



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

ULRTASONIC RANGE FINDER

Prof Aleem Sultana Shaikh

Assistant Professor

Dept of Electronics and Communication

RTE Society Rural Engineering College
Hulkoti

Aftabmalik Kudari

Student

Dept of Electronics and Communication

RTE Society Rural Engineering College
Hulkoti

Shoaibmalik Kudari

Student

Dept of Electronics and Communication

RTE Society Rural Engineering College
Hulkoti

Muskan Bagali

Student

Dept of Electronics and Communication

RTE Society Rural Engineering College
Hulkoti

Vijaylaxmi Patil

Student

Dept of Electronics and Communication

RTE Society Rural Engineering College
Hulkoti

ABSTRACT

This project proposes the principal of implementation of ultrasonic distance detector using arduino. In this process distance will be measured using an ultrasonic sensor. This is widely used for non contact distance measurements across various fields such as robotics, industrial automations and automotive systems. These sensors functions by emitting ultrasonic sound wave and calculating the time Taken for the echo to return after reflecting off an object. This paper delves into the fundamental principles of ultrasonic sensing focusing on the time-of-flight method to calculate distances.

KEYWORDS: Ultrasonic Sensor, Distance Measurement, Obstacle Detection, Echo Signal Processing, Sound Wave Technology, Non-Contact Measurement, Ultrasonic Transducer, Time of Flight, Range Finder Technology, Real-Time sensing, Environment Monitoring, Automatic Systems, Robotics Navigations, IOT Applications, Ultrasonic Waves.

1 INTRODUCTION

An ultrasonic range finder is a sensor device which is used to measure the distance between one object to another object by utilizing ultrasonic waves. It operates on the principle of echolocation, similar to how bats and dolphins navigate and locate objects. These use various kinds of accuracy and speed as well as it should be low cost is important. The development of smart cars requires new sensors that are able to measure distance in the range of a few centimeters to a few meters. Ultrasonic sensors typically consists of a transmitter which generate high frequency sound waves it measure the range between 20KHz to 40KHz

In this paper we explore the principles designs consideration and practical application of range finder zooming on their advantages limitations and potential for future advancements in the fields of sensor technology. This technique of distance measurement using ultrasonic in air include continuous wave and pulse echo technique. In the pulse echo method a burst of pulses is sent through the transmission medium and is reflected by an object kept at specified distance. The measuring principle of most method is the estimation of the time-of-light of an ultrasonic burst generated by a proper transducer and the direction of the echo originated by any discontinuity or reflected in the propogation medium.

LITERATURE REVIEW:

An ultrasonic range finder is a sensor device that measures distances to an object by sending out ultrasonic sound waves and calculating the time taken for the echo to return. Below is an overview of its implantation. The practical work of the project that is related to the design a circuit and develops program for the Arduino Uno to control both ultrasonic sensor and the direction of servo motor.

Working Analysis

In this project the sensor is a high performance ultrasonic range finder. It is compact and measures an amazingly wide range from 2cm to 4m. This ranger is a perfect for any robotics application, or any other projects requiring accurate ranging information. This sensor cab be connected directly to the digital input and output lines of Aduino Uno and distance can be measured In time required for travelling of sound signal using simple formula as below.

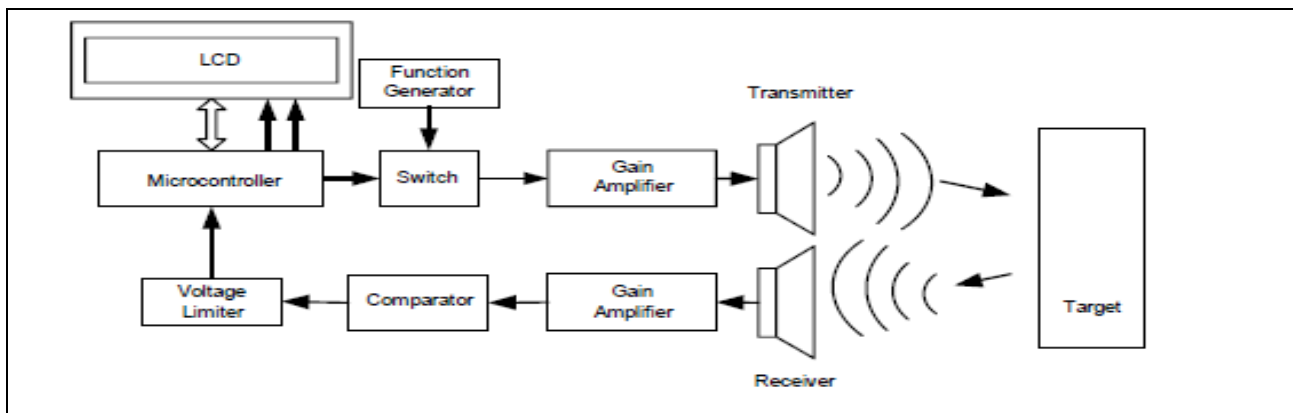
Distance in cm = Echo pulse width high time *0.017

The module works on 5VDC input and also gives as output directly for detection of any obstacles up to 4m.

Power up the sensor by 5VDC using pins VCC and GND. First of all a 10us trigger input has to be given to the pin named Trig on the sensor. This starts one cycle of range conversion and sends 8 bursts of sound waves from the transmitter. As soon as the signal are transmitted the Echo pins goes to high level until the same sound waves are received by the receiver. If the received sound waves are same as what the same

sensor transmitted then the Echo pin goes to low level. If no object is detected within 4m after 30ms the Echo signal will automatically go to low level.

Block Diagram



Ultrasonic range finder works based on the principal of time of flight. A transducer emits high-frequency sound waves (typically above 20 KHZ) That reflect off an object and return to the sensor. The distance is calculated using the formula

$$\text{Distance} = \text{Speed of sound} \times \text{Time} / 2$$

METHODOLOGY

An Ultrasonic range finder is a device that uses Ultrasonic waves to measure the distance to an object or surface. It operates based on the principal of sound wave reflection where the time taken for a sound wave to travel to a travel to reach and back is used to calculate the distance.

1 Hardware

- Ultrasonic Sensor: A module like HC-SR04, consisting of a transmitter and a receiver.
- Microcontroller: Processing data
- Display unit: LCD, LED or a serial monitor to show distance readings.
- Power Source: Provides a serial monitor to show distance readings.

2 Working Principal

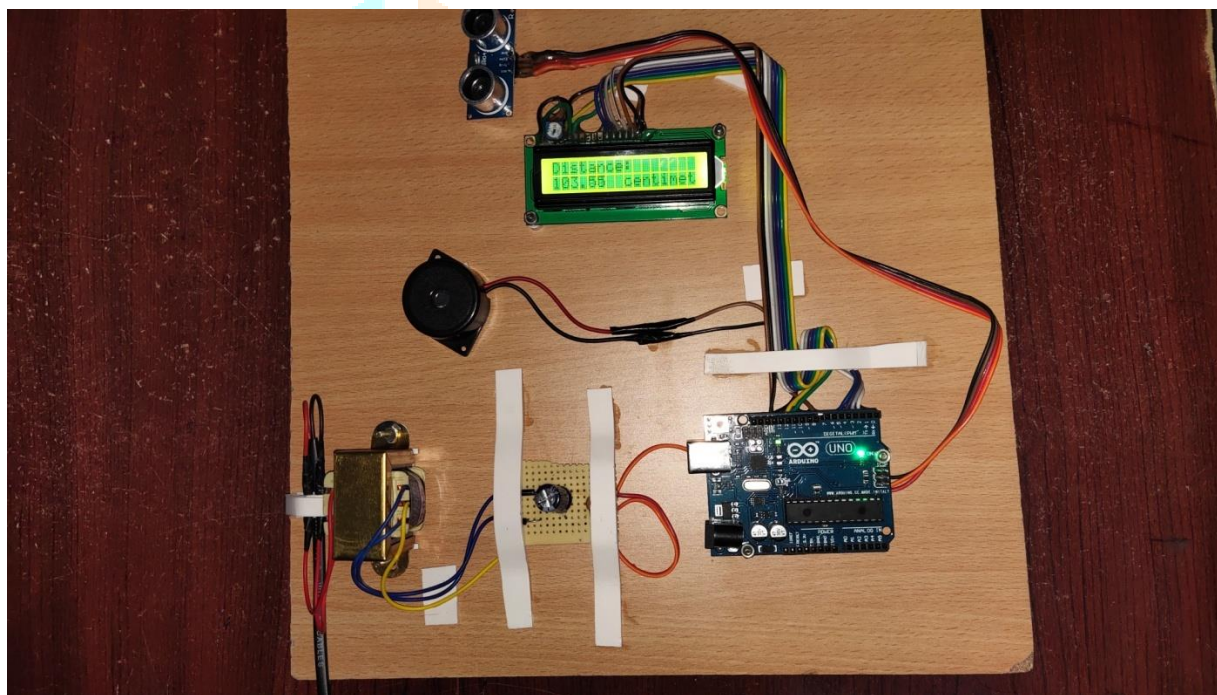
- Trigger Signal: A trigger signal is sent from the microcontroller to the ultrasonic sensor.
- Emission of Ultrasonic Waves: The sensor transmitter emits sound waves at a frequency of around 40KHz.
- Reflection from object: The sound waves travel through the air, hit the target, and reflect back.
- Echo Reception: The sensor receiver detects the reflected waves and converts them into an electrical signal.
- Time Measurements: The microcontroller calculates the time taken for the waves to travel to the object and return.

3 Signal Processing

- The microcontroller processes the received signal to remove noise and validate the time-of-flight data.
- Averaging multiple readings ensures consistent and reliable results.

RESULTS

The Ultrasonic range finder provides accurate and reliable distance measurements by utilizing the principle of sound wave reflection. It measures the time taken for ultrasonic waves to travel to an object and return, calculating the distance based on the speed of sound. The device demonstrates high accuracy within a typical range of 2cm to 400cm, with a minimal error of approximately 1cm under standard conditions. It operates efficiently in real-time, offering fast response times suitable for dynamic applications.



FUTURE SCOPE

The future scope of ultrasonic range finders is vast, driven by advancements in technology and their increasing integration into diverse industries. As sensor accuracy improves through advanced signal processing and machine learning algorithms, ultrasonic range finders will offer more precise measurements even in challenging environments. The range of these sensors is expected to extend beyond current limits, making them suitable for more applications, such as long-distance sensing in autonomous vehicles or robotics. Integration with other technologies like LIDAR and vision systems will enhance their functionality, allowing for more robust and reliable data. Additionally, the miniaturization of components and the push for energy-efficient designs will make ultrasonic sensors more portable and suitable for IoT, wearable devices, and smart homes.

In smart cities, ultrasonic range finder can optimizes waste management by monitoring the fill level of garbage bins. They are also valuable in agriculture fields where they assist in monitoring crop growth and managing irrigation systems.

REFERENCES

- Kuc, R. Introduction to Digital signal processing with Ultrasonic Applications. Wiley-Interscience
- MaxBotix. How ultrasonic Sensor work. Retrieved from <https://www.maxbotix.com>.
- Patil, S., & Joshi, R. Ultrasonic Sensor in Robotics : A Review

