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A Short Range Radar System using Arduino

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Abstract: *RADAR is a detection system that uses radio waves to determine the characteristics of the detected objects such as: range, height, direction, or the speed of objects. This paper, is aimed at designing a radar system that uses an ultrasonic sensor to detect objects. The ultrasonic sensor is used to measure the distance between the radar and any object-based non-contact technology. This system is controlled through Arduino. Arduino UNO board is sufficed to control ultrasonic sensor and also to interface the sensor and display device. Whereas, the movement of the sensor is controlled by using a small servo motor. This radar is controlled using the Arduino Uno board as a microcontroller. The signal received from the sensor is processed using "Processing Development Environment Software". Ultra-sonic sensor is attached to the servo motor it rotates about 180 degree and gives visual representation on the software called processing IDE. Processing IDE gives graphical representation and it also provides angle or position of the object and distance of the objects on the PC or monitor.*

Keywords: RADAR

I. INTRODUCTION

Radio Detection and Ranging (RADAR) is a device which is used for monitoring a particular area 24/7. The basic needs of these are security. RADAR is an object detecting device. It can be used to detect aircraft, spacecraft, missiles, vehicles, weather formation and so on. Radar is an addition to man's sensory equipment which affords genuinely new facilities. It consists of Trans-receiver and Processor. RADAR can be of many types.

Ultrasonic RADAR is an object detecting system which is used to monitor an area of short range. This system consists of an Arduino which is interfaced to an Ultrasonic Sensor mounted on a Servo Motor.

This system is programmed using embedded C, and the result is observed on MATLAB platform. Radar is an object-detection system that uses radio waves to determine the range, angle, or velocity of objects. It can be used to detect aircraft, ships, spacecraft, guided missiles, motor vehicles, weather formations, and terrain., This project gives sufficient knowledge of Arduino, MATLAB Simulink for Arduino and mechanics. Servos are small but powerful motors that can be used in a multitude of products ranging from toy helicopters to robots. In this project we are using the Ultrasonic Sensor for operate by emitting a burst of sound waves in very rapid succession.

These sound waves hit the intended target, bounce back to the sensor, and travel at known speed. An ultrasonic sensor, radar is much less affected by temperature, improving consistency and accuracy.

Radar was developed secretly for military use by several nations in the period before and during World War II. The term RADAR was coined in 1940 by the United States Navy as an acronym for Radio Detection and Ranging. Radar can track storm systems, because precipitation reflects electromagnetic fields at certain frequencies Radar can also render precise maps. Radar systems are widely used in air traffic control, air craft navigation and marine navigation. United States and four commonwealth countries: Australia, Canada, New Zealand and South Africa also developed their own radar systems. RADAR is a method of object detection using radio waves to determine objects size, height, direction or speed. Radar systems are available in various sizes with various performance requirements. Some radar systems are used in airport air traffic control, others are used in long distance surveillance systems and early warning systems

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Basic Concepts of Radar:

Radar is an electromagnetic system for the detect and determine the locations of objects and determine distance, and ranges. It operates by transmitting a particular type of waveform, a pulse-modulated, and detects the nature of the echo signal. Radar is used to extend the capability of one's senses for observing the environment, especially the sense of vision (Merrill 1. Skolnik, 1981). An elementary form of radar consists of a transmitting antenna emitting electromagnetic radiation generated by an oscillator of some sort, a receiving antenna, and the receiver.

A portion of the transmitted signal is intercepted by a reflecting object (target) and is radiated in all directions. The receiving antenna collects the returned energy and delivers it to a receiver, where it is processed to detect the presence of the target and to extract its location and relative velocity. The distance to the target is determined by measuring the time taken for the radar signal to travel to the target and back. The direction of the target determined from the direction of arrival of the reflected wavefront (Merrill I.Skolnik, 1981). The basic concept of radar transmitting a signal and receiving a return from a target is shown in Figure Shown Below:

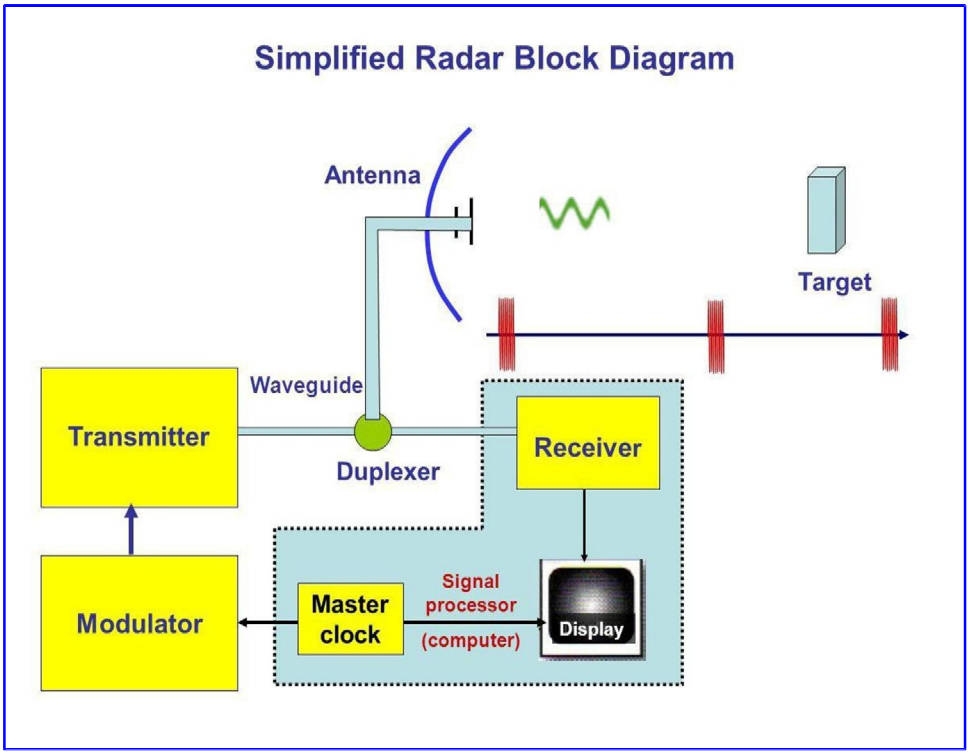

Fig. Block diagram of simplified radar system

Literature Survey

Subsequent to experiencing a portion of the papers with respect to usage utilizing ultrasonic sensors and ARDUINO, it was found that this idea is searched a lot and is a mainstream idea which is still in advance. The advances utilized were not just productive and solid yet in addition financially achievable.

Not only this, here other very useful applications of ultrasonic sensors were observed too. This paper discusses about a monitoring system which is designed measure to speed of waves and height of river through ultra-sonic sensor using microcontroller (Arduino). On the off chance that the waterway can't oblige the volume of water, then all the water will submerge with land and this phenomenon is called as flood or surge.

We can overcome this flood problem by earlier identification in height of water and observing speed. If we identify problem earlier we can overcome this problem before it become crisis. By testing the system i.e. simple water level, it was observed that

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ultra-sonic have accuracy of 96.6%. But when it is implemented in the rivers there are many errors because of different type of water levels due to heavy waves and speed of water and also due to floating of heavy objects.

Unlike Previous testing results, author directed this analysis on tracking of speed of water improvement or modification and level of water in flooding. The test was completed when the Arduino used as controller of application. For more research, information of depth level and speed of water of this system will be sent to database server website to be checked regularly.

An intelligent driver monitoring and vehicle control system is introduced in this research. This technology is create to avoid accidents by monitoring the driver's activities. The writer states some of the main reasons of accidents today. These are alcohol consumption by the driver, carelessness, drowsiness or medical illness. The various units in the framework, including motors, relays, power unit and ESP8299 module are tried and are observed to be in working condition. Ultrasonic sensor is utilized to alarm the driver if any vehicle draws close to his vehicle. The status of the driver can be observed by the assistance of sensors executed in the vehicle and the subtle elements are refreshed to the proprietor. This system overcomes all the different aspects due to which other technologies designed for this purpose have failed, making the system more useful, efficient and less costly and less time consuming

Aim of Project:

This goal of this project is the use of Ultrasonic Sensor by connecting to the Arduino UNO R3 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 distance, range, and angle at which the obstacle is detected by the sensor. In this study ultrasound sensor worked as a radar.

Scope of Project:

The radars have become the "eyes" of electronic devices and the use of radar has become increasingly popular in various fields of study. At the same time, these devices can also be used to assist people in all the fields the life. Ultrasonic radars can accomplish distance measurements by measuring the time delay between the emission of the ultrasonic signal and receipt of the echo signal. Microcontrollers can be connected to perform computations or control timers in these devices. The detection of the distance between the objects (targets) poses a challenge on the temporal resolution of the detector. The correct calibration of these radars is imperative given the fact that the safety of the user depends on the sensor system.

Objective of Project:

System's objective is to track the distance and angle of the object and to represent this information graphically, means its output should be in graphical form which will be represented through processing software. We can have an idea of an efficiency of this radar by testing objects at different levels and observe how faster or smoothly it detects an object that it finds in a way and gives us an expected range of the obstacles

II. OVERVIEW OF SYSTEM

2.1. Block diagram of the radar system:

The Block diagram of Short Range Radar System Using Arduino is as shown in above figure. In this work, the distance of the object is measured through an ultrasonic distance sensor, and the sensor output is connected to the signal conditioning unit.

After that, it is processed through the Arduino microcontroller. The measured results are displayed on the personal computer. The sensor is attached to the servo motor to find the polar distance around the sensor up to 180 rotations.

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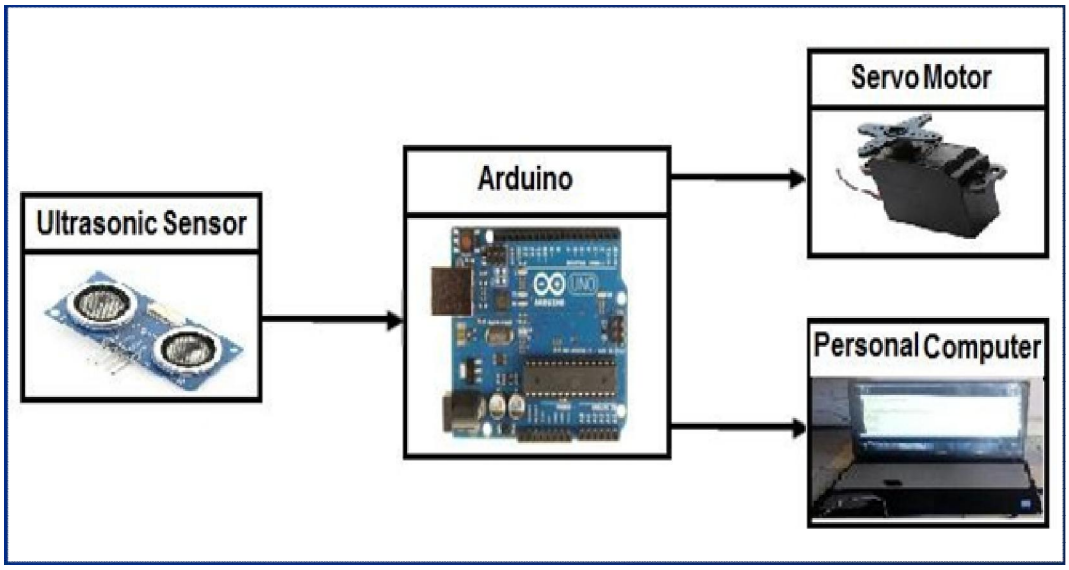

Fig: Block diagram of a short range radar system using arduino

2.2 Methodology:

In order to testify the working of this system, after its designing, construction and programming we placed few objects in front of the ultrasonic sensor. As the motor started to rotate, our monitor started to display the output through processing IDE. Hence, when the sensor crossed over the object it showed a red segment with the distance and angle where the object is paced. The first object was placed at the distance of 30.5cm measured through a ruler and the system measured the distance at 32cm. While the second object was placed at a distance of 20 cm and the system measured it as 21cm. Hence the calculated efficiency turned out to be 95%.

The above figure represents a brief overview of this radar system. Here, as it is shown the controller, we are using is Arduino, with the input Ultrasonic sensor and the output is the servo motor which rotates 180 degrees. The microcontroller controls all the operations of this system, from rotation of the motors to the obstacle detection of the ultrasonic and representation of the result on the screen.

2.3 Working:

The basic objective of our design is to ascertain the distance position and speed of the obstacle set at some distance from the sensor. Ultrasonic sensor sends the ultrasonic wave in various ways by rotating with help of servo motors. This wave goes in air and gets reflected back subsequent to striking some object. This wave is again detected by the sensor and its qualities is analyzed and output is shown in screen indicating parameters, for example, distance and position of object.

Arduino IDE is utilized to compose code and transfer coding in Arduino and causes us to detect position or angle of servo motor and it is communicated through the serial port alongside the covered distance of the nearest object in its way. Output of all of this working is shown in the software called processing, it will display the input/output and the range of the object . Implementations of the sensors are done in such a way that

ultra-sonic sensor is attached on top of the servo motor because it have to detect the object and its distance. Arduino (micro-controller) will control the ultra-sonic sensor and servo motor and also powered will be given to both of them through micro-controller.

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2.4 Components & component's Details:

Arduino Board UNO Model:

Arduino is an open-source computer hardware, open-source software and microcontroller-based device building kit and interactive objects that can sense and control physical devices. arduino designs and manufactures software, software and software

The project is focused on the design of the microcontrollers. The board contains a combination of digital and analog input / output (I / O) pins, which can connect to specific expansion boards (termed shields).

The plates have serial communication interfaces for loading programs from personal computers, including Universal Serial Bus (USB) in the UNO

model. The Arduino project provides the built-in development environment (IDE) for the programming of microcontrolling systems to allow code writing and uploading to the board. It runs on Mac OS X, Linux and Windows. The code is written in Java, which is based on open source software and processing. You can use this program on any board of the Arduino.

Fig: Arduino Board UNO Model

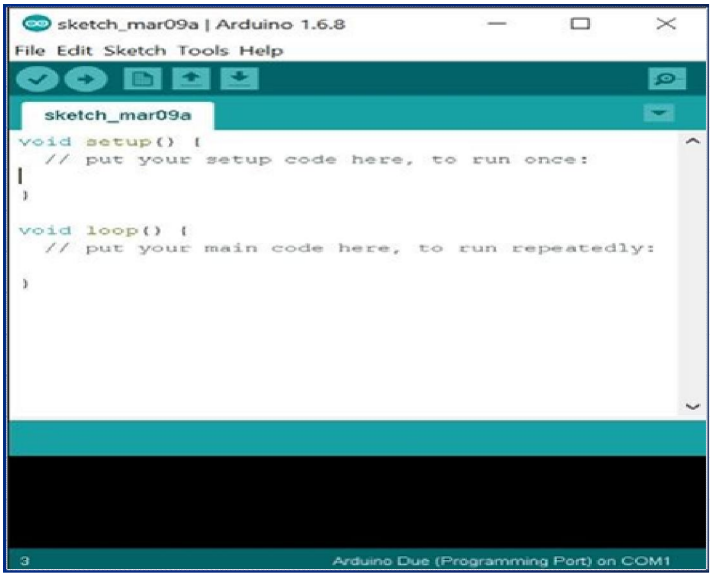

Fig: IDE Software

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Ultrasonic Sensor

The ultrasonic sensor emits ultrasound at 40, 000 hz, which passes through the air, while it bounces back into the module if there is an object or obstacle in its way. The distance can be determined based on the travel time and the speed of the sound.

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

Using IO trigger for at least 10us high level signal,

The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.

IF the signal back, through high level, time of high output IO duration is the time from sending ultrasonic to returning. Test distance (high level timexvelocity of sound (340M/S)/2,

Wire connecting direct as following**:**

5V Supply (VCC)

Trigger Pulse Input

Echo Pulse Output

0V Ground

Fig:-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 40kHz. Three different properties of the received echo pulse may be evaluated for different sensing Purposes: 1)Time of flight, 2)Doppler shift, 3)Amplitude attenuation. Ultrasonic ranging module HCSR04 provides 2cm-400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The ultrasonic sensor works using trigger and echo method. The transceiver module triggers and sends the signal to the water the water sends back an echo signal which is read by the echo ie. the receiver module. The Ultra sonic sensor calculated distance of the signal and returns the level of the water. The travel time value and the speed value allow the sensor to calculate the level of the water. The figure below is the image of the ultrasonic sensor used in the project.

Servo Motor:

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor It is just made up of simple motor which run through servo mechanism. Servo Motor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. Servos are controlled by sending an electrical pulse of variable width, or pulse width modulation [PWM] through the control wire. Servo motors have three wires: power, ground, and signal. If

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motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. The position of servo motor is decided by electrical pulse and its circuitry is placed beside the motor.

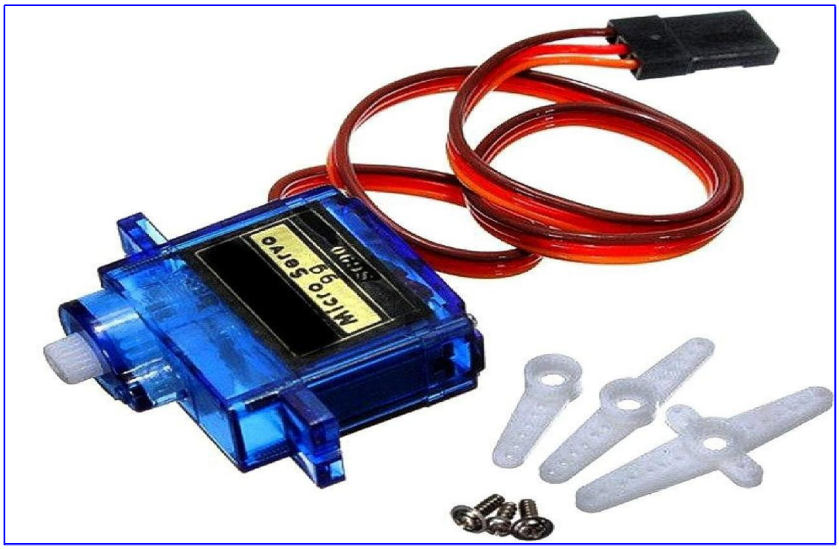

Fig: Servo motor

Tiny and lightweight with high output power. The servo will rotate about 180 degrees (90 in each direction) and operate just as small as the regular types (Figure 6)]. The Specifications of servo motor:

Weight: 9g
Dimension: 22.2 x 11.8 x 31 mm approx.
Stall torque: 1.8 kg·cm
Operating speed: 0.1 s/60 degree
Operating voltage: 4.8 V (~5V)
Temperature range:0°C -55 °C

The interfacing between the PC and the Arduino is done by RS232 USB. The Arduino receives the data from the ultrasonic sensor and process it. In the Arduino software, equation (1) is used to calculate the object distance. Also, the position angle of radar is calculated and controlled from the Arduino program. The Arduino sends these data, which are the angle position and the object distance to processing software to show them on the radar screen. The figure 7 shows the design of hardware that was designed with a scraper environment. The connection of different electronic components is displayed.

BUZZER:

A buzzer or beeper is an audio signal device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke. If embedded system is misplaced from dashboard, the IR sensor becomes active. The signal is sent to microcontroller to ring the buzzer. It is connected to the pin no 28 of microcontroller.

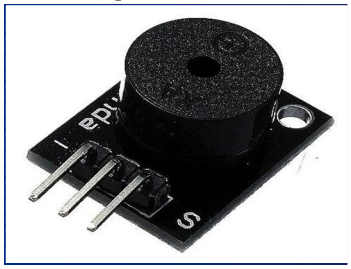

Fig: buzzer.

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Features:

- Operating power: 3-6V DC/25mA.
- Extremely compact, ultrathin construction.
- No electrical noise.
- Low current consumption yet high sound pressure level

16x2 Character LCD Display:-

Fig: 16x2 Character LCD Display

The LiquidCrystal library allows you to control LCD displays that are compatible with the Hitachi HD44780 driver. There are many of them out there, and you can usually tell them by the 16-pin interface.

The LCDs have a parallel interface, meaning that the microcontroller has to manipulate several interface pins at once to control the display. The interface consists of the following pins:

A register select (RS) pin that controls where in the LCD's memory you're writing data to. You can select either the data register, which holds what goes on the screen, or an instruction register, which is where the LCD's controller looks for instructions on what to do next.

A Read/Write (R/W) pin that selects reading mode or writing mode.

An Enable pin that enables writing to the registers.

8 data pins (D0 -D7). The states of these pins (high or low) are the bits that you're writing to a register when you write, or the values you're reading when you read.

There's also a display contrast pin (Vo), power supply pins (+5V and GND) and LED Backlight (Bklt+ and BKlt-) pins that you can use to power the LCD, control the display contrast, and turn on and off the LED backlight, respectively.

The process of controlling the display involves putting the data that form the image of what you want to display into the data registers, then putting instructions in the instruction register. The LiquidCrystal Library simplifies this for you so you don't need to know the low-level instructions.

The Hitachi-compatible LCDs can be controlled in two modes: 4-bit or 8-bit. The 4-bit mode requires seven I/O pins from the Arduino, while the 8-bit mode requires 11 pins. For displaying text on the screen, you can do most everything in 4-bit mode, so example shows how to control a 16x2 LCD in 4-bit mode.

POWER SUPPLY

Fig:- SMPS Power supply (12V=1A)

An SMPS (Switched-Mode Power Supply) is a type of power supply that efficiently converts AC mains voltage to DC, commonly found in devices like adapters and chargers. The design considerations for a 12V 1A SMPS involve

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selecting the right components like the Power Management IC, such as the TNY268PN, ensuring universal input compatibility, and meeting output requirements like 12V 1.25A with low ripple

The circuit typically includes sections for input surge protection, AC-DC conversion, filtering, driver circuitry, and more SMPS circuits can vary based on load types and environmental factors. They offer advantages like high efficiency (up to 96%), compact size, and reduced heat generation compared to linear power supplies.

Additionally, SMPS units like the 12V 1A SMPS Supply are widely available for various applications

III. HARDWARE DESIGN

3.1 PCB FABRICATION:

In initial stage of PCB fabrication is to study the circuit diagram. Study of diagram means to check out the components required and examine them and also note their size, dimensions etc. To note the dimensions is necessary to us in the next stage where after preparing the schematic we have give the footprints of respective components before preparation of the layout

Second stage is an important stage in PCB fabrication. Here we prepare the soft copy of the layout manually or with the help of any software. In case of our project we have used software named "PROTEL99SE" for the preparation of PCB layout.

We first prepare the schematic and give each component label and footprint. A footprint defines the size and shape of the particular component. After preparation of the schematic we create new PCB file, then define the size of PCB. Then we load net list and place the components at proper places and route to get the final PCB layout.

Now we have the layout ready with us. This layout is first checked for errors. If there are no errors then we go for preparation of negative of the layout. A photo is taken by Vertical Photographic Camera and a negative is taken which gets developed on the special paper of camera roll. This negative is then washed with clean water so as to remove the glueyness of the paper. The film is then developed in A-developer for Iminute where layout is gets appeared. Now to make the tracks transparent the film is passed through B-developer. Then

Wash the film with clean water and is then kept for baking in hot air oven and at last the film is cut in appropriate dimensions. The copper clad on which the film is to be kept and the layout is to be printed is cleaned with steel wool. This cleaning is necessary to remove the carbon and dust layer that gets formed on the clad.

After cleaning the clad a photo-resist layer is applied. This photo-resist is a liquid and needed to be dried. For this purpose the clad coated with photo-resist layer is kept for baking in hot air oven.

When the clad is baked in the hot air oven it is ready for printing of the layout on the clad. Hence for the same purpose the film prepared is now placed on the clad properly and this composition is kept in U.V. ray machine. The U.V. light passes only through the transparent part of the film and only tracks on the film are transparent as a result the U.V. light and photo-resist solution forms a chemical bond.

The PCB is developed in LPR developer and diablo ink is sprayed on whole PCB. The ink gets applied only on the chemical bond formed in the U.V. ray machine.

Now inspection is done and whenever the ink is faint by using marker we make it dark so that the copper doesn't come out. After inspection drilling with appropriate drill bit is done.

At last after drilling etching is performed. Here for etching FeCl3 solution is used. Because of this solution CuCl3 bond is formed copper gets removed whenever the ink is not applied. The PCB is washed with water and ink is removed with ready PCB.

3.2 PCB Layout and Artwork:

Layout actually means placing or arranging or mounting things in a particular order on the PCB. Layout means placing of components in an order. This placement is made such that the interconnection lengths are optimal and less complex. At the same time, layout also aims at providing accessibility to the components for purpose insertion testing and repair.

The PCB layout is the starting point for the final artwork preparation layout design. PCB layout should reflect the concept of final equipment of the system. There are various factors, which we should keep in mind for placing the layout. PCB can be design using eagle all or dip trace software.

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3.2.1. Schematic Diagram:
The schematic diagram of system forms main input document for creation of the layout. For this purpose the software for PCB design, PCB Wizard can be used.

3.2.2. Electrical and thermal requirement:
A designer should consider the atmospheric or environmental conditions which is required for various components.

3.2.3. Mechanical requirement:
Designer should consider the mechanical requirements required for the PCB. This can include the size of PCB that is width and length of the PCB. Vertical or horizontal orientation of the PCB can be selected as per requirements.

3.2.4. Component placing requirement:
Placing of component is done by considering the length required for the path which is provided for the various components of circuit. Length of the path provided to various components should as minimum as possible.

3.2.5. Components mounting requirements:
Components should be placed parallel to each other. Also they have more distance between each other. This will minimize the electromagnetic interference. Also this will minimize the mechanical on soldering.

3.2.6. Layout Methodology:
For proper layout design minimal, steps to be followed are;
1. Get the final circuit diagram and component list required for system.
2. Choose the board types, single sided/ double sided/multilayered/glass epoxy.
3. Identify the appropriate and correct scale for layout preparation.
4. Select appropriate grid pattern.
5. Select correct board size keeping in view the constraints.
6. Select appropriate layout technique, manual or automatic.
7. Document in the form of the layout scale.

3.2.7. Art Work:
Art work is accurately scaled configuration of the printed circuit of project from which the master pattern is made photographically

3.3. Steps of PCB Fabrication:
PCB fabrication has the following steps:
1) Layout of the Circuit
2) Artwork Designing
3) Printing
4) Etching
5) Drilling
6) Mounting of components & soldering

3.3.1 Layout:
The layout of a PCB has to incorporate all the information on the board before one can go onto all the work preparation. Detailed circuit diagram, the design concept and the philosophy behind the equipment are very important are very important for the layout.

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3.3.2. Procedure:

The first rule is to replace each and every PCB layout as viewed from the component side This rule must be strictly followed in order to avoid confusion, which otherwise be caused.
Another important rule is not to start the designing of a layout unless an absolutely clear circuit diagram is available.

3.3.3. Artwork:

The generation of PCB artwork should be considered as the first step of PCB manufacturing process. The importance of a perfect artwork should not be underestimated.
Problems like inaccurate registration, broken annular rings or too critical spacing are often due to bad artwork. And even with the most sophisticated PCB production facilities, PCB can be made better than the quality of artwork used.

3.3.4. Printing:

The schematic capture need to convert into PCB design. The design printed into transparency paper to be used with UV board to produce a circuit board.

3.3.5. Etching

In all subtractive PCB process, etching is one of the most important steps. The final copper pattern is formed by selective removal of the unwanted copper, which is not protected by etching unit. Solutions, which are used in etching process, are known as enchants. Ferric chloride Cupric chloride Heroic AcidAlkaline Ammonia Of these Ferric Chloride is widely used because it has short etching time and it can be stored for a long time. Etching of PCB's as required in modern electronic equipment production, is usually done in spray type etching machines. Tank or Bubble Etching, in which the boards kept in a tank were lowered and fully immersed in to the agitated, has almost disappeared.

3.3.6. Component Mounting

Careful mounting of components on printed circuit board increases the reliability of assembly:-Leads must be cleaned before they are inserted in the PCB holes. Non symmetric lead bending must be avoided while mounting. The ENT lead must fit in to holes properly so that they can be easily soldered. When the space is required to save then vertical mounting is selected. The vertical lead must have an insulating wrapper. Where pullover wire crosses over the conductors, they must be insulated

3.3.7. Soldering:

The points to be linked must be cleaned first and then fluxed. The hard solder iron and solder wire is applied to the work. The iron must be removed after adequate time and joint is allowed to cool after removing the iron. At the end, finishing of PCB is done.

IV. SOFTWARE DESIGN

MPLAB X IDE

Fig.4.1 MPLAB IDE

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This is a software program that runs on a PC (Windows, Mac OS. Linux) to develop applications for Microchip microcontrollers and digital signal controllers. It is called an Integrated Development Environment (IDE), because it provides a single integrated "environment" to develop code for embedded microcontrollers

MPLAB X Integrated Development Environment brings many changes to the PIC microcontroller development tool chain. Unlike previous versions of the MPLAB IDE which were developed completely in-house, MPLAB X IDE is based on the open source NetBeans IDE from Oracle. Taking this path has allowed us to add many frequently requested features very quickly and easily, while also providing us with a much more extensible architecture to bring you even more new features in the future.

Open MPLAB IDE v8.56.

From the 'Projects' tab, select the first option 'Project Wizard'.

Click on 'Next' in the welcome window that appears.

Select the desired PIC which you need to program or build your project on and click on 'Next'.

Select the active tool suite you require, among the list of tool suites given (Usually the HI-TECH Universal tool suite is preferred, if installed).

Check if the ToolSuite contents listed contains a compiler suiting your programming needs("HI-TECH ANSI C Compiler" in the case of a HI-TECH Universal toolsuite) and click 'Next'.

Create a new project file at your desired location in the desired name.

Take care that the project file is saved in the mep' format and click 'Next'.

In the next window, add any files you desire to add to your new project,if required.else just skip this step by clicking 'Next'.

Now click 'finish' and your new project is created.

Now select the 'New' option from the 'File' tab.

Select 'Save as' option from the 'File' tab and save the new file in the same folder in which you have created the project by selecting a suitable option from 'save as type'(depending on which type of program you're doing).

Go to the Project' tab and select the option 'Add Files To The Project' and add the file saved in the previous step you're doing programming in C.

Assembly Source Files if you're doing programming in ASSEMBLY language etc.

Begin programming in the file.

Programmer:

Pic kit 3:

The MPLAB PICkit 3 allows debugging and programming of PIC® and dsPIC® Flash microcontrollers at a most affordable price point using the powerful graphical user interface of the MPLAB Integrated Development Environment (IDE). The MPLAB PIC kit 3 is connected to the design engineer's PC using a full speed USB interface and can be connected to the target via an Microchip debug (RJ-11)) connector (compatible with MPLAB ICD 2, MPLAB ICD 3 and MPLAB REAL ICE).HID interface, say no more driver again Support windows 7 system USB (Full speed 12 Mbits/s interface to host PC) Real-time execution MPLAB IDE compatible (free copy included)Built-in over-voltage/short circuit monitor Firmware upgradable from PC/web download Totally enclosed Supports low voltage to 20 volts (20v to 60v range)Diagnostic LEDs (power, busy, error)Read/write program and data memory of microcontrollerErase of program memory space with verification Freeze-peripherals at breakpoint Program up to 512K byte flash with the Programmer-to-Go Material Plastic Housing Dimensions

95 x 40 x 13 mm/3.74 x 1.57 x 0.51 inch.

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Fig: Pic kit 3

Program:

```
#include<Servo.h> #define trigPin 8
#define echoPin 9
long duration; int distance;
Servo myservo.
intcalculateDistance(){
digitalWrite(trigPin,LOW); delayMicroseconds(2); digitalWrite(trigPin,HIGH); delayMicroseconds(10);
digitalWritngP,LOW);
duration-pubseln(echolin, HIGH) distance duration 0.034/2
return distance,
}
void setup()
{
pinMode(trigPin, OUTPUT). pinMode(echoPin, INPUT); myservo.attach(11);
Serial.begin(9600);
}
void loop()
{
int I;
for (i=15, i<=165, i++)
{
myservo.write(1); delay(15), calculateDistance(); Serial.print(1); Serial print(".");
Serial.print(distance); Serial.print("");
}
for(i=165, -15; i--)
{
myservo.write(i); delay(15); calculateDistance(), Serial.print(1);
Serial.print("."); Serial.print(distance); Serial.print(" ");
}
}
```

PC Application Program:(Processing 4)

```
import processing.serial.*; // imports library for serial communication
import java.awt.event.KeyEvent; // imports library for reading the data from the serial port
```

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```
import java.io.IOException;
Serial myPort; // defines Object Serial
// defubes variables String angle=""; String distance=""; String data=""; String noObject; float pixsDistance; int iAngle, iDistance; int index1=0;
int index2=0; PFont orcFont; void setup() {
size (1200, 700); // ***CHANGE THIS TO YOUR SCREEN RESOLUTION***
smooth();
myPort = new Serial(this, "COM4", 9600); // starts the serial communication myPort.bufferUntil('.'); // reads the data from the serial port up to the character '.'. So
actually it reads this: angle,distance.
}
void draw() {
fill(98, 245, 31);
// simulating motion blur and slow fade of the moving line noStroke();
fill(0, 4);
rect(0, 0, width, height-height*0.065);
fill(98, 245, 31); // green color
// calls the functions for drawing the radar 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(width/2, height-height*0.074); // moves the starting coordinats to new location
noFill(); strokeWeight(2);
stroke(98, 245, 31);
// draws the arc lines
arc(0, 0, (width-width*0.0625), (width-width*0.0625), PI, TWO_PI); arc(0, 0, (width-width*0.27), (width-width*0.27), PI, TWO_PI); arc(0, 0, (width-width*0.479), (width-width*0.479), PI, TWO_PI); arc(0, 0, (width-width*0.687), (width-width*0.687), PI, TWO_PI);
// draws the angle lines
line(-width/2, 0, width/2, 0);
line(0, 0, (-width/2)*cos(radians(30)), (-width/2)*sin(radians(30)));
line(0, 0, (-width/2)*cos(radians(60)), (-width/2)*sin(radians(60)));
line(0, 0, (-width/2)*cos(radians(90)), (-width/2)*sin(radians(90))); line(0, 0, (-width/2)*cos(radians(120)), (-width/2)*sin(radians(120))); line(0, 0, (-width/2)*cos(radians(150)), (-width/2)*sin(radians(150))); line((-width/2)*cos(radians(30)), 0, width/2, 0);
popMatrix();
}
```

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```
void drawObject() { pushMatrix();
translate(width/2, height-height*0.074); // moves the starting coordinats to new location
strokeWeight(9);
stroke(255, 10, 10); // red color
pixsDistance = iDistance*((height-height*0.1666)*0.025); // 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)),
(width-width*0.505)*cos(radians(iAngle)), -(width-width*0.505)*sin(radians(iAngle)));
}
popMatrix();
}
void drawLine() { pushMatrix();
 strokeWeight(9); stroke(30, 250, 60);
translate(width/2, height-height*0.074); // moves the starting coordinats to new location
line(0, 0, (height-height*0.12)*cos(radians(iAngle)),
-(height-height*0.12)*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";
}
fill(0, 0, 0); noStroke();
rect(0, height-height*0.0648, width, height); fill(98, 245, 31);
textSize(25);
text("10cm", width-width*0.3854, height-height*0.0833); text("20cm", width-width*0.281, height-height*0.0833);
text("30cm", width-width*0.177, height-height*0.0833); text("40cm", width-width*0.0729, height-height*0.0833);
textSize(40);
text("N_Tech ", width-width*0.875, height-height*0.0277); text("Angle: " + iAngle +" ", width-width*0.48, height-
height*0.0277); text("Distance: ", width-width*0.26, height-height*0.0277);
if (iDistance<40) {
text("     " + iDistance +" cm", width-width*0.225, height-height*0.0277);
}
textSize(25);
fill(98, 245, 60);
translate((width-width*0.4994)+width/2*cos(radians(30)), (height-height*0.0907)-width/2*sin(radians(30)));
rotate(-radians(-60));
text("30", 0, 0);
resetMatrix();
translate((width-width*0.503)+width/2*cos(radians(60)), (height-height*0.0888)-width/2*sin(radians(60)));
rotate(-radians(-30));
text("60", 0, 0);
resetMatrix();
translate((width-width*0.507)+width/2*cos(radians(90)), (height-height*0.0833)-width/2*sin(radians(90)));
rotate(radians(0)); text("90", 0, 0);
resetMatrix();
```

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```
translate(width-width*0.513+width/2*cos(radians(120)), (height-height*0.07129)-width/2*sin(radians(120)));
rotate(radians(-30)); text("120", 0, 0);
resetMatrix();
translate((width-width*0.5104)+width/2*cos(radians(150)), (height-height*0.0574)-width/2*sin(radians(150)));
rotate(radians(-60)); text("150", 0, 0);
popMatrix();
}
```

V. ADVANTAGES, APPLICATIONS

5.1 ADVANTAGES

- It is an open-source project, software/hardware is extremely accessible and very flexible to be customized.
- It is easy to use, connects to computer via USB and communicates using standard serial protocol, runs in standalone mode and as interface connected to PC/Macintosh computers.
- It is cheap.
- Arduino is backed up by a growing online community, lots of source code is already available and we can share and post our examples for others to use.

5.2 APPLICATIONS

This Radar System has various applications for security purposes and it is mainly used for mapping.
APPLCATION IN AIR FORCE:- It is used in airplanes or aircraft machines which have implemented radar system in it to detect the objects that comes in a way. It is also used to calculate height readings
APPLICATION IN MARINE:- This radar system also used in ships or marine It is implemented on big ships to calculate the distance of other boats or ships, with the help of this sea accidents can also be reduced by not colliding. It can also be implemented on ports to see the distance of other ships and to monitor or control the ship movements.
APPLICATON IN METEROLOGY :- Meteorologists also uses radar systems to track or monitor the wind. It has been become an important equipment for climate testing For example to detect tornados, storms.
It is very important to use these techniques for security in government offices, street, banks, and so and instead of the camera system because it is more accurate, not affected by the weather conditions like (rain, snow, and fog).

5.3 Future Scope:

We can further add features to this system ie, making it mobile, mounting an alarm system to it which turns on when obstacle is detected Further modifications could be an obstacle avoiding robot with surveillance system.

VI. CONCLUSION

6.1 Conclusion:

Numerous advanced control methods gave designers to have more command over different advanced applications. In our paper, the recommended mapping method of whole system is assessed on small principles or scale. The field that we have chosen for our design Radar System" is a very vast field and future scope of this technology is very high. We have tremendous applications in which radar system have been implemented or used. There is a lot of future scope of this design because of its security capacity. It can be used in many applications. This framework can also be developed or modified according to the rising needs and demand . As we have designed a short range radar therefore our research wiss specified and limited. This system can only detect objects from 6 to 180 degrees only because the servo motor that we have used can rotate only to this range. So, due to this limitation our design cannot be applied to places or areas for obstacle detection on a larger scale. Usage of a 360 degrees rotating servo motor can make the system more efficient. We look forward to modify this system and enhance our research work by using a fully 360 degrees rotating servo and a higher ranged ultrasonic sensor.

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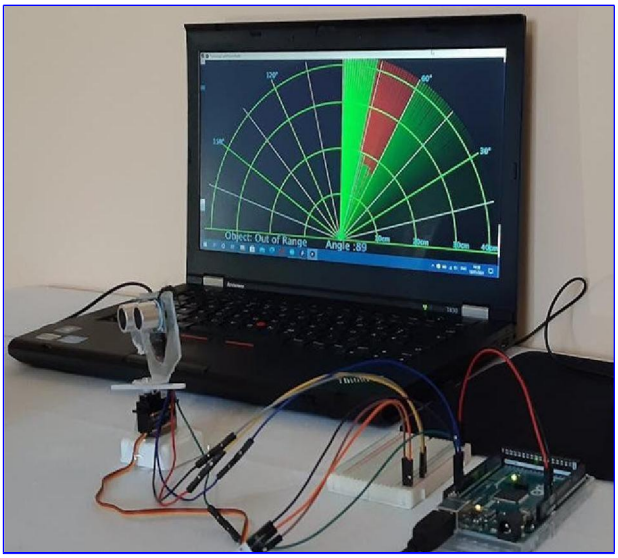
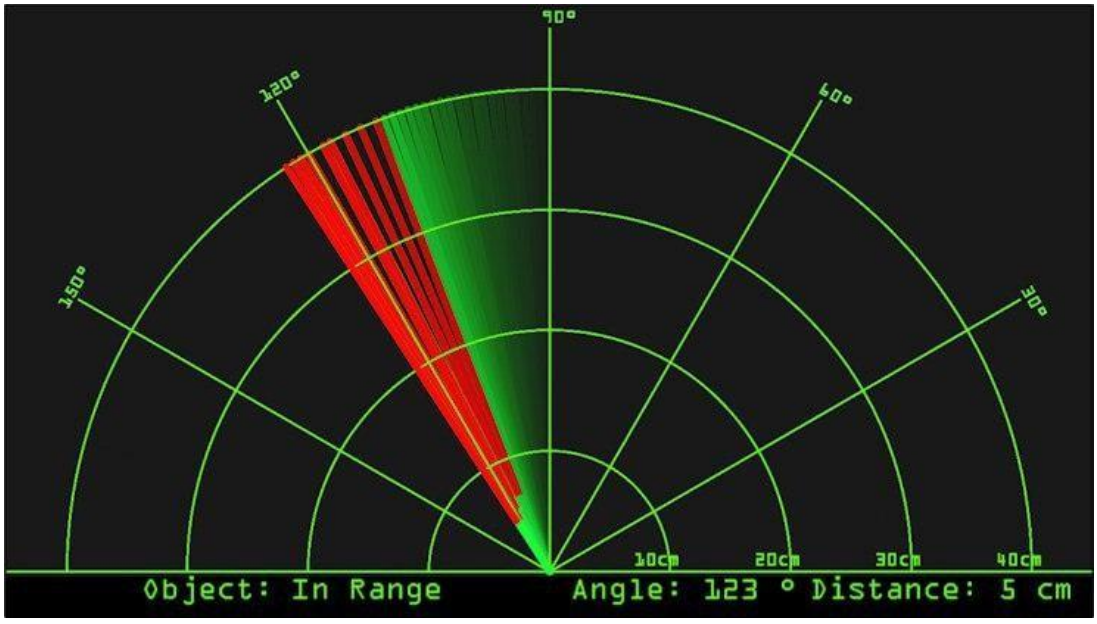
6.2 Result:





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