IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Portable Ultrasonic RADAR

[1]Dr B P Mishra, [2]Aditya Kumar, [3]Anand Dixit, [4]Tushar Gupta
[1]Associate Professor, [2,3,4]B. Tech Student
[1]Electronics and Communication Department
[1]JSS Academy of Technical Education, Noida, India

Abstract: When a target or object is close by or clearly visible, it is simple to detect it, recognize it, locate it, determine its pace of movement, etc. The same, however, is not always true, particularly when the object is far away or cannot be seen because of numerous reasons, such as the weather, day/night cycle, etc. As a result, the technology known as Radio Detection and Ranging (RADAR) [2], which uses radio waves to calculate an object's distance, angle, or speed, was developed. However, it takes a long time to detect, has a limited detection area, is too sensitive, is expensive, and does not have a target-specific detection range. Utilizing ultrasonic sensors [4], which employ sound waves for ranging and detecting, is a more affordable, simple, and efficient alternative method. This paper describes a technique for using the Ultrasonic Sensor (HC-SR04) as a RADAR to monitor environments, etc. The Servo Motor (MG996R) is linked to the HCSR04 to rotate and move the device. The SIM900A module is also used to send SMS or messages upon object detection. For the processing in order to identify and alert the user of the object, these components are connected to the Arduino Uno as in [7]. The RADAR may be utilized in dark conditions, and it does not get significantly impacted by dust, filth, or high moisture environments and is not affected by the colour or transparency of objects. The results were displayed on the screen using Processing- 4 software.

Index Terms **– RADAR, IDE, SIM, GSM, Sensors, SMS**

I.INTRODUCTION

In the past (during the world wars), finding, identifying, and tracking objects had to be done manually, which was challenging.

It was challenging for a mere human to predict the weather. It was challenging for humans to move about or investigate since the lake bodies were so large and what lay beyond them was invisible. Therefore, Radio Detection and Ranging (RADAR) was developed to address these issues as well as many others. In the military, it is used to locate targets, recognize enemies, or direct missiles. It may manage air traffic in the field of aircraft by locating the aircraft and directing it to land or take off.

In remote sensing, it can be used to forecast the weather so that precautions can be taken in the event of a natural disaster, to track satellites, to detect the locations of planets in orbit, to steer ships in the water, and to find items buried beneath them. Police officers utilize it in ground traffic control to gauge vehicle speed, spot impediments, and other things.

An antenna radiates an electromagnetic signal from the transmitter that makes up the RADAR into space. Any object that this signal strikes will reflect it in many different directions [2]. As it employs electromagnetic waves, has a large range, is flexible, and does not require a medium to move through, RADAR can be used to identify objects in adverse weather conditions. However, it is expensive, difficult to set up and manage, too close objects throw off the receiver, and because of its broad range, it is not target-specific.

The below figure shows the working of RADAR:

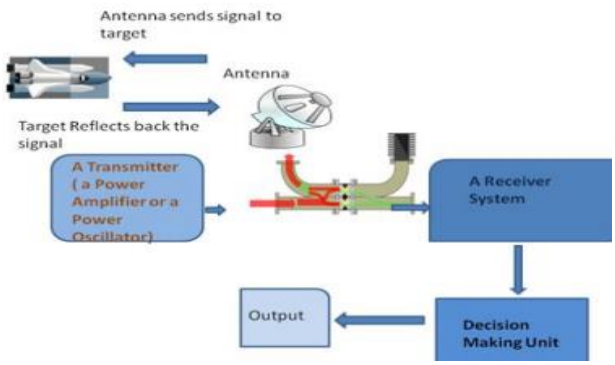

Fig.1: RADAR System

However, there is a superior option that is more manageable and affordable. Ultrasonic sensors use sound waves that are above the human auditory range of 20 kHz to measure distance. An ultrasonic wave is emitted by the sensor, and it then receives the wave that the target reflects back to it. The time elapsed between the emission and reception is measured by ultrasonic sensors to determine the target's distance. The benefits of using ultrasonic sensors include their low cost, ease of setup and handling, ability to connect to any IoT module, high frequency, sensitivity, penetrating power, and great accuracy. Ultrasonic sensors can also easily sense the nature, shape, and orientation of an object [3] and are not affected by light, smoke, colour, dust, or other environmental factors.

The HC-SR04 measures an object's distance using sonar [8]. When a high-frequency sound from the transmitter (the trig pin) encounters an item, it is reflected and the receiver (the echo pin) picks it up. A Servo motor (MG996R) is used to create movements and rotations [1] similar to RADAR.

SIM900A can be used to send an SMS or message with the position of an object when it is detected. As one can see, the RADAR can be replaced with these affordable, lightweight, simple-to-install, and manage modules, and even then, the entire program can be handled.

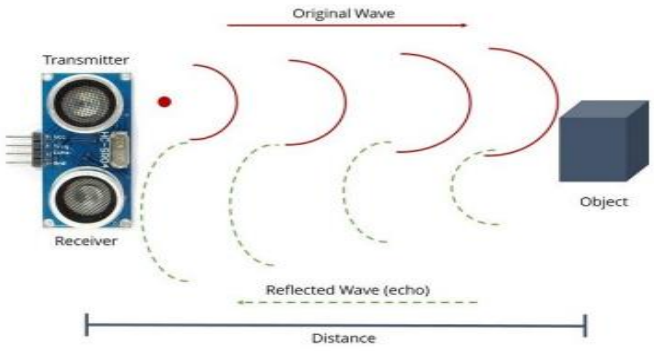

Fig.2: Ultrasonic Sensor
HC-SR04 System

II. LITERATURE REVIEW

Shih-An Li [1] The goal of this study is to decrease the latency between a personal computer and a servo motor. To that end, an FPGA chip-based servo motor controller was created, with SOPC technology serving as the system's main processing engine.

A. Patkar et al. [2] This paper examines how various road surfaces react to microwave and ultrasonic waves by backscattering.

Sujay Lokesh [3] The purpose of this study is to develop an inexpensive object-detecting system that uses ultrasonic sensors as support.

Shao Y. et al. [4] In this paper, a grid projection method to determine parking space size is proposed. By totaling the overlap percentages of the derived outlines in accordance with the callback ultrasonic signal, it may determine the boundaries of the obstacles. It is established that the overlap number of the echo signal is higher at the obstacle's edge than it is outside of it.

Eugen Hyun et. al. [5] This study provided a short-range ground surveillance radar concept that can detect moving targets. A recently developed target detection processing system was integrated inside a microprocessor using the new 24GHz FMCW radar transceiver and antennas. Based on the trial results on a real road, it can be said that the new system is effectively able to identify a moving car.

Aleksandr Bystrov et al. [6] In this paper, the researchers used ultrasonic sensors to detect distance because the signal loss is reduced. Due to the ability of ultrasonic sensors to measure distance, we can calculate the object's distance.

V. Hyndavi et.al. [7] It is suggested to develop a device that can locate and transmit notifications to loved ones for ladies without requiring their participation. Using outlier detection, it alerts the family members and the neighborhood police station in the event of a potential atrocity. Using a GSM and GPS module, the message is delivered to the recipients.

Manabu Ishihara et.al. [8] According to research findings, a sensor system can be utilized to locate a robot in a corridor or other narrow space. Additionally, the suggested system can be utilized as a position-detecting platform for robots that follow a path.

B. Mustapha et.al. [9] US and IR sensors were used in the making of an obstacle-detection system for the elderly and people with vision impairment. Both sensors were able to detect an obstacle at distances within their usable range with a percentage of accuracy between 95%and 99%. It had been shown that the IR sensor has a slightly higher resolution than that of the US sensor.

Sai Krishnan A. Nair et. al [10] This paper focuses on producing a 2D occupancy grip map using a robot that uses an ultrasonic sensor to generate the 2D occupancy grid map while moving. Because of the sensor's noise, the ghost spots are produced ultimately producing outliers on a map.

Nir Regev et. al. [11] This paper focuses on creating an ultrasonic sensor-based alert system to help specially-abled people who are not fond of wearing any bands and smart devices. It alerts the family members of specially-abled people when he/she wave their hands for 3s in front of the sensor-based system in case of any emergency.

III. PROPOSED MODEL

The proposed model is a "Portable Ultrasonic RADAR" that can detect the object in its proximity using ultrasonic waves. It uses an Arduino Uno, a servo motor, and an ultrasonic sensor to accomplish the objectives. It detects the object and tracks its range and distance from the RADAR and displays it on the screen using Processing 4 GUI. The detected object's distance and angle will be sent to the authorities' device using GSM.

Earlier, infrared sensor-based RADAR was used. But it had various disadvantages as it gets affected more by temperature, dust, moisture, and other environmental conditions and had less accuracy.

IV. METHODOLOGY

Due to the cost-effectiveness of the HC-SR04 ultrasonic sensor, the ultrasonic sensor is used in RADAR. The ultrasonic sensor is mounted on an MG996R servo motor which rotates the sensor to provide 360-degree coverage. To get digital results from the analog results of these components, they are connected to Arduino Uno which converts the analog input to digital output. Then the GSM is also connected to the Arduino Uno. The ultrasonic sensor then detects if there is an object in its range. If the object is present, it then sends the range and angle to Arduino Uno. The range and angle detected are then processed using Arduino and the result is displayed on the screen using Processing 4 GUI. The alert message is also sent to the authorities via GSM.

4.1. BLOCK DIAGRAM

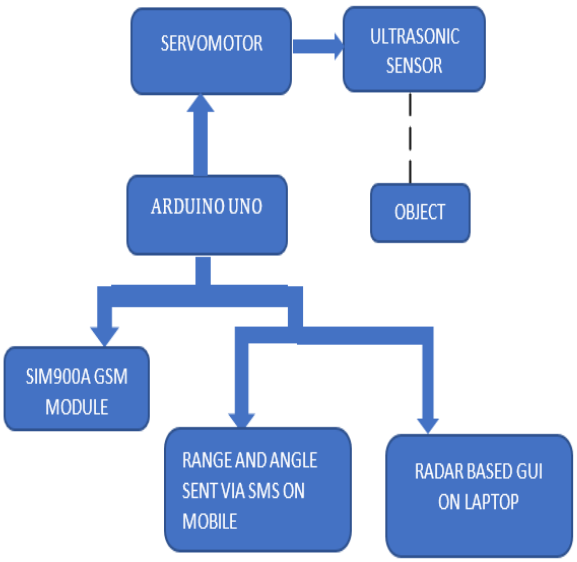

Fig. 3: Block diagram of Ultrasonic RADAR

4.2. FLOW CHART

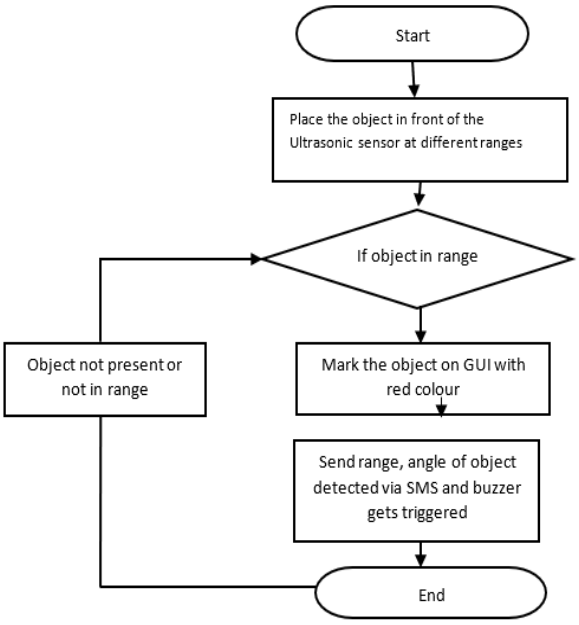

Fig. 4: Flow chart of the Ultrasonic RADAR system

The Ultrasonic Sensor checks whether an object is in range of the sensor or not. If the object is in range, then the object's distance and angle are detected and shown on the screen using Processing-4 GUI. The range and angle are also sent to authorities using GSM.

V. CONCLUSION

In recent times, there are so many studies carried out in order to detect the object. There are many RADARs already built using various sensors. This project also stands with the same ideology but has major improvements in it. Many studies have been done in great depth. This project focuses on increasing the efficiency of the RADAR and making it more reliable by adding extra features to it.

1. The Ultrasonic Sensor used is more reliable and effective in comparison to Infrared Sensor as the results are less affected by temperature and other atmospheric conditions.
2. The detected object's range and angle will be shown on the laptop using Processing 4 GUI.
3. The detected object's distance and angle will be calculated and sent to higher authorities using the GSM module via SMS.

V. REFERENCES

[1] Shih-An Li, S.A., Weng, C.W., Chen, Y.H., Lo, C.H., Yang, M.H., Lin, Y.C., Hsieh, M.H. and Wong, C.C., 2012, November. Servo motor controller design for a robotic manipulator. In 2012 International Symposium on Intelligent Signal Processing and Communications Systems (pp. 254-257). IEEE.

[2] Bystrov, A., Abbas, M., Hoare, E., Tran, T.Y., Clarke, N., Gashinova, M. and Cherniakov, M., 2014, October. Remote road surface identification using radar and ultrasonic sensors. In 2014 11th European Radar Conference (pp. 185-188). IEEE.

[3] Sujay Lokesh, Siddharth Mitta, Sri Vardhan Reddy Kalli, Dr. Sowmya Rani CN, Shlok Sethia. 2018. Object Classification based on Spatial Orientation using Ultrasonic Sensors. Fourth International Conference on Computing Communication Control and Automation (ICCUBEA)

[4] Shao, Y., Chen, P. and Cao, T., 2018, July. A Grid Projection Method Based on Ultrasonic Sensor for Parking Space Detection. In IGARSS 2018-2018 IEEE International Geoscience and Remote Sensing Symposium (pp. 3378-3381). IEEE.

[5] Hyun, E., Jin, Y.S., Ju, Y. and Lee, J.H., 2015, September. Development of short-range ground surveillance radar for moving target detection. In 2015 IEEE 5th Asia-Pacific Conference on Synthetic Aperture Radar (APSAR) (pp. 692-695). IEEE.

[6] Wobschall, D., Zeng, M. and Srinivasaraghavan, B., 2005, February. An ultrasonic/optical pulse sensor for precise distance measurements. In 2005 Sensors for Industry Conference (pp. 31-34). IEEE

[7] V. Hyndavi, N. Sai Nikhita, S. Rakesh, 2020 July. Smart Wearable device for women's safety using IoT. Proceedings of the Fifth International Conference on Communication and Electronics Systems (ICCES 2020).

[8] Manabu Ishihara, Makoto Shiina and Shin-nosuke Suzuki, June 2009. Evaluation of Method of Measuring Distance Between Object and Walls Using Ultrasonic Sensors. Journal of Asian Electric Vehicles, Volume 7, Number 1, June 2009.

[9] Baharuddin Mustapha, Aladin Zayegh, Rezaul K. Begg, 2003. Ultrasonic and Infrared Sensors Performance in a Wireless Obstacle Detection System. 2013 First International Conference on Artificial Intelligence, Modelling & Simulation, 2013 IEEE DOI 10.1109/AIMS.2013.89.

[10] Sir Krishnan A. Nair, Sharnappa Joladarshi, Nithin Ganesh, 2019. Evaluation of ultrasonic sensor in robot mapping. Proceedings of the Third International Conference on Trends in Electronics and Informatics (ICOEI 2019) IEEE Xplore Part Number: CFP19J32-ART; ISBN: 978-1-5386-9439-8.

[11] Nir Regev, Dov Wulich, 2020.A Simple, Remote, Ultra-Sonic Based Personal Emergency Response System. 2020 IEEE Texas Symposium on Wireless and Microwave Circuits and Systems(WMCS),DOI: 10.1109/WMCS49442.2020.9172404.