Bangladesh University of Business & Technology

(BUBT)

LAB REPORT

Course Title: Microprocessor and Microcontroller lab

Course Code: CSE 316

Experiment name: Radar System using Arduino

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1.Introduction

A radar is an electromagnetic sensor that is used to detect and locate an object.Radio waves or microwaves are radiated out from the radar into free space. Some of these waves are intercepted by reflecting objects.

1.1 Arduino

Arduino comprises of both a physical programmable circuit board (commonly known as a microcontroller) and a programming software, or IDE (Integrated Development Environment) that can be run on a PC, used to compose and transfer PC code to the circuit board. It can be done by using the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Unlike other programmable circuit boards, the Arduino does not require a different equipment (called a software engineer) to upload code to the circuit board, one can essentially utilize a USB link.

1.2 Common Components of Arduino Boards

There are different types of Arduino boards for different purposes.

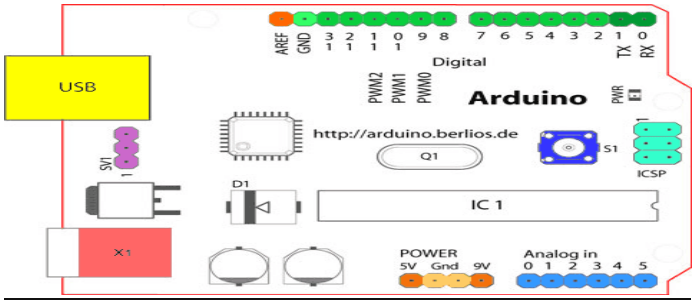

Figure 1: Common Components of Arduino Board

Digital Pins

The digital pins on an Arduino board can be used for general purpose input and output via the pinMode(), digitalRead(), and digitalWrite() commands. Each pin has an internal pull-up resistor which can be turned on and off using digitalWrite() (w/ a value of HIGH or LOW, respectively) when the pin is configured as an input.

Serial

0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data.

External Interrupts

2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.

PWM

3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function. On boards with an ATmega8, PWM output is available only on pins 9, 10, and 11.

Analog Pins

The analog input pins support 10-bit analog-to-digital conversion (ADC) using the analogRead() function. Most of the analog inputs can also be used as digital pins: analog input 0 as digital pin 14 through analog input 5 as digital pin 19.

Power Pins

9V → The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). Different boards accept different input voltages ranges.

5V→The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.

3V3 → (Diecimila only) A 3.3 volt supply generated by the on board FTDI chip.

GND→ Ground pins

2.Components Description

2.1 Arduino UNO

The Uno is one of the most popular Arduino boards. It consists of 14-digital I/O pins, where 6-pins can be used as PWM(pulse width modulation outputs), 6-analog inputs, a reset button, a power jack, a USB connection and more. It includes everything required to hold up the microcontroller; simply attach it to a PC with the help of a USB cable and give the supply to get started with a AC-to-DC adapter or battery.

Figure 2: Arduino UNO

2.2 Breadboard

A breadboard is a construction base for prototyping of electronics. In the 1970s the solderless bread- board (a.k.a. plugboard, a terminal array board) became available and nowadays the term ”bread- board” is commonly used to refer to these. Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also popular with students and in technological education. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs).

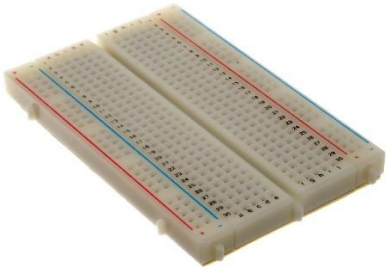

Figure 3: Breadboard

2.3 Servo Motor

A servomotor is a rotary actuator or linear actuator. It can precisely control angular or linear position, velocity and acceleration. 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.

Figure 4: Servo Motor

2.4 Arduino Software

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. The environment is written in Java and based on Processing and other open-source software. This software can be used with any Arduino board.

Figure 5: Arduino Software

2.5 Ultrasonic Sensor

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 (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

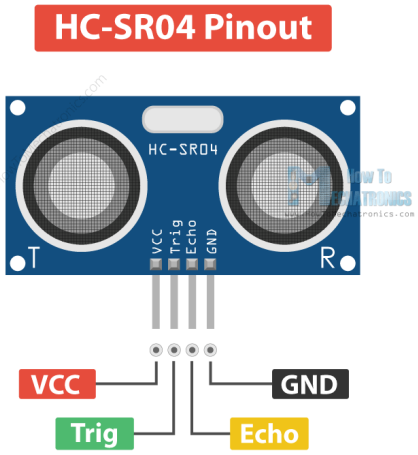

Figure 5: Ultrasonic Sensor

2.6 Processing-4.0 Software

Processing is a flexible software sketchbook and a language for learning how to code within the context of the visual arts.

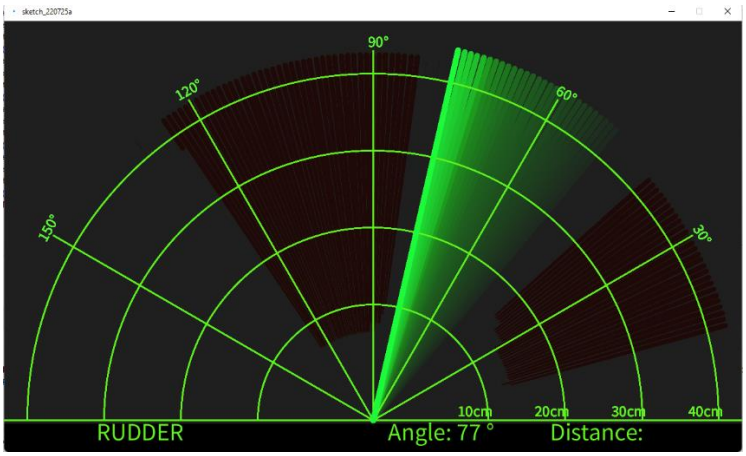

Figure 5: Processing-4.0 Software

3.Project

3.1 Objective

The objective of this project is to get the object location using Arduino and Ultrasonic Sensor.

3.2 Necessary Components

1. **Arduino UNO**
2. **Breadboard**
3. **Servo Motor**
4. **Arduino Software**
5. **Ultrasonic Sensor**
6. **Processing-4.0 Software**

3.3 Circuit diagram

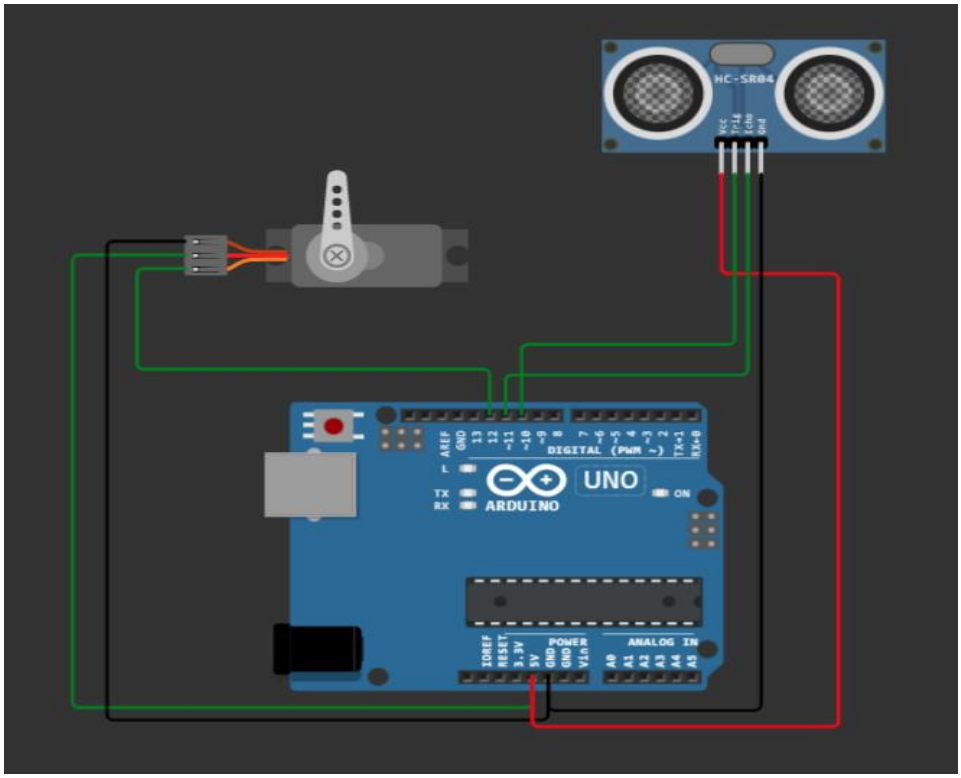

Figure 6: Processing-4.0 Software

3.4 Working principle

The full system runs with +5V power. The ultrasonic sensor is attached to the servo motor head. The servo motor rotates 15 degrees to 165 degrees. Now when the servo motor rotates from 15 to 165 the ultrasonic sensor collects data. First, we talk about the ultrasonic sensor that collects the object's location. Now the sensor collects data and sends it to 2.6 Processing-4.0 Software. Here we visualize this data with the accurate distance and degree location.

3.5 Output result

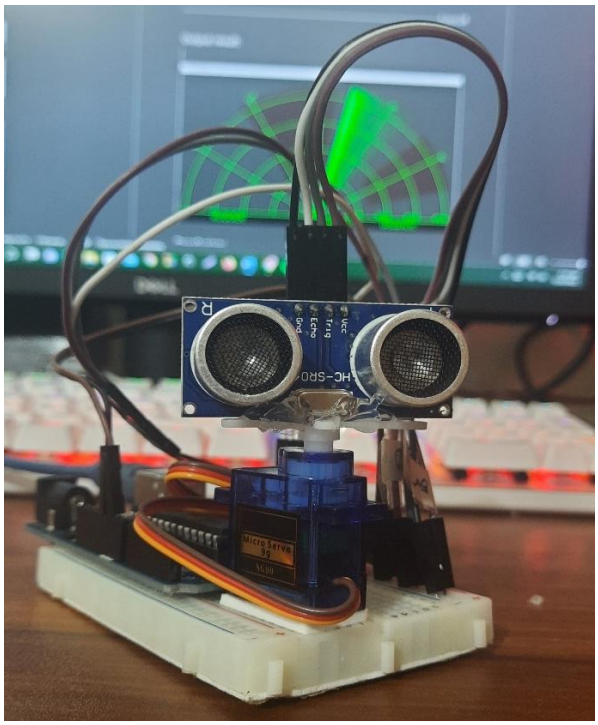

Figure 7: Project

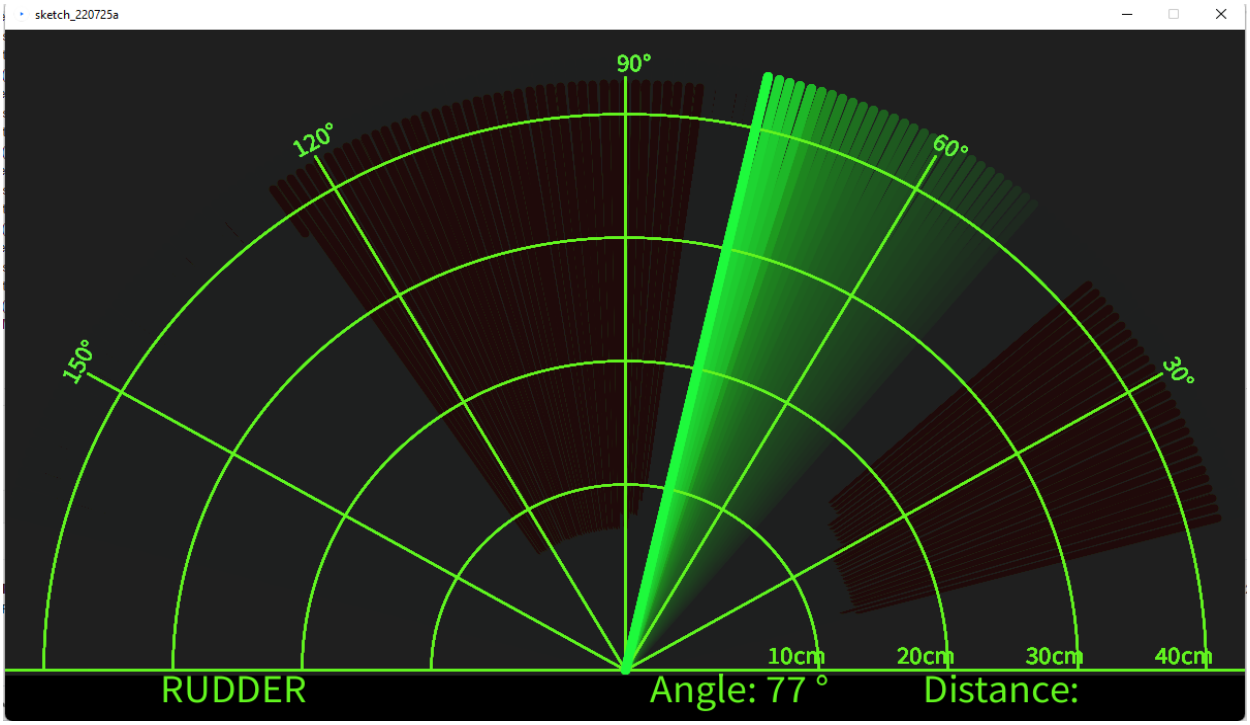

Figure 8: Radar Screen

3.6 Conclusion

We hereby conclude that the radar works successfully at 150 degrees and the range of it 40 cm. it can rotate 15 to 165 degrees and find any object from this range.

3.7 Future planning

In future we will update this radar in a large scale.

We will update this radar in 360 degree and the range of the rudder will be 1 km.

We will also update this radar in online version using more powerful sensor.

Reference

https://www.arduino.cc/

https://processing.org/

For more details:

https://wokwi.com/projects/337556889248203347

https://sites.google.com/view/radar-system-group-4