanks, the depth of snow banks and auto guidance systems. Most of these applications require that the detection system to be noninvasive and to not disturb the normal work environment, devices or living beings in the area of detection. This involve the choice of discrete vectors for information transport, with high immunity to all other factors unless the state of motion. The detection system may be passive, but in this case, the moving object must have a specific property that can be detected, for example, light or infrared radiation. This conditioning limits the field of system applicability, but presents the advantage of high discretion for detector. There are also active detection systems, consisting of a transmitter and a receiver that does not impose any special condition for the detected object [1], [2].

The distance is measured by the processing of the reflected ultrasound signal, after striking a quasi-flat surface. The 2-D dimensions of the reflective surface are larger compared to the wavelength of the sound.

As an overall approach, we have to consider mainly three different situations, regarding the mutual movements between the ultrasonic source and the detected object:

1. The detected object is stationary and the ultrasound source is in motion.
2. The ultrasound source is stationary and the detected object is in motion.
3. Both the ultrasound source and the detected object are moving.

Detection sensors could measure various parameters of the moving object: distance, speed, size and location [3]. These data supply information on mechanical, electrical, acoustic objects.

The extraction of information can be done by various methods: acoustic, magnetic, optical, radiation, electrical, pneumatic, electromagnetic, etc. Dealing with determination of a specific location, the acoustic sensors are a better option than optical ones [4], [5]. RADAR was secretly developed by several nations before and during the World War II. The term RADAR was coined in 1940 by the United States Navy as an acronym for "RADIO Detection and Ranging." Radar systems have a wide range of applications. Geologists use radar to map the earth and other planets. Meteorologists use radar to track the storms, hurricanes and tornadoes.

2. Aim of project

The Radar System for object detection, distance and speed measurement aims to brains any set or stirring entity which is in the range of Ultrasonic Module and to analyze the coldness of that entity from the device, also calculates accuracy of the stirring item. The speed and distance will be shown on the LCD display either it can be a monitor screen or external LCD.

A typical ultrasound system for distance measurements is almost identical as concept to the radar systems working on the board of the commercial or military aircrafts or watercrafts. Radar works in the GHz range while the sonar in the kHz range and ultrasonic system in the MHz Ultrasound designers adopt and expand their systems on the principle of steering beams using phased arrays, originated by radar system designers. Today these systems involve some sophisticated signal processing equipment aiming to detect a specific object [6].

Radar is also used in military (defensive) applications or in civil ones: air traffic control, speed detection of a vehicle, or obstacles avoiding [7], [8]. A radar system consists of a transmitter that transmits a fascicle to the target, which is then

reflected by the target as echo signal.

The reflected signal is received by a receiver. The receiver processes the received signal and provides information such as the existence of a target, distance, position (moving or stationary) or speed. Due to multiple reflections on different objects in the overseen area, a stationary or not ultrasound field is settled down.

3. Proposed system

The Radar device detects objects same as walls, being motor vehicle etc. and sends sequence of perceptible signals to alert the driver and stop a possible disaster. modules sense obstacles only at what time the vehicle is in movement after that provide real time response. modules contain the choice to button on and off at any time necessary.[9]

A. Ultra Sonic modules in trains

We can use ultrasonic modules in the train for their proper movement in the foggy weather. As we know that in winters trains get late by hours due to heavy fog but if we use ultrasonic sensors for detection of track clearance then this will help the Indian Railway to move their trains smoothly in the foggy weather. With these modules of Ultrasonic sensors, we can detect the objects on track [10].

B. Ultrasonic sensors for parking

Growing complexity to park automobile lack in damage in smaller parking area is necessity to force the advertise require over the predict period. The sensors can detect a variety of blockage such as walls, kids, mainstay and barrier 11].
Machinery embraces Ultrasonic and Electromagnetic Machinery is used to calculate the detachment among the automobile to objective via echo waves also compute space among the affecting and immobile things. Two to more modules built-in the back of automobile tinted with same shade of the back where the component can get throw ultrasonic gestures sense barrier that come into signal. This mechanism gearshift steering, acceleration and braking robotically, according to the parking zone and position in sequence gained from the ultrasonic module, to accomplish corresponding parking and garage parking [9].

C. Circuit Diagram for the Device

The circuit figure of the Radar Detection Device is extremely easy as it engages with extremely diminutive hardware [12].

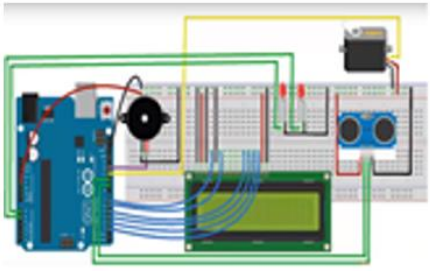

Fig. 1: Circuit diagram

4. System description

A. Arduino Uno

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.

B. Servo motor SG90

It is tiny and lightweight with high output power. This servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller.

C. Ultrasonic Sensor HC-SR04

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound.

D. Processing 2 software

Processing is a flexible software sketchbook and a language for learning how to code within the context of the visual arts. Since 2001, Processing has promoted software literacy within the visual arts and visual literacy within technology.

E. LASER Module

A laser diode, (LD), injection laser diode (ILD), or diode laser is a semiconductor device similar to a light-emitting diode in which a diode pumped directly with electrical current can create lasing conditions at the diode's junction.

5. Present and future scope

The thought of making an Ultrasonic RADAR System come into sight to us while screening the technology used in security, be it Military, Fleet or Air Force and now also used in the automobile make use of features like routine/ automatic parking arrangement, disaster hindrance for the period of driving etc. Use of such has been seen in recent times in the auto car parking systems instigate by AUDI, FORD etc. And even the forthcoming mechanical cars by Google named Prius and Lexus [9].

The device prepared by us can be placed in any equip you may want to use like in an automatic car, a cycle mountain bike or all else. The draw on of Arduino board in the development gives the litheness of convention of the over said component according to the necessities [10].

6. Application

A. Applications in Sky

In aeronautics airships are prepared by means of radar systems that help airships or other objects in or forthcoming their way, forecasting weather conditions, and give exact elevation readings. Airships with the Radar System can take off in foggy airports prepared with radar support ground illicit loom

systems in which the airship's flight is pragmatic on radar monitor at the same time as operators' radio landing commands to the pilot [12].

B. Submarine (Under Water) Applications

In the Marine Devices Radar System can be used for determining the obstacles in the way of the Marines. By using the radar system in marines, we can measure the bearing and the distance of other objects like Ships and others and the Radar System can be used to prevent the collision with the obstacles. This can also be able to find the Islands, Buoys and Lightships [10].

C. Applications in Army Fields

In Army Fields two high range video cameras are used to automatically detect and are used to track the individuals' movements anywhere the system is located. But we can use the Radar System for the detection of the movement and any other activity then this can help us very broadly. Because in Army Fields cameras are not enough to observe the activities. And this may cause of low security in fields. So for this we can use Radar System. Because device do this by returning the signals to radar system with the movement distance and angle. This can help them to aim their guns easily towards the targets [8].

D. Device Circuit

The device structure plan has been shown in figure, was planned using friezing environs. It views the connection among the relevant electronic machinery. In the below given figure the trigg badge of the ultra-sonic module is connected to the badge D8 of the Arduino board microcontroller, the echo badge is connected to badge D7 of the microcontroller and the control line of the servo motor is linked to badge D6 of the micro-controller Arduino board. The VCC badge of both the servo motor and the ultra-sonic module are linked to the 5V badge out of the Arduino at the same time as the GND badge of both the ultra-sonic module and the servomotor are linked to the GND badge out of the Arduino [11].

7. Working

To start the Arduino radar sensor, you should know the programming code. There are two programming codes need to start the radar. One is the Arduino Uno and another one is the processing. After uploading the code to Arduino, the servo sweeping from 00 to 180 degree and back again to 00 degree. Since the Ultrasonic Sensor is riding the Servo. Now open the processing application and run the code. If there is no error, then another processing window open up. This is a Graphical representation of the data. The Ultrasonic Sensor represented in a radar type display. When the Ultrasonic Sensor detects any object within its range, the object will be shown on screen as a graphically. When obstacle is detected laser will fall on object that is shown on screen. The basic objective of our design is to ascertain the distance position and speed of the obstacle set at some distance from the sensor. Ultrasonic sensor sends the ultrasonic wave in various ways by rotating with help of servo motors. This wave goes in air and gets reflected back subsequent to striking some object. This wave is again detected by the sensor and its qualities is analyses and output is shown in screen indicating parameters, for example, distance and position of object. Arduino IDE is utilized to compose code and transfer coding in Arduino and causes us to detect position or angle of servo motor and it is communicated through the serial port alongside the covered distance of the nearest object in its way. Output of all of this working is shown in the software called processing, it will display the input/output and the range of the object. Implementations of the sensors are done in such a way that ultra-sonic sensor is attached on top of the servo motor because it has to detect the object and its distance. Arduino will control the ultra-sonic sensor and servo motor and also powered will be given to both of them through micro-controller.

8. Conclusion

In this term paper a model radar system has been intended and put into action by an Arduino board, a servo motor and an ultrasonic feeler hc-sr04. The proposed model is capable to calculate the aloofness of object and the location of occurrence and changes this information into Visual Representation Form using monitor display. The device measures up distance and angle of any object come across in its path. And provide predictable range distance of obstacle. A very versatile purpose for this device would be in the field of object recognition and forestalling device for transportation vehicles maybe in imposition detection devices for position volume where it may not be inexpensive to run. The device's range is based on the variety of the ultrasonic feeler used in the. In this device system ultrasonic sensor module HC-SR04 has been used which has range approx. of distance between 4cm and 40cm [9].

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