



DISTANCE MEASURING DEVICE USING ULTRASONIC SENSOR

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ABSTRACT

Ultrasonic sensors are based on the principle of sound waves, which are emitted by a transducer and then reflected when they encounter an obstacle. These reflected waves are then detected by the sensor and used to determine the distance and direction of the obstacle.

INTRODUCTION

Ultrasonic sensors are great tools to measure distance and detect objects without any actual contact with the physical world. It is used in several applications, like in measuring liquid level, checking proximity and even more popularly in automobiles to assist in self-parking or anti-collision systems . This is an efficient way to measure small distances precisely. In this project, we have used the HC-SR04 Ultrasonic Sensor with Arduino to determine the distance of an obstacle from the sensor. The basic principle of ultrasonic distance measurement is based on ECHO. When sound waves are transmitted in the environment then waves return back to the origin as ECHO after striking on the obstacle. So we only need to calculate the traveling time of both sounds means outgoing time and returning time to origin after striking on the obstacle. As the speed of the sound is known to us, after some calculation we can calculate the distance. We are going to use this same technique for this Arduino distance measurement project.

METHODOLOGY

1. Wireless distance measurement system is used to measure the distance between two object precisely. In this particular project we are using an ultrasonic sensor to measure the distance and we placed the ultrasonic sensor on the top of a servo motor to rotate it at a range of 15 degree to 165 degree. So by this angle range upto 400cm distance the ultrasonic senses can locate and measure the distance of any object .
2. Now for the hardware port first we take a male to male jumper wire and connect it with 5V pin and connect the other end to the positive rail of breadboard. Next we take another male to male jumper wire and connect it to the 'GND' pin of Arduino and we connect the other port to negative rail of the breadboard. After that we connect 'Vcc' and 'GND' pin of both ultrasonic sensor and servo motor to the positive and negative rail of the breadboard respectively. Next we connect the trigger pin of ultrasonic sensor to 'pin 9' of Arduino board and we connect pin of ultrasonic sensor to 'pin 11' of Arduino board and we connect the data pin of servo motor to 'pin 12' of Arduino board. And hence the connection of Arduino is complete. Next we write the code on Arduino IDE and burn it to the Arduino board.
3. We use 'processing 3.3.7' software. It is mainly programming language and environment built for the electronics art and graphics used design. We use this software to locate the object on the computer screen. And print the distance of the object measured by the ultrasonic sensor.
4. We use 'processing IDE' to write the code processing IDE similar to the 'Arduino IDE'. And the 'processing IDE' communicate through serial communication with the 'Arduino IDE'.
5. For the communication process we send the data received from ultrasonic sensor to the serial monitor with the same additional characters. These data in the serial monitor will be later

received by the 'processing IDE' and hence the communication between Arduino IDE and processing IDE is completed.

6. Now we can see the distance of the object at which angle it is located as well as the location of the object in the mirror

COMPONENTS REQUIRED

Ultrasonic sensor (HC-SR04)

The HC-SR04 Ultrasonic Distance Sensor is a sensor used for detecting the distance to an object using sonar. It's ideal for any robotics projects you have which require you to avoid objects, by detecting how close they are you can steer away from them.

16×2 LCD display

A 16×2 LCD display is a liquid crystal display that can show 16 characters in each of its two rows, providing a total of 32 characters of information.

Jumper wire

A jump wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Arduino Uno

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller (MCU) and developed by Arduino.cc and initially released in 2010. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button.

Working of Ultrasonic Sensor:-

Ultrasonic sensors measure distance by sending and receiving the ultrasonic wave. The ultrasonic sensor has a sender to emit the ultrasonic waves and a receiver to receive the ultrasonic waves. The transmitted ultrasonic wave travels through the air and is reflected by hitting the Object. Arduino calculates the time taken by the ultrasonic pulse wave to reach the receiver from the sender.

We know that the speed of sound in air is nearly 344 m/s,

So, the known parameters are time and speed (constant). Using these parameters, we can calculate the distance traveled by the sound wave.

$$\text{Formula: Distance} = \text{Speed} * \text{Time}$$

In the code, the "duration" variable stores the time taken by the sound wave traveling from the emitter to the receiver. That is double the time to reach the object, whereas the sensor returns the total time including sender to object and object to receiver. Then, the time taken to reach the object is half of the time taken to reach the receiver.

CIRCUIT DIAGRAM

