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A SHORT-RANGE RADAR SYSTEM - USING ARDUINO

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Abstract: *Radio Detection and Ranging (RADAR) is a machine used to monitor a specific area 24 hours a day, seven days a week. Their primary desire is protection. RADAR is an object detection tool. It can attack aircraft, spacecraft, missiles, vehicles, weather formations, etc. Radar is an addition to the human sensory system that provides new centres. It includes a Trans-receiver and processor. RADAR can be of many types. Ultrasonic RADAR is an element detection device that shows the rapid range area. This system consists of an Arduino connected to an ultrasonic sensor mounted on a servo motor. The proposed system, "ultrasonic radar for the object detection distance and the speed measurement", employs an ultrasonic module that includes an ultrasonic transmitter and receiver. It operates by transmitting a 40 kHz frequency pulse which is not audible to the human ear.*

Keywords: *Radar, object detection, Arduino, ultrasonic RADAR, Servo Motor.*

I. INTRODUCTION

A radar is an object-detection device that uses radio waves to determine objects' type, direction, or pace. It can trip aircraft, ships, spacecraft, guided missiles, engines, and weather and terrain formations. This assignment provides sufficient knowledge of Arduino and MATLAB Simulink for Arduino and mechanics. Machines are small yet efficient vehicles used in many products ranging from helicopters to robots. In this challenge, we use an ultrasonic sensor to operate with the help of emitting a wave of sound waves in swift succession. These sound waves hit the intended target, reach the sensor, and travel at the required speed. Ultrasonic sensors, the radar is far below the temperature, which improves consistency and accuracy. Radar was developed secretly for military use by several countries in the lead-up to World War II

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and sometime during World War II. The term RADAR was coined in 1940 by the US Navy as an acronym for Radio Detection and Ranging. Radar can detect hurricane systems because rainfall reflects electromagnetic fields at specific frequencies. Radar can also generate accurate maps. Radar structures are widely used in air traffic control and marine navigation. The United States and four Commonwealth countries: Australia, Canada, New Zealand, and South Africa, have also developed their radar structures.

We realize that everything produces sound waves only through the patterns of life and the effect of the air drifting around you with its herbal frequency. These frequencies are outside the range of hearing in humans. Waves with a frequency range of 20,000 Hz and more or less are called ultrasonic waves, and these waves can be detected by an ultrasonic sensor that allows us to obtain various information.

The ultrasonic detector usually contains a transducer that converts acoustic electricity into electrical energy and electrical energy into sound power. They measure the role and direction of objects, collision avoidance devices, monitoring systems, and many more. Ultrasound technology relieves ailments, including linear size problems, as it allows a person to obtain non-contact measurements in this way, and the distance between objects, speed, and many other things can be measured without difficulty. The travel velocity of an acoustic wave depends on the square root of the relationship between mean intensity and stiffness. In addition, the origins of the vocal rhythm can also be modified through the use of phytosociological conditions such as temperature. So, an ultrasonic sensor sends out ultrasonic waves that travel through the air and get reflected after you suspend anything. By reading the properties of the contemplated wave, we will gain knowledge about distance, location, speed, and many other devices. Processing software and Arduino software are used with the device to detect several article parameters. Scoping is one of the most common uses for an ultrasonic sensor. It is also known as sonar, the same radar in which the ultrasound is directed in a certain direction. If something is in its path, it hits it and looks at it again, and after calculating the time, it takes to return, we can determine the object's distance. In real life, bats use this approach.

II. LITERATURE SURVEY

The Army, Navy, and Air Force employ this generation. The use of this generation has been visible these days in parking systems for cars launched by AUDI,

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FORD, etc., and even impending driverless vehicles via Google, such as Prius and Lexus. The project we carry out can be used in any structure that the customer wants to use, such as a car, bicycle, or something else. Using Arduino [1] in the task provides more flexibility to use the above module according to the requirements. The idea to make an ultrasonic radar arose as part of a test conducted on the operation and mechanism of "cars of the future." Also, as ECE undergraduates, we have always been interested in the current generation of the latest generation in the world, such as Arduino, Raspberry Pi, Beagle-Bone board, and so on. As a result, this time, we could maintain one of the Arduino forums, Arduino UNO R3. So, knowing roughly about electricity and the excellent processing capabilities of Arduino, we thought we would make it a sizeable purpose-built unit of everyday utilities that can be easily used and configured anywhere and by anyone.

III. DESIGN AND IMPLEMENTATION OF RADAR SYSTEM

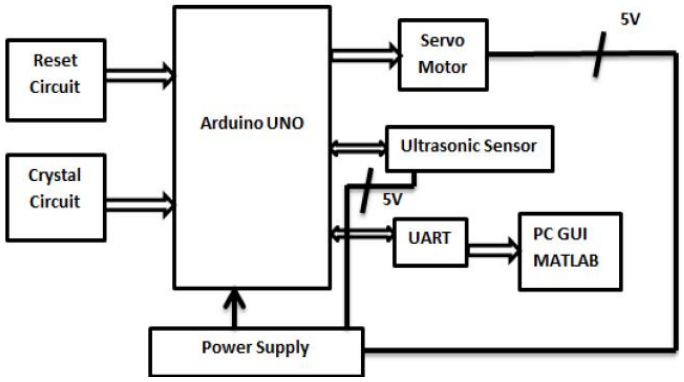

Fig.1 Block diagram of the short-range radar

The above fig.1 shows the Block Diagram of the short-range radar system. Here we use Arduino Uno microcontroller which is open source to implement embedded based system. ATMEGA 328 microcontroller send 10 micro second pulse width to ultrasonic transmitter, echo back signal receive by TX module of ultrasonic. After then receive pulse width calculated by micro controller. Here we use servo motor on which ultrasonic module is mounted for receive 180-degree signal.

Microcontroller and MATLAB communicated through UART protocol with the baud rate of 9600. This protocol work on ASCII value. So calculated distance transmits from microcontroller to MATLAB COM PORT. According sensing different obstacle which are around 180 degree and 250 cm range, visible as a red spot-on MATLAB GUI.

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A) ARDUINO TECHNOLOGY

A typical example of the Arduino board is Arduino Uno. It includes an ATmega328 microcontroller and it has 28-pins. The pin configuration of the Arduino Uno board is shown in the above. It consists of 14-digital i/o pins. Wherein 6 pins are used as pulse width modulation o/p's and 6 analog i/p's, a USB connection, a power jack, a 16MHz crystal oscillator, a reset button, and an ICSP header. Arduino board can be powered either from the personal computer through a USB or external source like a battery or an adaptor. This board can operate with an external supply of 7-12V by giving voltage reference through the IO Ref pin or through the pin Vin.

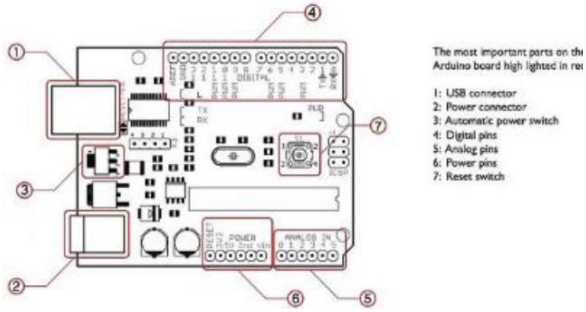

Fig.2 Arduino board

Table.1 Arduino Microcontroller specifications

Fig.3 Arduino UNO R3 and Raspberry Pi boards

Moreover, in this rapid international movement, there is an urgent need for equipment that can be used in order to improve the lives of mankind instead of destroying their lives. Therefore, we decided to make a number of changes, and taking advantage of the processing capabilities of Arduino [1], we decided to make the module more specific for the application.

Thus, from the idea of self-driving cars came the concept of self-parking. The main concern of human beings in India or even most countries is protection, even like riding a horse. So, we came up with an option with the help of using this task to constantly scan the site for traffic, population, etc., as well as the safety of the engines at the same time to avoid injuries or minor scratches on the machines.

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ARDUINO MICROCONTROLLER	
Microcontroller	ATmega328
Architecture	AVR
Operating Voltage	5 V
Flash memory	32 KB of which 0.5 KB used by bootloader
SRAM	2 KB
Clock Speed	16 MHz
Analog I/O Pins	6
EEPROM	1 KB
DC Current per I/O Pins	40 mA on I/O Pins; 50 mA on 3,3 V Pin
GENERAL	
Input Voltage	7-12 V
Digital I/O Pins	20 (of wich 6 provide PWM output)
PWM Output	6
PCB Size	53.4 x 68.6 mm
Weight	25 g
Product Code	A000066 (TH); A000073 (SMD)

B) ULTRASONIC SENSOR

Ultrasonic sensors rely entirely on the size of sound waves and house frequencies above the human audible range, often around 40 kHz. Three distinct houses of the received echo pulse can be evaluated for different detection purposes: 1) time of flight, 2) Doppler shift, and 3) amplitude attenuation. HC-SR04 ultrasonic range unit provides non-contact measurements from 2cm to 400cm, and the range accuracy can reach 3mm. The units consist of ultrasonic transmitters, receivers, and management. The ultrasonic sensor works with the cause and echo method. The transceiver unit is activated and sends the signal to the water, and the water sends an echo signal to the lower back, which the echo reads to, i.e., the receiver unit. The ultrasonic sensor calculates the signal distance and returns the range of the water. The travel time price and fare value allow the sensor to calculate the water level. The following figure is an image of the ultrasonic sensor used in the task.

Fig.4 Ultrasonic sensor

Table.1 Ultrasonic sensor specification

Power Supply	+5V DC
Working Current	15mA
Effectual Angle	<15°
Ranging Distance	2cm – 400 cm/1″ –
Resolution	0.3 cm
Measuring Angle	30 degree
Trigger Input Pulse	10uS
Dimension	45mm x 20mm x

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C) 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 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.5 Servo motor

D) ZIGBEE

ZigBee is a new wireless technology guided by IEEE 802.15.4. It is currently operating 2.4GHZ in worldwide at a maximum data rate up to 250kbps. One of the major advantages is provide noise free for communication. There are three different devices: (1) ZigBee coordinator node, (2) The full function devices FFD, (3) The reduced function device RFD. ZigBee provides the ability to run for years on inexpensive batteries for a host of monitoring and control applications. The ZigBee network layer ensures that networks remain operable in the conditions of a constantly changing quality between communication nodes

Fig.6 Zigbee

SYSTEM FLOW DIAGRAM

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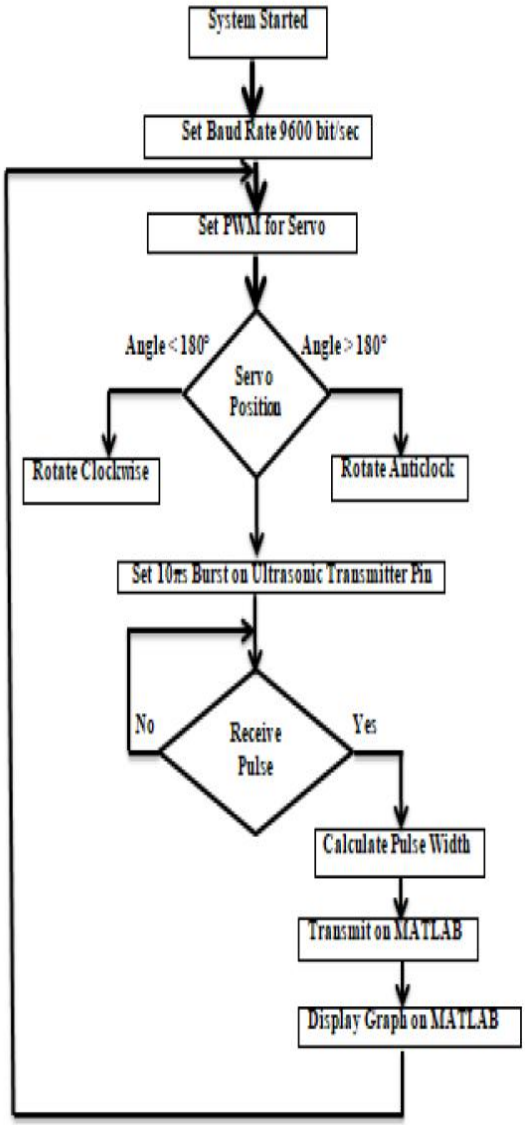

Fig.7 System flow diagram

First, we set the baud rate 9600 to communicate with the MATLAB. Here we are mounting ultrasonic module on the servo motor which rotate 180° from clockwise to anti-clockwise direction for this we set. PWM for servo motor. After than choosing the timer we are sending 10μS pulse width on ultrasonic TX pin. Now RX echo pulse width calculates by Arduino Uno microcontroller. After than the real time distance passing for MATLAB terminal at 9600 baud rate. This distance display on MATLAB through graphical geo

IV. RESULTS

Fig.8 Initial Arduino IDE

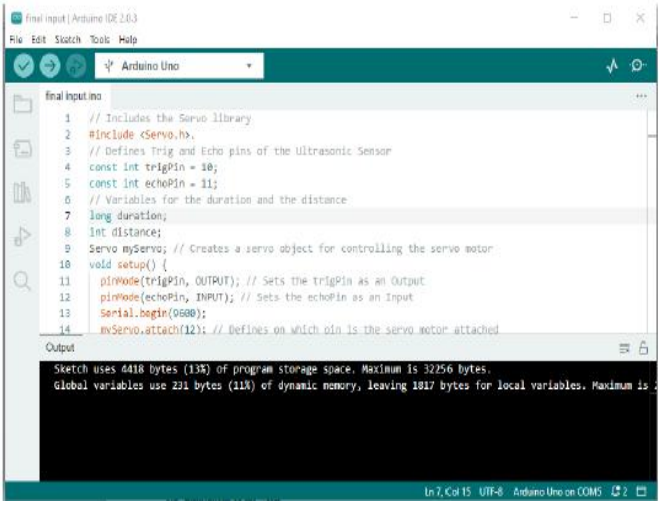

Fig.9 Arduino IDE after Uploading the code

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Fig.10 *Initial Processing IDE*

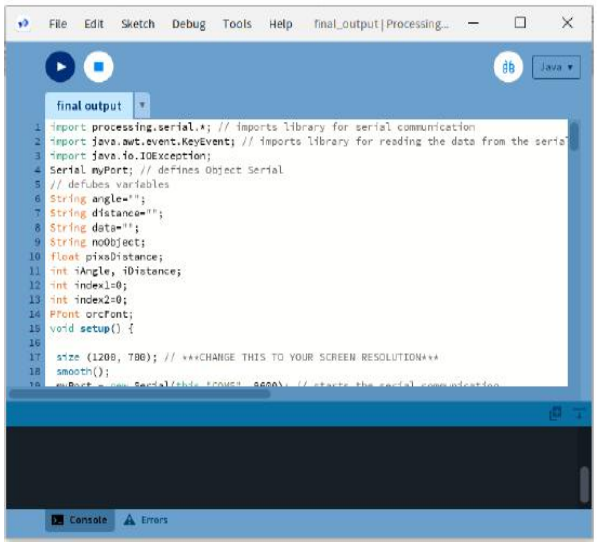

Fig.11 Processing IDE after uploading of Processing Code

d

Fig.12 Initial GUI when Processing Code is Executed

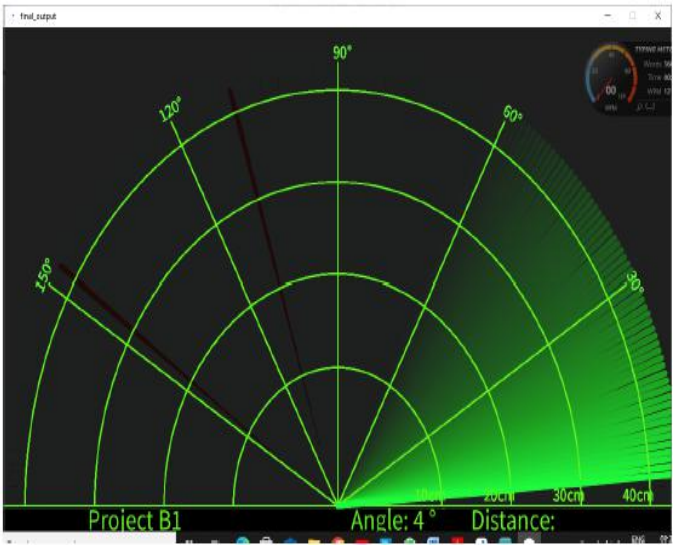

Fig.13 GUI When no object was detected

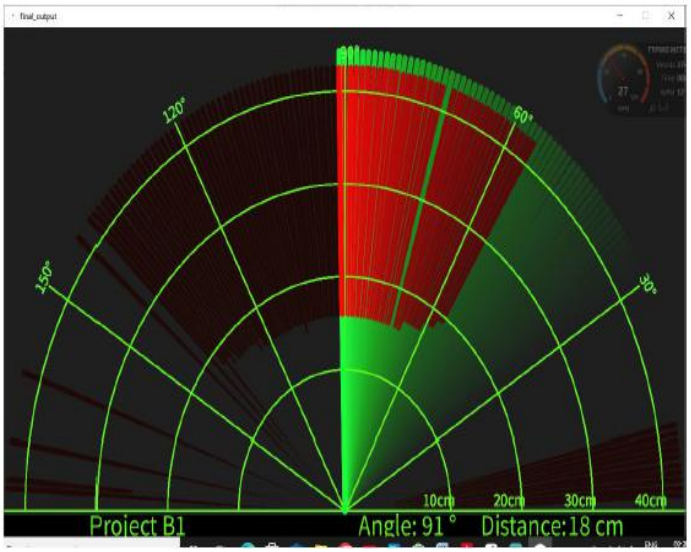

Fig.14 GUI when object is detected

V. CONCLUSION

We have represented a project on Ultrasonic RADAR for security system for human or object interference in a short range. The system has been successfully

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implemented and the aim is achieved without any deviation. There is a lot of future scope of this project because of its security capacity. It can be used in many applications. This project can also be developed or modified according to the rising needs and demand.

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