A STUDY AND IMPLEMENTATION OF ANTI-DEFENSE AIRCREFT SYSTEM ULTRASONIC (RADAR)

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Abstract: **RADAR is an object detection system which uses Microwaves. Microwaves are nothing but the radio waves. It uses microwaves to determine the Range, Altitude and Direction or Speed of objects.The radar dish or antenna transmits pulses of radio waves or microwaves which bounce off any object in their path. 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.**

Keywords: **Arduino microcontroller UNO, Ultrasonic sensor, Basic structure to mount, Jumper wires, Processing 3.**

I. INTRODUCTION

Technology in 21st century puts an emphasis on making the devices autonomous, be it self-driving car or a defence system all are being made autonomous. In this modern era there is an advancement in radar system also having privileges over the existing systems. The term RADAR itself, not the actual development, was coined in 1940 by United States Navy as an acronym for Radio Detection and Ranging.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 the World War II. The term RADAR itself, not the actual development, was coined in 1940 by United States Navy as an acronym for Radio Detection and Ranging. The modern uses of radar are highly diverse, including air traffic control, radar, astronomy, air-defence systems, antimissile systems, marine radars to locate landmarks and other ships; aircraft anticollision systems; ocean surveillance systems, outer space surveillance and rendezvous systems; meteorological precipitation monitoring; altimetry and flight control 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 extracting useful information from very high noise levels.

II. Literature review

The place of radar in the larger story of science and technology is argued differently by different authors. On the one hand, radar contributed very little to theory, which was largely known since the days of Maxwell and Hertz.“The Idea” Army, Navy and the Air Force make use of this technology.the United States, the Rad Lab at MIT officially closed at the end of 1945. The Naval Research Laboratory (NRL) and the Army’s Evans Signal Laboratory continued with new activities in centimeter radar development. The United States Air Force (USAF) – separated from the Army in 1946 – concentrated radar research at their Cambridge Research Center (CRC) at Hansom Field, Massachusetts. In 1951, MIT opened the Lincoln Laboratory for joint developments with the CRC. While the Bell Telephone Laboratories embarked on major communications upgrades, they continued with the Army in radar for their ongoing Nike air-defense program. Using Arduino UNO and processing 3 the mini model of this type of radar can be made working on the principle of object detection system, but most important concept of the system used in anti-aircraft defense system can be understood.

III. System development method

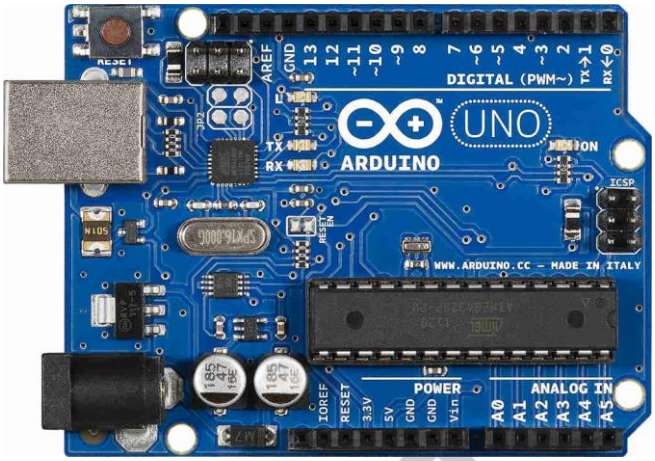

Fig 1.0 Arduino microcontroller UNO

Arduino

Arduino is an open-source project that created microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices.

The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers. These systems provide sets of digital and analogy input/output (I/O) pins that can interface to various expansion boards (termed shields) and other circuits. The boards feature serial communication interfaces, including Universal Serial Bus (USB) on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named Processing, which also supports the languages C and C++. The first Arduino was introduced in 2005, aiming to provide a low cost, easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

Arduino boards are available commercially in preassembled form, or as do-it-yourself kits. The hardware design specifications are openly available, allowing the Arduino boards to be produced by anyone. Adafruit Industries estimated in mid-2011 that over 300,000 official Arduinos had been commercially produced and in 2013 that 700,000 official boards were in users' hands.

IV. Servo Motor

Fig. 2.0 Servo Motor

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. [7] 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 servomotors.

Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system. Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing.More sophisticated servomotors use optical rotary encoders to measure the speed of the output shaft and a variable-speed drive to control the motor speed

V. Ultrasonic Sensor

Fig. 3.0 Ultrasonic Sensor

Ultrasonic sensors "are based on the measurement of the properties of acoustic waves with frequencies above the human audible range," often at roughly 40 kHz. They typically operate by generating a high-frequency pulse of sound, and then receiving and evaluating the properties of the echo pulse. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring wind speed and direction (anemometer), tank or channel level, and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculatesthe speed from the relative distances to particulates in the air or water. To measure tank or channel level, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultra sonography, burglar alarms and non-destructive testing. Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed.

The Ultrasonic sensor is mounted on servomotor which provides desired rotation to sensor to increase range of sensor which is connected to Arduino UNO board. Arduino UNO board is connected to computer which has Arduino IDE and processing 3. With the help of suitable programming the position object is displayed.

VI. Working of the components

Using Arduino Software, The Arduino integrated development environment (IDE) is a cross-platform application written in Java and is derived from the IDE for the Processing programming language and the Wiring projects. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. A program or code written for Arduino is called a "sketch". Arduino programs are written in C or C++. The Arduino IDE comes with a software library called "Wiring" from the original Wiring project, which makes many common input/output operations much easier. Users only need define two functions to make a run able cyclic executive program: • Setup (): a function run once at the start of a program that can initialize settings • Loop (): a function called repeatedly until the board powers off. Open the Arduino IDE software and select the board in use. To select the board: • Go to Tools. • Select Board. • Under board, select the board being used, in this case Arduino Uno. • Go to Tools and to Port and select the port at which the Arduino board is connected. • Write the code in the space provided and click on compile. Once the code is compiled, click on upload to upload the sketch to the Arduino board. (b). Connecting Servo Motor: A servomotor is a rotary actuator that allows for precise control of angular position, velocity and acceleration. A normal servo motor has three terminals: 1.VCC 2. GND 3. PULSE. A servo motor works at normally 4.8 to 6 volts. Ground is provided by connecting it to the Ground of the Arduino. The total time for a servo motor pulse is usually 20ms. To move it to one end of say 0degree angle, a 1ms pulse is used and to move it to other end i.e. 180 degrees, a 2ms pulse is applied. Hence, according to this to move the axis of the servo motor to the centre, a pulse of time 1.5 ms should be applied. For this, the pulse wire of the servo motor is connected to the Arduino that provides the digital pulses for pulse width modulation of the pulse. Hence, by programming for a particular pulse interval the servo motor can be controlled easily.

. Connecting Ultrasonic Sensor: An Ultrasonic Sensor consists of four wires. One for VCC, second for Ground, third for trigger signal and fourth for echo. The ultrasonic sensor is mounted on the servo motor and both of them further connected to the Arduino board. The ultrasonic sensor uses the reflection principle for its working. When connected to the Arduino, the Arduino provides the pulse signal to the ultrasonic sensor which then sends the ultrasonic wave in forward direction. Hence, whenever there is any obstacle detected or present in front, it reflects the waves which are received by the ultrasonic sensor. If detected, the signal is sent

to the Arduino and hence to the PC/laptop to the processing software that shows the presence of the obstacle on the rotating RADAR screen with distance and the angle at which it has been detected.

Processing Software: Processing is an open source programming language and integrated development environment (IDE) built for the electronic arts, new media art, and visual design communities with the purpose of teaching the fundamentals of computer programming in a visual context, and to serve as the foundation for electronic sketchbooks.

The project was initiated in 2001 by Casey Reas and Benjamin Fry, both formerly of the Aesthetics and Computation Group at the MIT Media Lab. One of the stated aims of Processing is to act as a tool to get nonprogrammers started with programming, through the instant gratification of visual feedback. The language builds on the Java language, but uses a simplified syntax and graphics programming models

VII. Applications

The idea of making an Ultrasonic RADAR appeared to us while viewing the technology used in defence, be it Army, Navy or Air Force.Air Force: In aviation, aircraft are equipped with radar devices that warn of aircraft or other obstacles in or approaching their path, display weather information, and give accurate altitude readings. The first commercial device fitted to aircraft was a 1938 Bell Lab unit on some United Air Lines aircraft. Such aircraft can land in fog at airports equipped with radarassisted ground-controlled approach systems in which the plane's flight is observed on radar screens while operators radio landing directions to the pilot.Most of the important use is as a heart of anti-aircraft defence system for detecting an illegal flight in a surveillance area or no flight permitted area.

VIII. CONCULSION

This project aims on the use of Ultrasonic Sensor by connected to the Arduino UNO board and the signal from the sensor further provided to the screen formed on the laptop 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 by the sensor. We implemented this project successfully and the result are obtained as per desired. Motor will rotate 0 to 180 degree for the object detection in the range of 3meter.when the object is within the range motor will stop for some time and on graph which is shown on the screen will indicated red colour line that mean object is detected and it also measure the distance of object from source point.

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