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Sensors and Instrumentaion

(TA1)

Project Final Review

Made by

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ACKNOWLEDGEMENT:

I would like to express my special thanks of gratitude to my teacher (Proffesor K.Govardan)as well as our College (Vellore institute of technology,Vellore)who gave me the golden opportunity to do this wonderful project on the Sensors and Instrumentation(Arduino Based Radar System), which also helped me in doing a lot of Research and i came to know about so many new things and I came to experience more struggle and learnt lots of life lessons and management of time.I am really thankful to them.
Secondly i would also like to thank my parents and friends who helped me a lot in finalizing this project within the limited time frame.

Content:

*Abstract:

We are gonna do a model of radar that will detect any object within its given range and an led and buzzer will alarm if an object is detected within an specific region and we can see the angle of the object with respect to the ultrasonic sensor placed in the servo motor.This is very useful in this modern world in borders of india

*Introduction:

*Now a days terroist attack using any missiles or any weapons and even while car parking there are some accidents happening.So we came up with the idea to do a Radar with help of ultrasonic sensor and servor motor which will detect objects in front of us and alert us and we have did a working model of RADAR
***RADAR** is an object detection system which uses radio waves to determine the range, altitude, direction, or speed of objects. Radar systems come in a variety ofsizes and have different performance specifications. Some radar systems are used forair-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.
*Small portable radar systems that can be maintained and operated by o ne person areavailable as well as systems that occupy several large rooms.Radar was secretly developed by several nations before and during World War II. Theterm RADAR itself, not the actual development, was coined in 1940 by the UnitedStates Navyas an acronym for radio Detection and Ranging. The term radar has sinceentered Englishand other languages as the common noun radar, losing allcapitalization
*The modern uses of radar are highly diverse, including air traffic control, radarastronomy, air-defense systems, antimissile systems; marine radarsto locatelandmarks and other ships; aircraft anti-collision systems; ocean surveillancesystems,outer space surveillance and rendezvoussystems; meteorological precipitationmonitoring; altimetry and flight control systems; guided missiletarget locatingsystems; andground-penetrating radarfor geological

observations. High tech radarsystems are associated with digital signal processingand are capable of extractinguseful information from very high noiselevels.
*Ultrasonic Sensor is a device which can be used to find the distance of the object
*We will use ultrasonic sensors in this project to know the distance and we will use servor motor to rotate the ultrasonic sensor and find the object which will be in range and display the object if it located in the radar and we can see them in our radar

Components Used:

*Arduino

*Ultrasonic Sensor

*Servo Motor

*Bread Board

*Jumper Wires

*One Led

*Buzzer

Cost of the project is approximately 1000 Rs

Softwares Required:

*ARDUINO IDE

*Processing

Explanation of Components:

ULTRASONIC (HC-SR04): The HC-SR04 Ultrasonic Sensor is a very affordable proximity/distance sensor that has been used mainly for object avoidance in various robotics projects . It essentially gives your Arduino eyes / spacial awareness and can prevent your robot from crashing or falling off a

table. It has also been used in turret applications, water level sensing, and even as a parking sensor. This simple project will use the HC-SR04 sensor with an Arduino and a Processing sketch to provide a neat little interactive display on your computer screen.

SERVO: A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback.

ARDUINO: Arduino is a computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world.

Buzzer: buzzer is a device that can make noise if the buzzer is programmed to sound alarm at that point.Its cheap and afforadable and useful for many projects

Construction:

*Connect +5v and Ground from Arduino to the breadboard

*Connect the +5V of servo motor to Arduino 5volt and Ground of Servo motor to Arduino ground

*For the ultrasonic sensor connect the Trigger pin to 2 and Echo pin to pin 3 of Arduino

*And connect VCC to 5v of Arduino and ground to ground of Arduino

*Connect the ground of Ultrasonic sensor to Arduino ground

*Place the ultrasonic sensor on the servo motor with any support to make it stand

*Connect the buzzer to pin 5 of Arduino and ground it in the Arduino

*Connect the LED With a resistor to avoid damage of LED On bread board

*Now our Circuit is ready

Code:

The values for the angle and the distance measured by the sensor will be read from the Arduino board by the Processing IDE using the SerialEvent() function which reads the data from the Serial Port.

These values will be used for drawing the lines, the detected objects and some texts. For drawing the radar display we make this function drawRadar() which consist of arc() and line() functions

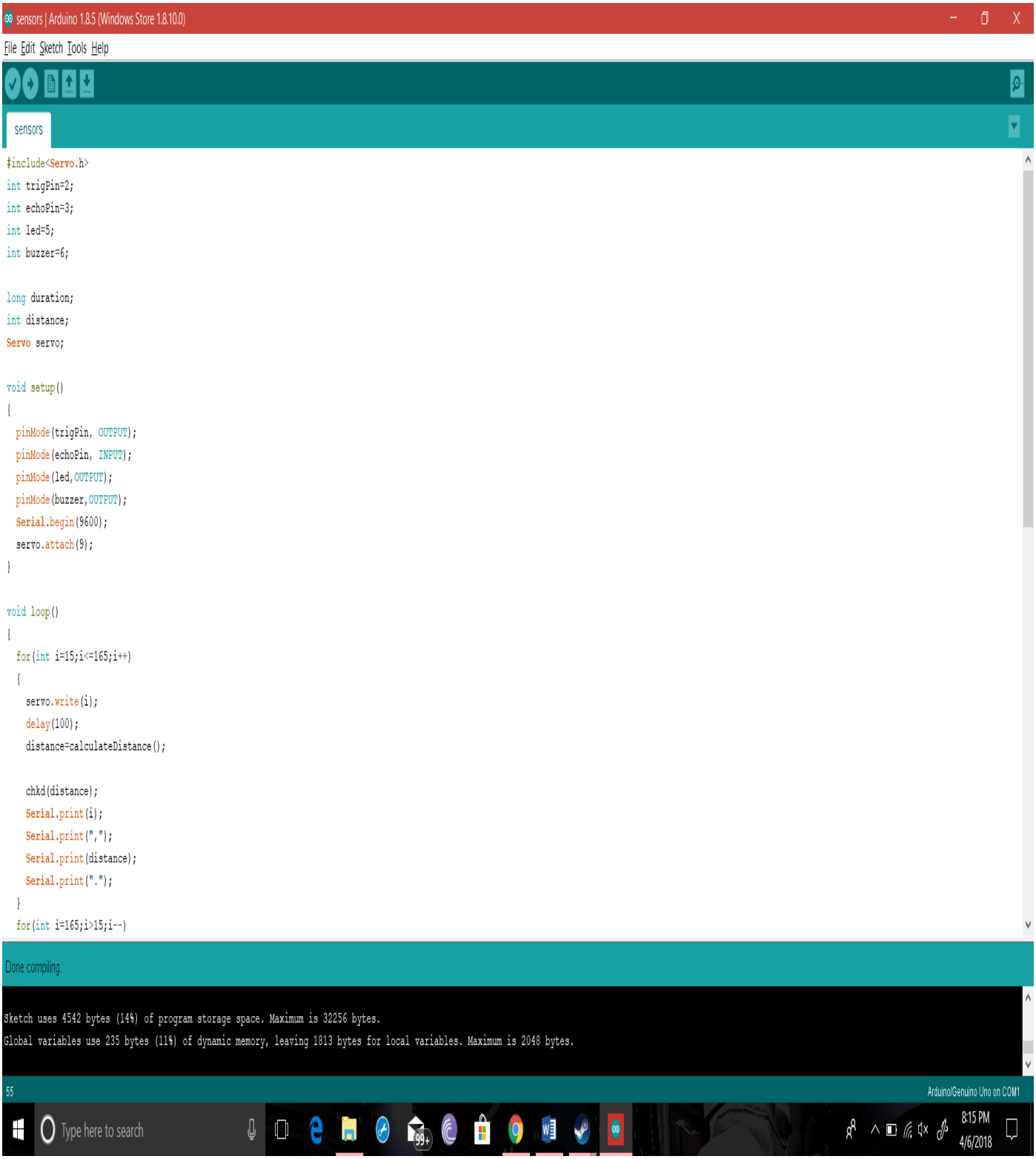
For drawing the moving lines we make this function drawLine(). Its center of rotation is set with the translate() function and using the line() function in which the iAngle variable is used to redraw the line for each degree.

For drawing the detected objects we made the drawObject() function. It receives the distance from the ultrasonic sensor, transforms it into pixels. Then, using the angle detected by the sensor it draws the object on the radar screen

To illustrate the text on the screen, we make the drawText() function that draws texts on some particular locations. All of these functions are called in the main draw() function which is repeated in each iteration to draw the screen details.

We are using the fill() function with 2 parameters for simulating motion blur and slow fade of the moving line shows the final appearance of the radar screen:

Adruino Code:



sensors | Arduino 1.8.5 (Windows Store 1.8.10.0)

File Edit Sketch Tools Help

sensors

```
    distance=calculateDistance();

    chkd(distance);
    Serial.print(i);
    Serial.print(",");
    Serial.print(distance);
    Serial.print(".");
  }
  for(int i=165;i>15;i--)
  {
    servo.write(i);
    delay(100);
    distance=calculateDistance();

    chkd(distance);
    Serial.print(i);
    Serial.print(",");
    Serial.print(distance);
    Serial.print(".");

  }
}
void chkd(int d)
{
  if(d<=20)
  {
    digitalWrite(led,HIGH);
    digitalWrite(buzzer,HIGH);
  }
  else
  {
    digitalWrite(led,LOW);
    digitalWrite(buzzer,LOW);
  }
}
```

Done compiling.

```
Sketch uses 4542 bytes (14%) of program storage space. Maximum is 32256 bytes.
Global variables use 235 bytes (11%) of dynamic memory, leaving 1813 bytes for local variables. Maximum is 2048 bytes.
```

55 Arduino/Genuino Uno on COM1

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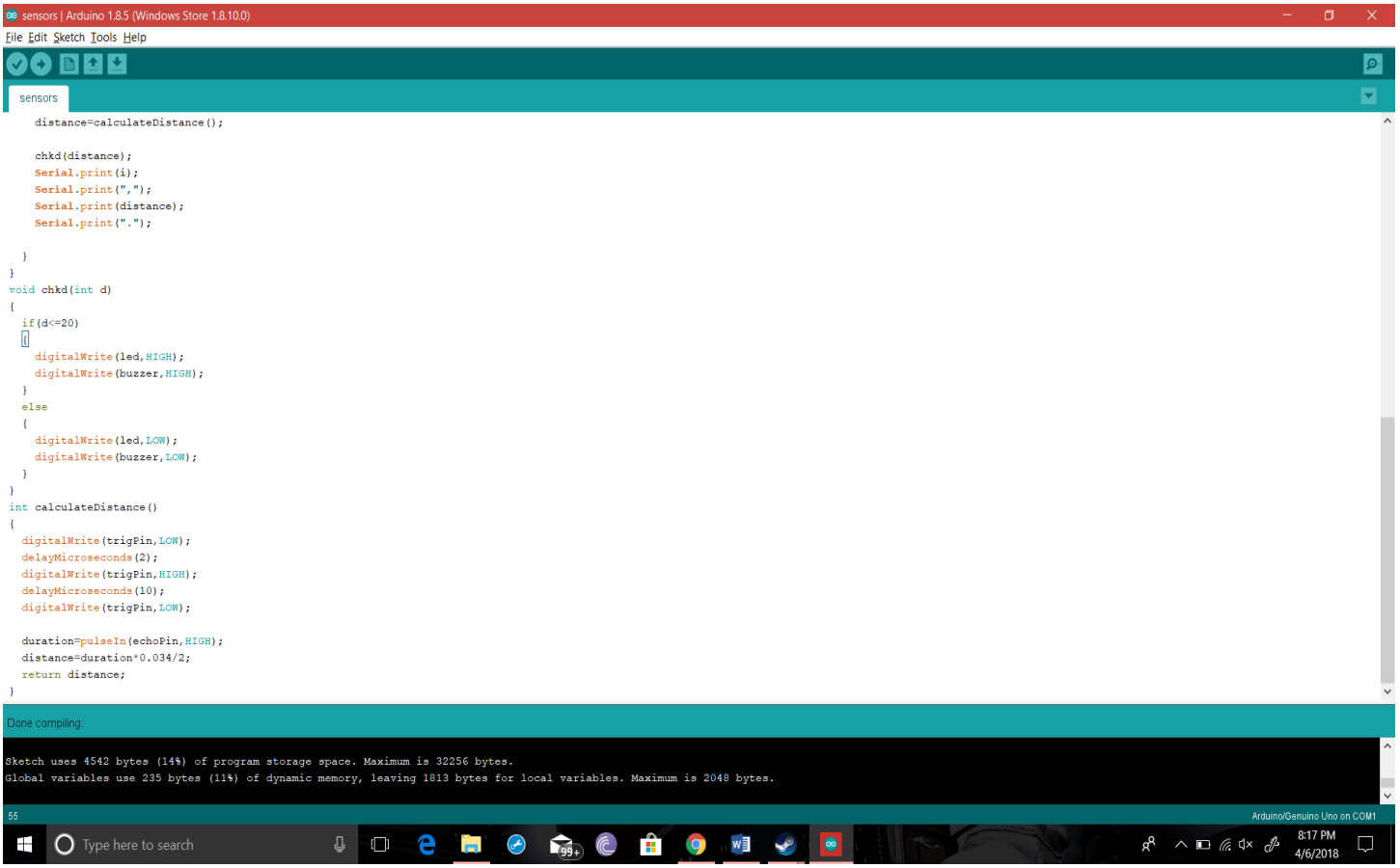
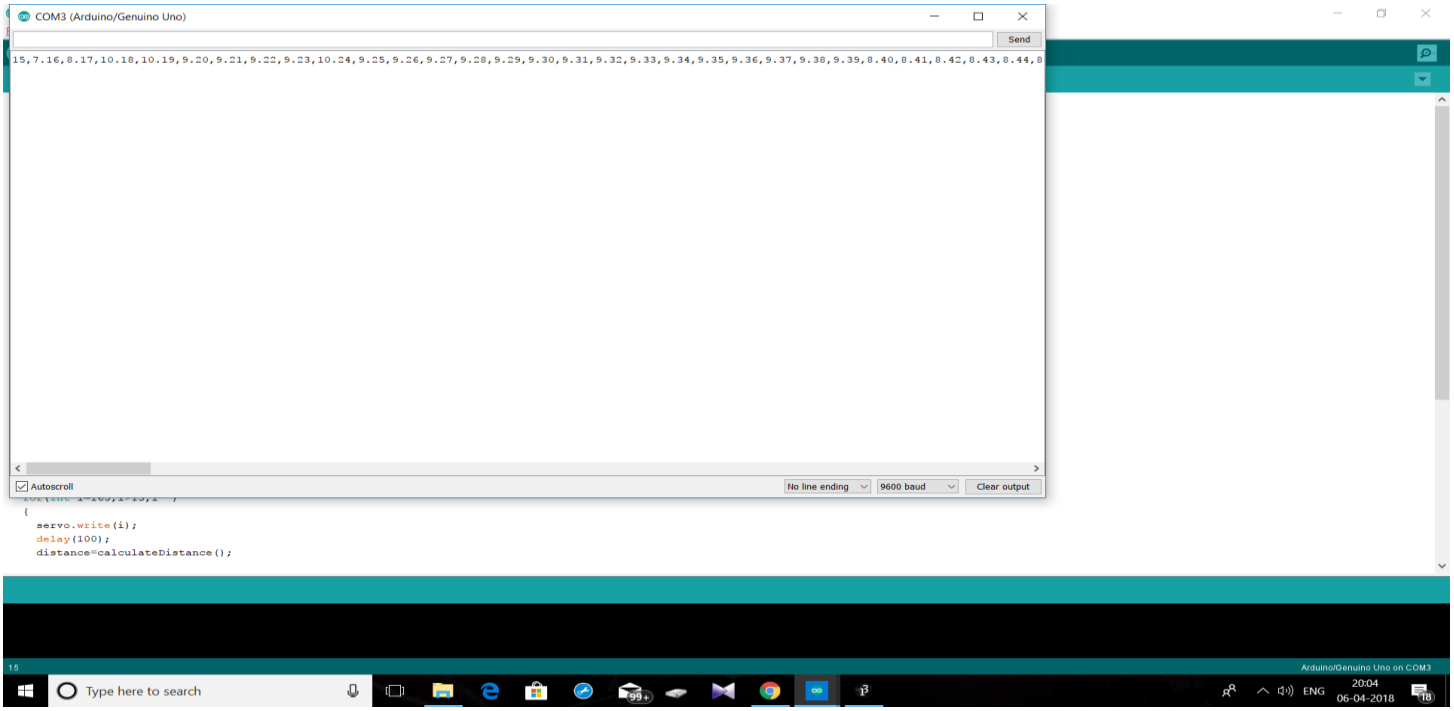
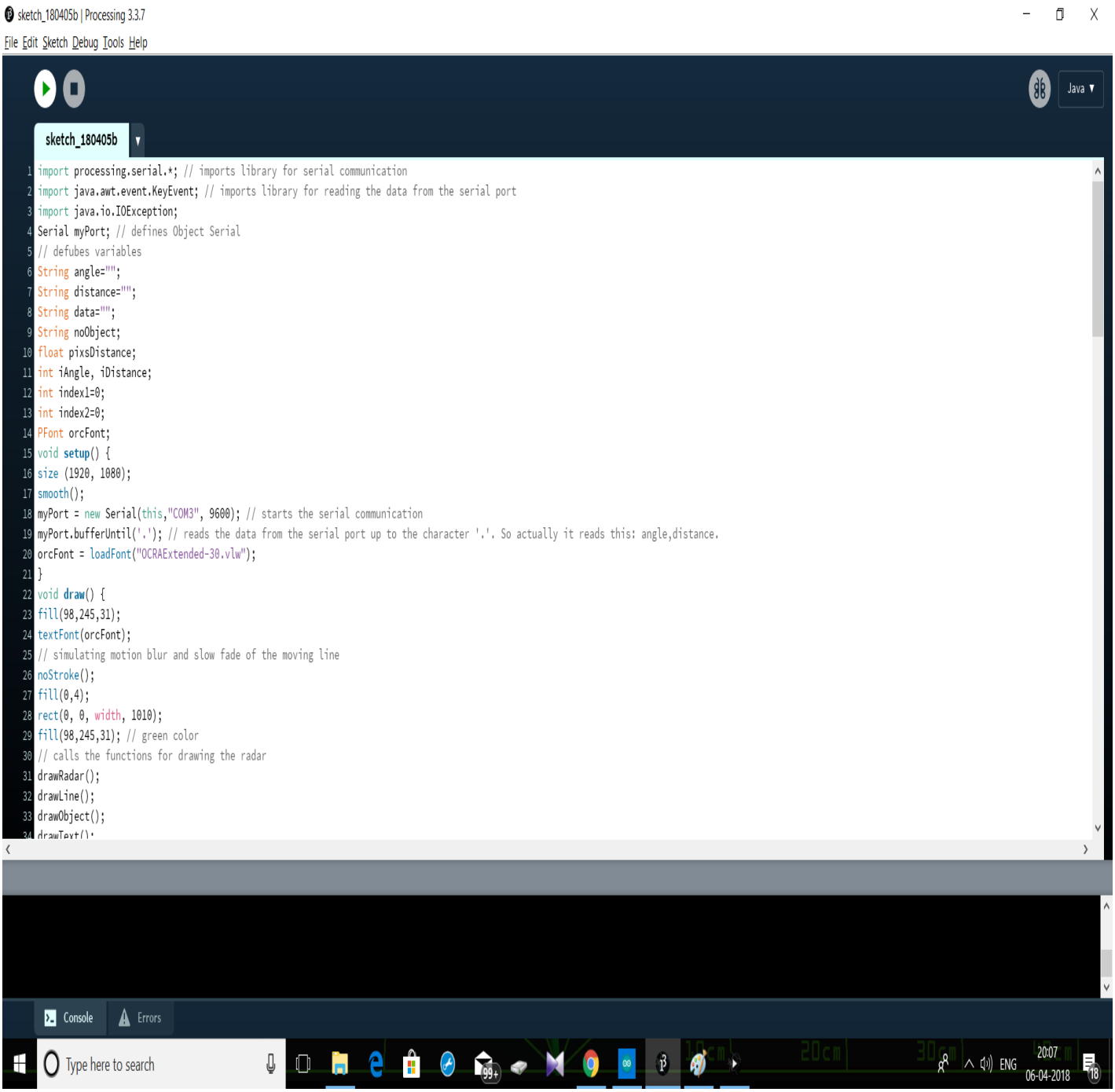




Output of Arduino:

We get the angel of servo and distance of object in output

Proccessing3 Code:



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File Edit Sketch Debug Tools Help

Java

sketch_180405b

```
drawRadar();
drawLine();
drawObject();
drawText();
}
void serialEvent (Serial myPort) { // starts reading data from the Serial Port
// reads the data from the Serial Port up to the character '.' and puts it into the String variable "data".
data = myPort.readStringUntil('.');
data = data.substring(0,data.length()-1);
index1 = data.indexOf(","); // find the character ',' and puts it into the variable "index1"
angle= data.substring(0, index1); // read the data from position "0" to position of the variable index1 or thats the value of the angle the Arduino Board sent into the Serial Port
distance= data.substring(index1+1, data.length()); // read the data from position "index1" to the end of the data pr thats the value of the distance
// converts the String variables into Integer
iAngle = int(angle);
iDistance = int(distance);
}
void drawRadar() {
pushMatrix();
translate(960,1000); // moves the starting coordinats to new location
noFill();
strokeWeight(2);
stroke(98,245,31);
// draws the arc lines
arc(0,0,1800,1800,PI,TWO_PI);
arc(0,0,1400,1400,PI,TWO_PI);
arc(0,0,1000,1000,PI,TWO_PI);
arc(0,0,600,600,PI,TWO_PI);
// draws the angle lines
line(-960,0,960,0);
line(0,0,-960*cos(radians(30)),-960*sin(radians(30)));
line(0,0,-960*cos(radians(60)),-960*sin(radians(60)));
line(0,0,-960*cos(radians(90)),-960*sin(radians(90)));
line(0,0,-960*cos(radians(120)),-960*sin(radians(120)));
line(0,0,-960*cos(radians(150)),-960*sin(radians(150)));
```

Console Errors

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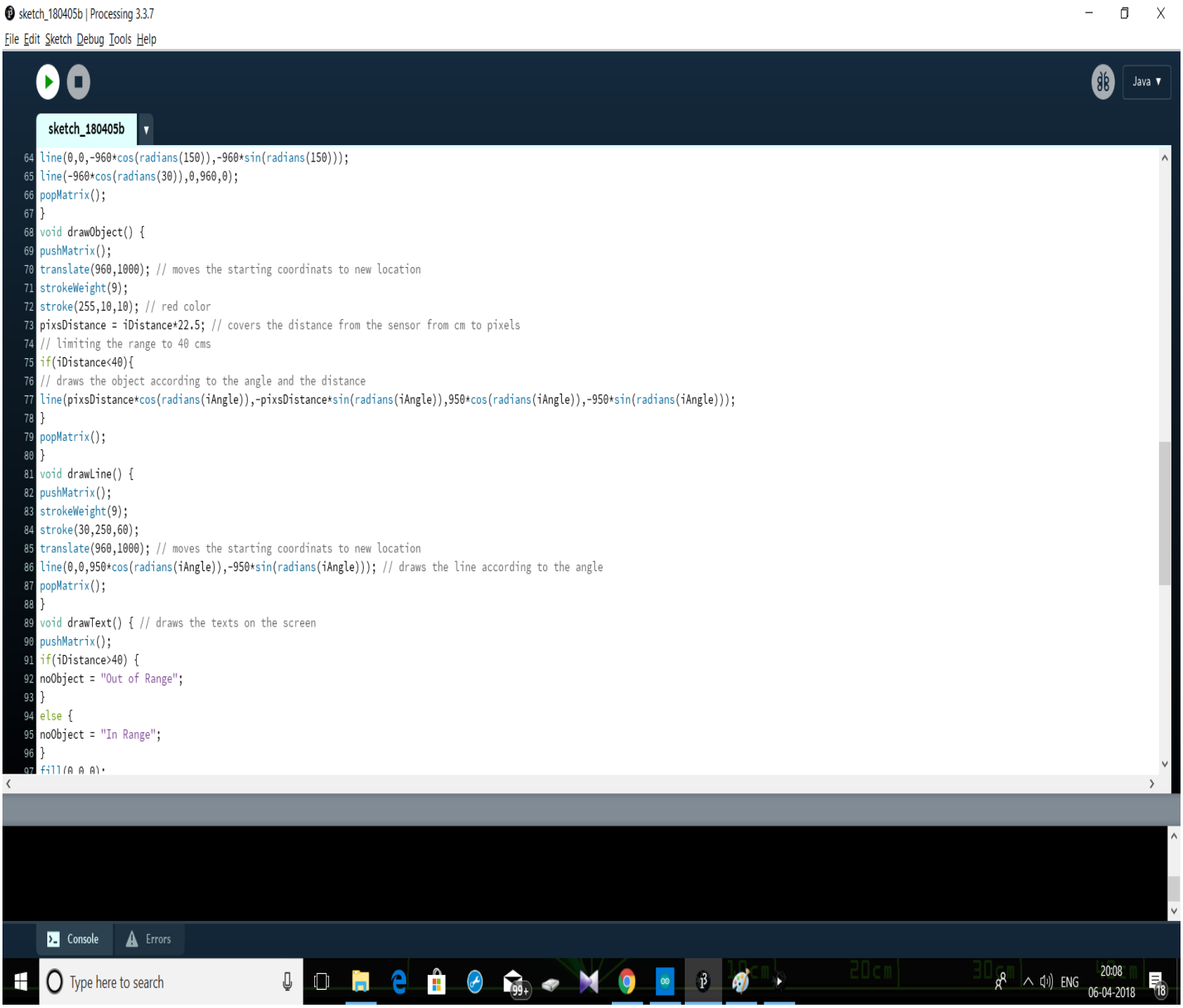
sketch_180405b | Processing 3.3.7
File Edit Sketch Debug Tools Help
Java
sketch_180405b
line(0,0,-960*cos(radians(150)),-960*sin(radians(150)));
line(-960*cos(radians(30)),0,960,0);
popMatrix();
}
void drawObject() {
pushMatrix();
translate(960,1000); // moves the starting coordinats to new location
strokeWeight(9);
stroke(255,10,10); // red color
pixsDistance = iDistance*22.5; // covers the distance from the sensor from cm to pixels
// limiting the range to 40 cms
if(iDistance<40){
// draws the object according to the angle and the distance
line(pixsDistance*cos(radians(iAngle)),-pixsDistance*sin(radians(iAngle)),950*cos(radians(iAngle)),-950*sin(radians(iAngle)));
}
popMatrix();
}
void drawLine() {
pushMatrix();
strokeWeight(9);
stroke(30,250,60);
translate(960,1000); // moves the starting coordinats to new location
line(0,0,950*cos(radians(iAngle)),-950*sin(radians(iAngle))); // draws the line according to the angle
popMatrix();
}
void drawText() { // draws the texts on the screen
pushMatrix();
if(iDistance>40) {
noObject = "Out of Range";
}
else {
noObject = "In Range";
}
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Errors
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Java

sketch_180405b

```
else {
noObject = "In Range";
}
fill(0,0,0);
noStroke();
rect(0, 1010, width, 1080);
fill(98,245,31);
textSize(25);
text("10cm",1180,990);
text("20cm",1380,990);
text("30cm",1580,990);
text("40cm",1780,990);
textSize(40);
text("Object: " + noObject, 240, 1050);
text("Angle: " + iAngle +" °", 1050, 1050);
text("Distance: ", 1380, 1050);
if(iDistance<40) {
text(" " + iDistance +" cm", 1400, 1050);
}
textSize(25);
fill(98,245,60);
translate(961+960*cos(radians(30)),982-960*sin(radians(30)));
rotate(-radians(-60));
text("30°",0,0);
resetMatrix();
translate(954+960*cos(radians(60)),984-960*sin(radians(60)));
rotate(-radians(-30));
text("60°",0,0);
resetMatrix();
translate(945+960*cos(radians(90)),990-960*sin(radians(90)));
rotate(radians(0));
text("90°",0,0);
resetMatrix();
translate(935+960*cos(radians(120)),1003-960*sin(radians(120)));
```

Console Errors

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sketch_180405b | Processing 3.3.7

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Java

sketch_180405b

```
text("20cm",1380,990);
text("30cm",1580,990);
text("40cm",1780,990);
textSize(40);
text("Object: " + noObject, 240, 1050);
text("Angle: " + iAngle +" °", 1050, 1050);
text("Distance: ", 1380, 1050);
if(iDistance<40) {
text(" " + iDistance +" cm", 1400, 1050);
}
textSize(25);
fill(98,245,60);
translate(961+960*cos(radians(30)),982-960*sin(radians(30)));
rotate(-radians(-60));
text("30°",0,0);
resetMatrix();
translate(954+960*cos(radians(60)),984-960*sin(radians(60)));
rotate(-radians(-30));
text("60°",0,0);
resetMatrix();
translate(945+960*cos(radians(90)),990-960*sin(radians(90)));
rotate(radians(0));
text("90°",0,0);
resetMatrix();
translate(935+960*cos(radians(120)),1003-960*sin(radians(120)));
rotate(radians(-30));
text("120°",0,0);
resetMatrix();
translate(940+960*cos(radians(150)),1018-960*sin(radians(150)));
rotate(radians(-60));
text("150°",0,0);
popMatrix();
}
```

Console Errors

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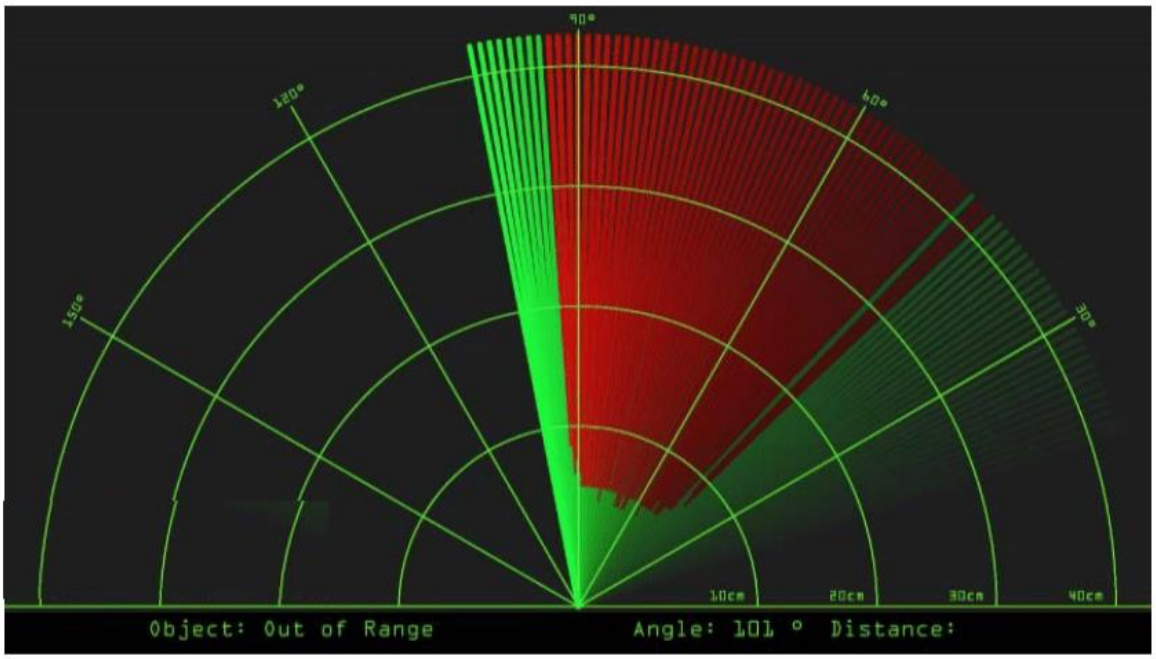

Fig:Radar Image

Output screen of Proccesing will be like this..This is the Radar

Working:

*After Steuping the circuit upload the Arduino code to Arduino and then run the processing code.

*When it Starts running the servor motor will rotate and ultrasonic sensor will also rotate along with it and servo motor starts roating from the specified angle and now the ultrasonic sensor send and receives waves and calculates the distance and if there is no obstacle for its specified distance then it would be green in the radar which will be displayed on computer or Mobile phone using processor software and it displays the angle of ultrasonic sensor and distance of object also

*Then if the sensor detects any object within a specific range then the LED glows up and buzzer in our Arduino starts ringing and we can know that some object is that specific region and we can know the distance from the Radar in our computer

*Thus we can know the object which may be incoming without knowing to us

*Our Project idea is just a basic working model still there are lots of applications used by radar

*This is a important application in all parts of science

*We could even use MAT LAB to display radar instead of processing3 application.

Application:

*My Radar Object can be used near by doors to detect any person walking through the door and then to identifiy angle of object with respective to the servo motor and can be used to find distance or angle of any object from the sensor.

→Now some application of usual sensors are,

Military Applications:

The RADAR has 3 major applications in Military:

- In air defense it is used for target detection, target recognition and weapon control (directing the weapon to the tracked targets).
- In missile system to guide the weapon.
- Identifying enemy locations in map.

Air Traffic Control:

The RADAR has 3 major applications in Air Traffic control:

- To control air traffic near airports. The Air Surveillance RADAR is used to detect and display the aircraft's position in the airport terminals.
- To guide the aircraft to land in bad weather using Precision Approach RADAR.
- To scan the airport surface for aircraft and ground vehicle positions

Remote Sensing: RADAR can be used for observing weather or observing planetary positions and monitoring sea ice to ensure smooth route for ships.

Ground Traffic Control: RADAR can also be used by traffic police to determine speed of the vehicle, controlling the movement of vehicles by giving warnings about presence of other vehicles or any other obstacles behind them.

Space:RADAR has 3 major applications:

- To guide the space vehicle for safe landing on moon
- To observe the planetary systems
- To detect and track satellites
- To monitor the meteors

Conclusion:

Radar is normally used to determine velocity, range, and position of an object. In this technical project, we read the distance and angles of detected objects in order to convert these data into visual information. The performance of our project is so good. It works smoothly to detect objects within the designed

range. The screen shows the information clearly with enough delay for the user to read it. This project could be helpful for object avoidance/ detection applications. This project could easily be extended and could be used in any systems may need it.

References

[1] Ultrasonic Radar and Its Applications 'MANSOOR-UL-HASSAN SIDDIQUE' Chief Executive Officer Digitronics Communication Pvt. Ltd DCPL Opp. Aladdin Amusement Park Pakistan

[2] Ultrasonic RADAR/Electronic Design Lab (EE-318) Submitted by:Praveen Tamhankar (06d07007),Piyush Mittal (06d07035), Ashutosh Singh (06d07034) Guide: Prof. Jayanta Mukhergee.

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[7] http://howtomechatronics.com/projects/arduino-radar-project/

THANK YOU!!!!!!!!