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RADAR USING ARDUINO UNO: A REVIEW

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ABSTRACT

A detection system called RADAR (Radio detection and Ranging) utilises radio waves to identify the properties of the objects it has detected, including their height, direction, and speed. In addition to being expensive and non-target specific for wide-range detection, radar is only useful for short-range applications. The primary objective of the project is to build a simple, low-cost RADAR model using an Arduino uno and ultrasonic sensors. Sound waves are used by the ultrasonic sensor for both range and detection. Since this is a limited range detection radar system project, the ultrasonic sensor functions as a RADAR in this instance with a range of 3 to 4 metres. Thus, an Arduino will be used to examine the distance, angle, and speed of the identified item in terms of a graphical representation.

I. INTRODUCTION

Radar is an electromagnetic technique employed to track and identify things. It operates as follows:

- Radiates electromagnetic energy that is able to travel over space via an antenna.
- The illustrating item, also referred to as the target, subsequently absorbs the emitted energy.
- The reradiated energy is captured by the target to the radar antenna.

Though some radar equipments are utilized as initial alerting and broad monitoring systems, some are utilised in airport air traffic control. A system for radar detection is the intellectual apparatus of a missile directing system. The radar (Radio detection and Ranging) system was developed surreptitiously by many countries before and at the time of World War II. Along with a number of other breakthroughs, the U.S. Navy came up with the term 'RADAR', in 1940. There are many new applications for radar technology, including air traffic monitoring systems, radar, air defence , naval maritime radars for site and vessel recognition and repositioning, aircraft collision prevention systems, sea surveillance, space monitoring, and contact systems. The earliest radars were built in the 1930s[1]. Radar systems have been extensively deployed by the military ever since. Because of their large bulk and initial exorbitant cost, radar systems were limited to usage in military environments. Antenna-on-chip or antenna-in-package techniques allow for the integration of a radar system into a single chip thanks to advancements in IC and packaging technology[5]. Radar systems are operating at higher frequencies in higher frequency bands. Radars serve a purpose in commercial as well as military contexts. It has no impact by the colour or transparency of objects, suitable for usage in dimly lit areas, and not much impactby dust, filth, or conditions with high moisture content, among other factors.

II. BLOCK DIGARAM

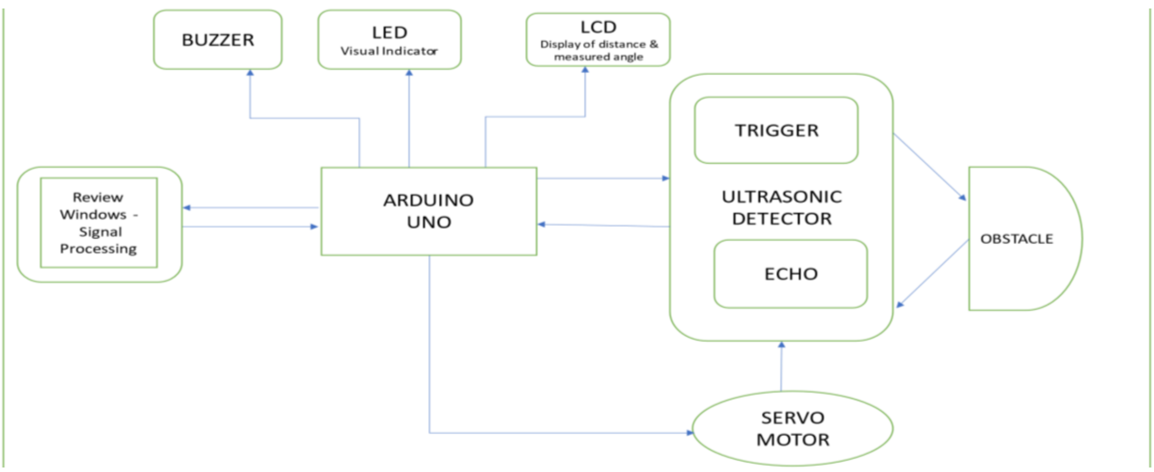

Fig 1: Block Digaram of ultrasonic radar detection system.

An Arduino module is used to create interactive devices. It employs the use of a microcontroller, a tiny computer with real-world sensing and control capabilities. Motors and sensors can be connected to it.

The Arduino board has pins you can connect things to, like sensors or lights. You can also add extra parts called shields.

To program the Arduino, you use software called the Arduino IDE. It works on Mac, Windows, and Linux. You write code in a language similar to Java. Then, you upload the code to the Arduino board using a USB cable.

Sound waves are released by the ultrasonic device at a frequency of 40,000 Hz. When these waves come into contact with an item, they move through the air and reflect back.

The sensor determines the range to the object by timing the wave's journey to and from it and factoring in the air's approximately 341 meters per second is the sound speed.

Here's the simplified formula:

$$\text{Range (d)} = (\text{Time(t)} \times \text{Sound speed(s)}) / 2$$

You divide by 2 because the time measured includes both the duration of the wave's arrival at the item and its subsequent return to the sensor. So, halving the time gives the one-way distance.The servo motor is lightweight (9g) and compact, with a high stall torque of 1.8 kilograms f cm and an speed of operation is 0.1 s/60 degrees. It operates at 4.8V and can rotate 180 degrees (90 in each direction). Interfacing with Arduino via RS232 USB, it communicates with an ultrasonic sensor to calculate object distance and control radar position. Arduino processes data using equation (1) and sends position of angle(azimuth) and range information to software used for processing to display on a screen.

Hardware design includes connections for various electronic components.

Processing is indeed a free, Integrated Development Environment (IDE) and free software programming language that are mostly intended for the visual arts, electronic arts, and new media art groups.

It supports interactive programs with 2D, 3D, or PDF results, making computer programming instruction easier to provide in a visual setting.

It executes on GNU/Linux, Mac OS X, and Windows system, includes OpenGL for accelerated graphics, and offers more than 100 libraries to expand its basic features.

Processing has a wealth of documentation, and there are many books available to delve deeper into the subject.

III. CONCLUSION

In conclusion, utilizing Arduino Uno for radar applications offers a cost-effective and versatile solution. By interfacing with ultrasonic sensors and servo motors, the Arduino Uno can efficiently control the radar's scanning and data processing functions. This setup enables accurate object detection and distance calculation, making it appropriate for a range of uses, including surveillance, navigation, and obstacle avoidance. Additionally, the open-source nature of Arduino Uno fosters accessibility and encourages innovation in radar technology development. Overall, Arduino Uno proves to be a reliable and adaptable platform for implementing radar systems.

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