NEW HORIZON COLLEGE OF ENGINEERING

New Horizon Knowledge Park, Ring Road, Marathalli

Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC

Accredited by NAAC with 'A' Grade, Accredited by NBA

"ULTRASONIC DISTANCE MEASUREMENT"

A MINI PROJECT

REPORT

Submitted by

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In partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

NEW HORIZON
COLLEGE OF ENGINEERING
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CERTIFICATE

Certified that the mini project work entitled "**Ultrasonic Distance Measurement**" carried out by**, A Hemanth Reddy(1NH18EC701), B Rathan Teja(1NH18EC707), S Vamsi Krishna Reddy(1NH18EC743), Santhosh H M(1NH18EC745)** bonafide students of Electronics and Communication Department, New Horizon College of Engineering, Bangalore.

The mini project report has been approved as it satisfies the academic requirements in respect of mini project work prescribed for the said degree.

Project Guide	HOD ECE
(Mr. Puvirajan. T)	(Dr. Sanjeev Sharma)
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External Viva

Name of Examiner	Signature with Date
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ACKNOWLEDGEMENT

The satisfaction that accompany the successful completion of any task would be, but impossible without the mention of the people who made it possible, whose constant guidance and encouragement helped us succeed.

We thank **Dr. Mohan Manghnani**, Chairman of **New Horizon Educational Institution**, for providing necessary infrastructure and creating good environment.

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ABSTRACT

Ultrasonic Distance measurement is based on the principle of Ultrasonic Waves. Where Ultrasonic waves travel in the air medium and get reflected when there is an obstacle. The ultrasonic waves are unaffected to the human beings, so they can be used in many applications. In this project the transmitter of the Ultrasonic Sensor module sends the ultrasonic signal and the reflected signal is received by the receiver. The Total time required for transmission and receiving of the ultrasonic signal is recorded. Using the total time distance can be calculated by using the below formula

Distance = (T/2) * S

Where,

S = speed of sound around 340m per second.

T = total time taken by signal

In this project we have used Arduino UNO for controlling the circuit. The Ultrasonic sensor module is connected to the Arduino. The Arduino is programmed in such a way that it triggers the ultrasonic transmitter at a specified interval of time and calculates the distance by using the data received from the ultrasonic sensor module. The calculated distance gets displayed in the 16*2 LCD display. The distance is displayed in both centimeter and meter.

It can be used as a measuring tape or device for a smaller distance ranging from 2cm to 400cm.

CHAPTER 01

INTRODUCTION

There are several ways to measure distance without contact. One way is to use ultrasonic waves at 40 kHz for distance measurement. Ultrasonic transducers measure the amount of time taken for a pulse of sound to travel to a particular surface and return as the reflected echo. This circuit calculates the distance based on the speed of sound at 25°C ambient temperature and shows it on a 7-segment display. Using it, you can measure distance up to 4 meters.

Linear measurement is a problem that a lot of applications in the industrial and consumer market segment have to contend with. Ultrasonic technology is one of the solutions used by the industry. However, an optimized balance between cost and features are a must for almost all target applications. The ultrasonic distance measurer (UDM) is used mainly when a non-contact measurer is required.

A Distance meter is used to measure the distance between two objects. Ultrasonic Distance Measurement working principle is based on ultrasonic waves. As the human ear's audible perception range is 20 Hz to 20 kHz, it is insensitive to ultrasonic waves, and hence the ultrasound waves can be used for applications in industries/vehicles without hindering human activity. The distance can be measured using pulse echo and phase measurement method. The signal is transmitted by an ultrasonic transducer, reflected by an obstacle and received by another transducer where the signal is detected. The time delay of the transmitted and the received signal corresponds to the distance between the system and the obstacle.

The speed which sound travels depends on the medium which it passes through. In general, the speed of sound is proportional (the square root of the ratio) to the stiffness of the medium and its density. This is a fundamental property of the medium. Physical properties and the speed of sound change with the conditions in the environment. The speed of sound in the air depends on the temperature. In the air speed are approximately 345 m/s, in water 1500 m/s and in a bar of steel 5000 m/s.

A common use of ultrasound is for range finding. This use is also called sonar. Sonar works similarly to radar. An ultrasonic pulse is generated in a particular direction. If there is an object in the way of this pulse, the pulse is reflected back to the sender as an echo and is detected. Measuring the difference in time between the pulse transmitted and the echo received, it is possible to determine how far away the object is. Bats use a variety of ultrasonic ranging (echolocation) to detect their prey.

Ultrasonic generators use piezoelectric materials such as zinc or lead zirconium tartrates or quartz crystal. The material thickness decides the resonant frequency when mounted and excited by electrodes attached on either side of it. The medical scanners used for abdomen or heart ultrasound are designed at 2.5MHz. In this circuit, a 40 kHz transducer is used for measurement in the air medium. The velocity of sound in the air is around 330 m/s at 0°C and varies with temperature.

CHAPTER 02

LITERATURE SURVEY

The development of the first light wave Electronic Distance Measurement (EDM) instrument is connected with the name of the Swedish scientist E.Bergstrand. He designed the First Geodetic meter (short form of GEOdetic distance METER) for the determination of the velocity of light in 1943.

The first EDM instrument using radio waves was developed by T.L. Wadley at the National Institute of Telecommunications Research of South Africa in 1954. It became available under the name Tellurometer in 1957. Its range exceeded that of the Geodimeter and it was therefore in much wider use until lasers were introduced in EDM late in the 1960's.

The first prototypes of short range EDM instruments (incorporating luminescence diodes) appeared in the mid 1960's (Tellurometer MA 100 in 1965; Zeiss SM 11 in 1967). These instruments have been commercially released since the late 1960's (Wi Id/Secret Distomat DI 10 in 1968; Tellurometer MA 100 in 1969; Zeiss SM 11 in 1970). Short range instruments with infrared (I R) light sources are now increasingly used for all types of surveys; long range instruments are used for the measurement of geodetic networks.

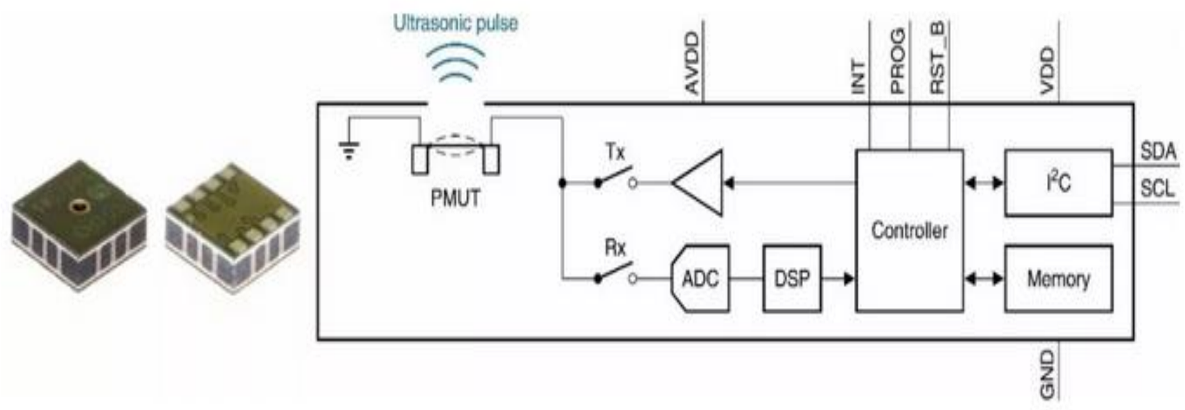

Fig (2.1) Worlds First ultrasonic time of flight sensor

The roots of ultrasonic technology can be traced back to research on the piezoelectric effect conducted by Pierre Curie around 1880. He found that asymmetrical crystals such as quartz and Rochelle salt (potassium sodium tartrate) generate an electric charge when mechanical pressure is applied. Conversely, mechanical vibrations are obtained by applying electrical oscillations to the same crystals.

One of the first applications for ultrasonic was sonar (an acronym for sound navigation ranging). It was employed on a large scale by the U.S. Navy during World War II to detect enemy submarines. Sonar operates by bouncing a series of high frequency, concentrated sound wave beams off a target and then recording the echo. Because the speed of sound in water is known, it is an easy matter to calculate the distance of the target. Prior to World War II researchers were inspired by sonar to develop analogous techniques for medical diagnosis. For example, the use of ultrasonic waves in detecting metal objects was discussed beginning in 1929. In 1931 a patent was obtained for using ultrasonic waves to detect flaws in solids.

Japan played an important role in the field of ultrasonic from an early date. For example, soon after the end of the war, researchers there began to explore the medical diagnostic capabilities of ultrasound. Japan was also the first country to apply Doppler ultrasound, which detects internal moving objects such as blood flowing through the heart.

In the 1950s researchers in the United States and Europe became increasingly aware of the progress that had been made in Japan, and they began work on additional medical applications. The first ultrasonic instruments displayed their results with blips on an oscilloscope screen. That was followed by the use of two-dimensional, gray scale imaging. High resolution, color, computer-enhanced images are now common,

Ultrasonic technology is now employed in a wide range of applications in research, industry and medicine.

CHAPTER 03

PROPOSED METHODOLOGY

Ultrasonic generators use piezoelectric materials such as zinc or lead zirconium tartrates or quartz crystal. The material thickness decides the resonant frequency when mounted and excited by electrodes attached on either side of it. The medical scanners used for abdomen or heart ultrasound are designed at 2.5MHz. In this circuit, a 40kHz transducer is used for measurement in the air medium. The velocity of sound in the air is around 330 m/s at 0°C and varies with temperature.

In this project, we excite the ultrasonic transmitter unit with a 40kHz pulse burst and expect an echo from the object whose distance we want to measure transmitted burst, which lasts for a period of approximately 0.5ms. It travels to the object in the air and the echo signal is picked up by another ultrasonic transducer unit (receiver), also a 40 kHz pre-tuned unit. The received signal, which is very weak, is amplified several times in the receiver circuit and appears somewhat as shown figure when seen on a CRO.

Weak echoes also occur due to the signals being directly received through the side lobes. These are ignored as the real echo received alone would give the correct distance. That is why we should have a level control. Of course, the signal gets weaker if the target is farther than 2.5 meters and will need a higher pulse excitation voltage or a better transducer.

Here the microcontroller is used to generate 40 kHz sound pulses. It reads when the echo arrives; it finds the time taken in microseconds for to-and-fro travel of sound waves. Using velocity of 333 m/s, it does the calculations and shows on the four 7-segment displays the distance in centimeters and millimeters (three digits for centimeters and one for millimeters).

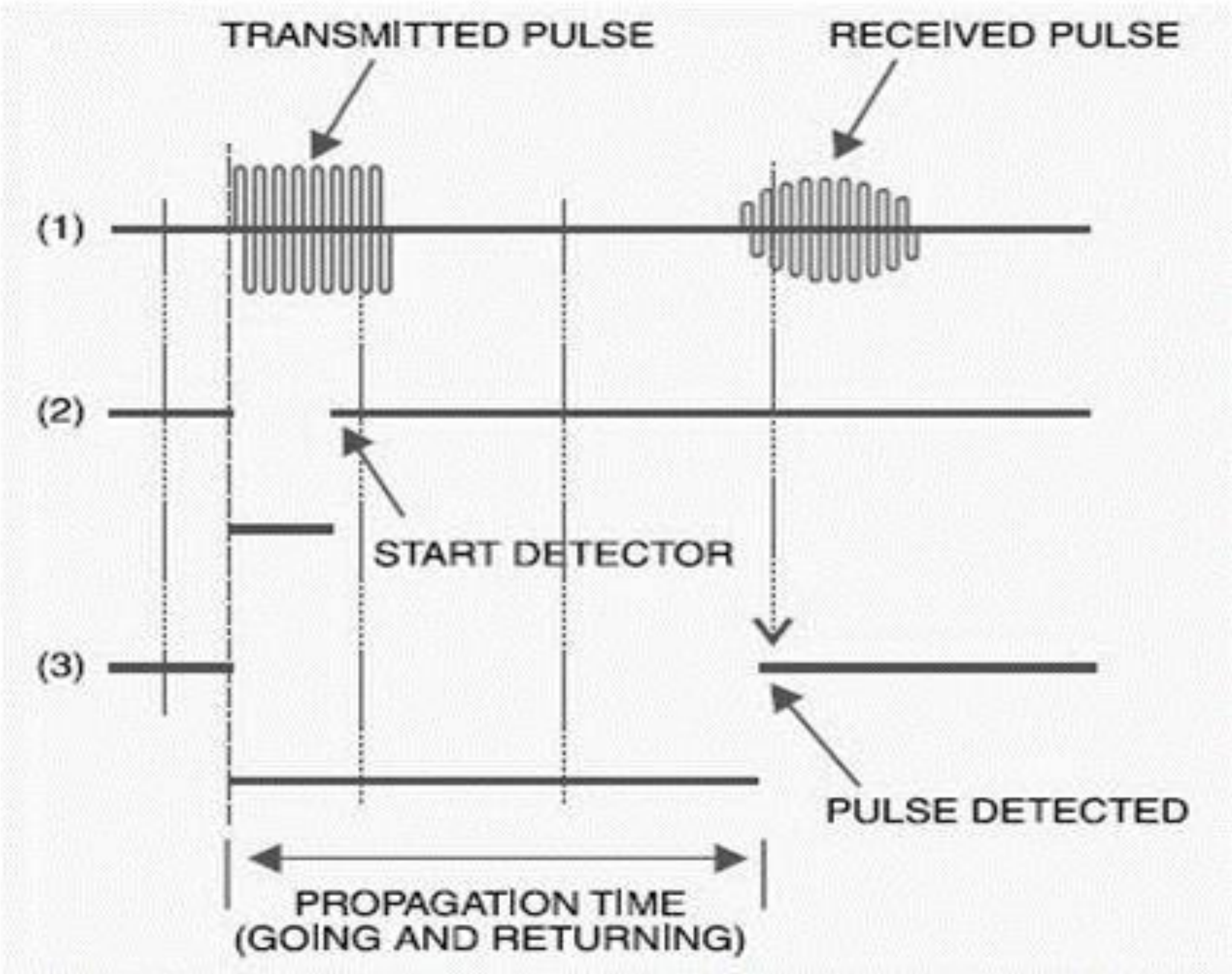

Fig (3.1) The ultrasonic pulse, echo signal and time measurement

Ultrasonic sensors can measure the following parameters without contacting the medium to be measured

- Distance
- Level
- Diameter
- Presence
- Position

Ultrasonic sensors make accurate measurements in many difficult environments and unusual materials.

Measurements are unaffected by:

•Material

•Surface

•Light

•Dust

•Mist and Vapor

To measure the distance of a sound signal transmitted, it needs to be reflected. This sound signal is a longitudinal sound wave that strikes a flat surface. Sound is then reflected, provided that the dimension of the reflective surface is large compared to the wavelength of the sound.

First of all, we need to trigger the ultrasonic sensor module to transmit signal by using Arduino and then wait for receive ECHO. Arduino reads the time between triggering and Received ECHO. We know that speed of sound is around 340m/s. so we can calculate distance by using given formula:

Distance = (T/2) *S

Where

S = speed of sound around 340m per second.

T = travel time.

Distance

The shorter the distance from the ultrasonic sensor to an object, the stronger the returning echo is. Therefore, as the distance increases, the object requires better reflective characteristics to return a sufficient echo.

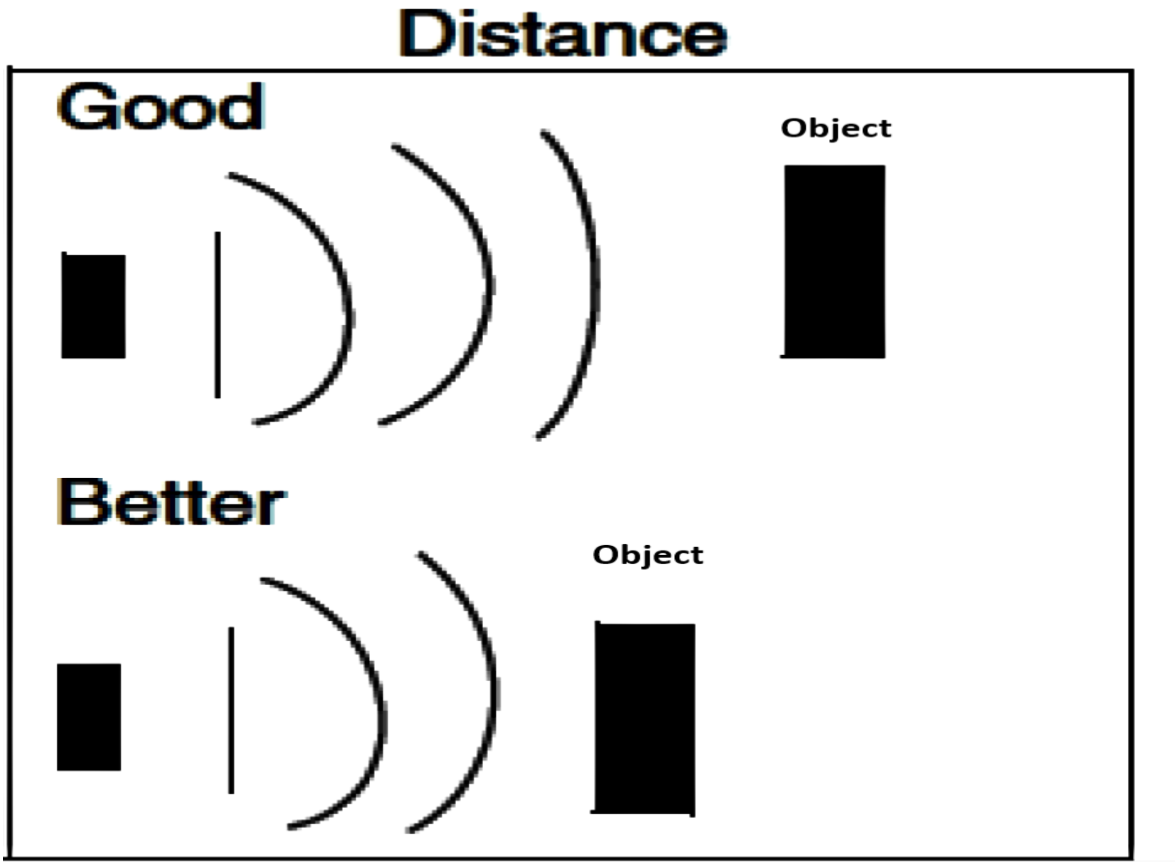

Fig (3.2) Reflection cases

CHAPTER 04

PROJECT DESCRIPTION

4.1 Software Description

Arduino IDE is an open source software that is mainly used for writing and compiling the code into the Arduino Module.

It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process.

It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment.

A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more.

Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code.

The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board.

The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module.

This environment supports both C and C++ languages.

The Arduino software is open-source. The source code for the Java environment is released under the GPL and the C/C++ microcontroller libraries are under the LGPL.

Sketch: The first new terminology is the Arduino program called “sketch”.

Structure

Arduino programs can be divided in three main parts: Structure, Values (variables and constants), and Functions. In this tutorial, we will learn about the Arduino software program, step by step, and how we can write the program without any syntax or compilation error.

Software structure consist of two main functions:

1. Setup( ) function
2. Loop( ) function

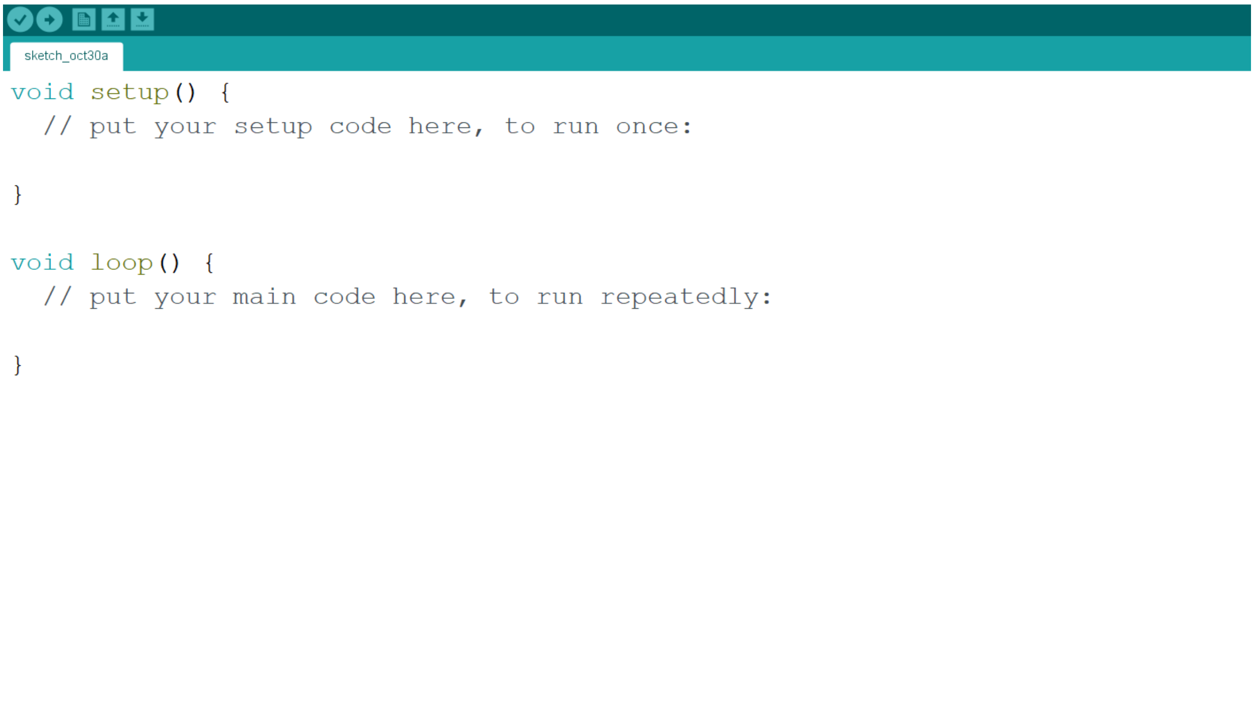

Fig (4.1.1) Software Window

4.2 Hardware Description

Circuit Diagram

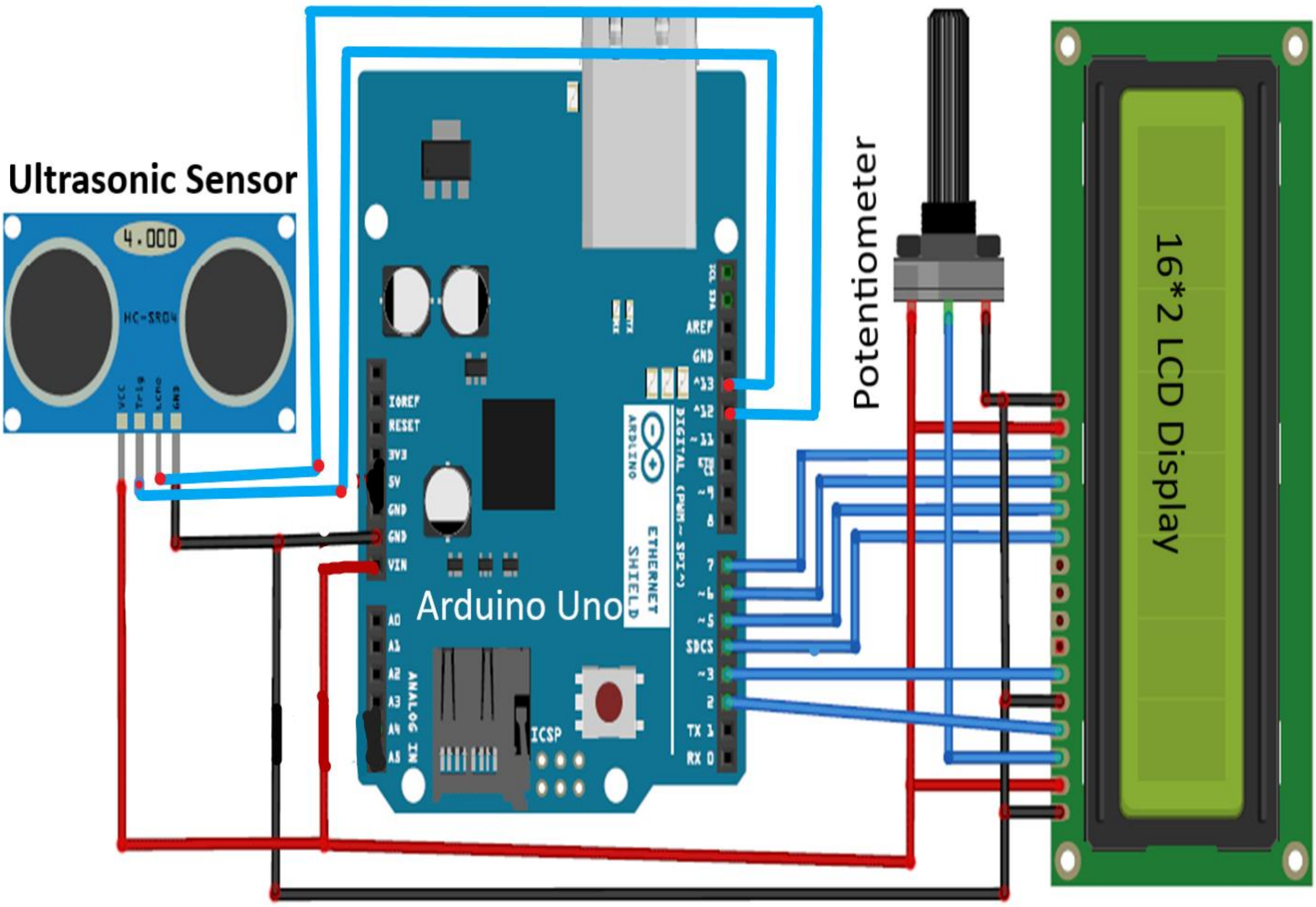

Fig (4.2.1) Project Circuit Diagram

Block Diagram

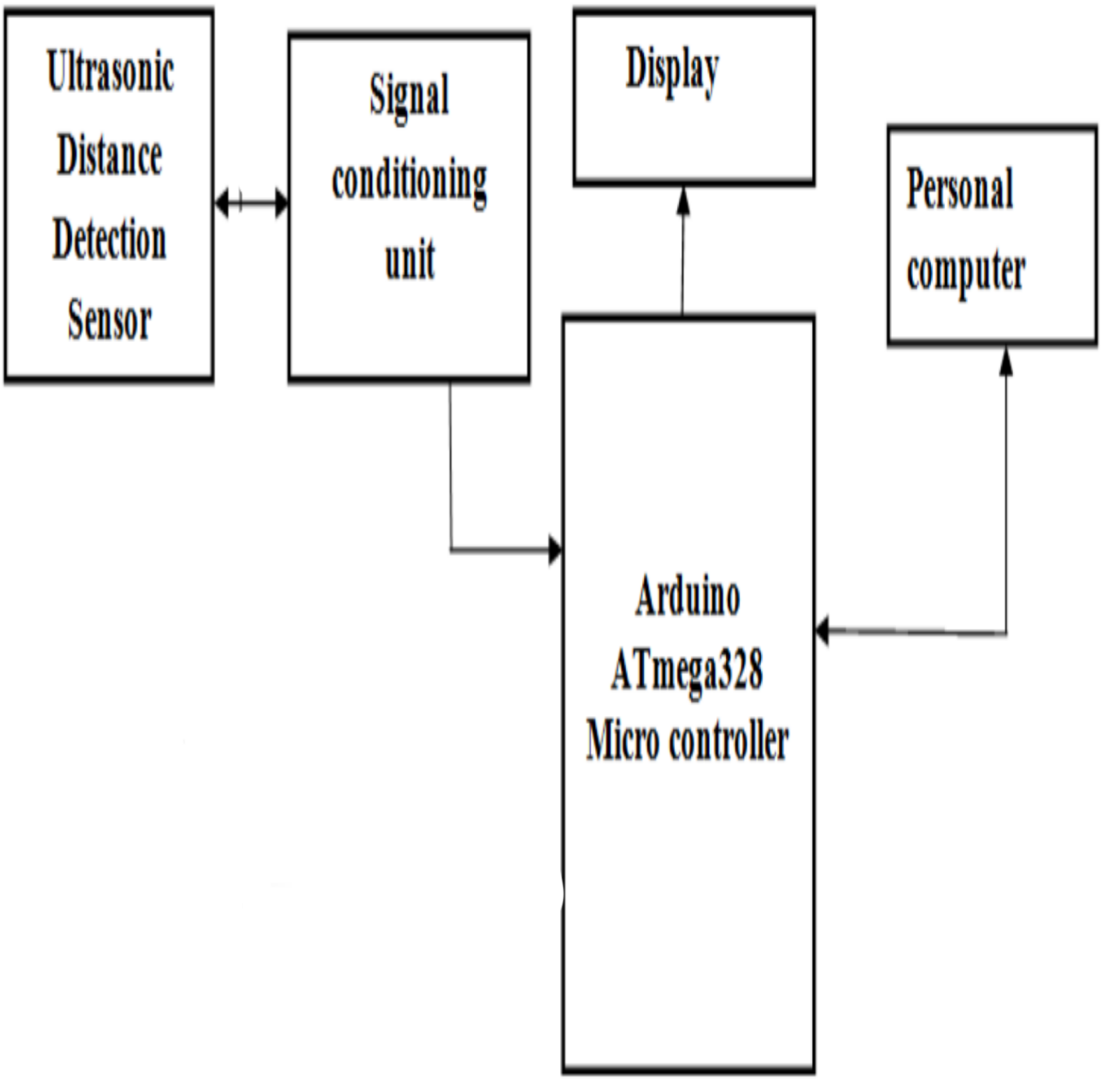

Fig (4.2.2) Block Diagram

Circuit Connections

- The circuit diagram for Arduino and ultrasonic sensor is shown above to measure the distance. The battery positive terminal is connected to Vin of the Arduino board and negative terminal is connected to GND of the Arduino. We Can connect power supply through Programing USB Cable.
- In circuit connections Ultrasonic sensor module's "trigger" and "echo" pins are directly connected to pin 13 and 12 of Arduino.
- A 16x2 LCD is connected with Arduino in 4-bit mode. Control pin RS, RW and En are directly connected to Arduino pin 2, GND and 3.
- And data pin of D4,D5,D6,D7 is connected to 4, 5, 6 and 7 of Arduino.
- Vcc and GND of LCD are connected to Battery.
- Potentiometer middle pin is connected to 5^{th} pin of LCD. Which will control the contrast of LCD. Another two pins are connected to Vcc and GND of the battery.

Components Used

1. Arduino Uno
2. Ultrasonic Sensor Module
3. 16*2 LCD Display
4. Potentiometer
5. Switch and Wires

Description of Components

1. Arduino Uno

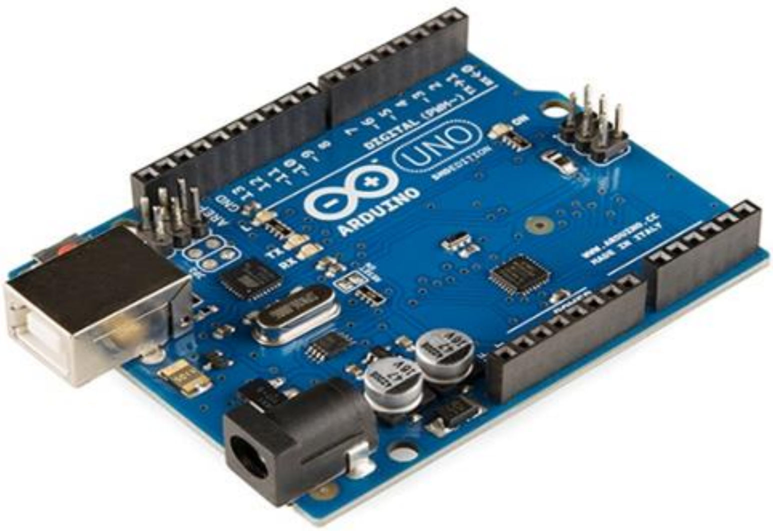

Fig (4.2.3) Arduino Uno

Overview

The Arduino Uno is a microcontroller board based on the ATmega328 Microcontroller. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

Revision 3 of the board has the following new features:

- Pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins are placed near to the RESET pin. The IOREF that allow the shields to adapt the voltage provided from the board. In future, the shields will be compatible both with the board that use the AVR, which operate with 5Volts and with the Arduino Uno Due that operate with 3.3Volts. The second pin is a not connected pin, that is reserved for further purposes.
- It has stronger Reset Circuit
- Atmega 8U2 is replaced by the 16U2

Summary

I.	Microcontroller	ATmega328p
II.	Operating Voltage	5Volts
III.	Input Voltage (recommended)	7-12Volts
IV.	Input Voltage (limits)	6-20Volts
V.	Digital I/O Pins	14 (6 is PWM output)
VI.	Analog Input Pins	6
VII.	DC Current per I/O Pin	40 mAmps
VIII.	DC Current for 3.3V Pin	50 mAmps
IX.	Flash Memory	32 KB of microcontroller of which 0.5 KB used by bootloader
X.	SRAM	2 KB (microcontroller)
XI.	EEPROM	1 KB (microcontroller)
XII.	Clock Speed	16 MHz

Input and Output

All the 14 digital pins on the Arduino Uno can be used as an input or output pins , using pinMode( ), digitalWrite( ), and digital Read( ) functions. They work at 5 volts. Each pin can send or receive a maximum of 40 mAmps and has an internal pull-up resistor of 20-50kOhms. In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX). They are used to receive (RX) and transmit (TX) TTL serial data. These pins can be connected to the corresponding pins of the ATmega328p USB-to-TTL Serial chip.
- External Interrupts: 2 and 3. These are the pins that can be configured to trigger an interrupt on a low value, a rising or a falling edge, or a change of the value.
- PWM: pins 3, 5, 6, 9, 10, and 11. They will provide 8-bit PWM output with the analogwrite ( ) function in the programming.
- SPI: pin 10 (SS), 11 (MOSI), 12 (MISO), and 13 (SCK). These are the pins that support SPI communication using the SPI library.
- LED: 13. There is a built in LED connected to digital pin 13 to indicate high or low value. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- The Arduino Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of values (i.e. 1024 different values). By default, they measure from 0 to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference ( ) function.

Additionally, some pins have specialized functionality

- TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.
- There are a couple of other pins on the board:
- AREF. Reference voltage for the analog inputs. Used with analog Reference ().
- Reset. Bring this connection LOW to reset the microcontroller. Typically used to add a reset button to shields which acts to block the one on the board.

2.Ultrasonic Sensor Module

Fig (4.2.4) Ultrasonic sensor

Ultrasonic sensors use sound to determine the distance between the sensor and the closest object in its path. How do ultrasonic sensors do this? Ultrasonic sensors are essentially sound sensors, but they operate at a frequency above human hearing.

The sensor sends out a sound wave at a specific frequency. It then listens for that specific sound wave to bounce off of an object and come back. The sensor keeps track of the time between sending the sound wave and the sound wave returning.

Specifications

The sensor chosen for the Ultrasonic distance measurement Project was the HCSR04.This section contains the specifications and why they are important to the sensor module. The sensor modules requirements are as follows

- Cost
- Weight
- Community of hobbyists and support

- Accuracy of object detection
- Probability of working in a smoky environment
- Ease of use

The HCSR04 Specifications are listed below

- Power Supply: +5V DC
- Quiescent Current: <2mA
- Working current: 15mA
- Effectual Angle: <15º
- Ranging Distance: 4000cm
- Resolution: 0.3 cm
- Measuring Angle: 30º
- Trigger Input Pulse width: 10uS
- Dimension: 45mm x 20mm x 15mm

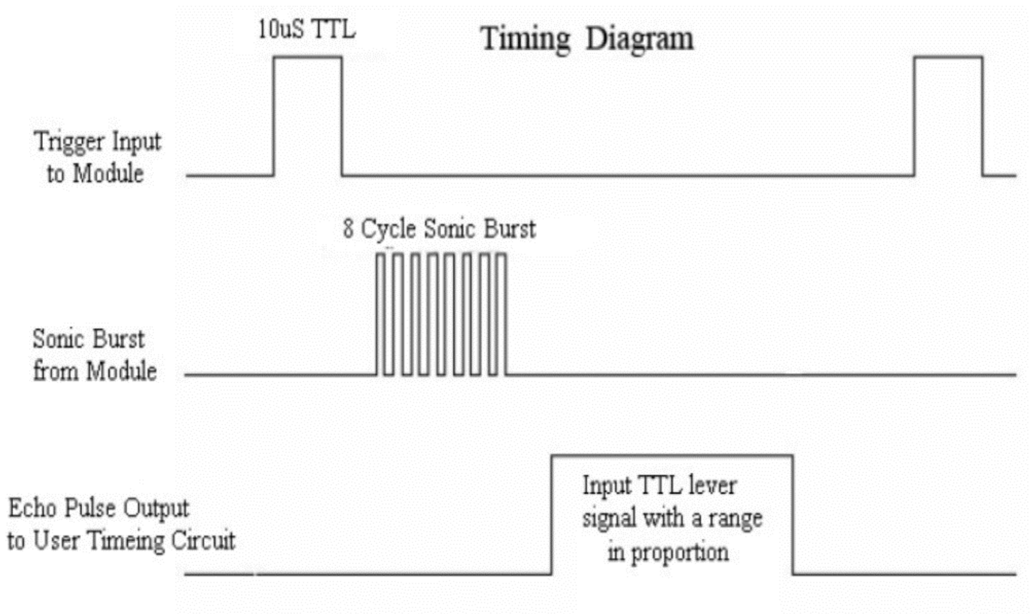

Fig (4.2.5) Timing Diagram

Timing chart

The Timing diagram is shown in figure 3. 10uS pulse is required to the trigger input and start the ranging, and then the module will send out an 8 cycle burst of ultrasound at 40 kHz and raise its echo. The Echo is a distance object that is pulse width and the range in proportion. Then calculate the range through the time interval between sending trigger signal and receiving echo signal. We suggest to use over 60ms measurement cycle, in order to prevent trigger signal to the echo signal. There are only four connections, +5v, Gnd, trigger and Echo.

The HCSR04 can be triggered to send out an ultrasonic burst by setting the TRIG pin to HIGH. Once the burst is sent the ECHO pin will automatically go HIGH. This pin will remain HIGH until the burst hits the sensor again. You can calculate the distance to the object by keeping track of how long the ECHO pin stays HIGH. The time ECHO stays HIGH is the time the burst spent traveling. Using this measurement in equation 1 along with the speed of sound will yield the distance travelled. A summary of this is listed above.

The HCSR04 has 4 pins: VCC, GND, TRIG and ECHO.

1. VCC is a 5v power supply. This should come from the microcontroller
2. GND is a ground pin. Attach to ground on the microcontroller.
3. TRIG should be attached to a GPIO pin that can be set to HIGH
4. ECHO is a little more difficult.

The HCSR04 outputs 5v, which could destroy many microcontroller GPIO pins (the maximum allowed voltage varies). In order to step down the voltage use a single resistor or a voltage divider circuit. Once again, this depends on the specific microcontroller you are using, you will need to find out its GPIO maximum voltage.

Working of ultrasonic sensor

The Ultra Sonic sensor works as a burst signal is transmitted for short duration (is emitted) by the emitter. After that there will be a silent period. This period is actually called “response time” and is the time waiting for reflected waves. The acoustic emitted signal may find an obstacle or not. If an obstacle is found, the acoustic signal will be bounced back from the obstacle. This back bounced signal is called “echo”. The echo is received by the receiving transducer and is converted into electrical signal. Usually this signal is amplified, filtered and can be converted into digital form. Using the elapsed time between transmission and reception, the distance between the Ultra Sonic system and obstacle/object can be calculated.

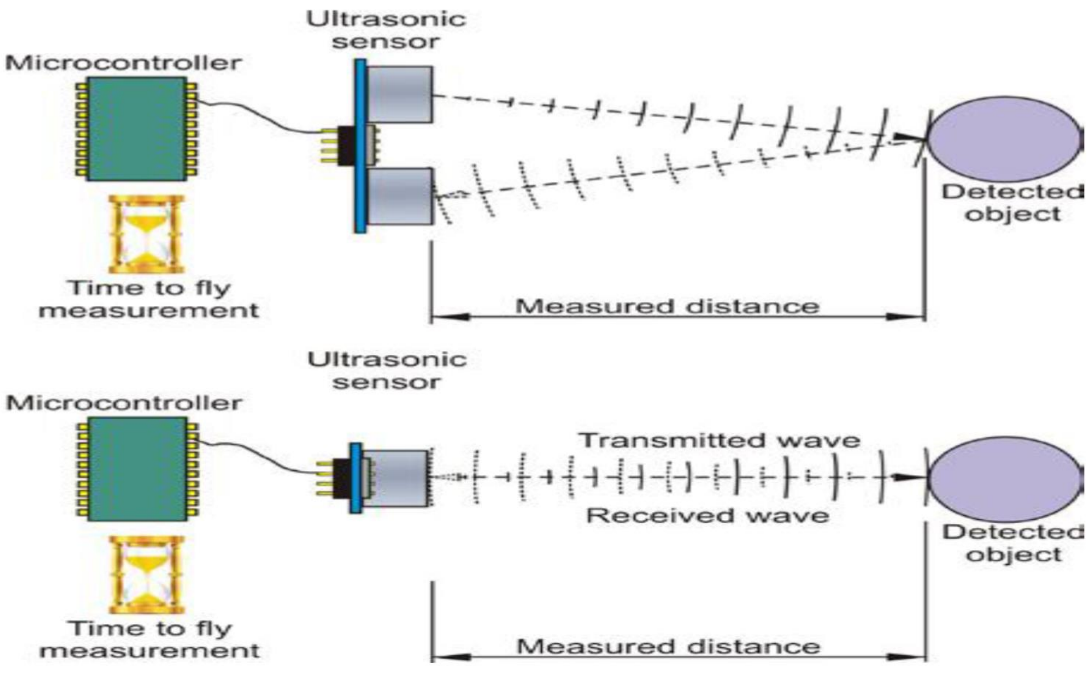

Fig (4.2.6) Ultrasonic Signal Transmission

3. 16*2 LCD Display

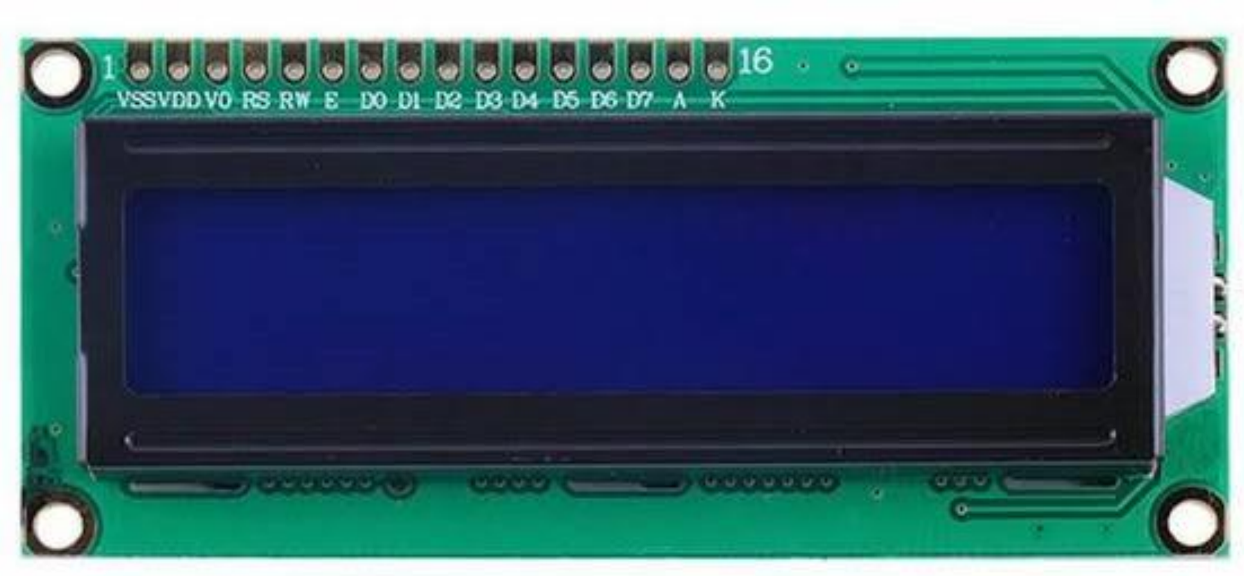

Fig (4.2.7) 16*2 LCD Display

This is an LCD Display designed for E-blocks. It is a 16 character, 2-line alphanumeric LCD display connected to a single 9-way D-type connector. This allows the device to be connected to most E-Block I/O ports.

The LCD display requires data in a serial format, which is detailed in the user guide below. The display also requires a 5V power supply. Please take care not to exceed 5V, as this will cause damage to the device. The 5V is best generated from the E-blocks Multiprogram or a 5V fixed regulated power supply.

The potentiometer RV1 is a contrast control that should be used to adjust the contrast of the display for the environment it is being used in.

Features

· E-blocks compatible

· Low cost

· Compatible with most I/O ports in the E-Block range

· Ease to develop programming code using Flow code icons.

The PIC micro board uses pins 1 - 6 on the 9-way D-type connector to program the LCD, as shown in the circuit diagram below. When the LCD board is turned on, data can only be sent to it after 30ms, this is the time taken for the LCD to initialize [as it clears all the RAM and sets up the Entry Mode].

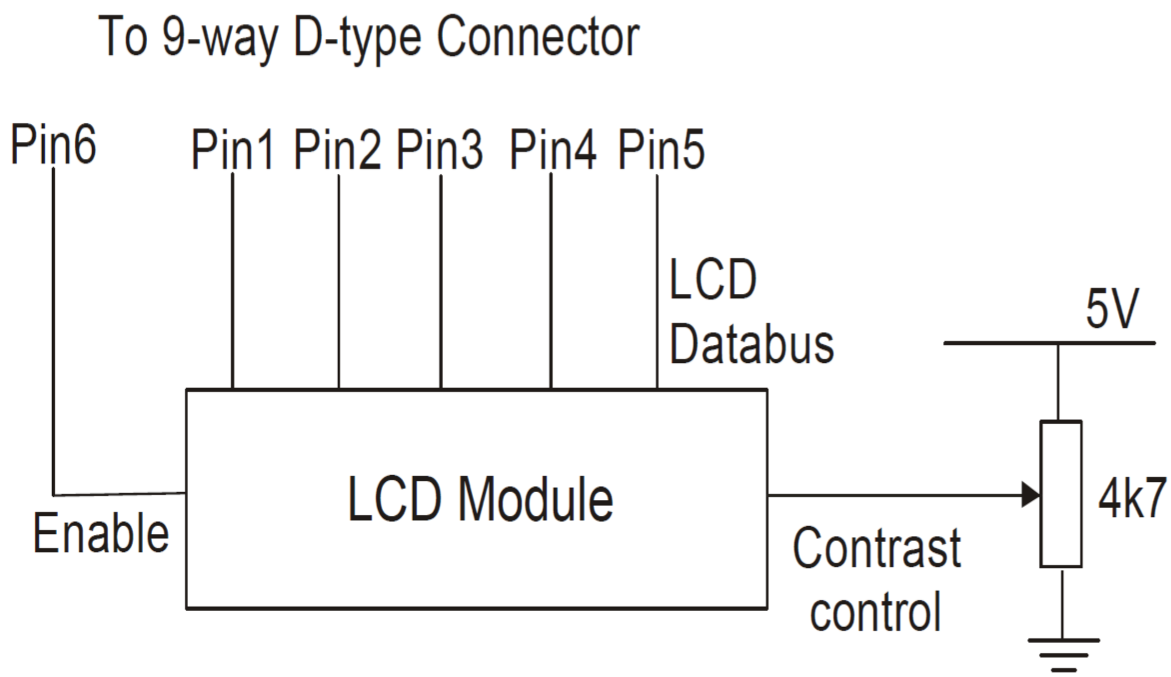

Fig (4.2.8) LCD block diagram

To send a command to the LCD, data must be sent in two steps, the MSB followed by the LSB [byte is data on pins 1 - 4]. As each byte is sent to the LCD, B5 must be go high then low, for the LCD to acknowledge the byte. After the second byte has been acknowledged the LCD executes the command. The PIC micro board must wait for at least the length of the execution time for that command, before the next command can be sent.

4. Potentiometer

Fig (4.2.9) Potentiometer

Potentiometers also known as POT, are nothing but variable resistors. They can provide a variable resistance by simply varying the knob on top of its head. It can be classified based on two main parameters. One is their **Resistance (R-ohms)** itself and the other is its **Power (P-Watts)** rating.

The value or resistance decides how much opposition it provides to the flow of current. The greater the resistor value the smaller the current will flow. Some standard values for a potentiometer are 500Ω, 1K, 2K, 5K, 10K, 22K, 47K, 50K, 100K, 220K, 470K, 500K, 1 M.

Resistors are also classified based on how much current it can allow; this is called Power (wattage) rating. The higher the power rating the bigger the resistor gets and it can also more current. For potentiometers the power rating is 0.3W and hence can be used only for low current circuits. The diagram shows the parts present inside a potentiometer. We have a resistive track whose complete resistance will be equal to the rated resistance value of the POT.

As the symbol suggests a potentiometer is nothing but a resistor with one variable end. Let us assume a 10k potentiometer, here if we measure the resistance between terminal 1 and terminal 3 we will get a value of 10k because both the terminals are fixed ends of the potentiometer. Now, let us place the wiper exactly at 25% from terminal 1 as shown above and if we measure the resistance between 1 and 2 we will get 25% of 10k which is 2.5K and measuring across terminal 2 and 3 will give a resistance of 7.5K.

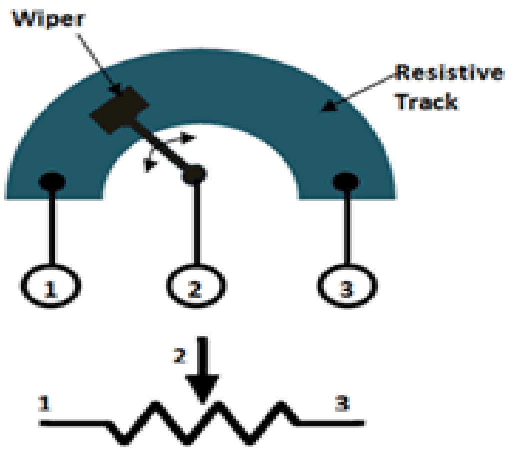

Fig (4.2.10) Potentiometer Pin Configuration

So the terminals 1 and 2 or terminals 2 and 3 can be used to obtain the variable resistance and the knob can be used to vary the resistance and set the required value.

Applications

- Voltage and Current Control Circuits
- Used as volume control knobs in radios
- Tuning or controlling circuits
- Analog input control knobs

In this project the potentiometer can be used to vary the contrast level of the 16*2 LCD.

The knob of the potentiometer is adjusted in such a way that the reading is observed in the LCD.

5. Switch and Wires

Fig (4.2.11) Switch

Fig (4.2.12) Multicolor ribbon wires

CHAPTER 05

RESULT AND DISCUSSION

By using Ultrasonic distance measurement, we recorded the values

Distance Measured using Scale in cm	Distance Measured Using Ultrasonic Sensor	
	In cm	In Meters
10	10.017	0.10
20	20.031	0.2
30	30.066	0.3

Table (5.1) Observation of measured distances

After going through all the hard times of completing the Ultrasonic Range Finder, the brief experience has opened our eyes to a wider world. For all the mistakes that we have made and the number of dead ends that we have accidentally trapped in. It is with pride that our team announces the completion of this project according to the requirement of objectives that have been stated in the early chapters.

Through this project, we have gained a lot of knowledge in Arduino UNO and its related family especially on how to use the capture features and controlling the input-output ports and timers. A lot of valuable information also obtained during this project which is not taught in classes through 1 year of study. Besides, other skills such as communication, problem-solving, self-learning skills and self-working ability have been developed in our minds while achieving this project.

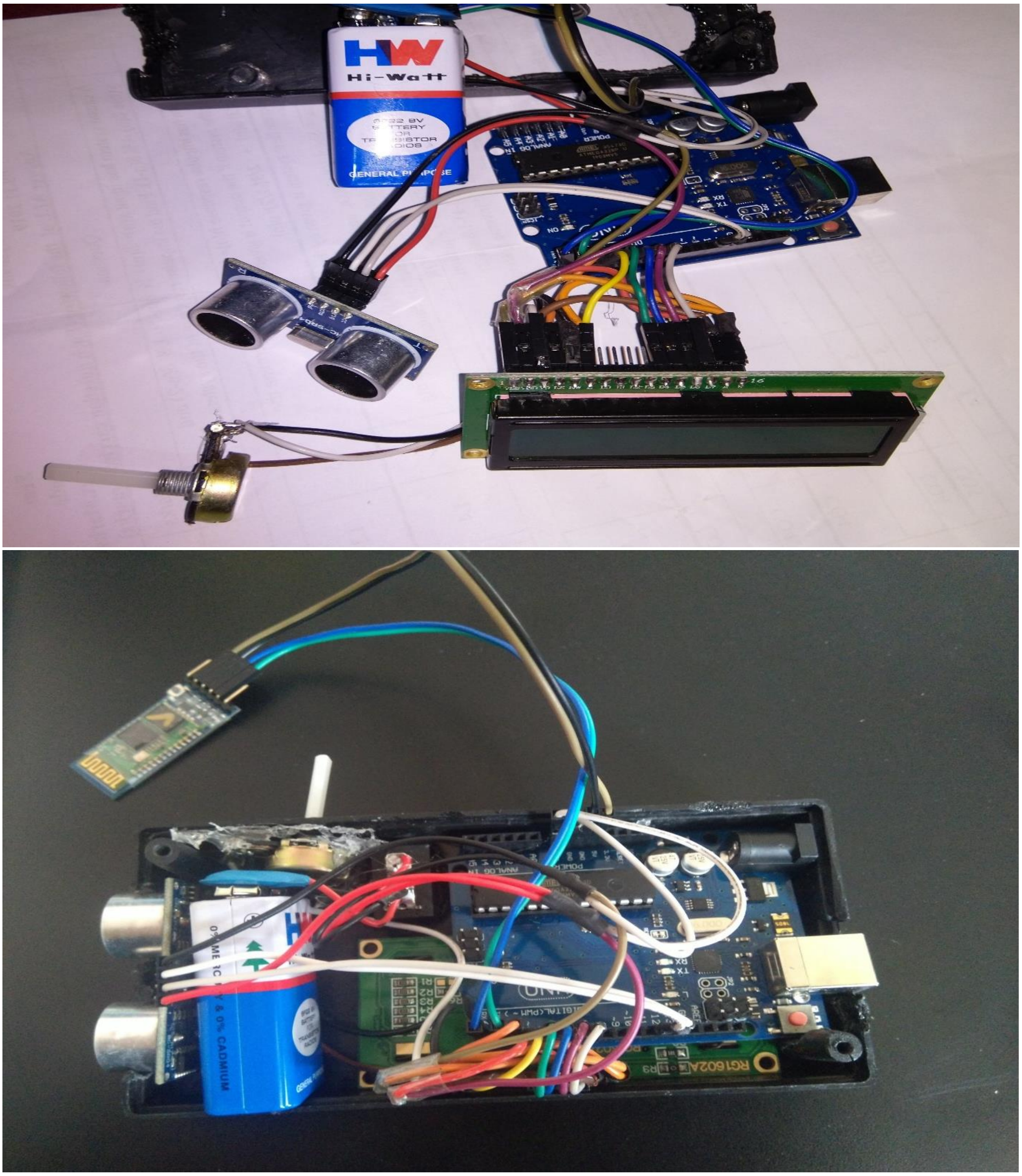

Fig (5.1) General Pictures of Project

CHAPTER 06

CONCLUSION AND FUTURE SCOPE

Conclusion

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.

Future Scope

I. Ultrasonic technology can be used to detect moving object on the basis of Doppler frequency shift principle using sensor with high rang mounting on a stepper motor. Hence it acts as radar. This type of ultrasonic radar can also be used in navigation and civilian applications and military.

II. The sound wave propagation speed in air changes with the ambient temperature. So if we want to get precise results, some modification can be made at receiver circuit and microcontroller to detect temperatures around. The temperature control results also can be displayed on LCD to show the complete task of sending and receiving the waves.

III. When applied the Ultrasonic Range Finder on a car a buzzer or a beeper which is a signaling device can be used to show the distance of the car with the obstacles behind it. The faster tone of the beep of buzzer means the distance of obstacles and car are closer.

IV. New prototyping hardware & capability & interfacing with other consumer elantrine/tv/smartphones & flooding of shields.

V. Mining equipment's may require where entail.

VI. Already compatible with many major simulation software like MATLAB & lab view, we may see even move flexible programming environment & development option

VII. Using temp. Compensation, it can be used over wide temp range.

VIII. Height measurement, agriculture veiled, collision /protection can be other application.

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APPENDIX

Programming code used for the project

```
#include <LiquidCrystal.h>            // includes the Liquid Crystal Library

LiquidCrystal lcd(2,3,4,5,6,7);       // Creates an LCD object. Parameters:
                                        (rs, enable,  d4,d5, d6, d7)

#define trigPin 13                    // Defining the pins of ultrasonic Sensor

#define echoPin 12

long timet;                           // Initializes the time

float distancecm,distancem;           // Initilizing the measured distance


void setup()

{

  lcd.begin(16,2);                    // Initializes the interface to the LCD screen, and
                                   specifies the dimensions (width and height) of the display

  lcd.setCursor(0,0);                 // Sets the location at which subsequent text written to the
                                        LCD will be displayed

  lcd.print("Ultrasonic Dista");

  lcd.setCursor(0,1);

  lcd.print("nce Measurement");

  delay(4000);

  lcd.setCursor(0,0);

  lcd.print("Guided By:-       ");
```

```
    lcd.setCursor(0,1);
    lcd.print("Puvirajan       ");
    delay(4000);
    Serial.begin (9600);
    pinMode(trigPin, OUTPUT);
    pinMode(echoPin, INPUT);
   }

void loop()
{
    digitalWrite(trigPin, LOW);              // Trigering the sound signal
    delayMicroseconds(2);
    digitalWrite(trigPin, HIGH);
    delayMicroseconds(10);
    digitalWrite(trigPin, LOW);
     timet = pulseIn(echoPin, HIGH);         // Measuring the travelled time
    distancecm= (timet*0.034/2);
    distancem = (distancecm/100);
    lcd.setCursor(0,0);                      // Sets the location at which subsequent text
                                                written to the LCD will be displayed
    lcd.print("MeasuredDistance: ");         // Prints string Measured Distance on the LCD

    lcd.setCursor(0,1);
```

```
    lcd.print(distancecm);                    // Prints the distance value from the sensor

    lcd.setCursor(6,1);

    lcd.print("cm");

    lcd.print("    ");

    lcd.setCursor(10,1);

    lcd.print(distancem);

    lcd.print("m  ");

    Serial.println(" distance = ");

    Serial.print(distancecm);

    Serial.print("cm");

    Serial.print(distancem);

    Serial.print(" M");

    Serial.print("          ");

    delay(2000);

}
```