

ULTRA SONIC RANGE FINDING FOR DISTANCE MEASURING IN COAL MINING

Sneha Punia¹, Ramandeep Singh²

¹M.Tech (E.S), ITM University, Gurgaon

²Assistant Professor, ITM University, Gurgaon

Abstract

Measuring distances has always been a challenge in coal mines as it involves a lot of risks and disturbances. One method to measure the distances without any hindrances in sensitive places like coal mines is via Ultra Sonic waves which generates 40 KHz sound pulse that travels with the speed of sound to the object and returns its echo that helps in calculating the distance, which is further displayed on the LCD. The medium required here is air. This project performs the distance measuring techniques, required in coal mines. This technique is proven to be very helpful in places where human reach is not possible or difficult.

Keywords: UltraSonic Sensors, Range Finding, AVR Microcontroller.

1. INTRODUCTION

Ultra sound is a popular technique of sensing distance of objects. It is fast, accurate and does not create disturbances in human activities. The main idea of this paper is to find out the range of applications and to learn the possibilities and advantages of an Ultra Sonic sensor in the measuring world. In this paper we will learn to measure the distances by sending a 40 KHz sound wave and get back the echo for calculating time and distance. Microcontroller ATmega128 is used to generate the pulses, calculate the distance by sensors and display on a LCD. Before Ultra Sonic waves the other method uses many a number of sensors and then detects the distance. Ultra Sonic range finder uses less number of detectors and measures the distance to the surface of the required object.

If the transmitter does not find the suitable surface the LCD displays an error indicating distance out of range or fails to calculate the distance.

2. BLOCK DIAGRAM

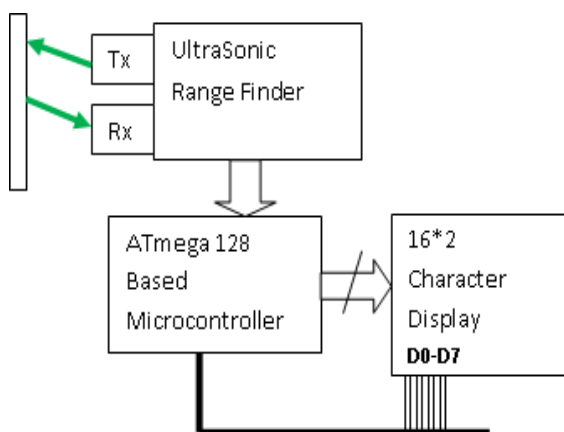


Fig 1

The distance of an object is measured by sending Ultra Sonic waves from a transmitter towards the object, the waves colliding with the object return an echo to the sensor. The time taken by the waves is calculated by the sensor and sent to the microcontroller which controls the measurement and sends it to the LCD display showing the measured distance in centimeters.

3. ALGORITHM

When the program starts, a pulse of 10ms is triggered towards the sensor. Mostly these pulses get easily distorted by the narrow band response of the transducer. [1][2] To avoid such distortions small cycles up to 15 cycles are used for the transducer excitation. Once the pulse triggers an echo is produced by the transducer. The sensor produces an echo in a similar way as bats produce ultrasonic noise. The status of the echo is monitored at regular intervals of time and the high status of the echo pin is checked. When the timer gets started, an echo error is checked. After checking for an echo error, the distance is calculated based on the pulse width of the echo signal. Due to temperature variations $\pm 0.2\%$ / $^{\circ}\text{C}$ error can be observed and considered in the calculations. As during mining the temperature increases/decreases rapidly when the distance increases and decreases. The distance measured in centimeters is calculated by dividing the elapsed time in microseconds by 58 and when the value in feet for distance is measured by dividing the elapsed time in microseconds by 148. The distance calculated is displayed on the LCD attached to the sensor via the controller.

4. APPLICATION AREA

Ultra Sonic ranging has a wide area of applications. Ultra Sonic ranging is used in robotics applications [1][2] [3] [4] [5]. Measure the amount of liquid in a tank, Humidifiers, Sonar, Ultrasonography, burglar and testing [6]

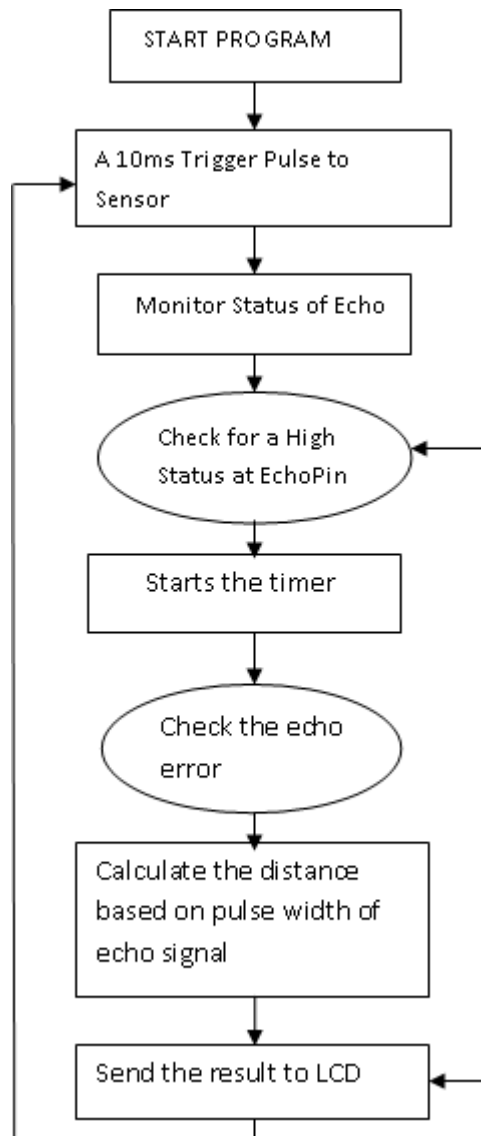


Fig 2

5. ADVANTAGES

UltraSonic range finders are of low cost. They are high speed for measurement which eventually reduces the time and increases the performance. Simple structures of Ultrasonic range finders are easy to manufacture. They work in severe weather therefore reliable.

6. DISADVANTAGES

Sharp sensors maximum range limited to 80cm. Ordinary sensors maximum range limited to 30cm. Poor resolution of wave beam [4]. Unexpected reflection phenomenon mirror [4].

7. RESULT

Result of this paper is that with the use of Ultra Sonic range finder the distance is measured with accuracy without creating hindrances in the sensitive areas like coal mines, water bodies, human bodies.

8. CONCLUSION AND FUTURE SCOPE

This paper discuss about how the problem of measuring distances in sensitive areas can be overcome by using Ultra Sonic sensors with the help of its algorithm the accurate measurement can be taken and displayed.

ACKNOWLEDGEMENTS

I would like to thank our University and laboratory faculty without them the completion of this project and research would not be possible.

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