

A CONCEPTUAL STUDY OF ULTRASONIC RANGE FINDER

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Abstract: Distance measurement of an object in the path of a person, equipment, or moving is used in large number of applications such as robotic movement control, medical application, blind man's walking stick, etc. Ultrasonic sensor is one of the cheapest among various options. In this project distance measurement of an obstacle by using ultrasonic sensor and microcontroller is presented. The microcontroller based Ultrasonic distance meter or is anon contact and non-loading distance measuring device. This device can be used to even large distance with pin point accuracy. The heart of this distance meter is the microcontroller AT89C2051. This system has very large applications not only in various industries, the luxury automobile sector but also in the armed force where accuracy and durability is of primary importance.

Keywords: Distance measurement, robotic movement, ultrasonic, sensors, microcontroller

I. Introduction

Distance measurement of an object in front of a moving body is required in a large number of devices. These devices may be simple or complicated and also quite small or large. Such distance measurement systems are available. These use various kinds of sensors. Accuracy and speed as well as it should be low cost is important. In this paper, we describe such a measurement system which uses ultrasonic transmitter and receiver units mounted at a small distance between them and a Phillips P89C51RD2 microcontroller-based system.

This microcontroller is very easily available at low cost and equivalent to the most popular 8051 microcontroller. They are also providing the cheapest solutions. Ultrasonic sensors are very versatile in distance measurement Ultrasound waves are useful for both the air and underwater. Ultrasonic sensors are also quite fast for some easy applications. In simpler system a low-cost version of 8-bit microcontroller can also be used in the system to lower the cost. This system has been developed and tested for use in a garbage monitoring system inspection of system is under development.

II. Working Architecture

- The sensor senses the presence of any obstacle (a wall in our case).
- If a sensor senses a wall it informs the controller and then it will display distance on the LCD screen.
- It calculates the time of ultrasonic rays transmitted through the transmitter and received at the receiver and then it gives the approximate distance between the wall and the circuit.
- It displays the distance with 0.3 mm approximated.

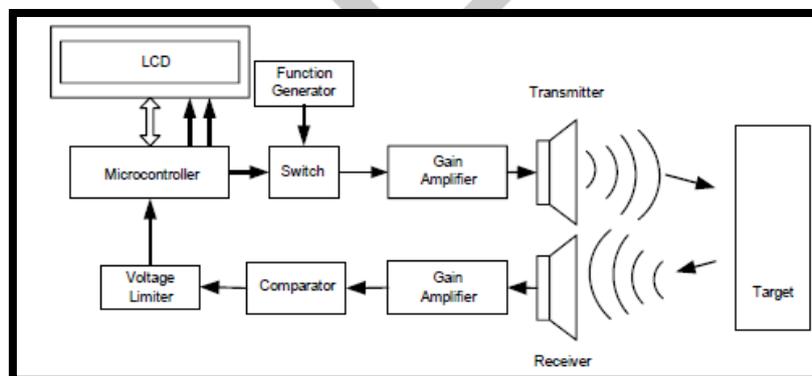


Fig. 1.0 Block diagram of working of Ultrasonic Range Finder

III. Working Component

Arduino UNO:

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 programmed as a USB-to-serial converter.



Fig. 2.0 Arduino UNO

ULTRASONIC SENSOR

If you are sourcing a ultrasonic ranging module, the HC-SR04 is good choice. Its stable performance and high ranging accuracy make it a popular module in electronic market. Compared to the Sharp IR ranging module, HC-SR04 is more inexpensive than it. But it has the same ranging accuracy and longer ranging distance.

SPECIFICATION:

- Power supply: 5V DC
- Quiescent current: <math><2\text{mA}</math>
- Effectual angle: <math><15^\circ</math>
- Ranging distance: 2cm – 500 cm
- Resolution: 1 cm
- Ultrasonic Frequency: 40k Hz

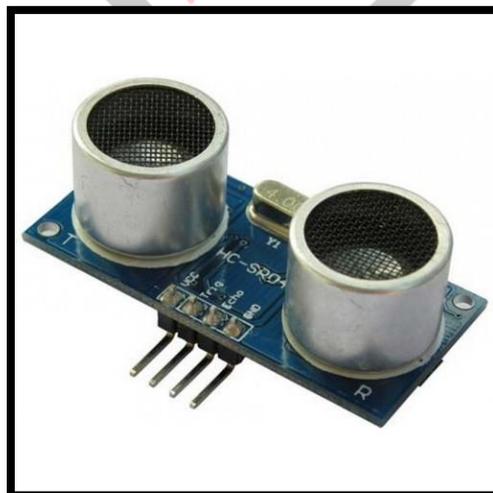


Fig. 3.0 Ultrasonic sensor HC-SR04

LASER DIODE

A laser diode, (LD), injection laser diode (ILD), or diode laser is a semiconductor device similar to a light-emitting diode in which the laser beam is created at the diode's junction. Laser diodes are the most common type of lasers produced, with a wide range of uses that include fiber optic communications, barcode readers, laser pointers, CD/DVD/Blu-ray disc reading/recording, laser printing, laser scanning and light beam illumination.

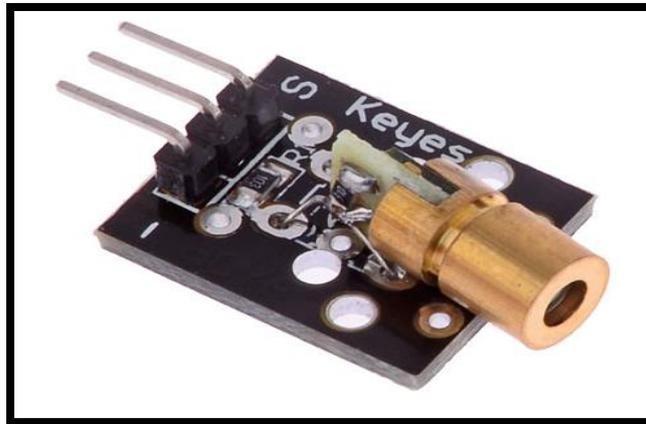


Fig. 4.0 Laser Diode
16x2 LCD Display

To establish a good communication between human world and machine world, display units play an important role. And so they are an important part of embedded systems. Display units - big or small, work on the same basic principle. Besides complex display units like graphic displays and 3D displays, one must know working with simple displays like 16x1 and 16x2 units. The 16x1 display unit will have 16 characters and are in one line. The 16x2 LCD will have 32 characters in total 16 in 1st line and another 16 in 2nd line. Here one must understand that in each character there are $5 \times 10 = 50$ pixels so to display one character all 50 pixels must work together. But we need not to worry about that because there is another controller (HD44780) in the display unit which does the job of controlling the pixels.



Fig. 5.0 LCD 16x2

IV. Implementation

Future Expansions

- I. New prototyping hardware & capability & interfacing with other consumer electron/tv/smartphones & flooding of shields.
- II. Mining equipment's may require where entail.
- III. Already compatible with many major simulation software like MATLAB & lab view, we may see even move flexible programming environment & development option
- IV. Using temp. Compensation, it can be used over wide temp range.
- V. Height measurement, agriculture veiled, collision /protection can be other application.

Applications

1. Ultrasonic sensor is used in oil, chemical, milk or water tanks for level measurements or for liquid level control.
2. This sensor is used in thru beam detection for high speed counting.
3. This sensor is used in robotic industry for robot sensing.
4. This sensor is used in car parking system where car entry is controlled through barrier system, the barrier must not be lowered when there is beneath a vehicle. This whole process is controlled through ultrasonic sensor.

Advantages of Ultrasonic Range Finder

1. The ultrasonic sensor has high frequency, high sensitivity and high penetrating power therefore it can easily detect the external or deep objects.
2. These sensors easily interface with microcontroller or any type of controller
3. These sensors have greater accuracy than other methods for measuring the thickness and depth of parallel surface.

Potential Limitations of Ultrasonic Rang Finder

1. During use of ultrasonic tester for testing it is very important to know the operational manual, in other words it required careful attention for experienced technician.
2. During the development inspection procedure of equipment using ultrasonic tester extensive knowledge is required is testing technicians.
3. When these sensors are used for inspection purpose then these should be water resistive otherwise they could be damaged.

V. Conclusion

As conclusion, the objectives of this project have been achieved. The hassle in searching for calculating distance between two objects using a meter tape is solved by this product.

The feature of this product is that this is useful in construction sites where you can save amount of time by holding and opening the meter tape and calculating distance.

The designed system could be applied everywhere due to its ease of use and effectiveness.

References

- [1] International Journal of Computer Theory and Engineering, Vol. 2, No. 1 February, 2010 1793-8201 68
- [2] International Journal of Scientific & Engineering Research Volume 4, Issue3, March20131 ISSN 2229-5518
- [3] 2016, IFAC (International Federation of Automatic Control) Hosting by Elsevier Ltd. All rights reserved.