DISTANCE MEASUREMENT OF AN OBJECT USING ULTRASONIC SENSOR (Blind Stick)

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What is an Ultrasonic Sensor and its working?

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object.

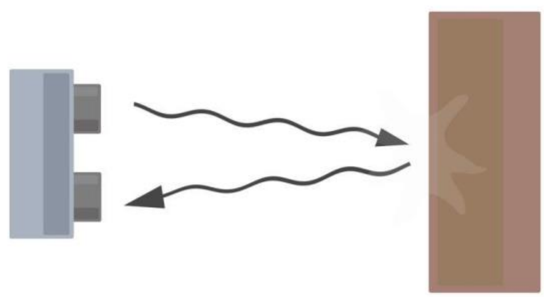


Diagram of the basic ultrasonic sensor operation

$$distance = \frac{speed\ of\ sound \times time\ taken}{2}$$

Since it is known that sound travels through air at about 344 m/s (1129 ft/s), you can take the time for the sound wave to return and multiply it by 344 meters (or 1129 feet) to find the total round-trip distance of the sound wave. Round-trip means that the sound wave traveled 2 times the distance to the object before it was detected by the sensor; it includes the 'trip' from the sonar sensor to the object AND the 'trip' from the object to the Ultrasonic sensor (after the sound wave bounced off the object). To find the distance to the object, simply divide the round-trip distance in half.

NOTE: The accuracy of Ultrasonic sensor can be affected by the temperature and humidity of the air it is being used in. However, for these tutorials and almost any project you will be using these sensors in, this change in accuracy will be negligible.

It is important to understand that some objects might not be detected by ultrasonic sensors. This is because some objects are shaped or positioned in such a way that the sound wave bounces off the object but are deflected away from the Ultrasonic sensor. It is also possible for the object to be too small to reflect enough of the sound wave back to the sensor to be detected. Other objects can absorb the sound wave all together (cloth, carpeting, etc), which means that there is no way for the sensor to detect them accurately.

10 Applications of Ultrasonic Sensors

- Roll diameter, tension control, winding and unwind
- Liquid level control
- Thru beam detection for high-speed counting
- Thread or wire break detection
- Robotic sensing
- Stacking height control
- People detection for counting
- Contouring or profiling using ultrasonic systems
- Vehicle detection for car wash and automotive assembly
- Irregular parts detection for hoppers and feeder bowls

COMPONENTS:

Arduino UNO R3 Board - 1
Ultrasonic Sensor HC-SR04 - 3
Piezoelectric Buzzer - 1
Vibrating Motor - 1
Small Breadboard - 1
9V Battery - 1
Toggle Switch - 1
Connecting Wires

WORKING:

Circuit shown below operates using a minimum of 5V DC power supply (Across Vcc & GND pin of Arduino UNO). The Arduino itself requires only 5V to operate but considering the fact that it has to power three ultrasonic sensors, one piezo-electric buzzer & a vibrating motor we have used a 9V supply. Arduino has an inbuilt 5V voltage regulator so we also have the options to power it using a 6V or 12V supply.

The brain of the circuit is Arduino Uno MCU board. Three Ultrasonic sensors “HCSR04” are used for obstacle detection using ultrasonic waves. These sensors require a power supply of 3.3V each to operate up to a distance of 3 m and can detect obstacles within an average angle of 25 degrees in the sphere.

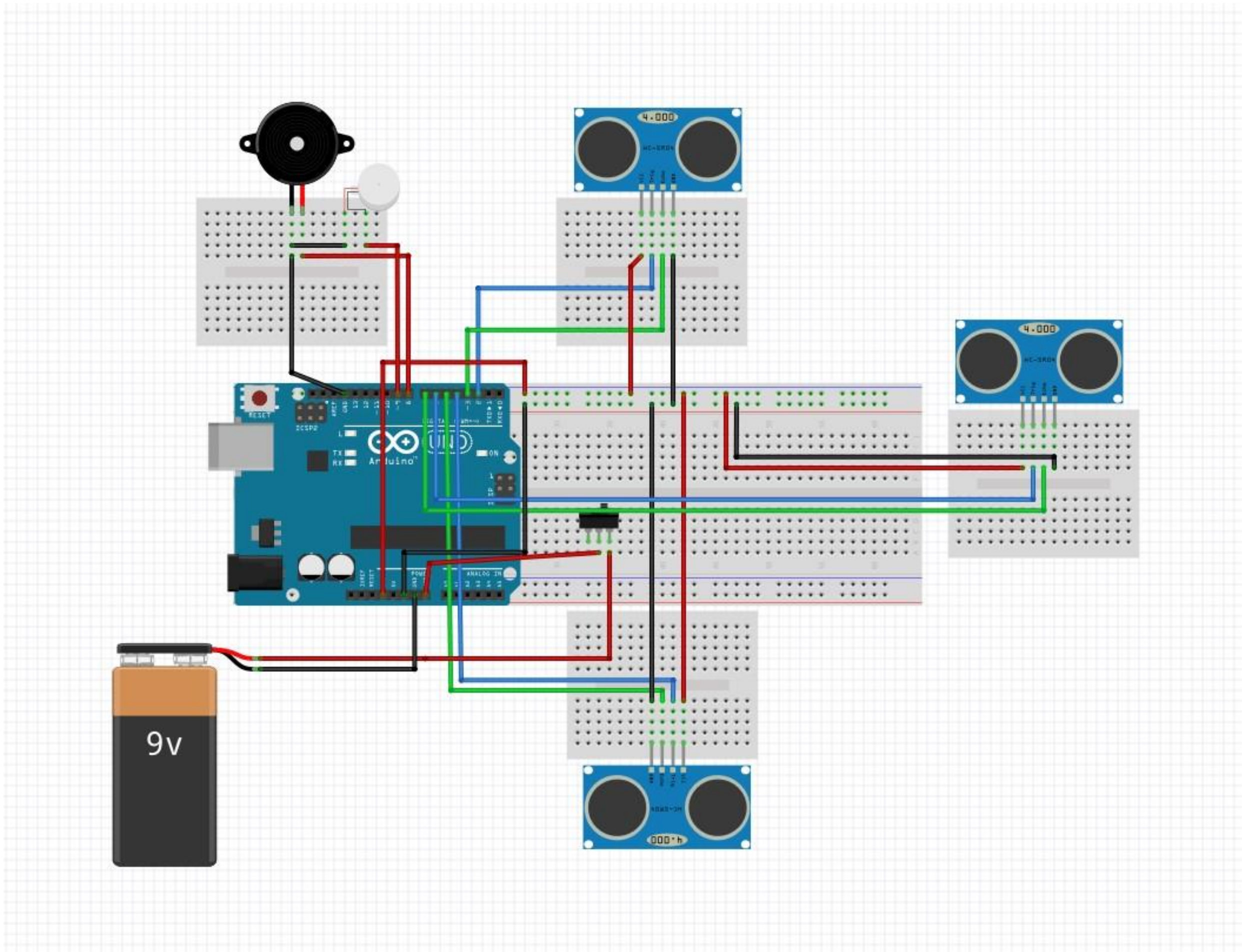
SOURCE CODE:

```
#define trig1 2
#define echo1 3
#define trig2 6
#define echo2 7
#define trig3 4
#define echo3 5
#define buzzer 8 #define
motor 9
long duration1, distance1, duration2, distance2, duration3, distance3;

void setup ()
{
pinMode (trig1, OUTPUT);
pinMode (echo1, INPUT); pinMode
(trig2, OUTPUT); pinMode (echo2,
INPUT); pinMode (trig3,
OUTPUT); pinMode (echo3,
INPUT); pinMode (motor,
OUTPUT);
```

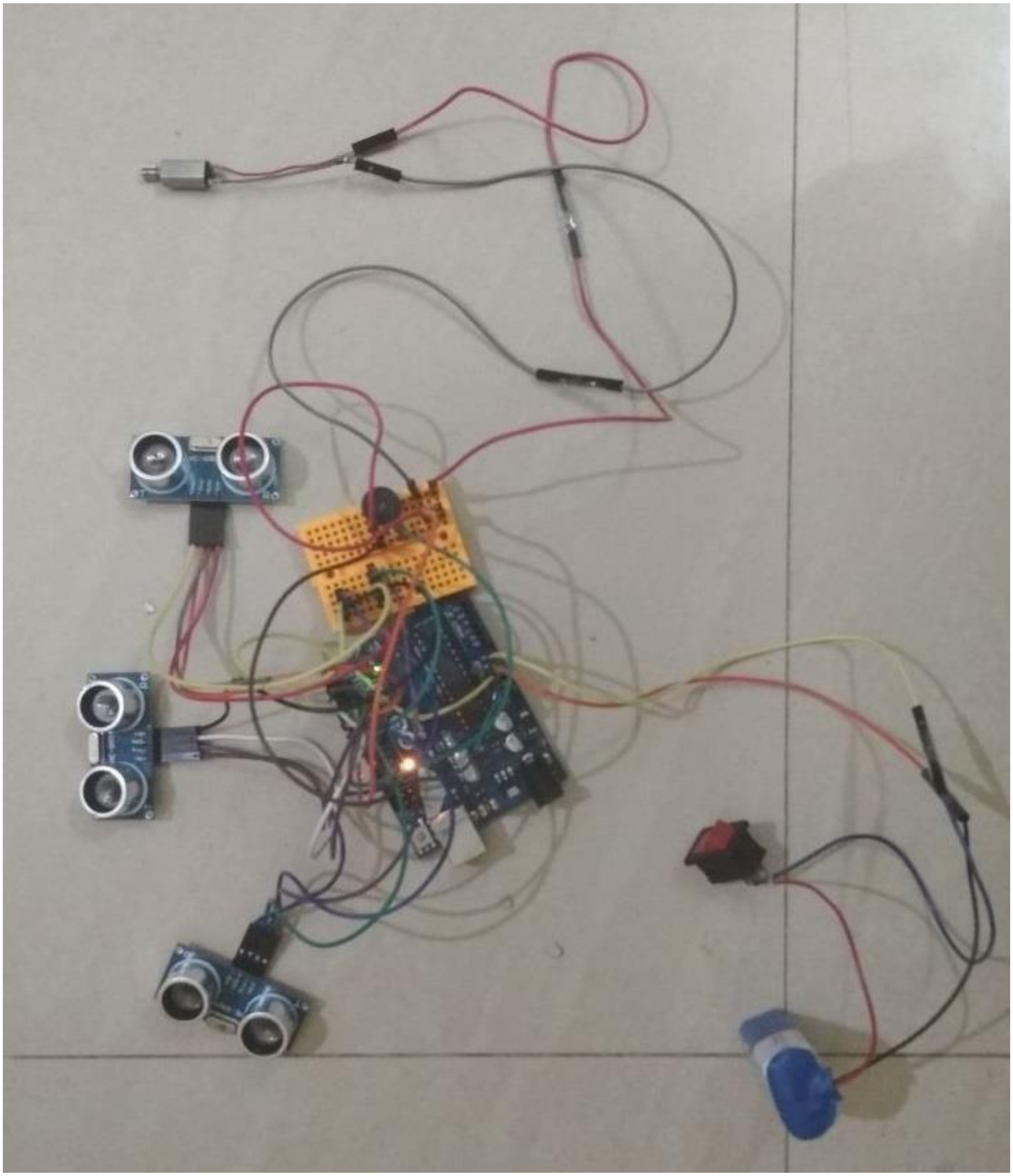
```
pinMode (buzzer, OUTPUT);
}




void loop ()
{
//For sensor 1 digitalWrite
(trig1, LOW);
delayMicroseconds (2);
digitalWrite (trig1, HIGH);
delayMicroseconds (10);
duration1 = pulseIn (echo1, HIGH);

//For sensor 2 digitalWrite
(trig2, LOW);
delayMicroseconds (2);
digitalWrite (trig2, HIGH);
delayMicroseconds (10);
duration2 = pulseIn (echo2, HIGH);

//For sensor 3 digitalWrite
(trig3, LOW);
delayMicroseconds (2);
digitalWrite (trig3, HIGH);
delayMicroseconds (10);
duration3 = pulseIn (echo3, HIGH);

distance1 = (duration1*0.017); distance2
= (duration2*0.017); distance3 =
(duration3*0.017);

if (distance1 < 20 && distance1 < distance2 && distance1 < distance3 )
{
digitalWrite (buzzer, HIGH);
digitalWrite (motor, HIGH);
delay (300); digitalWrite
(buzzer, LOW); digitalWrite
(motor, LOW); delay (300);
}
else if (distance2 < 20 && distance2 < distance1 && distance2 < distance3 )
{
digitalWrite (buzzer, HIGH);
digitalWrite (motor, HIGH);
delay (150); digitalWrite
```

```
(buzzer, LOW); digitalWrite
(motor, LOW); delay (150);
}



else if (distance3 < 20 && distance3 < distance2 && distance3 < distance2 )
{
digitalWrite (buzzer, HIGH);
digitalWrite (motor, HIGH);
delay (50); digitalWrite
(buzzer, LOW); digitalWrite
(motor, LOW); delay (50);
}
digitalWrite (buzzer, LOW);
digitalWrite (motor, LOW);
}
```

CIRCUIT DIAGRAM:



CIRCUIT IMAGE:



BLIND STICK: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