DESIGN PROJECT - 1
(B. TECH – CSE 2021-22)

Group No. – 13

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Project Title:

Ultrasonic Distance Meter and Motion Sensing Alarm

Checkpoint – 1:

Conduct project research, understanding existing solutions, conducting field work/ surveys.

Problem Statement:

As their name suggests, distance sensors are used for determining the distance of an object from another object or obstacle without any physical contact involved (unlike a measuring tape, for example).

In restricted areas where unwanted intruders have a chance to break in, a simple home solution which is compact and cheap can be used on a small or large scale needs to be prepared.
Also the need to measure distances conveniently.

The distance meter is used for accurately determining the distance of an object without contact by way of a laser. The distance meter is frequently used in the industrial sectorand especially with professions relating to construction, such as architecture, surveying, carpentry, masonry, locksmiths, etc. The distance meter is attractive due to its ease of use and its high level of accuracy in the results recorded. Depending on the model, the distance meter comes with a Leica lens, the world leader in producing optical distance meters.

The distance meter can measure, store the readings to memory and determine the surface, the volume or height showing these on their display. There is also a distance meter for fixed mounting for multiple applications in the industrial sector such as position testing, testing coil weight, etc.

Objectives :

To come up with a solution to make a compact device using small scale electronic components and find a cheaper alternative.

Understanding existing solutions:

The existing large scale motion sensors are available and have distance measuring capabilities, but are usually bigger and expensive to install and also you can't have full control on its potential.

A Laser Distance Meter sends a pulse of laser light to the target and measures the time it takes for the reflection to return. For distances up to 30m, the accuracy is É3mm. On-board processing allows the device to add, subtract, calculate areas and volumes and to triangulate. You can measure distances at a distance. Compared with a good, old-fashioned tape there's no contest. A Laser Distance Meter wins on every count: speed , accuracy, safety, versatility, convenience and functionality. Ultrasonic devices offer many of the same features but are less accurate.

A Laser Distance Meter* sends out a finely focussed pulse of light to the target and detects the reflection. The meter measures the time between those two events, and converts this to a distance. The formula is simple: Distance = Ä (Speed x Time). However the speed of light is 300,000 km per second, so to resolve differences of (say) 1 cm, the meter must measure time intervals of the order of billionths of a second. But don't worry – the technology is well established and reliable! A laser distance meter can measure distances of up to 30m with an accuracy of É3mm. An Ultrasonic Distance Meter works on a similar principle, but instead of light it uses sound with a pitch too high for the human ear to hear. The speed of sound is only about ⅓ of a km per second, so the time measurement is easier, but there are other issues

- **Laser versus Ultrasonic**

On the face of it, ultrasound has many of the same advantages that a Laser Distance Meter enjoys – one-person / onehanded operation, no need to access the target personally, etc. However ultrasound is intrinsically less accurate, because sound is far more difficult to focus than laser light. Accuracy is typically several centimetres, compared with a few millimetres for laser. And in some conditions, the ultrasound accuracy can be much poorer than the 'typical' values. Ultrasound needs a fairly large, smooth, flat surface as the target, so that is a severe limitation. You can't measure to a narrow pipe, for example. The ultrasound signal spreads out in a cone from the meter and any objects in the way can interfere with the measurement. Even with laser aiming, you can't always be sure that the surface from which the sound reflection is detected is the same as that where the laser dot is showing. This can lead to gross errors. Range is limited to about 15m, whereas some laser devices can measure up to 200m. Ultrasonic measuring devices may be cheaper, but the cost of their inaccuracies and limitations is far greater

<u>Conducting field work/survey:</u>

- The Working:

Commonly associated with ultrasonic sensors, it functions by outputting a signal (depending on technology; ultrasonic waves, IR, LED, etc.) and measuring a change when the signal returns.

The change measured can be in the form of either:

- Time it takes for a signal to return,
- Intensity of a returned signal,
- Or phase change of the returned signal.
- Distance sensors sense distance from the object and the measuring device through an output current. These currents are generated as a result of several waveforms, such as ultrasonic waves, laser, IR, etc.

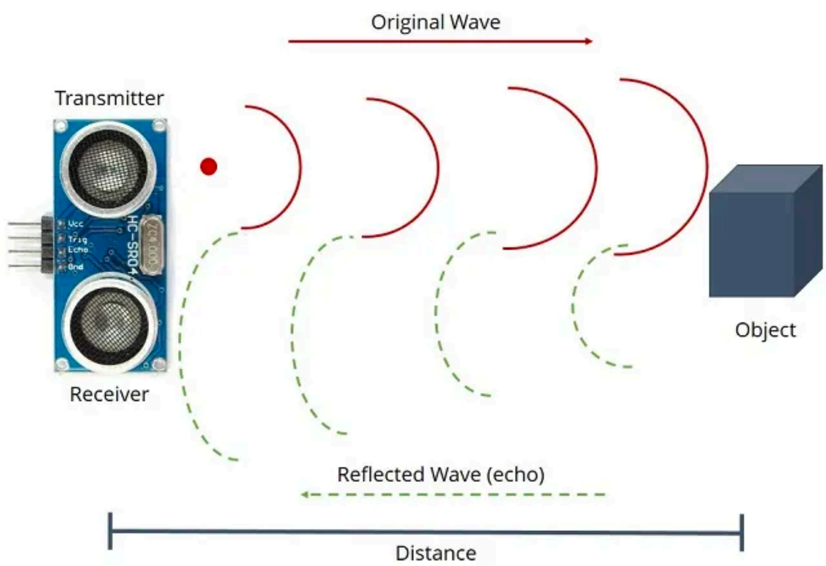
- Working Principle:

1. The ultrasonic sensor emits high-frequency sound waves towards the target object, and a timer is started
2. Target object reflects the sound waves back towards the sensor
3. The receiver picks up the reflected wave and stops the timer
4. The time taken for the wave's return is calculated against the speed of sound to determine the distance travelled

Survey:

A lot of household and private areas must have a cheap motion Sensing device for their security. Its cheap, reliable, readily available and when asked a lot of people would prefer a sensor rather than a camera keeping an constant eye on them in private Spaces.

Also can be used in agricultural fields as a scarecrow. The device Will be activated after sensing a bird or an animal preying on the Crops, the device then will make loud noises to scare away the prey Keeping the crops safe. Its main objective being distance measure- Ment, it will of big use in construction field as it relies heavily on Distance measurement.



Checkpoint – 2:

ideas for solutions to address the problem, build a prototype

Problem:

As their name suggests, distance sensors are used for determining the distance of an object from another object or obstacle without any physical contact involved (unlike a measuring tape, for example).

In restricted areas where unwanted intruders have a chance to break in, a simple home solu- tion which is compact and cheap can be used on a small or large scale needs to be prepared. Also the need to measure distances conveniently

A good old tape measure may be simple and reliable, but it is limited. You'll need to find someone to hold the other end and you'll need to raise hot-work permits, make risk assessments and method statements. A Laser Distance Meter is accurate and quick and requires only one person and one hand. It's easy to use and versatile. Laser Distance Meters have on-board processing enabling the device to triangulate and calculate – it knows Pythagoras! You can measure distances at a distance, add, subtract and calculate areas and volumes. An Ultrasonic Meter has many of the same features as a laser-based meter but is less accurate, less versatile, and less reliable. It is a lower range product and a false economy!

Solution:

- Why not a Tape?

A Laser Distance Meter is accurate to within a few millimetres, certainly equalling a tape for larger distances, and the line is always dead straight – no bending or sagging! You have a choice of units, and there is no risk of misreading, as with the intermediate marks on a tape. The Laser Distance Meter is much faster – point, click, and you have the result in front of you on the display. The job is done in just a fraction of the time it would take to use a tape. You don't need to walk to and fro, or have a helper at the other end. What is more, you can use it with one hand, leaving the other free to hold your notebook. With a backlit display and the laser dot itself, you can use your Laser Distance Meter in relatively poor lighting conditions. There's no need to wait until morning or to rig up lights. You don't have to access the far end of the measurement range or poke anything where it shouldn't be poked. Only the laser light has to do that – you do not have to worry about obstacles on the ground, or even large features such as pipes or cables. If there is a line of sight to your target, and it is within range, you can very quickly find out exactly how far away it is. For the same reason, you can measure upwards without climbing – to a ceiling or to the top of a building. So, the Laser Distance Meter brings safety benefits as well. No more scrambling up ladders or over steep or wet surfaces to get a measurement. These safety and versatility benefits are particularly valuable in hazardous environments, and there will be occasions when you would not be able to do the job at all with a tape. Only a Laser Distance Meter will do

Suppose you have to measure up for a cable run underneath a building? There is no line of sight between the start and end of the run – you have to walk around the corner. Obviously a complicated task with a tape, followed by some work on a calculator. However with your Laser Distance Meter you can measure two sides of a right-angled triangle, and it will work out the third with its built-in pythagoras functionality! Similarly, you can get the height of a structure without even being next to it, just by measuring your distance from the base and from the top, and you can measure the width of a building by standing some distance away and taking measurements from there. Something else that a tape simply cannot do is to work out an area from two length measurements, or a volume from three measurements. Answers in seconds without a notebook and calculator. Another feature intrinsic to a Laser Distance Meter is that it can measure continuously in situations where you would have to reposition a tape repeatedly. You can walk along, marking out a path that is (say) a certain minimum distance from a building. This is another bonus that has great value in hazardous environments.

The existing large scale motion sensors are available and have distance measuring capabili- ties, but are usually bigger and expensive to install and also you can't have full control on its potential.

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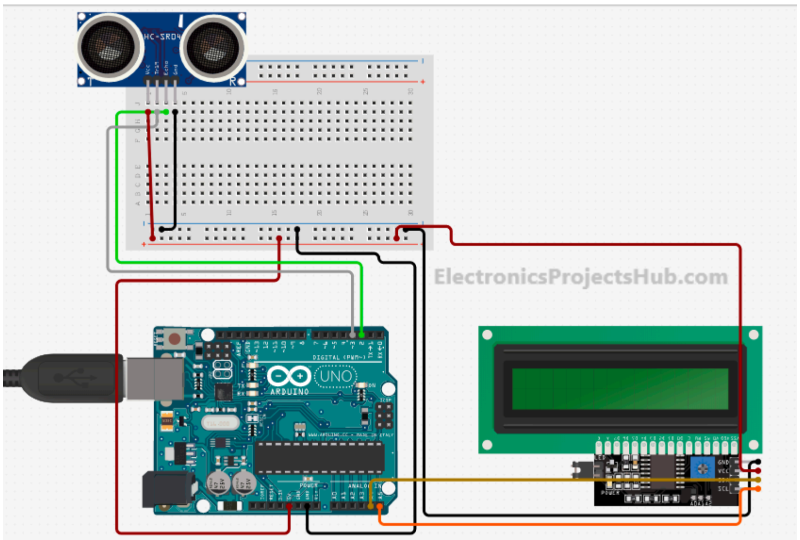
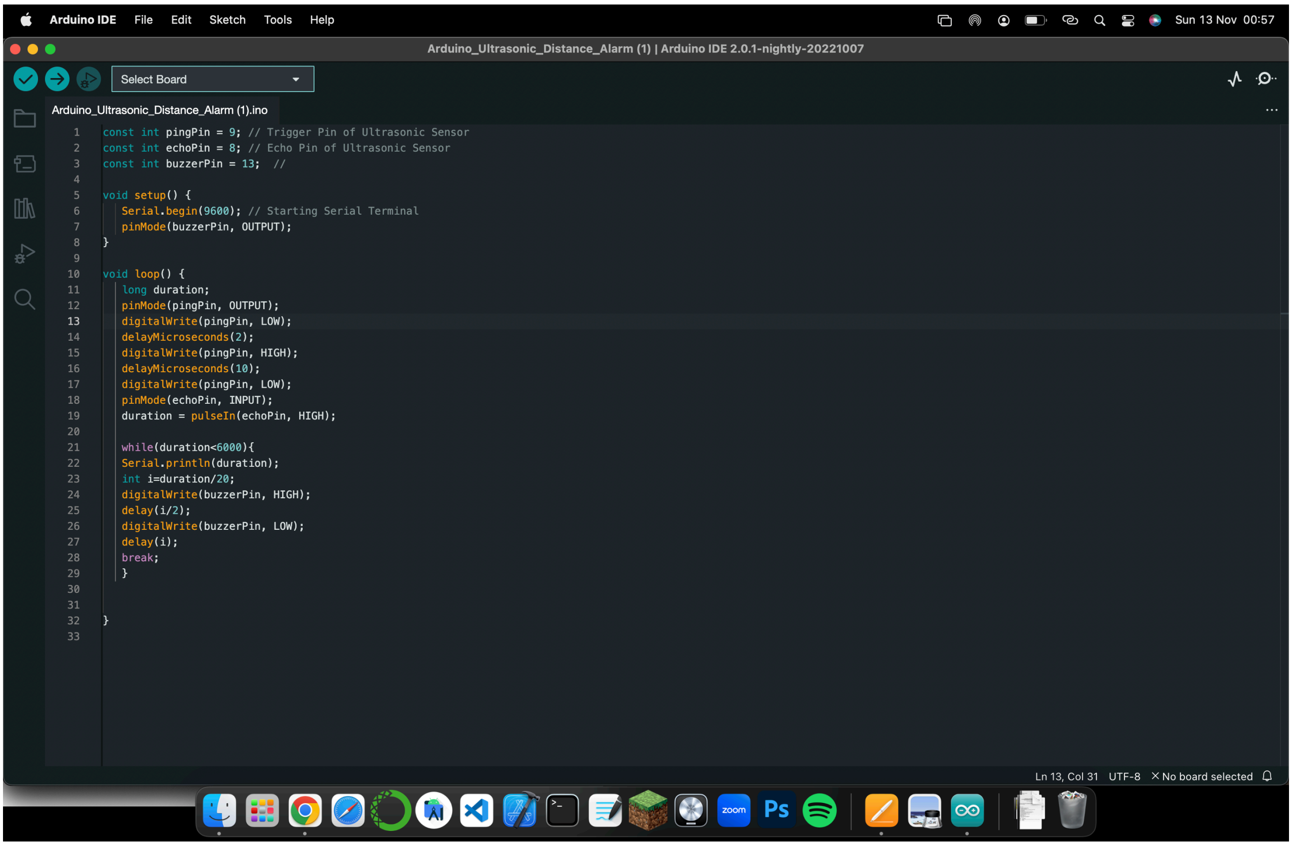


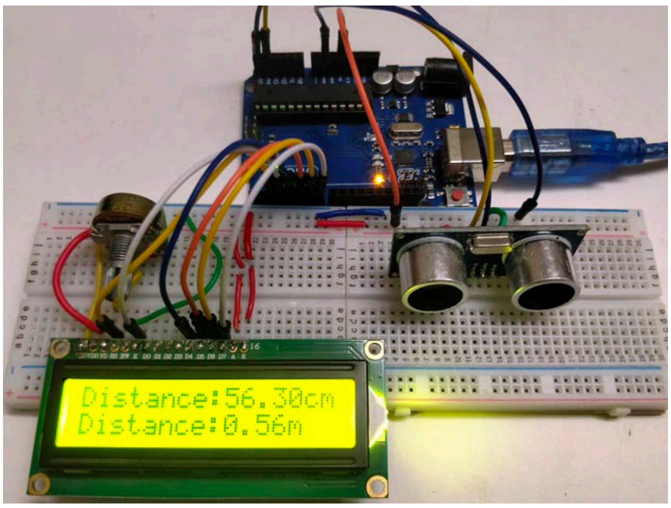
Testable Prototype:

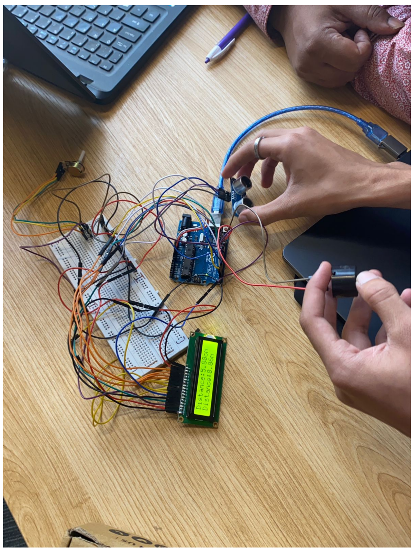
WORKING PROTOTYPE:

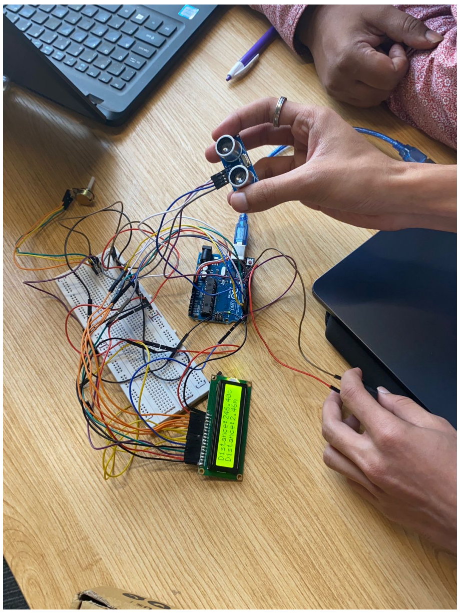
CODE:

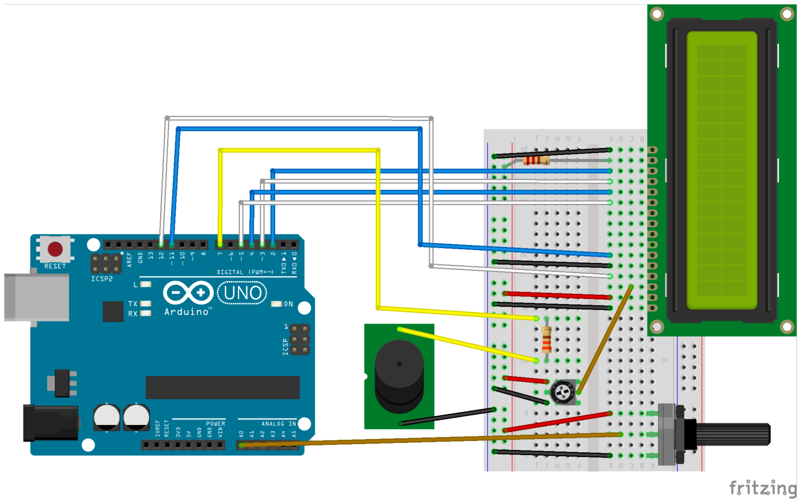


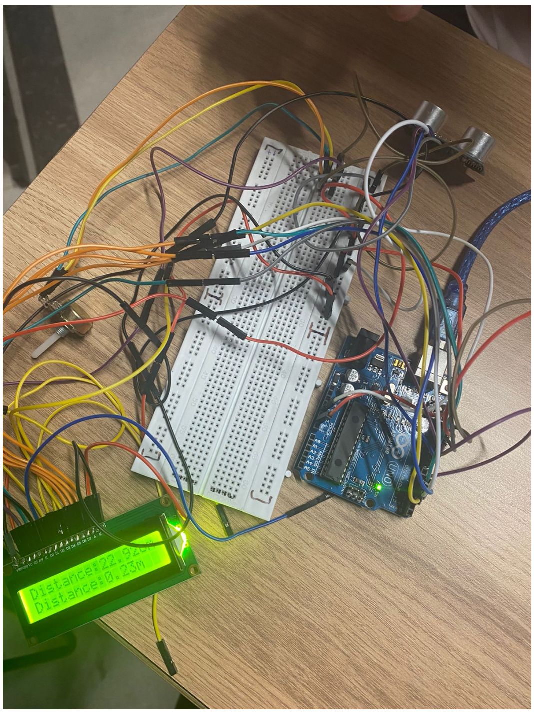
```
const int pingPin = 9; // Trigger Pin of Ultrasonic Sensor
const int echoPin = 8; // Echo Pin of Ultrasonic Sensor
const int buzzerPin = 13;  //

void setup() {
   Serial.begin(9600); // Starting Serial Terminal
   pinMode(buzzerPin, OUTPUT);
}

void loop() {
   long duration;
   pinMode(pingPin, OUTPUT);
   digitalWrite(pingPin, LOW);
   delayMicroseconds(2);
   digitalWrite(pingPin, HIGH);
   delayMicroseconds(10);
   digitalWrite(pingPin, LOW);
   pinMode(echoPin, INPUT);
   duration = pulseIn(echoPin, HIGH);

   while(duration<6000){
   Serial.println(duration);
   int i=duration/20;
   digitalWrite(buzzerPin, HIGH);
   delay(i/2);
   digitalWrite(buzzerPin, LOW);
   delay(i);
   break;
   }


}
```

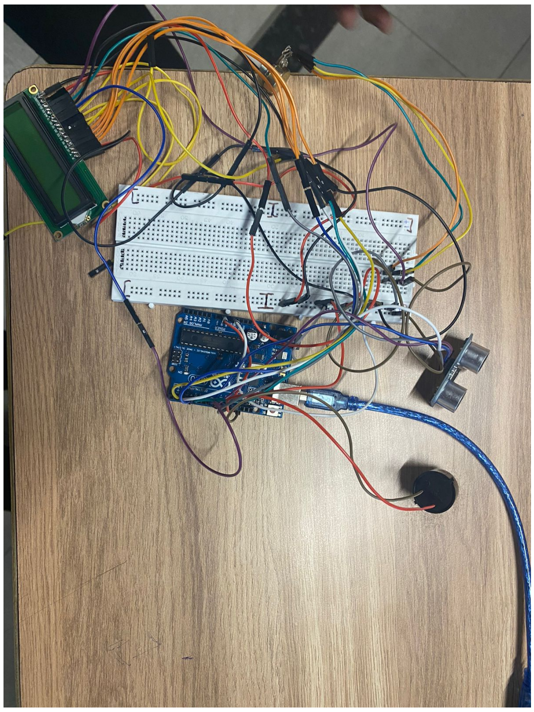




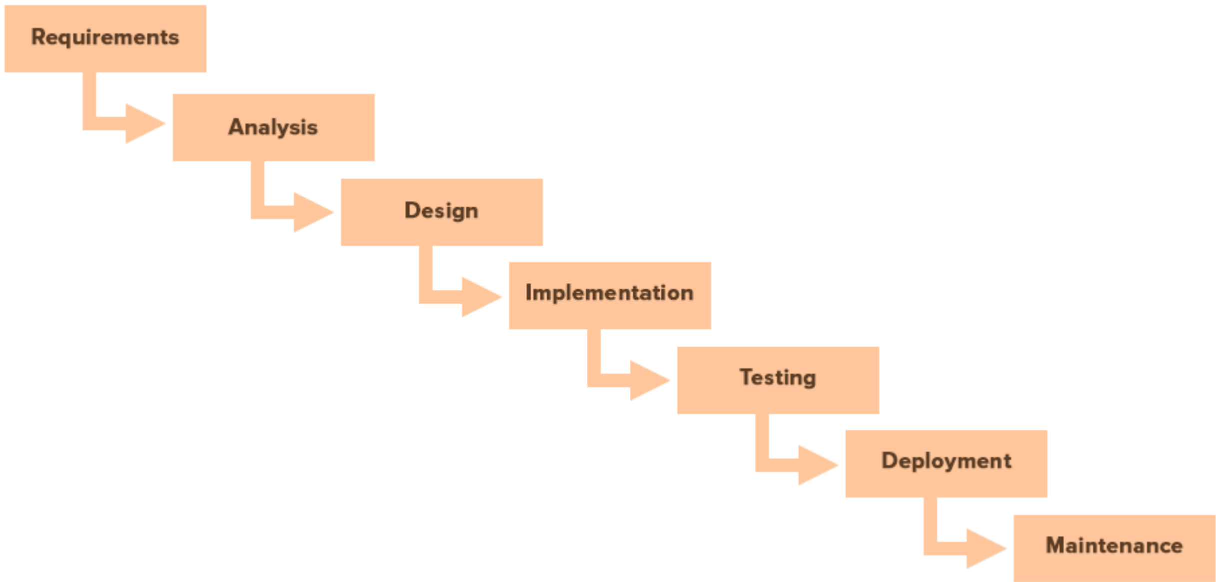



UNO
Arduino
fritzing





Methodology:



Requirements:

We are going to see a different use of the HC-SR04 ultrasonic module. This module is often used on robots and toy cars to locate obstacles but it can be used to measure distances as well.
Distances measured by the HC-SR04 will be shown on our beloved LCD 16x2 display.

The maximum range of HC-SR04 is 4 meters, and the shortest measurable distance is 2cm with an accuracy of 3mm. We made a piezoelectric speaker ring when the distance meters goes out of reach.

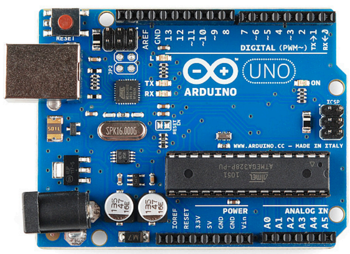
Other two things are required if you want your distance meter to do more accurate measurements:

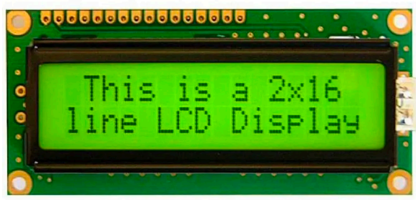
1. A spirit level
2. A laser pointer

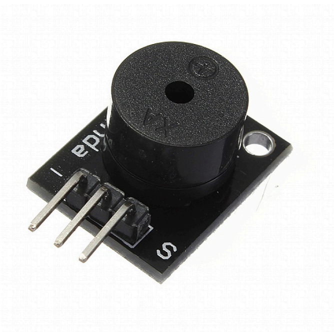
Unfortunately, while making tests we discovered this device can't be powered by a 9V battery because of a lack of energy (in terms of supplied Ampere). So, you have to supply your distance meter by using a computer or an AC adapter

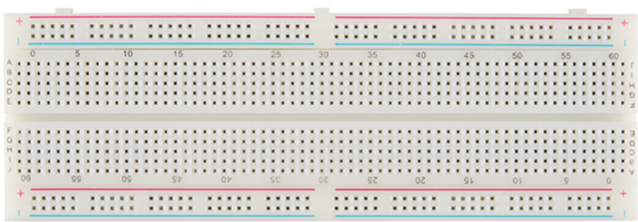
Parts Required:

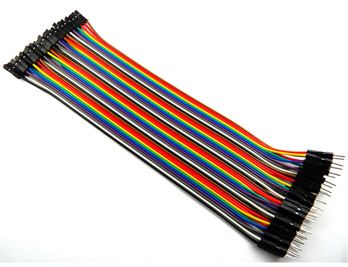
- Arduino UNO
- USB cable
- The Arduino IDE installed on your PC
- Set of Dupont cables
- MB-102 breadboard
- An HC-SR04 ultrasonic sensor
- LCD 16x2 display
- 10k Ohm linear potentiometer
- 2N3904 transistor (or a 2N2222)
- Number 2 10k Ohm resistor (1/4 Watt)
- Push-button
- Buzzer











Analysis:

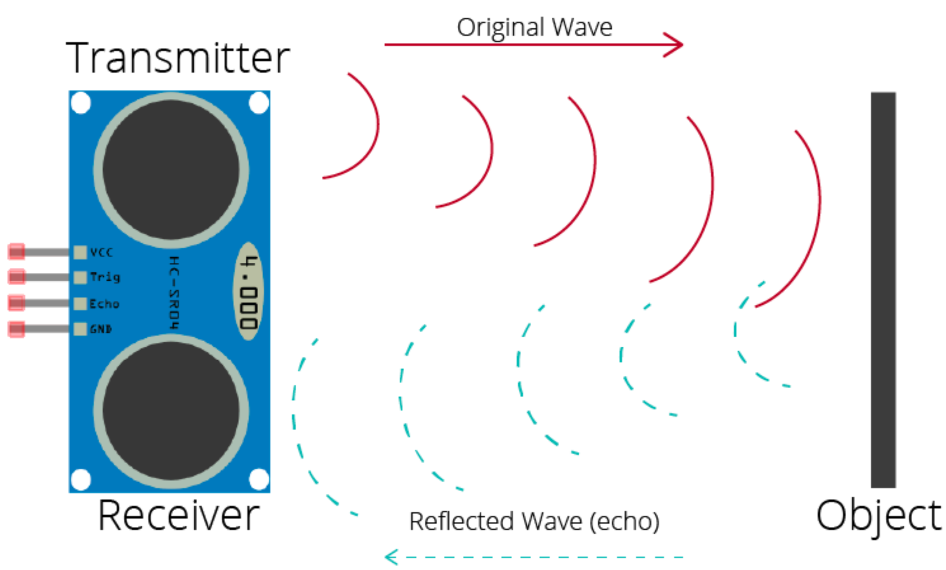
Here's a list of some of the HC-SR04 ultrasonic sensor features and specs—for more information, you should consult the sensor's datasheet:

- Power Supply :+5V DC
- Quiescent Current : <2mA
- Working Current: 15mA
- Effectual Angle: <15°
- Ranging Distance : 2cm – 400 cm/1″ – 13ft
- Resolution : 0.3 cm
- Measuring Angle: 30 degree
- Trigger Input Pulse width: 10uS TTL pulse
- Echo Output Signal: TTL pulse proportional to the distance range
- Dimension: 45mm x 20mm x 15mm

- How does it work?

The ultrasonic sensor uses sonar to determine the distance to an object.:

1. The ultrasound transmitter (trig pin) emits a high-frequency sound (40 kHz).
2. The sound travels through the air. If it finds an object, it bounces back to the module.
3. The ultrasound receiver (echo pin) receives the reflected sound (echo).



The time between the transmission and reception of the signal allows us to calculate the distance to an object. This is possible because we know the sound's velocity in the air. Here's the formula:

```
distance to an object = ((speed of sound in the air)*time)/2
```

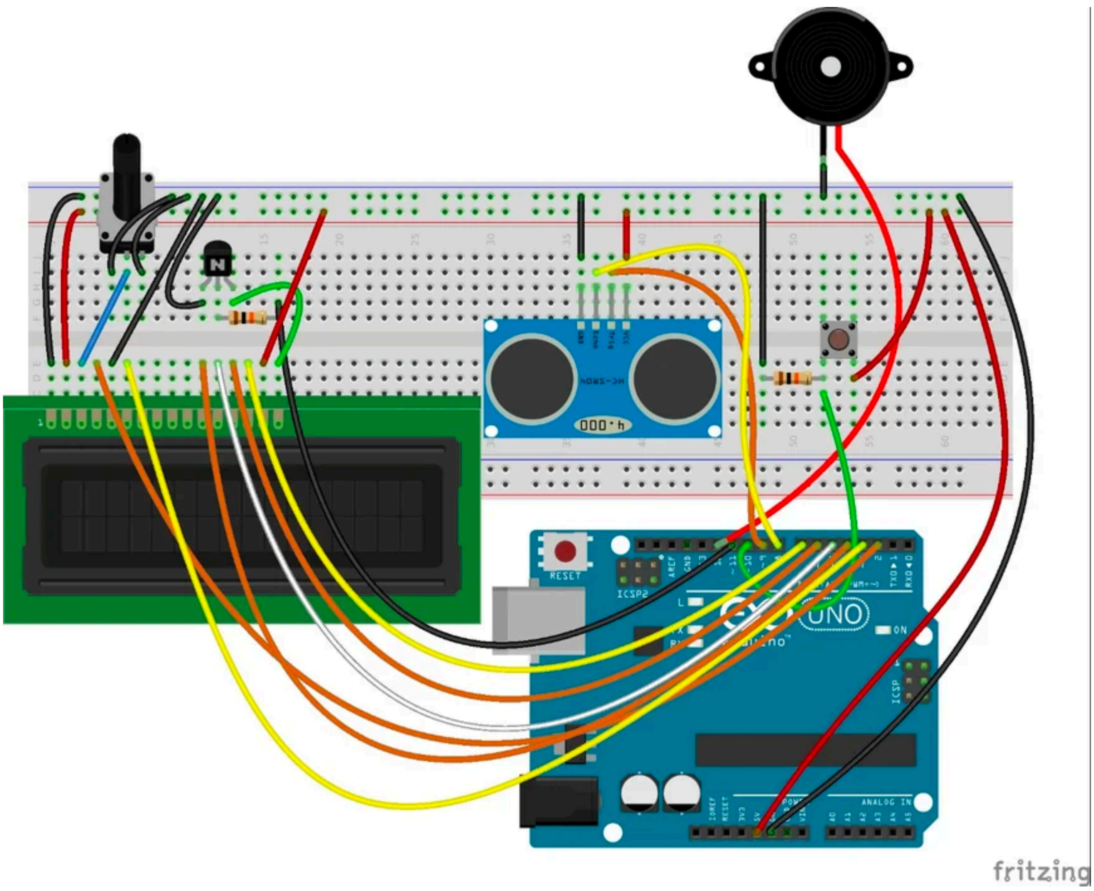
- speed of sound in the air at 20ºC (68ºF) = **343m/s**

Here's the pinout of the HC-SR04 Ultrasonic Sensor:

VCC	Powers the sensor (5V)
Trig	Trigger Input Pin
Echo	Echo Output Pin
GND	Common GND

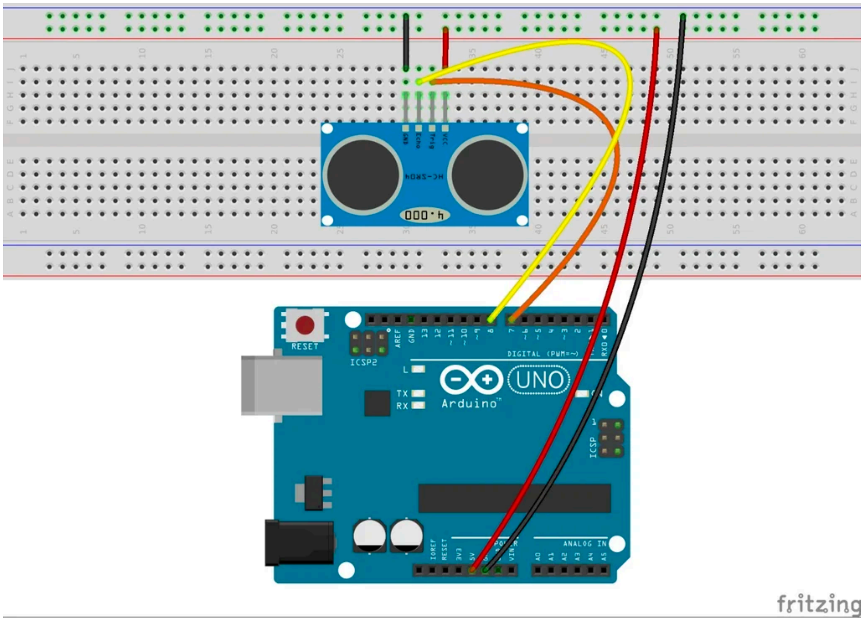
<u>Design:</u>

Tinkercad:



Implementation:

Step 1: Connecting HC-SR04 Ultrasonic Module to Arduino



HC-SR04 wiring

The HC-SR04 module doesn't need any extra library. You just have to connect it to Arduino following the attached Fritzing drawing or the scheme below:

5V ----> Vcc

GND ----> GND

pin 7 ----> Trig

pin 8 ----> Echo

Uploading the code

Now, download the file ultrasonic.ino and then double click on it. Arduino IDE will ask you to save the new sketch into a folder whose name will be the same one used for the .ino file. Save the file where you prefer.

Setup function

At the beginning of the sketch, we define the two pins used for trigger and echo:

```
int triggerPort = 7;
int echoPort = 8;
```

In order to make the HC-SR04 transmit a burst of 8 ultrasound waves (40kHz), Arduino sends a pulse (10us) to the pin 7.

Into the *setup* function, we properly set them as OUTPUT and INPUT:

```
pinMode( triggerPort, OUTPUT );
pinMode( echoPort, INPUT );
```

Loop function

The first four instructions into the *loop* allow the HC-SR04 to transmit microwaves towards an object:

```
digitalWrite(triggerPort, LOW);                 // set to LOW trigger's output
digitalWrite(triggerPort, HIGH);          // send a 10us pulse to the trigger
delayMicroseconds( 10 );
digitalWrite(triggerPort, LOW);
```

By sending a 10us pulse to the *triggerPort*, Arduino sets the pin 7 to HIGH. After this instruction, the sketch waits 10us before setting the pin 7 LOW again.

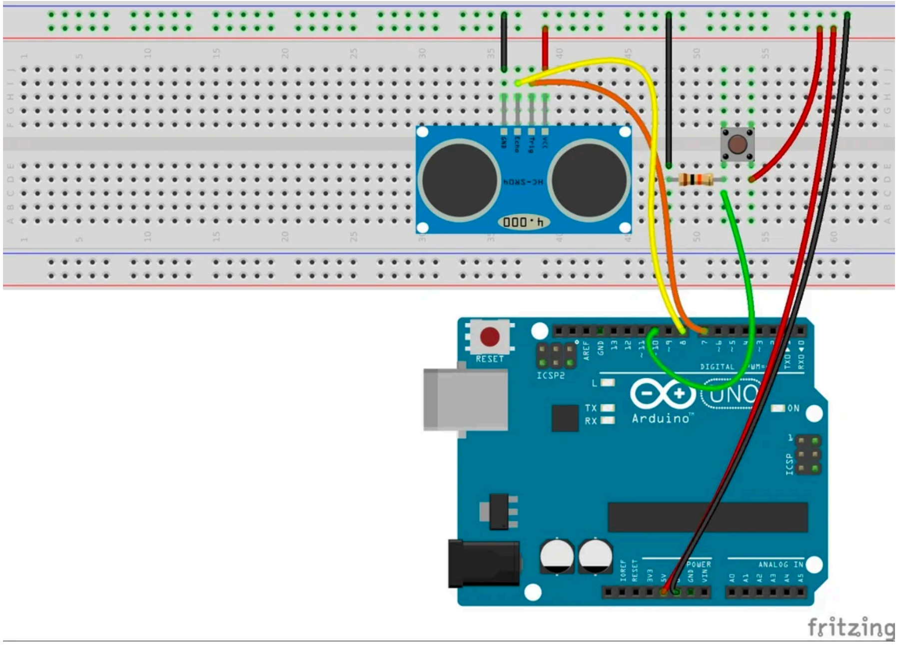
In the first line of the following instructions, Arduino receives the reflection time of ultrasonic waves from the HR-SR04. This time is needed to calculate the distance by using the formula *distance = (high level time × speed of sound*) / 2* shown in the second line.

```
long duration = pulseIn(echoPort, HIGH);

long r = 3.4 * duration / 2;              // here we calculate the distance

float distance = r / 100.00;
```

The last lines determine if the object is too far, checking if the reflection time is greater than 38ms.

```
if( duration > 38000 ) Serial.println("out of reach");
else { Serial.print(duration); Serial.println("cm");}
```

Step 2: Adding a Pushbutton



Of course, we want our distance meter to do measurements only when we need. We can simply implement this feature adding a push-button. So, pressing a bush-button, Arduino and HC-SR04 do a measurement.

See the attached Fritzing scheme to see how to connect the push-button. Remember that a 10k Ohm resistor is required for this wiring.

The first step is to declare the pin used to connect the button (we chose the pin 10):

```
#define BUTTON 10
```

Then, into the *setup* function, we set this pin as an INPUT:

```
pinMode(BUTTON, INPUT);
```

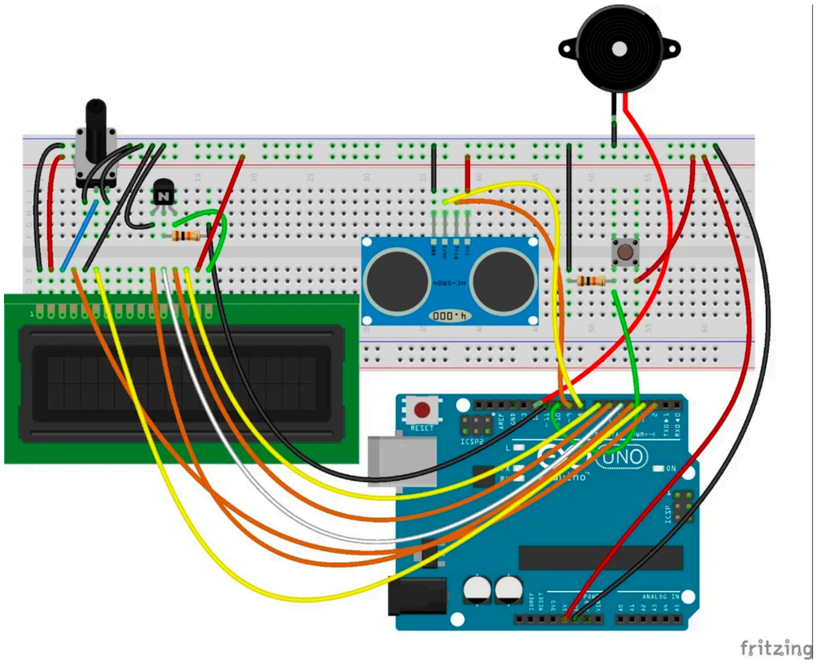
The last instruction has to be put into the *loop* function:

```
while(digitalRead(BUTTON) == LOW);
```

What does the previous instruction do?

When the push-button isn't pressed, the logical condition inside the while cycle is *TRUE*, so the sketch stays endlessly inside it and will not execute the next lines.On the contrary, when the push-button is pressed, the logical condition becomes *FALSE* and the sketch comes out from the while loop and executes the following lines doing a measurement.

Step 3: Connecting a Lcd Display and a Piezoelectric Buzzer



Now it's time to connect the LCD display to our Arduino. As seen in the Introduction, you'll also need some other things to make this circuit: a 2N3904 transistor (or, alternatively, a 2N2222), a 10k Ohm resistor, a 10k Ohm linear potentiometer for adjusting the contrast. These components are needed to make the LCD display turn on when pressing the push-button during measurements.

Furthermore, adding a piezoelectric speaker can be a wise choice if you want to be informed when the distance meter goes out of reach.

NOTE: We are not going to explain how to connect an LCD display to Arduino as well as how to control its back-light

The sketch

Let's adapt the sketch according to the changes we want to make.

In the first part of the sketch, we have to declare two constants and a variable. The first constant is the PWM pin used to turn on and off the display back-light and second one is the frequency of the note played by the piezo speaker when the distance meter goes out of reach.
The variable is needed to set the back-light brightness up to the maximum value.

```
#define LUMIN 11

#define NOTE_A4 440

int l = 255;
```

Then we include the LiquidCrystal library and initialize the LCD display library:

```
// include the library code:
#include <LiquidCrystal.h>
```

```
// initialize the library with the numbers of the interface pins
LiquidCrystal lcd(2, 3, 4, 5, 6, 7);
```

Setup function

Into the *setup* function we need to declare the pin 11 as an OUTPUT and initialize the LCD display (16 columns and with 2 rows):

```
pinMode(LUMIN, OUTPUT);
// set up the LCD's number of columns and rows:
lcd.begin(16, 2);
```

In the *loop* function we make some changes. First of all we modify the *while loop* as shown below:

```
while(digitalRead(BUTTON) == LOW) {
  analogWrite(LUMIN, 0);  // turn LED off
  lcd.clear();
  noTone(12);
}
```

When the button is not pressed down, the logical condition is TRUE, as a consequence the sketch waits into this *while loop*. In this situation, the first line in the block turns the back-light off, the second line clears the display and the third one turns the tone generator off.

When the push-button is pressed, the logical condition becomes FALSE and Arduino skips this *while loop* and goes on executing the following line...

```
analogWrite(LUMIN, l);  // turn LED on
```

...which turns the backlight on.

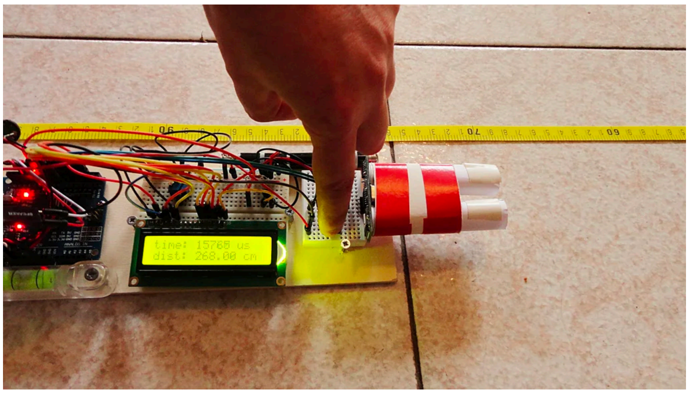
As we are not using the serial monitor any more, we have to change the functions *Serial.print* to *lcd.print*.

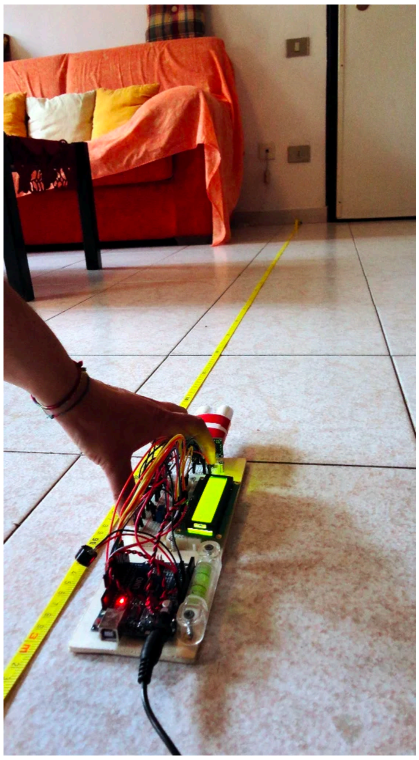
```
lcd.setCursor(0, 0);
lcd.print("time: ");
lcd.print(duration);
lcd.print(" us    ");
lcd.setCursor(0, 1);
```

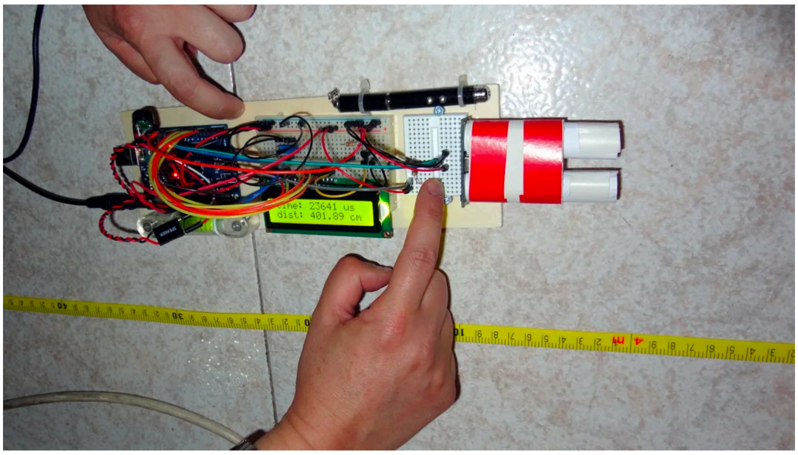
```
if( duration > 38000 ) {lcd.println("out of reach    "); tone(12, NOTE_A4);}
else { lcd.print("dist: "); lcd.print(distance); lcd.println(" cm    ");
noTone(12);}
```

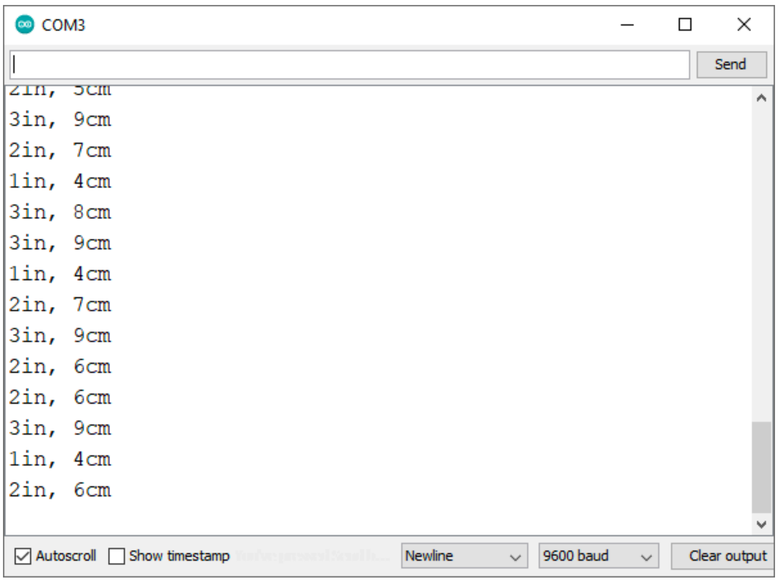
In the first row the display it prints the reflection time and the distance in the second one. If reflection time is greater than 38ms, the obstacle is out of reach and the piezo buzzer will play a sound and the display will show the message "out of reach", otherwise the sketch will print the measured distance.

Testing:









In order to make the device easier to use, we placed the components on a 24x8cm wooden board. We also used two different breadboards: a mini breadboard for the ultrasonic module and the pushbutton, and a medium size breadboard for the other components.

In addition, we installed two essential things to do more accurate measurements: a simple laser pointer and a tubular spirit level.

The last useful thing is a couple of paper pipes (ours are 7.5 cm long) which have to be placed in front of the two speakers of the ultrasonic module. They are required in order to focus the ultrasonic pulses coming out from the ultrasonic module speakers, which otherwise would diverge excessively. In fact, according to the datasheet, the measuring angle is 15 degrees.

While doing measurements, we discovered that the pipes are required for "long distances" (greater than 1 meter) and misleading for short ones.

The longest distance we did has been 418cm.

<u>FINAL CODE:</u>

```
#include <Adafruit_LiquidCrystal.h>


 
#define trigger 9
#define echo 8
 
Adafruit_LiquidCrystal lcd(12,11,5,4,3,2);
 
float time=0,distance=0;
const int pingPin = 9; // Trigger Pin of Ultrasonic Sensor
const int echoPin = 8; // Echo Pin of Ultrasonic Sensor
const int buzzerPin = 13; 

 
void setup()
{ 
 Serial.begin(9600);
   pinMode(buzzerPin, OUTPUT);
 lcd.begin(16,2);
 pinMode(trigger,OUTPUT);
 pinMode(echo,INPUT);
 lcd.print(" Ultra sonic");
 lcd.setCursor(0,1);
 lcd.print("Distance Meter");
 delay(2000);
 lcd.clear();
 lcd.print(" group 13");
 delay(2000);
 lcd.clear();
 lcd.print("raghav");
 delay(1000);
 lcd.clear();
 lcd.print("ishita");
 delay(1000);
 lcd.clear();
 lcd.print("ishika");
 delay(1000);
 lcd.clear();
 lcd.print("khushi");
 delay(2000);
```

```
}

void loop()
{
  long duration;
   pinMode(pingPin, OUTPUT);
   digitalWrite(pingPin, LOW);
   delayMicroseconds(2);
   digitalWrite(pingPin, HIGH);
   delayMicroseconds(10);
   digitalWrite(pingPin, LOW);
   pinMode(echoPin, INPUT);
   duration = pulseIn(echoPin, HIGH);

   while(duration<6000){
   Serial.println(duration);
   int i=duration/20; 
   digitalWrite(buzzerPin, HIGH);
   delay(i/2);
   digitalWrite(buzzerPin, LOW);
   delay(i);
   break;
   }
 lcd.clear();
 digitalWrite(trigger,LOW);
 delayMicroseconds(2);
 digitalWrite(trigger,HIGH);
 delayMicroseconds(10);
 digitalWrite(trigger,LOW);
 delayMicroseconds(2);
 time=pulseIn(echo,HIGH);
 distance=time*340/20000;
 lcd.clear();
 lcd.print("Distance:");
 lcd.print(distance);
 lcd.print("cm");
 lcd.setCursor(0,1);
 lcd.print("Distance:");
 lcd.print(distance/100);
 lcd.print("m");
 delay(1000);
```

Maintenance:

Maintenance is important, but it’s often hard to quantify. How much time does maintenance take? How often does your system need it? Does maintaining one part necessitate a complete system shut down? What does that represent in lost income because your system is not making product? Maintenance is important, but minimizing maintenance is even more important.

Maintenance is also important for your sensors. While everyone (yes, us, too!) would really like for sensors to maintenance free for life, reality dictates that all equipment needs a check-up from time to time. It’s true for pumps and motors, and it’s true for sensors.

- **Maintaining your ultrasonic sensor:**

Your ultrasonic sensor has three specific enemies: corrosion, buildup, and extreme temperature changes. The while all three relate to the general environment of the sensor, first two are linked directly to the substance being monitored (for sensors within an enclosure, such as a tank). If your sensor has sustained exposure to corrosive fumes, or solid or liquid buildup is likely to form on your sensor, then preventative maintenance must be scheduled at regular intervals. A sensor exposed to extreme temperature changes may have condensation or even ice crystals form on the face of the sensor.
But what about the *sides* of the transducer? If your ultrasonic sensor has an extruded face, the sides of your transducer can also be susceptible to buildup. And since the ultrasonic waves aren't travelling out those sides, you won't have erroneous readings to tip you off to the presence of that buildup. Which means it's not too big of a problem unless, A, the buildup is corrosive and will eat through the side walls of the sensor; or B, the buildup is substantial enough that it will prevent you from removing the ultrasonic, or it threatens to extend into the path of the ultrasonic waves. If the buildup is potentially corrosive

- **Maintaining your Arduino Uno:**

General advice

- Wash your hands before working with your board.
- Avoid dust build-up by using a case or putting the board away when not in use. Smaller amounts of dust can be removed using any readily available air duster.
- Despite the temptation to carry on with your project through dinner, try to avoid eating and drinking whilst using your Arduino board.

How to clean your board

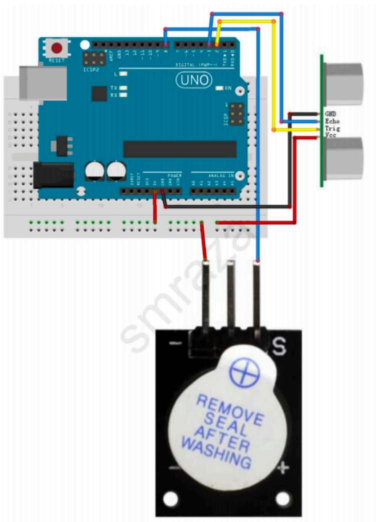
Accidents happen. Follow these steps if you need to thoroughly clean your board:

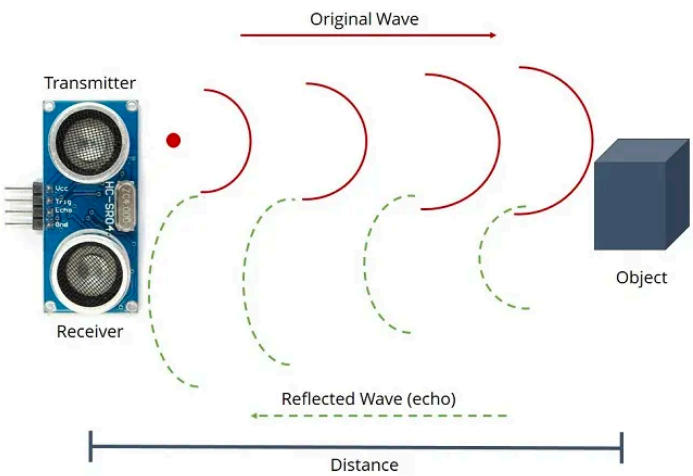
1. Disconnect your board from your computer or battery.
2. Use an air duster or dry cloth to remove any loose debris.
3. Use an isopropyl alcohol (IPA) wipe to safely remove grease, dirt and dust from the board. Apply only gentle pressure to avoid damaging board components.
4. Allow the IPA to evaporate before running the board.

Another thing are electrolytic capacitors, which are aging. Their lifespan mainly depends on their environmental temperature. A rule of thumb says that each +10°C halfs their lifespan. So depending on the environmental temperature they can live from 2-3 years (hot environment) up to 10-15 years (cool environment).

Results:

After carefully wiring the circuit, checking component polarities and layout of the various segments of the construction were separately tested for their workability. The output of the Astable Oscillator (555 timer) in the transmitter circuit was tested with a frequency meter before connecting the translator to ensure that a frequency of approximately 40KHZ was supplied to the ultrasonic transmitting transducer. The output of the Astable oscillators (555 timer) in the alarm circuit was also tested with a frequency meter to make sure their output signal was in accordance to the required value. The resistors and capacitors were tested to verify their value before the start of construction. After all tested were carried out, the system was found to be very suitable for detecting all the motion within an area of 3-4 meters.
The Ultrasonic Distance meter can now also be used as a compact and cheap alternative for bigger devices of the same use.
Can be used in household for measuring accurate distances on a limited range and also be used as a in home or door alarm system for security purposes or also in various other fields like agriculture for scarecrow or water level alert etc.





Conclusion:

It could be deduced from the foregoing design analysis that the design of ultrasonic motion detector like any other electronic need careful planning and implementation. There are various motion detectors but this particular one is unique because of its mode of operation, as it transmit exactly 40 kHz waves. This work is mainly a design and construction of a system that has the ability to sense motion through movement of humans or any target, to design a low cost and portable motion detector system, and the design of a system that can be used to trigger another circuit which can trigger ON or OFF the circuit depending on the circuit attached to it. Generally, the design is made to detect movement or moving object in a an enclosed area. In this work, a transmitter transducer generates a signal at a frequency of 40khz, and when the signal is blocked by any moving object, the receiver will be notified and this in turn triggers a buzzer via a timing circuit. This system works on the principle of the signal interference by a moving body. This system works on the principle of the signal interference by a moving body, and the system is dependent on the presence of an intruder or moving object within a monitored Area. The system after design and construction was tested and found to work in accordance with specifications.

The objective of the project was to design and implement an ultrasonic distance meter. The device described here can detect the target and calculate the distance of the target. The ultrasonic distance meter is a low cost, low a simple device for distance measurement. The device calculates the distance with suitable accuracy and resolution. It is a handy system for non-contact measurement of distance. The device has its application in many fields. It can be used in car backing system, automation and robotics, detecting the depth of the snow, water level of the tank, production line. This device will also have its application in civil and mechanical field for precise and small measurements. For calculating the distance using this device, the target whose distance is to be measured should always be perpendicular to the plane of propagation of the ultrasonic waves. Hence the orientation of the target is a limitation of this system. The ultrasonic detection range also depends on the size and position of the target. The bigger is the target, stronger will be the reflected signal and more accurate will be the distance calculated. Hence the ultrasonic distance meter is an

extremely useful device■

So, we have covered pretty much everything that we need to know about using the HC-SR04 Ultrasonic sensor with Arduino. It’s a great sensor for many DIY electronics projects where we need a non-contact distance measuring, detection of presence or objects, level or position something etc.

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