

# Obstacle Sensing By Ultrasonic Sensor

Paper Submission: 12/10/2020, Date of Acceptance: 25/10/2020, Date of Publication: 26/10/2020



## Shikha Jaiswal

Assistant Professor,  
Dept of Physics,  
Feroze Gandhi College,  
Raebareli, Uttar Pradesh, India

## Shubham Pandey

Project scholar,  
Dept of Physics,  
Feroze Gandhi College,  
Raebareli, Uttar Pradesh, India

## Vibha Sharma

Assistant Professor,  
Dept of Chemistry,  
N.A.S. College, Meerut  
Uttar Pradesh, India

### Abstract

Ultrasonic sensor uses ultra sound waves to detect objects. It uses one transmitter and one receiver. Transmitter will transmit the ultrasonic waves which will be received by the receiver. The applications of the ultrasonic sensor are very viable in practical application. The Ultrasonic Sensor can be used in many different applications. It is very viable because of its accuracy and cost. he ultrasonic sensor contains a transmitter and a receiver. The Ultrasonic transmitter periodically emits ultrasonic signals into an open area. If the signal ever hits any physical objects, it will be reflected back and the receiver part of the sensor will then capture it. The output of receiver is used to analyze the distance of the object. To check the output of the receiver constantly microcontroller unit (MCU) is used. The MCU will initiate an alarm when object is above threshold. This paper reviews the basic principle and working of ultrasonic range finder sensor module HC-SR 04 and study of the challenges to enhance the reliability.

**Keywords:** Sensor, Ultrasound, Microprocessor.

### Introduction

A sensor is a device that detects input from the physical environment. This input can be any physical parameter like light, heat, motion, moisture. The output signal is converted to human readable display at the sensor location or transmitted electronically. The block diagram is shown in Fig 1.1

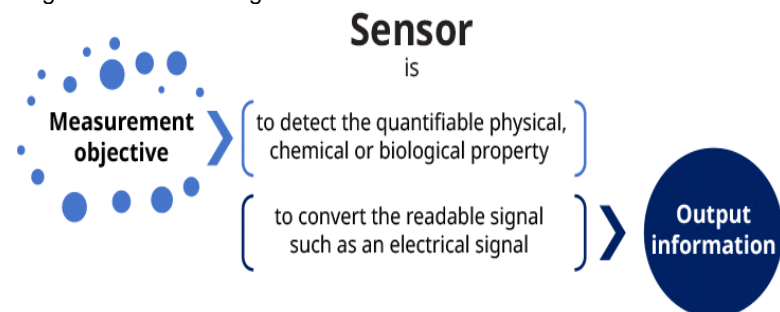


Fig1.1 Sensors

### Aim of the Study

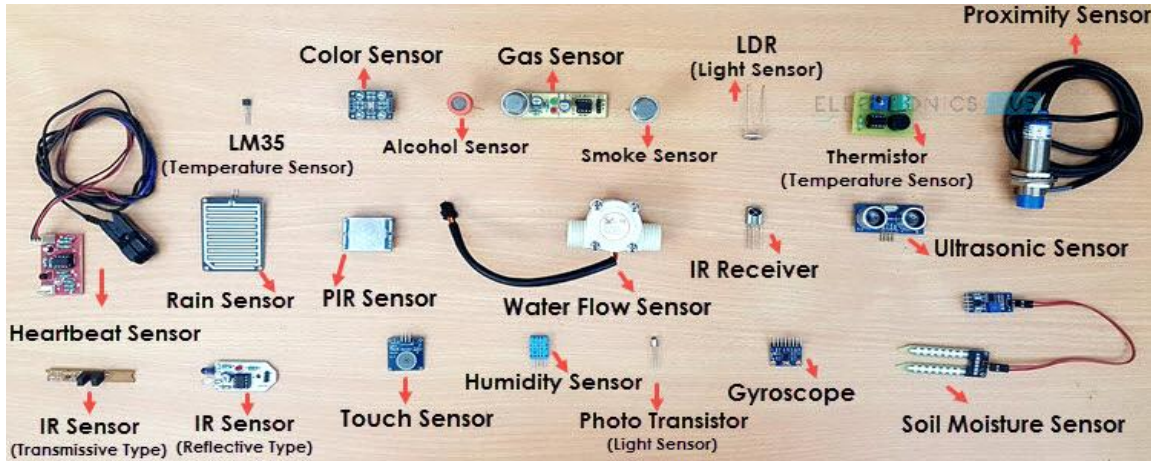
The potential application of Ultrasonic Sensor is Obstacle Sensing. These sensors are widely used for a distance measurement. Bats, which use ultrasonic waves to navigate in the dark, are source of inspiration a bioinspired method of identify the type of obstacles which could appear e.g. on the MAV's (Micro Air Vehicles) way. This paper reviews on the basic principle of working of ultrasound range finder sensor HC-SR 04 but aims to innovate the bioinspired method used by ultrasound sensors to collect the knowledge about the surrounding world. These sensors uses echo of ultrasound signal.

### Classification of Sensor

1. Active sensors require an external excitation signal or a power signal while passive sensors doesn't require any external power signal and directly generates output response.
2. The classification is based on the means of detection used in the sensor like Electric, Biological, Chemical, Radioactive etc.
3. The classification is based on conversion phenomenon like Photoelectric, Thermoelectric, Electrochemical, Electromagnetic, Thermo-optic, etc.
4. Analog Sensors produce a continuous output signal with respect to the quantity being measured. Digital Sensors work on digital data.

The following are different types of sensors that are commonly used in various applications. All these sensors are used for measuring one of the physical properties like Temperature, Resistance, Capacitance, Conduction, Heat Transfer etc.i.e.

Temperature Sensor, Proximity Sensor, Accelerometer, IR Sensor (Infrared Sensor), Pressure Sensor, Light Sensor, Ultrasonic Sensor, Smoke, Gas and Alcohol Sensor, Touch Sensor, Color Sensor, Humidity Sensor, Tilt Sensor, Flow and Level Sensor.



**Fig 1.2 Ultra SonicSensor (HC-SR 04)**

**Ultrasonic Sensor**

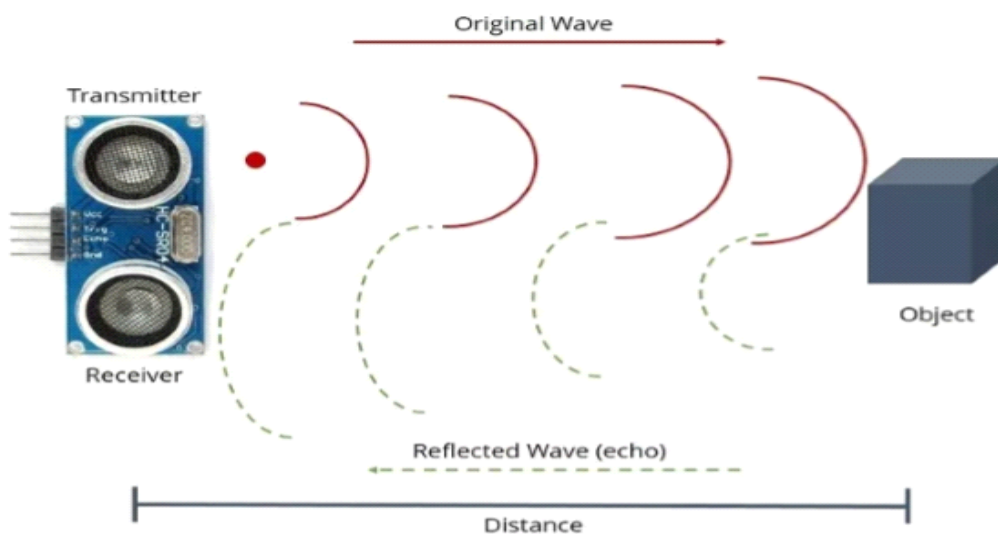
Sound is mechanical wave that carries mechanical energy. For the transmission of this energy between transmitter and receiver, the medium is must. The medium can be solids, liquids or gases.[3] The sound energy travels by causing disturbance in the medium it is travelling and this is called propagation of sound waves. The velocity of the sound is 330m/s.

Ultrasound is high pitched sound waves with frequencies higher than the audible limit of human hearing. The ultrasonic sensor works on the principle of SONAR and RADAR system which is used to determine the distance to an object. SONAR or Sound Navigation and Ranging is a non-contact distance measuring technique generally used in submarines.[4] The Ultrasonic ranging module HC-SR04 [1,2] shown in Fig 1.2 provides a 2cm - 400cm non-contact measurement function, the ranging accuracy can reach as close as 3mm.

In this technique, a high frequency sound wave is transmitted by a transmitter and the reflected echo from a target is captured by a receiver. As the velocity of the sound wave is known, by measuring the time of travel, the distance between the source and the target can be calculated.

**The BASIC PRINCIPLE**

An ultrasonic sensor generates the high-frequency sound (ultrasound) waves. As the waves hit object, an echo is reflected and sensed by the receiver as shown in fig 1.3. By measuring the time required for the echo to reach to the receiver, the distance can be calculated.[5] It includes ultrasonic transmitter, receiver and control circuit. It is based on Arduino, Ultrasonic range finder Sensor and a Relay Module HC-SR 04.[6,7]



**Fig 1.3 Ultrasonic sensor module**

**Challenges**

The accuracy of measurements is influenced by many factors that should be considered. The factors are ambient temperature, the propagation path of the signal, the angle of incidence of the wave, the shape and size of the object. However, even taking into account all the errors, it was not possible to achieve the accuracy stated by the developer. If one needs the most accurate measurements, one should use laser rangefinders. And ultrasound is better suited, for example, as motion sensors at short distances or as a vision of a robot, to find objects around them.

**Conclusions**

The ultrasonic range finder HC-SR 04 sensors are widely used sensor in many applications such as computer applications, general purpose applications, medical applications, automotive applications and industrial grade applications. It is a good and cheap module for measuring distance. The measurement process is fairly simple and straightforward, and the interface between the sensor and the microcontroller does not require specialized interfaces. The readings of the ultrasound range finders are not affected by sunlight or the color of objects, as is the case with infrared sensors. The ultrasonic wave is reflected from almost any surface, even transparent. The ultrasonic range finder sensor has advantages like easy to use, fast in measuring process, non-contact measurement and suitable for air and underwater environment.

**References**

1. Kuldeep Singh Kaswan, Santar Pal Singh, Shreddha Sagar "Role of Arduino In Real World Applications", *International Journal of Scientific & Technology Research* Vol 9, Issue 01, Jan 2020
2. Leo Louis "Working Principle of Arduino and using it as a tool for study and research," *International Journal of Control, Automation, Communication and Systems (IJACS)*, Vol.1, No.2, April 2016 DOI: 10.5121/ijcacs.2016.1203.21.
3. Shinu N Yoannan, Vince T Vaipicherry, Don K Thankachan Prof. Ram Prasad Tripathy "Security System Based on Ultrasonic Sensor Technology," *IOSR Journal of Electronics and Communication Engineering (IOSR-JECE)*, Volume 7, Issue 6 (Sep. - Oct. 2013), PP 27-30
4. Boguslaw Szlachetko, Michal Lower "A surrounding world knowledge acquiring by using a low-cost ultrasound sensors," *18th International Conference knowledge based intelligent information and engineering systems Procedia Computer science* 35 (2014) 93-100.
5. Mohit Rane, Kalpan Mehta "Potential Applications of Ultrasonic Sensor," *International Journal of Engineering and Computer Science* ISSN:2319-7242 Volume 6 Issue 3 March 2017, Page No. 20583-20586.
6. Eka Cahya Prima, Siti Sarah Munifahab, Robby Salamb, Muhamad Haidzar Azizb, Agustin Tia Suryanic "Automatic Water Tank Filling System Controlled using ArduinoTM based Sensor for Home Application," *Engineering Physics International Conference, EPIC 2016, Procedia Engineering* 170 (2017) 373-377
7. V A Zhmud1, N O Kondratiev, K A Kuznetsov, V G Trubin1 L V Dimitrov "Application of ultrasonic sensor for measuring distances in robotics," *IOP Conf. Series: Journal of Physics: Conf. Series* 1015 (2018) 032189 doi :10.1088/1742-6596/1015/3/032189