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ULTRASONIC RANGE FINDER USING ARDUINO

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Abstract : Sound is the result of the mechanical vibration of a material and characterized as the mechanical waves that carry mechanical energy. For the transmission of these waves, it is necessary the existence of some material between the transmitter and the receiver. This material can be any type, such as solid, fluid or gas. Ultrasonic sensors use sound to determine the distance between the sensor and the closest object in its path. Ultrasonic sensors are essentially sound sensors, but they operate at a frequency above human hearing. The HC-SR04 ultrasonic distance sensor is used here. This economical sensor provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm[1].

Keywords **- Ultrasonic, Arduino, Range**

I. INTRODUCTION

The sound energy travels by causing disturbance in the medium it is travelling and this is called propagation of sound waves. Under normal conditions, the velocity of the sound is 330m/s.Ultrasonic sensors work by sending out a sound wave at a frequency above the range of human hearing. The transducer of the sensor acts as a microphone to receive and send the ultrasonic sound. The ultrasonic sensor uses a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse. In this project, a Portable Ultrasonic Range Meter is designed which can be used to measure distance of a target in non-contact fashion. The project is based on Arduino, Ultrasonic Sensor, LCD Display and Potentiometer.

Hardware required for this project as follows

- Arduino Uno
- Ultrasonic Sensor HC-SR04
- 16X2 LCD Display
- 10K POT

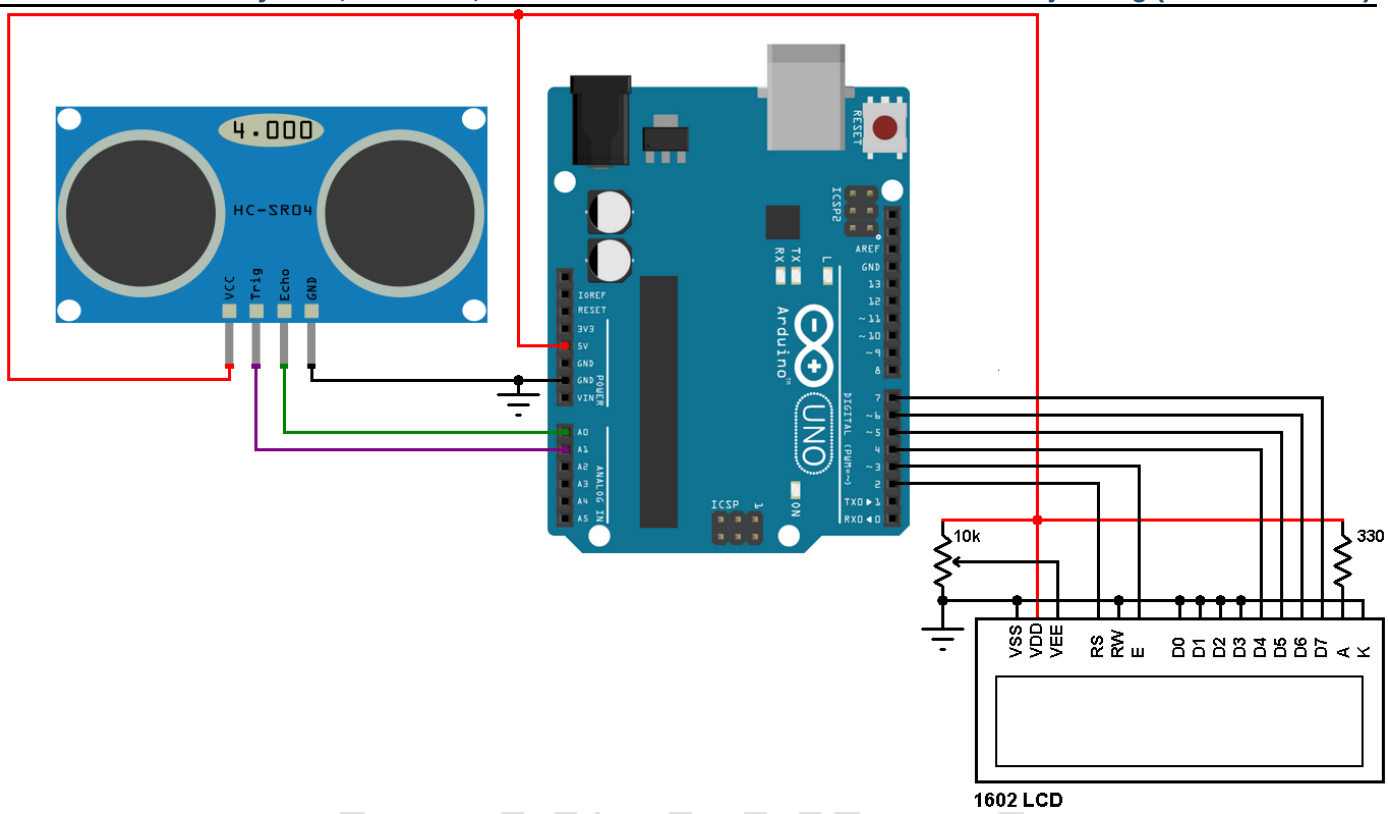

Figure 1 circuit diagram

II. CIRCUIT DESIGN OF ULTRASONIC RANGE FINDER

The circuit consists of Arduino Uno, which is the brain of the project, an Ultrasonic sensor and an LCD display to instantaneously display the results. The design of the circuit is very simple and is explained below Of the available 14 I/O pins on Arduino, we use 8 pins in this project. 2 pins are used for Ultrasonic sensor and other 6 pins are used to control the LCD.

The 4 pins of Ultrasonic sensor are Vcc, Gnd, Trig and Echo. Trig is connected to Pin 11 of Arduino and Echo is connected to Pin 10. With respect to Arduino, Pins 10 and 11 are input and output respectively[2].Pins 15 and 16 (LED+ and LED-) of the LCD are backlight pins. They are connected to Vcc and Gnd respectively (not shown in circuit diagram).

Four data pins of LCD are used to display the information. Pins 11, 12, 13 and 14 of LCD (D4 – D7) are connected to pins 5, 4, 3 and 2 of Arduino.Pins RS and E (pins 4 and 6) of LCD are connected to pins 7 and 6 of Arduino respectively while RW (pin 5) is connected to ground.Pins 1 and 2 (Vss and Vdd) are connected to ground and Vcc respectively. In order to control the contrast of the LCD display, pin 3 (VE) of LCD is connected to the wiper of a 10 KΩ POT with the other terminals of POT connected to Vcc and Gnd.

Ultrasonic sensor is the main module in the range meter circuit. An ultrasonic sensor consists of an ultrasound transmitter and a receiver. The transmitter sends a sonic burst of 8 pulses at 40 KHz frequency. This signal hits the target and the echo is received by the receiver module. By measuring the time between the events of sending the pulse and receiving the echo, the distance can be calculated.

III. CODE

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(7, 6, 5, 4, 3, 2);
const int trigPin = 11;
const int echoPin = 10;
const int led = 13;
```

```
void setup()
{
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
pinMode(led, OUTPUT);
lcd.begin(16, 2);
lcd.print ("Ultrasonic ");
lcd.setCursor(0, 1);
lcd.print ("Range Finder");
delay (5000);

}
long duration, r;
float distance;

void loop()
{
lcd.clear();
lcd.print("Distance in cm");

digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);

duration = pulseIn(echoPin, HIGH);
long r = 3.4 * duration / 2;
float distance = r / 100.00;

lcd.setCursor(0, 1);
lcd.print(distance);
delay (300);



if(distance<10)
{
digitalWrite(led,HIGH);
}
else
{
digitalWrite(led,LOW);
}

delay(300);
}
```

IV. WORKING

Ultrasonic sensor is the main module in the range meter circuit. An ultrasonic sensor consists of an ultrasound transmitter and a receiver. The transmitter sends a sonic burst of 8 pulses at 40 KHz frequency. This signal hits the target and the echo is received by the receiver module. By measuring the time between the events of sending the pulse and receiving the echo, the distance can be calculated as Figure (2).

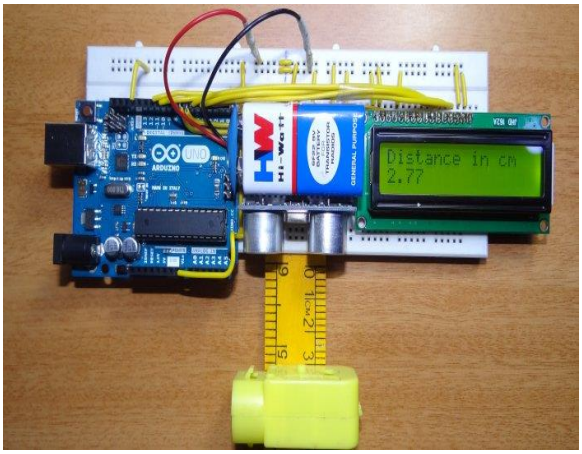

Figure 2 content of model

The ultrasonic sensor used in this project is HC-SR04. It can be used to measure distance in the range of 2cm to 400cm with accurate readings as Figure (3).

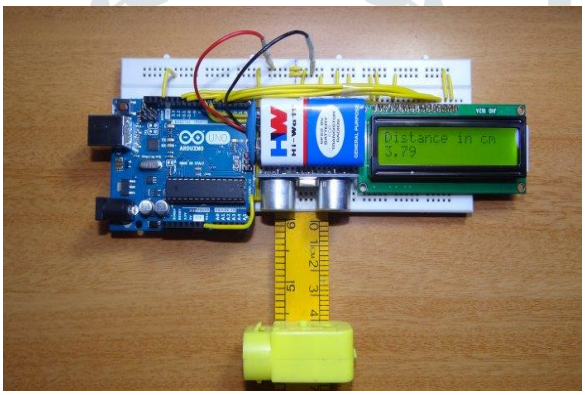

Figure 3 working the model to measure distance

The sensor module consists of 4 pins: Vcc, Gnd, Trig and Echo. When the Trig pin is high for a duration of at least 10µs, the ultrasonic sensor sends the ultrasound signals. The Echo pin is high from the moment of sending the signal and receiving it. This duration for which the Echo signal is high is calculated by Arduino as per the code and is converted to distance in centimeters. The same data is displayed on the LCD.Arduino continuously sends the Trig signal, and the distance of the target can be measured continuously without any delay as Figure (4).

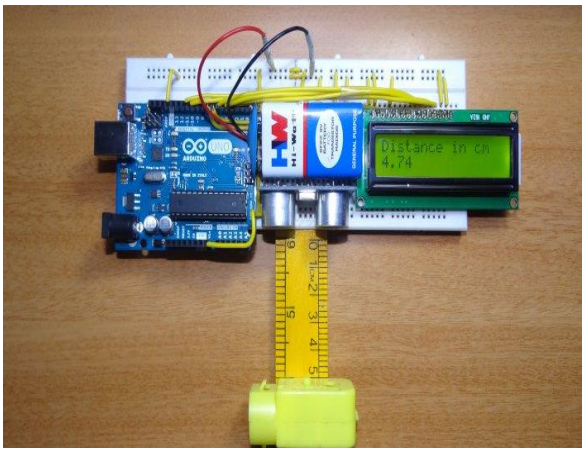

Figure 4 measured continuously without any delay

As the power requirement of the circuit is very less, the whole system can be powered by a 9V battery and can be used as a Portable Range Meter.

Range finding at 2 cm : The ultrasonic sensor used in this project is HC-SR04. It can be used to measure distance in the range of 2cm to 400cm with accurate readings.

Range Finding at 3 cm : The sensor module consists of 4 pins: Vcc, Gnd, Trig and Echo. When the Trig pin is high for a duration of at least 10µs, the ultrasonic sensor sends the ultrasound signals. The Echo pin is high from the moment of sending the signal and receiving it. This duration for which the Echo signal is high is calculated by Arduino as per the code and is converted to distance in centimeters. The same data is displayed on the LCD. Arduino continuously sends the Trig signal, and the distance of the target can be measured continuously without any delay.

Range Finding at 4 cm : As the power requirement of the circuit is very less, the whole system can be powered by a 9V battery and can be used as a Portable Range Meter[3][4].

V. CONCLUSION

This sensor has a variety of applications such as wireless charging, medical ultrasonography, depth measurement, humidifiers, non-destructive testing, embedded systems, burglar alarms etc.
This sensor uses sonar to measure the distance between sensor and object. The transmitter sends a high-frequency sound signal. Once the signal discovers an object then it reflects back to the echo pin of the transmitter. The time taken for the signal transmission as well as reception permits us to determine the distance to an object.
A simple change in code may result in additional information like distance in different metrics, time, date etc.

VI. REFERENCES

[1] HCSR04 Ultrasonic Sensor Elijah J. Morgan Nov. 16 2014
[2] Washburn, R.A., and H.J. Montoya, “The assessment of physical activity by questionnaire,” Am. J. Epidemiol., vol. 125, pp. 563- 576, 1986.
[3] Zhang Jian ,Li Jiazheng.A study Of Flow Rate Instrumentation Style Choice In oil Production Factories .Technology Supervision in petroleum Industry ,2009 (8):39-40(in Chinese).
[4] An Ultrasonic Range Finder Designed for an Autonomous Vehicle Navigation System - by JiqiuSai 2009