A MINI PROJECT ON :-

DISTANCE MEASURMENT

USING

ARDUINO UNO R3

Submitted by

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T.E. (SEM V)

Department:- MECHANICAL ENGINEERING

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UNIVERSITY OF MUMBAI

GUIDED BY:

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YADAVRAO TASGAONKAR COLLEGE OF ENGINEERING AND MANAGEMENT

Certificate

This is to certify that this report entitled

'DISTANCE MEASUREMENT'

Submitted by the following students of **MECHANICAL DEPARTMENT** *in the academic year 2016-2017 towards the practical fulfillment in the requirements in* **'MECHANICAL MEASUREMENTS AND CONTROLS'**

Submitted by

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Throughout their tenure of completion of task they have been guided by me, I am satisfied that contribution was proportionate, they were satisfactory and their task is up to standard by University of Mumbai.

Date:- Place:-

(Project Guide)	Principal	(Head of Department)
Prof. NITIN NANDESHWAR	**Dr. A. K. SEN**	**Prof. R. K. AGARWAL**

TABLE OF CONTENT

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We are highly indebted to ***Prof. Nitin Nandeshwar*** for his guidance and constant supervision as well as for providing necessary information regarding the project & also for his support in completing the project.

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Ours thanks and appreciations also go to my colleague in developing the project and people who have willingly helped me out with their abilities."

INTRODUCTION

Arduino is composed of two major parts: the Arduino board, which is the piece of hardware you work on when you build your objects; and the Arduino IDE, the piece of software you run on your computer. You use the IDE to create a sketch (a little computer program) that you upload to the Arduino board.

Figure: Arduino Development Module

The first Arduino was introduced in 2005, aiming to provide an inexpensive and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

Hardware An official Arduino Uno with descriptions of the I/O locations An early Arduino board with anRS-232 serial interface (upper left)and an Atmel ATmega8 microcontroller chip (black, lower right); the 14 digital I/O pins are located at the top and the six analog input pins at the lower right. An Arduino board consists of an Atmel 8-, 16- or

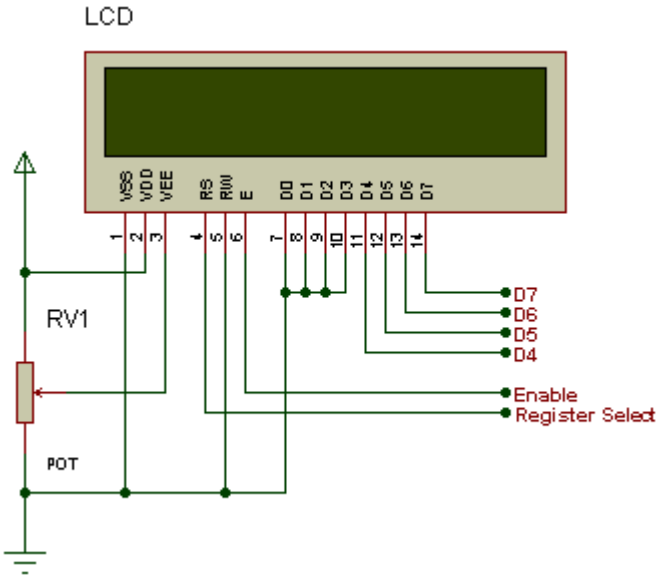
32-bit AVR microcontroller with complementary components that facilitate programming and incorporation into other circuits. An important aspect of the Arduino is its standard connectors, which lets users connect the CPU board to a variety of interchangeable add-on modules known as shields, Some shields communicate with the Arduino board directly over various pins, but many shields are individually addressable via an I²C serial bus—so many shields can be stacked and used in parallel.

Official Arduino shave used the mega AVR series of chips, specifically the ATmega 8 , ATmega168 ,ATmega328 , ATmega1280 , and ATmega2560 .A handful of other processors have been used by Arduino compatibles. Most boards include a5 volt linear regulator and a 16 MHz crystal oscillator (or ceramic resonator in some variants), although some designs such as the LilyPad run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions.

An Arduino's microcontroller is also pre-programmed with about loader that simplifies uploading of programs to the on-chip flash memory , compared with other devices that typically need an external programmer . This makes using an Arduino more straightforward by allowing the use of an ordinary computer as the programmer. Currently, boot loader is the default boot loader installed on Arduino

➢ ALPHANUMERIC LCD DISPLAY (16 X2)

Order Code:-
LED008 16 x 2 Alphanumeric Display
FRM010Serial LCD Firmware (optional)



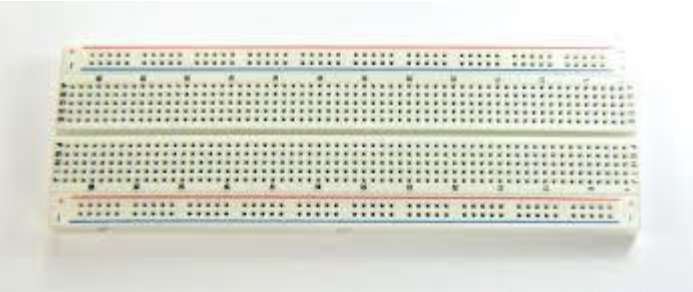
- **Content :**

1 x 16x2 Alphanumeric Display
1 x data booklet

- **Introduction :**

Alphanumeric displays are used in a wide range of applications, including palmtop computers, word processors, photocopiers, point of sale terminals, medical instruments, cellular phones, etc. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. A full list of the characters and symbols is printed on pages 7/8 (note these symbols can vary between brand of LCD used). This booklet provides all the technical specifications for connecting the unit, which requires a single power supply (+5V).

➢ Breadboard:



A **breadboard** is a construction base for prototyping of electronics. Originally it was literally a bread board, a polished piece of wood used for slicing bread.

In the 1970s the **solder less breadboard** (AKA **plug board**, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these. "Breadboard" is also a synonym for "prototype".

Because the solder less breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solder less breadboards are also extremely popular with students and in technological education. Older breadboard types did not have this property.

A strip board (Vero board) and similar prototyping printed circuit boards, which are used to build semi-permanent soldered prototypes or one-offs, cannot easily be reused. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs).

➢ Jump wires

Stranded 22AWG jump wires with solid tips

Jump wires (also called jumper wires) for solder less bread boarding can be obtained in ready-to-use jump wire sets or can be manually manufactured. The latter can become tedious work for larger circuits. Ready-to-use jump wires come in different qualities, some even with tiny plugs attached to the wire ends. Jump wire material for ready-made or homemade wires should usually be 22 AWG (0.33 mm^2) solid copper, tin-plated wire - assuming no tiny plugs are to be attached to the wire ends. The wire ends should be stripped $\frac{3}{16}$ to $\frac{5}{16}$ in (4.8 to 7.9 mm). Shorter stripped wires might result in bad contact with the board's spring clips (insulation being caught in the springs). Longer stripped wires increase the likelihood of short-circuits on the board. Needle-nose pliers and tweezers are helpful when inserting or removing wires, particularly on crowded boards.

Differently coloured wires and colour-coding discipline are often adhered to for consistency. However, the number of available colours is typically far fewer than the number of signal types or paths. Typically, a few wire colours are reserved for the supply voltages and ground (e.g., red, blue, black), some are reserved for main signals, and the rest are simply used where convenient. Some ready-to-use jump wire sets use the colour to indicate the length of the wires, but these sets do not allow a meaningful colour-coding schema.

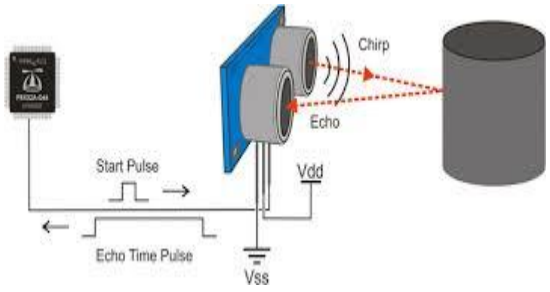
➢ Resistor:

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment. Practical resistors as discrete components can be composed of various compounds and forms. Resistors are also implemented within integrated circuits.

The electrical function of a resistor is specified by its resistance: common commercial resistors are manufactured over a range of more than nine orders of magnitude. The nominal value of the resistance falls within the manufacturing tolerance, indicated on the component.

➢ Ultrasonic Distance Sensor:



The Ultrasonic Sensor sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has 2 openings on its front. One opening transmits ultrasonic waves, (like a tiny speaker), the other receives them, (like a tiny microphone).

The speed of sound is approximately 341 meters (1100 feet) per second in air. The ultrasonic sensor uses this information along with the time difference between sending and receiving the sound pulse to determine the distance to an object. It uses the following mathematical equation:

Distance = Time X Speed of Sound divided by 2

Time = the time between when an ultrasonic wave is transmitted and when it is received
You divide this number by 2 because the sound wave has to travel to the object and back.

Why/When to use Ultrasonic Sensors ?

1. Ideally suited to accurate, automatic distance measurement in normal and difficult environments
2. Particularly suitable for environments where optical sensors are unusable such as smoke, dust and similar.
3. Very accurate, stable and can be used over large ranges.

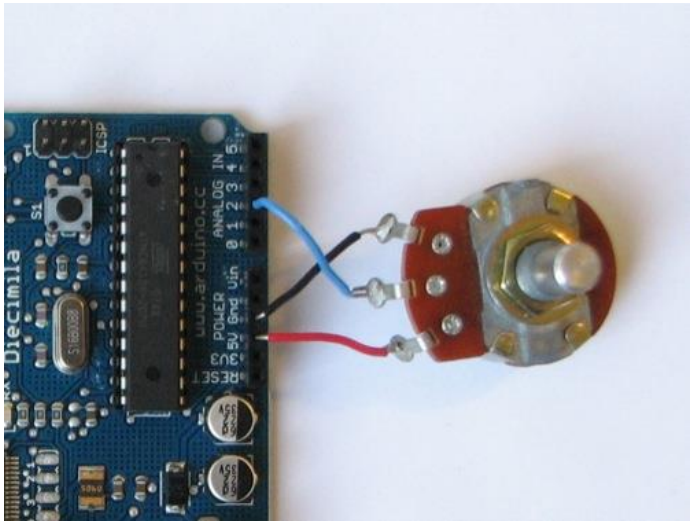
Ultrasonic sensors can measure the following parameters without contacting the medium to be measured:

- 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

➢ Potentiometer:



A potentiometer is a simple knob that provides a variable resistance, which we can read into the Arduino board as an analog value. In this example, that value controls the rate at which an LED blinks.

We connect three wires to the Arduino board. The first goes to ground from one of the outer pins of the potentiometer. The second goes from 5 volts to the other outer pin of the potentiometer. The third goes from analog input 2 to the middle pin of the potentiometer.

By turning the shaft of the potentiometer, we change the amount of resistance on either side of the wiper which is connected to the centre pin of the potentiometer. This changes the relative "closeness" that pin to 5 volts and ground, giving us a different analog input. When the shaft is turned all the way in one direction, there are 0 volts going to the pin, and we read 0. When the shaft is turned all the way in the other direction, there are 5 volts going to the pin and we read 1023. In between, analog Read() returns a number between 0 and 1023 that is proportional to the amount of voltage being applied to the pin.

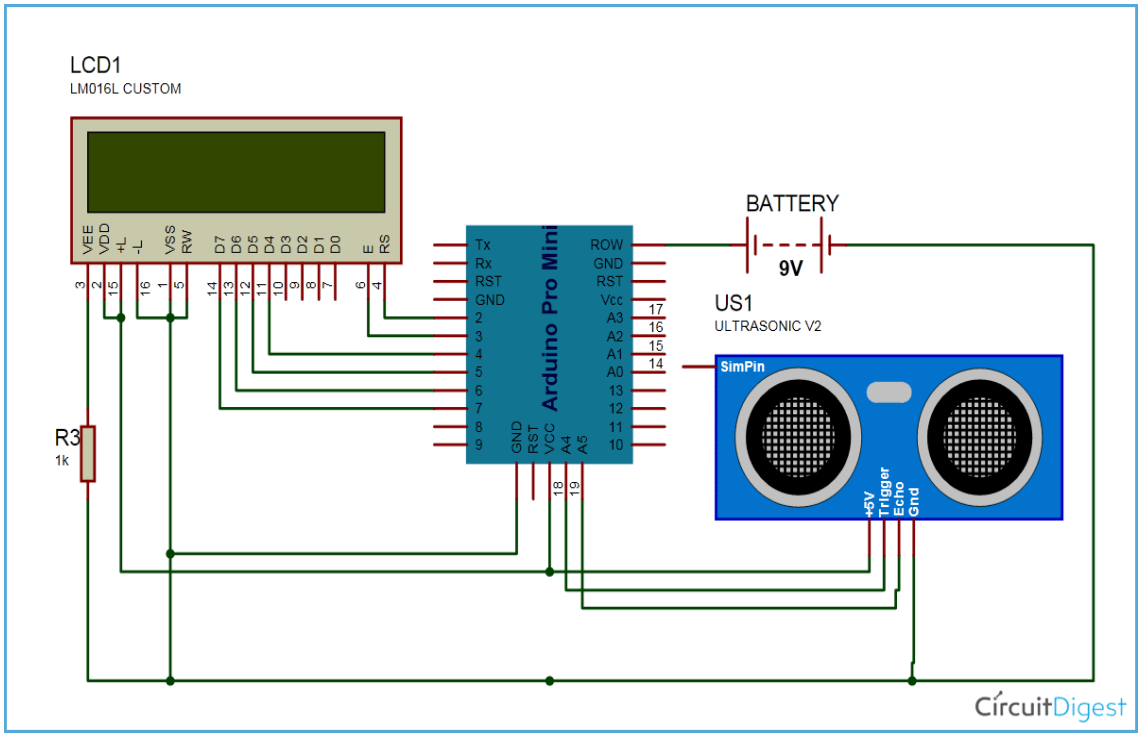
➢ Project information:

Ultrasonic sensors are great tools to measure distance without actual contact and used at several places like water level measurement, distance measurement etc. This is an efficient way to measure small distances precisely. In this project we have used an Ultrasonic Sensor to determine the distance of an obstacle from the sensor. Basic principal of ultrasonic distance measurement is based on ECHO. When sound waves are transmitted in environment then waves are return back to origin as ECHO after striking on the obstacle. So we only need to calculate the travelling time of both sounds means outgoing time and returning time to origin after striking on the obstacle. As speed of the sound is known to us, after some calculation we can calculate the distance.

➢ Circuit components:

1. Arduino UNO R3
2. Ultrasonic sensor Module
3. 16x2 LCD
4. Scale
5. Bread board
6. Connecting wires

➢ Circuit Diagram and Explanation:



In circuit connections Ultrasonic sensor module's "trigger" and "echo" pins are directly connected to pin 18(A4) and 19(A5) 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 D4-D7 is connected to 4, 5, 6 and 7 of arduino.

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= (travel time/2) * speed of sound

Where speed of sound around 340m per second.

A 16x2 LCD is used for displaying distance.

➢ Applications of this project:

- Useful for car while parking.

➢ Limitation of this circuit:

- Use for only short range what we input in circuit, not useful for wide range.
- Only provide distance less than or equal for given input range.

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THANK YOU