

## Ultrasonic Distance Measurement

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**Abstract:** Measuring distance of an obstacle in the direction of a person, stationary or moving object is important parameter. Measuring the distance using ultrasonic sensors is one of the cheapest among various options. In this paper measuring distance of an obstacle in the direction of a person done by ultrasonic sensor. 40 kHz ultrasonic transducer is used for scaling the outpost between obstacle and the person. Ultrasonic sensor with a microcontroller it calibrates the distance which is displayed on an android device connected via Bluetooth. An android application displays the distance in various scaling units. The scaling units are Centimetre, Meter, Inches, Yards, Foot.

**Keywords**—Transducer, Microcontroller, Android device, Bluetooth, scaling units

### I. INTRODUCTION

Distance measurement is an important parameter in day-to-day life. Measuring instruments are available in different size and shape. The simple and convenient method of measuring distance is by implementing the device with Ultrasonic sensor. Low cost and accuracy as well as rapidity is important in most of the cases where measuring instruments are used.

In this design, we have developed measuring instrument which uses ultrasonic sensor unit and ARDUINO microcontroller based system. Microcontroller used in this system is less in cost when it is analyse with other microcontroller.

An error approximation Algorithm is enforced to curtail the error in the consistent distance. Ultrasound sensors are more oftenly used in measuring range. Ultrasonic-sound waves are and underwater distance measurement. Ultrasonic sensors are also quite fast for most of the common applications.

beginners, Simpler system a low cost version of 32-bit Atmega ARDUINO microcontroller can also be used in the system to lower the cost.

The main Advantage of these systems are that they can tell you the exact distance or location of the obstacle.

### II. RELATED WORK

One of the most commonly used sensor by engineers is the obstacle detection sensor. There are many convenient methods for designing cost effective sensors. Infrared

trigger/echo pair or led/ldr pair is used by these sensors but such sensors are affected by environmental conditions [1]. So, we make use of ultrasonic sensor to overcome such problems. An Ultrasonic Sensor calculates range with the help of ultrasonic sound wave. These sensors consist of an ultrasonic transmitter also known as trigger and ultrasonic receiver also known as echo. Trigger emits the ultrasonic wave and echo collects the reflected wave after striking a surface. The time between start of transmitted wave and received wave is calculated which is used to find the distance of the obstacle. HC-SR04 has an operating range of 1cm to 400cm and an accuracy of 1cm. These specs make it ideal for calculating distance [2].

### III. METHODOLOGY

#### DESIGN METHOD:

##### Pulse-Echo method:

The technique used by the ultrasonic sensor is known as pulse-echo method. In this method, a burst of pulse is sent out from the trigger pin which is then received by the echo pin after striking a surface. Time taken for the wave to propagate from the trigger pin to the obstacle and from obstacle to the echo pin is calculated which is directly proportional to the distance.

The speed of Ultra Sonic waves is 343m/s which is the speed of sound. This speed is not too fast for a microcontroller to calculate accurately. Pulse travels in both the direction(to and fro).Time taken by the pulse is reduced to half in order to consider only one direction.

$$\text{Distance} = \text{Speed} * \text{Time}/2$$

$$\text{Speed of sound} = 343 \text{ m/s}$$

$$\text{Thus, Distance} = 17150 * \text{Time (unit cm)}.$$

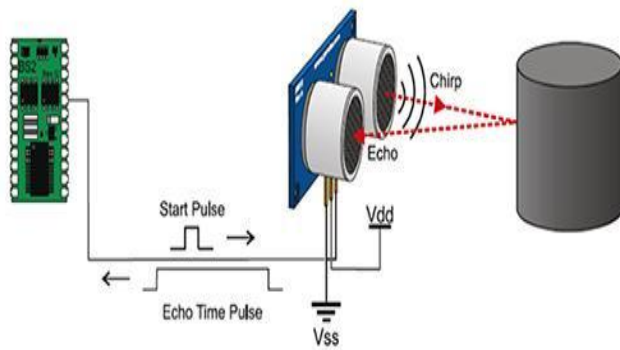


Fig 2.1 block diagram

**IMPLEMENTATION AND DISCUSSION:**

**Ultrasonic Sensor Interface with Microcontroller**

These modules are made in such a way that they are compatible with the microcontroller. The plug-in is a single pin called SIG. A single i/o pin is used to connect the microcontroller to the ultrasonic sensor.

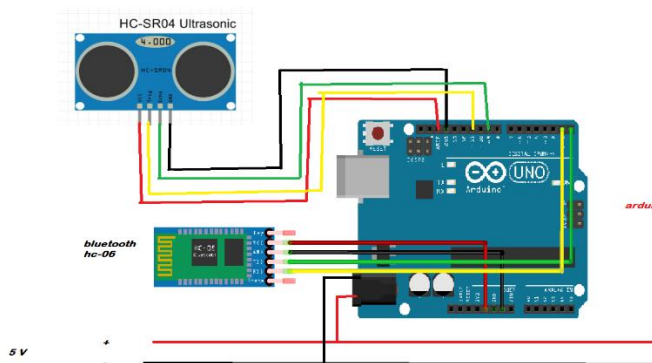


Fig 2.2 Arduino UNO interfacing with Android

**Arduino UNO interfacing with Android:**

The Bluetooth module(HC-06) is used to interface between the Arduino microcontroller and Android Device shown in fig.2.2. Setting up the HC-06 is as easy as ABC. All you need to know is the pin configuration. The HC-06 has 6 pins: wakeup, state, GND, VCC, TXD and RXD.

The Bluetooth module acts as a serial path which helps in communication. By using an application which supports Bluetooth on your computer or phone, we can communicate with the microcontroller. A bluetooth android app is used as a serial terminal. Disconnect the bluetooth module before uploading the Arduino code into the microcontroller because it shares the RX/TX pins. Once the code is uploaded, connect back the module to the microcontroller.

This code transmits a string to the Arduino and get an echo on your android app.

```
while(serial.available())
    BTserial.print(distance);
```

Pairing:

Pair the HC-06 with your Bluetooth device.

Connection and operation:

Once the module is paired. Open Bluetooth app in android Device, Select the serial port that corresponds to the HC-06. Once the time is given to the microcontroller, distance is measured in a unit as per the user requirement from the app through bluetooth and the desired result is received in the app.

- Distance in different Units for different variables like,
- C-Centimeters
- M-Meters
- I-Inches
- Y-Yards
- F-Foots, Respectively.

**IV. RESULTS AND DISCUSSION**

- 1.) Device is capable of measuring distance between the object and a given point or object as shown in the fig 4.1.
- 2.) Measurements displayed in five different units on android device as per the user choice as shown in the fig 4.2.
- 3.) Can be used in places with varied temperatures and pressures.
- 4.) Makes use of error approximation to provide accurate readings.

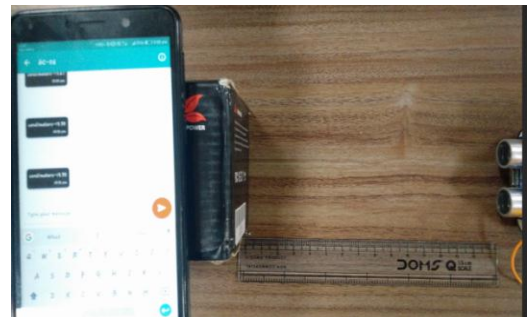


Fig 4.1 Results

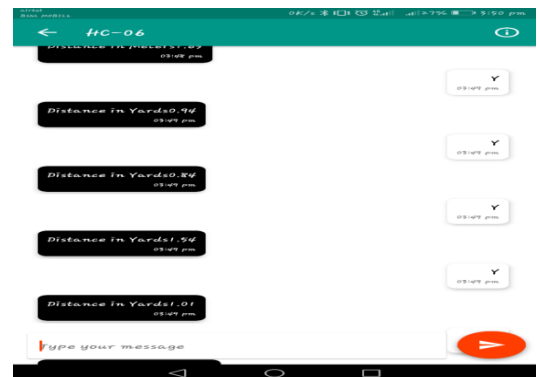


Fig 4.2 Results

## V. CONCLUSION AND FUTURE SCOPE

This project was to design and implement a distance measuring device capable of providing the range in five different units as per the user choice. With respect to the requirements for an ultrasonic distance calculator, the followings can be concluded.

1. The system can find the range of the obstacle with sufficient accuracy by using error approximation algorithm.
2. This design can interact with other peripheral if used as a secondary device.
3. This Device can able to show distance in five different measurement Units.
4. this provides a cost efficient way of measuring distance.

### Future Scope:

The range can be improved by:

- 1.Using temperature adjustable devices, it can be used over wide temperature range.
- 2.Using High Range Ultrasonic sensors to extend the range of distance measurement.
- 3.Using two ultrasonic sensors for Two-Dimensional Measurement like Length and Breadth at a same time.

## REFERENCES

- [1]. Spasov Peter, Microcontroller Technology the 68HC11 and 68HC12 Upper Saddle River, Pear-son Prentice Hall, Fifth Edition, 2004.
- [2] Sinclair Ian R. and Dunton John, Practical Electronic Handbook, 6th Edition, 2007.
- [3] Horton Ivor, Beginning C, Wrox Press Ltd, Birmingham, U.K, 2nd Edition, 2002.
- [4] Brown Forrest John, Embedded Systems Programming in C and Assembly, Van Nostrand Rein-hold, N.Y, Prentice-Hall, 2003.
- [5] Deshmukh V Ajay, Microcontrollers Theory and Applications, New Delhi, Tata McGraw-Hill Publishing Co. Ltd, 2005.

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