Microcontroller Based Ultrasonic Distance Measurement System

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Abstract--- An Ultrasonic distance measurement system uses ultrasonic waves (inaudible to humans) to measure distance. These system consist of an Ultrasonic Transmitter (Tx) that emits the ultrasonic wave, the waves after striking any obstacle bounces back and reach the Ultrasonic Receiver (Rx). By measuring the time it take for the whole process to complete and using simple arithmetic we can measure the distance to the obstacle. This system has a wide operating range of 1cm to 400cm with an accuracy of 1cm. This specification makes it ideal for distance measurement application

Keywords: Ultrasonic distance measurement, ultrasound distance measurement, ultrasound range finder, ultrasonic distance meter, ultrasonic radar.

I. Introduction

Nowadays, there are many devices invented to detect the object and it is become popular among people especially to avoid the accident or car crash from happening. but they can't able to measure distance so the main purpose of this project is to measure the distance to unreachable objects, obstacles or places using a ultrasound technology.

II. Basic Elements

The basic elements of this project can help to obtain the understanding about the whole project in order to develop the project and these elements are Ultrasonic Sensor, microcontroller, display and power supply section.

III. System Working

An elementary form of this system consists of a transmitting antenna emitting electromagnetic radiation generated by an oscillator and a receiving antenna or detecting device or receiver. A portion of the transmitted signal is intercepted by a reflecting object (target). It is the energy radiated in back direction that is of primary interest of this system. The receiving antenna collects the returned energy and delivers it to a receiver, where it is processed to detect the distance. The distance to the target is measured by measuring the time taken for the radar signal to travel to the target and back using microcontroller. The distance is nothing but the total round trip delay divide by two.

IV. Calculation

The calculations are done by the following way. First of all, the device calculates the time that the ultrasonic wave took to reach the targeted object and come back to the receiver.

Thus, if we need to calculate the time needed for the ultrasonic wave to reach the object from the device, we divide the previous time we had by two. Second, the device multiplies the time by the speed of sound (340 m/s) to get the distance between the device and the object. The time from transmission of the pulse to reception of the echo is the time taken for the sound energy to travel through the air to the object and back again. Since the speed of sound is constant through air, measuring the echo reflection time lets you calculate the distance to the object using this equation:

Distance = (s * t)/2 (in meters)

Where, s=velocity of ultrasound(343 m/s)

t= overall round trip time(second)

V. Applications

A. Car Parking System

This system may be implement of the car for accurate car parking by affix ultrasound transducer in front and behind side of car to prevent any damage of car.

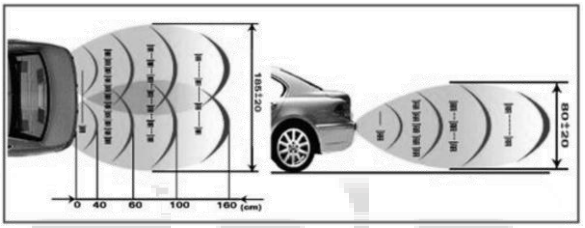

Fig. 1: Car parking system

B. Ultrasonic Water Level Transmitters

Non-contact ultrasonic level sensors emit ultrasonic (20 kHz to 200 kHz) acoustic waves from a transducer which also detects and measures the reflected waves. This type of sensor is ideal for measuring bulk solids such as sand, cement, grain, rice and plastic pellets as well as liquids with high viscosity such as slurries, heavy oil, grease and latex.

VI. Conclusion

In this Project we conclude the fundamentals in ultrasonic sensing is presented. Some advanced techniques and applications also introduced. The essentials of ultrasonic sensing are how to drive an ultrasonic wave into an object and how to capture the ultrasonic wave from the object. In addition, another essential is how to extract the information we want from the captured ultrasonic wave.

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