RADAR SYSTEM USING ARDUINO AND ULTRASONIC SENSORS

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Abstract: -Radio Detection and Ranging (RADAR) is a device which is employed for monitoring a specific area 24/7. The basic needs of these are security. RADAR is an object detecting device. It will be used to detect aircraft, spacecraft, missiles, vehicles, weather formation etc. Radar is an addition sensory equipment for man which can affords genuinely new technology. Ultrasonic RADAR is an object detecting system which helps to observe a region of short range. This system consists of an Arduino and Ultrasonic Sensor mounted on a Servo Motor for rotation in a wide angle.

This project aims to make an efficient, cheaper RADAR which reflects all the possible techniques that a radar consists of. ultrasonic sensor transmits the signal and if any obstacle that's target is detected then echo pulse sense. Furthermore, this project is often enhanced by employing a laser gun. When the target is detected then the gun will be fired inn this proper direction. Arduino controller and ultrasonic sensor is that the base of this project.

KEYWORDS: Ultrasonic sensor, Arduino, servo motor, Arduino ide, processing ide.

I. INTRODUCTION

RADAR is a system which detects obstacle in a given range . it uses ultrasonic or radio waves to determine the range, direction, altitude or speed of objects. Radar system comes in a variety of specifications and may have different performance specifications. Some of the radar systems are often used for air-traffic control at airports and others are used for long range surveillance and early-warning systems. A radar system is one of the main parts of a missile guidance system or we can say its the heart of the radar system. Small portable radar systems which will be maintained and operated by one person are available also as systems that occupy several large rooms .

Radar can track storm , because precipitation reflects electromagnetic fields at certain frequencies. Radar can also render precise maps. Radar systems used in air traffic control, air craft navigation and marine navigation. United States and four commonwealth countries: Canada, Australia, South Africa and New Zealand also developed their own radar systems.

Secretly the Radar was developed by many nations before and during the World War II. The term RADAR itself , not the actual development, was coined in 1940 by United States Navy as a crony for Radio Detection and ranging. The uses of radar are highly wide as it used in air traffic control, air defense systems, astronomy; where marine radars used to locate landmarks and other ships; antimissile systems and aircraft anti-collision systems; rendezvous systems for outer space surveillance, ocean surveillance systems, meteorological and flight control precipitation monitoring; altimetry and guided missile target locating systems and ground-penetrating radar for geological observations.

In this project we used the ultrasonic sensor to emit a burst of sound waves in rapid succession. these emitted sound waves hits the intended target, bounce back to the ultrasonic sensor, and travel at known speed. an ultrasonic sensor, radar is much less affected by temperature and weather, thus it improve consistency and accuracy of the radar system.

II. LITURATURE SERVEY

A great many applications have been found for the ultrasonic sensing technology since its emergence [1] and some of these include home security systems, robotics applications, distance measurement, tank level measurement, in production lines, and proximity detection applications [2]. These innumerable applications have made it possible to solve technical problems faster and cheaper without compromising safety, quality and stability [3].

The authors in [1] designed a system for vehicle drivers to navigate unseen spots easily in traffic and night by installing an ultra-sonic sensor in the back of the vehicle and a light on the dashboard to indicate the proximity of other commuters that are coming from behind. The sensor is graded as a variety detecting apparatus and a threshold value set. The driver gets a flash on the dashboard as the oncoming vehicles comes closer than this threshold value.

The remote monitoring system that was designed and constructed in [4] features the use of ultra-sonic sensors for obstacle avoidance. The system comprises of a foreign station (the robot) and a base station (user) who can send commands to the remote terminal for teleportation. an obstacle avoidance system, a web enabled camera for remote monitoring. Based on the data coming from the system, the GPS system, and the camera user is able to send commands to the remote station to alter course or otherwise.

Ultrasonic radar systems were developed in the defense industry. its myriad applications in under the water object detection and identification plus tracking of upcoming missiles [5], the navy and the air force is major field in the RADAR utilization community.

III. METHODOLOGY

The hardware system consists of three components as Arduino micro-controller, servo motor and ultra-sonic sensor. The ultrasonic sensor is fitted on the servo-motor to provide a rotating mechanism. Both the ultra-sonic sensor and the servo motor controlled by the Arduino micro-controller.

A. COMPONENTS REQUIRED

1) Arudino uno:- The Arduino Uno is a micro controller board supported the ATmega328. It consist of 14 digital Input / Output pins (out of which 6 used as PWM outputs), 6 analog inputs, USB connection, power jack and a reset button. It contains hardware needed to support the micro controller; simply connect the computer with a USB cable otherwise power it with an AC-DC adapter or battery or charger to power on. The Atmega 16U2 faeture is to programmed as USB-to-serial converter. "Uno" termed as one in Italian and is named for the upcoming release of Arduino 1.0. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.

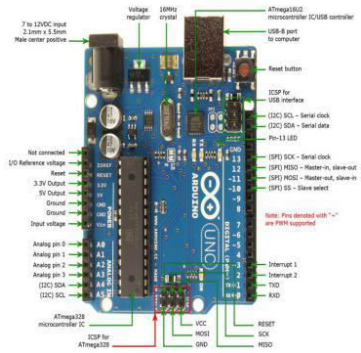

Fig 1: - Arduino Uno

2) Servo motor:- A servomotor is a motor that rotates in precise manner and allows for precise control to the angular position, acceleration and velocity. It consists of a motor coupled with the sensor for position feedback. It also requires a comparatively sophisticated controller, often a fanatical module designed specifically to be used with servomotors. Servomotors aren't a special class of motor, on the idea of fundamental operating principle, but uses servomechanism to realize closed-loop system control with a generic open loop motor. Servomotors are utilized in applications like robotics, automated manufacturing or in CNC machinery.

Fig 2: - Servo Motor

3) Ultrasonic sensor:- Ultrasonic sensors (also known as transceivers as it send and receive) work on a principle almost like radar or sonar which determines the key values of a target by interpreting the pulses and echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and determines echos received back by the sensor. it calculates the time interval between sending and receiving that is sending the pulse and receiving the echos to calculate the distance of an object. This technology often used for measuring the wind speed and direction, tank or channel level, and speed through air or water. For measuring speed or direction through air or water it uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure tank level or water level, the sensor measures a distance from the bottom surface of the fluid. Further applications include: sonar, humidifiers, medical sonography, burglar alarms and non-destructive testing. Systems uses a transceiver which produces sound waves from electrical energy to ultrasonic sound ranges above 18,000 hertz , then on receiving the echo the sound waves converts into electrical energy which gets measured and displayed.

Fig 3: - Ultrasonic Sensors

IV. RESULT

In this research paper we have mentioned that the system is designed using the following components such as Arduino micro-controller, a servo- motor and an ultra-sonic sensor and some necessary equipment like breadboard and wires. main objective is to determine the distance and angle of the target and to display this sensitive information graphically, means its output should be in graphical form which will be represented through processing software. We can have thought of an accuracy of this radar by testing objects at different levels and observe how faster or smoothly it detects an object in a particular range and gives us an expected range of the obstacle [3].

below figure show the results of our design when the Ultra-sonic sensor rotates within the area and detects obstacle in its path. The red area indicates the presence of obstacle and below the angle of incident and distance is being displayed.

a) Testing of the System

Object 1 is placed 21.3 cm far from the radar, radar gives the distance 22 cm, so:

- error = (22-21.3)/21.3) *100= 3.286%
- efficiency 1 = 100-error =96.71%

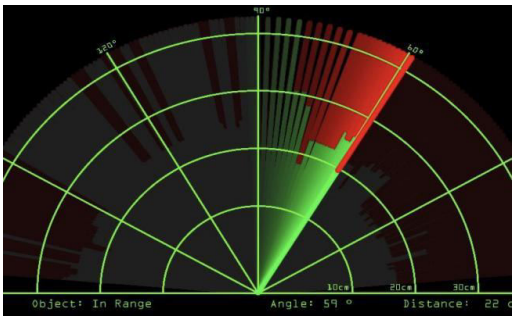

Fig 6: - Output of Radar System

V. CONCLUSION

In this paper, radar system was designed and implemented using an Arduino, a servo-motor and an ultra-sonic sensor. The designed system is capable of reading the distance of obstacles and the angle of obstacle from system incident and convert this data into visually represented information. The system performance measures up with other systems at its level as it level because it instantly reports any obstacle whenever it finds in its path and provides an estimated range of the object.

A very handy application for this system would be in the area of object detection and avoidance systems for robotics or maybe in intrusion detection systems for location sizes. The system's range to determine the obstacle is dependent on the range of the ultra-sonic sensor that is used in the system. In this system, the HC-SR04 ultrasonic sensor is used which has a range between 2 to 40 centimeters.

VI. REFERENCES

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