CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1: INTRODUCTION

In this modern era of industrialization most of the industries contain rotating objects such as motor, rotor etc for its proper monitoring its speed has to be measured and controlled. For such measurements, there are many methods and one of such method is use of tachometer. Tachometer is an instrument which measures the speed of any rotating objects in revolution per minute (RPM). There exist mechanical tachometers, where direct contact between motor and the tachometer is needed for measurement of RPM. This kind of tachometers requires regular maintenance and is complicated to use. These instruments suffer from wear and tear. Hence there is a requirement for a contactless digital tachometer which can be easily used with monitoring system. This paper is about contact-less digital tachometer designed using infrared methodology. It works on the principle that the number of times the IR receivertransmitter circuit is cut and re-established in a second gives the number of rotations per second. The value is displayed.

In this project, we have designed Digital Tachometer using IR Sensor with Arduino for measuring the number of rotations of rotating Motor in RPM. Simply we have interfaced IR sensor module with Arduino and 16*2 LCD module for display. The IR sensor module consists of IR Transmitter and Receiver in a single pair that can work a Digital Tachometer for speed measurement of any rotating object.

The Tachometer is an RPM counter which counts the no. of rotation per minute. There are two types of tachometer one mechanical and another one is digital. Here we are going to design an Arduino based digital tachometer using an IR sensor module to detect object for count rotation of any rotating body. IR transmits IR rays which reflect back to IR receiver and then IR Module generates an output or pulse which is detected by the Arduino controller when we press the start button. It counts continuously for 5 seconds.

Digital tachometers are preferable due to its better accuracy, no A/D conversion, less maintenance (as they are brushless) and noise immunity. A digital tachometer works on the principle of frequency measurement which has two distinct approaches which are –

(1) Measurement of elapsed time between successive pulses.

(2) Counting the number of pulses in a fixed period of time.

1.2: BACKGROUND

In olden days tachometers were completely mechanical, but tachometers have changed due to development of modern technology. The first mechanical tachometer was similar in operation to a centrifugal governor. The inventor of the first mechanical tachometer is assumed to be a German engineer Dietrich Uhlhorn; he used it for measuring the speed of machines in 1817. Since after then, it has been used to measure the speed of locomotives in automobiles, trucks, tractors and aircrafts. Early tachometer designs were based on the principle of mono stable multi vibrator, which has one stable state and one quasi stable state.

The circuit remained in a stable state, producing no output. However when it receives triggering current pulse from the ignition system, the circuit transitions to the quasi stable state for a given time before returning again to the stable state. This way, each ignition pulse produced a clean pulse of fixed duration that was fed to the gauge mechanism. The more of such fixed duration pulses the gauge received per second, the higher it read. The mono stable multi vibrator is still used in tachometers today, although the tendency is to use voltage pulses rather than current pulses, the latter requiring that the ignition coil current passes through the tachometer on its way to the coils. Later designs of tachometer were in no way to do any improvement on the early type; indeed the change seemed to have been made to be more economical. Integrated Circuit (IC) where in their infancy in the late 1960's and was both expensive and not proven to be robust in automobile applications.

CHAPTER 2: WORKING PRINCIPLE AND SYSTEM ARCHITECTURE

2.1: WORKING PRINCIPLE

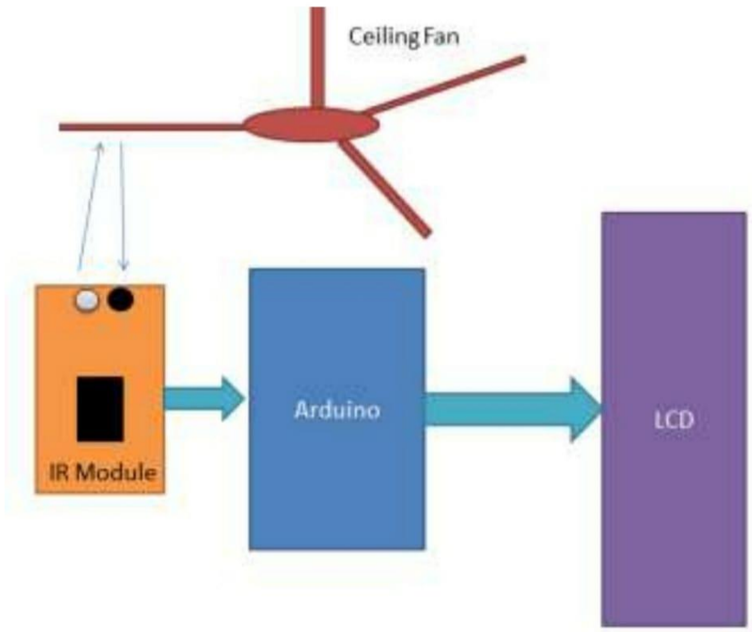

Fig.2.1 Working Principle of Digital Tachometer

Tachometer is an RPM counter which counts the no. of rotation per minute. There are two types of tachometer one mechanical and other one is digital. Here we have designed an Arduino based digital tachometer using IR sensor module to detect object for count rotation of any rotating body. As IR transmits IR rays which reflect back to IR receiver and then IR Module generates an output or pulse which is detected by the arduino controller when we press start button. It counts continuously for 5 seconds. After 5 seconds arduino calculate RPM for a minute using given formula. RPM= Count x 12 for single object rotating body. But here we demonstrate this project using ceiling fan. So we have done some changes that is given below: RPM=count / objects where object = number of blades in fan. The methodology employed in this work is shown in the Figure 2.1 above.

2.2: SYSTEM ARCHITECTURE

The system works mainly on infrared transmission principle. It has mainly controlling unit, sensing unit display unit and motor. The object of interest I.e. motor is placed in front of sensors. The sensor has IR LED and photodiode and the IR LED emits continuous beam of light rays. When motor starts rotating this light ray will be interrupted. The light ray will be rebound back and will be absorbed by the photodiode. This interruption of light ray is continuous in each and every rotation. This results in pulse of light ray that is fed to the microcontroller. The microcontroller counts the number of pulses and that in turn is the number of rotations. This obtained value will be displayed on the LCD screen. Tachometer using arduino is shown in figure 2.2.

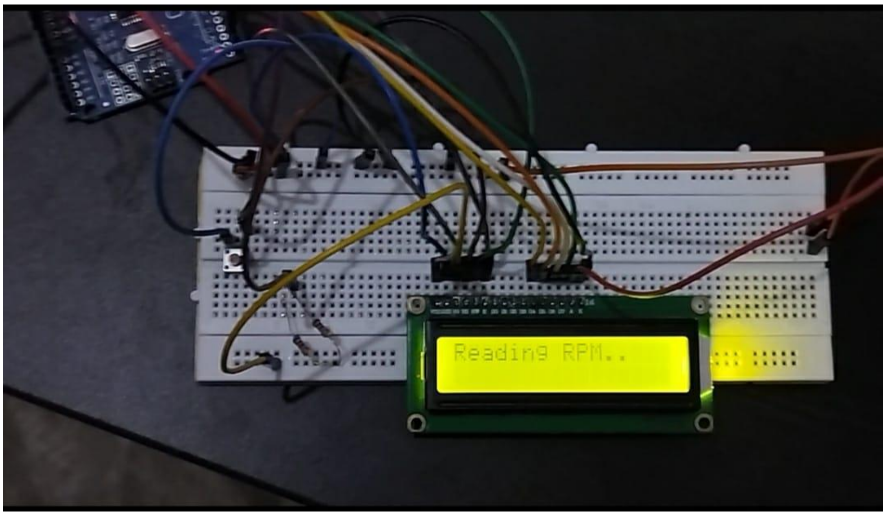

Fig.2.2 System Architecture

CHAPTER 3: DIGITAL TACHOMETER

A digital tachometer is a digital device that measures and indicates the speed of a rotating object. A rotating object may be a bike tire, a car tire or a ceiling fan, or any other motor, and so on. A digital tachometer circuit comprises LCD or LED readout and a memory for storage. Digital tachometers are more common these days and they provide numerical readings instead of dials and needles.

Fig3.1 Digital Tachometer

A digital tachometer is an optical encoder that determines the angular velocity of a rotating shaft or motor. Digital tachometers are used in different applications such as automobiles, airplanes, and medical and instrumentation applications.

3.1 WHAT IS TACHOMETER ?

The word tachometer is derived from two Greek words: tachos mean “speed” and metron means “to measure”. It works on the principle of a tachometer generator, which means when a motor is operated as a generator, it produces the voltage according to the velocity of the shaft. It is also known as revolution-counter, and its operating principle can be electromagnetic, electronic, or optical-based. Power, accuracy, RPM range, measurements, and display are the specifications of a tachometer. Tachometers can be analog or digital indicating meters.

3.2 DIGITAL TACHOMETER TYPES

Digital tachometers are classified into four types based on data acquisition and measurement techniques.

Based on the data acquisition technique, the tachometers are of the following types:

- Contact type
- Non-Contact type

Based on the measurement technique, the tachometers are of the following types:

- Time measurement
- Frequency measurement

3.2.1 Contact Type Digital Tachometer

A tachometer which is in contact with the rotating shaft is known as contact type tachometer. This kind of tachometer is motor. An optical encoder or magnetic sensor can also be attached to this so that it measures its RPM.

Fig3.2 Contact Type Digital Tachometer

Digital Tachometers are capable of measuring low-speeds at 0.5 rpm and high speed at 10,000 rpm and are equipped with a storage pocket for the circumferential measurement. The specifications of this tachometer are LCD 5 digit display, the operational temperature range of 0 to + 40oC, temperature storage range of – 20 to + 55o C, and rotating speed of about 0.5 to 10,000 rpm.

3.2.2 Non-Contact Type Digital Tachometer

A tachometer that does not need any physical contact with the rotating shaft is called a non-contact digital tachometer. In this type, a laser or an optical disk is attached to the rotating shaft, and it can be read by an IR beam or laser, which is directed by the tachometer.

Fig3.3 Non-Contact Type Digital Tachometer

This type of tachometer can measure from 1 to 99,999 rpm; the measurement angle is less than 120 degrees, and the tachometer has a five-digit LCD. These types of tachometers are efficient, durable, accurate, and compact, and also visible from long distance.

3.2.3 Time Measurement Digital Tachometer

A tachometer that calculates the speed by measuring the time interval between incoming pulses is known as a time-based digital tachometer. The resolution of this tachometer is independent of the speed of the measurement, and it is more accurate for measuring low speed.

3.2.4 Frequency Measurement Digital Tachometer

A tachometer that calculates the speed by measuring the frequency of the pulses is called as a frequency-based digital tachometer. This type of tachometer is designed by using a red LED, and the revolution of this tachometer depends on the rotating shaft, and it is more accurate for measuring high speed. These tachometers are of low-cost and high-efficiency, which is in between 1Hz-12 KHz.

The internal operation of these tachometers can be with the use of a tachometer generator or purely with the electronic components that are described below.

3.3. Tachometer Generator

A micro-electric machine that is used to convert, the rotating speed, and the shaft values of a machine into an electric signal is known as a tachometer generator. The operation of the tachometer generator is based on the principle that the angular velocity of the rotor is proportional to the generated EMF if the excitation flux is constant.

Fig3.4 Tachometer Generator

These tachometers are specified with generated voltage, accuracy, maximum speed, ripples, and operating temperature. This kind of tachometer generators is used as sensors in various automobile and electro-mechanical computer devices.These generators can be AC or DC types.

3.4 Electronic Tachometer

A tachometer made purely from electronic components and is used to measure the speed of an engine or any other moving object in revolutions per minute is known as an electronic tachometer. Electronic tachometers are used in the dashboard of a car for measuring the driving speed. These tachometers are lightweight, easy to view, and accurate under all conditions.

Fig3.5 Electronic Tachometer

CHAPTER 4: COMPONENTS

COMPONENTS USED ARE:

1. Arduino UNO
2. IR sensor Module
3. (16x2) LCD Display
4. Push button
5. Bread board
6. 9 volt battery
7. Connecting wires
8. DC Motor

4.1 ARDUINO UNO

4.1.1 What is Arduino?

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Fig4.1 Arduino

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments.

4.1.2 Why Arduino?

Thanks to its simple and accessible user experience, Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone - children, hobbyists, artists, programmers - can start tinkering just following the step by step instructions of a kit, or sharing ideas online with other members of the Arduino community.

There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems.

4.1.3 Advantages of Arduino:

- Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than $50. Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.
- Simple, clear programming environment - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.
- Open source and extensible software - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.
- Open source and extensible hardware - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

4.1.4 What is Arduino UNO?

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, 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.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

Fig4.2 Arduino UNO

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases.The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

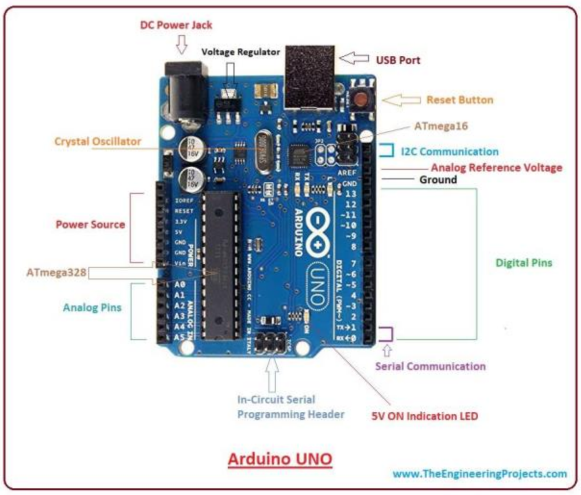

Fig4.3 Different Components of Arduino UNO

4.2 INFRARED SENSOR

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William Herchel in 1800 .While measuring the temperature of each color of light (separated by a prism), he noticed that the temperature just beyond the red light was highest.

IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum). Anything that emits heat (everything that has a temperature **above around five degrees Kelvin**) gives off infrared radiation.

4.2.1 Working

An IR sensor consists of an IR LED and an IR Photodiode; together they are called Photo-Coupler or Opto-Coupler.The Infrared Obstacle Sensor has a builtin IR transmitter and IR receiver. Infrared Transmitter is a light-emitting diode (LED) that emits infrared radiation. Hence, they are called IR LEDs. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye.

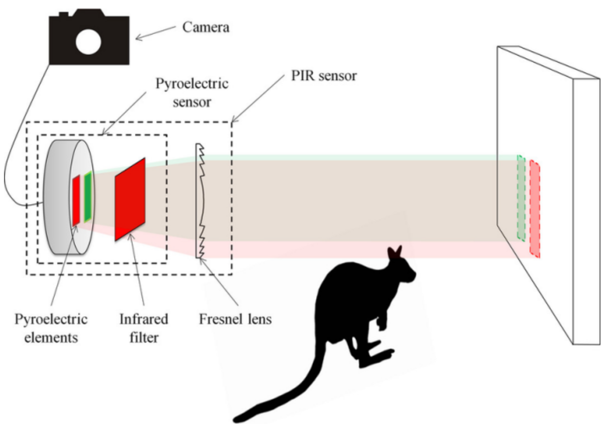

Fig4.4 Working of IR Sensor

Infrared receivers are also called as infrared sensors as they detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors. Infrared Photodiodes are different from normal photodiodes as they detect only infrared radiation. When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver.Infrared receivers are also called as infrared sensors as they detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors. Infrared Photodiodes are different from normal photodiodes as they detect only infrared radiation. When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver.

4.2.2 Types of IR Sensor

There are two types of infrared sensors:

a.Active IR Sensor

Active infrared sensors both emit and detect infrared radiation. Active IR sensors have two parts: a light emitting diode (LED) and a receiver. When an object comes close to the sensor, the infrared light from the LED reflects off of the object and is detected by the receiver. Active IR sensors act as **proximity sensors**, and they are commonly used in obstacle detection systems (such as in robots).

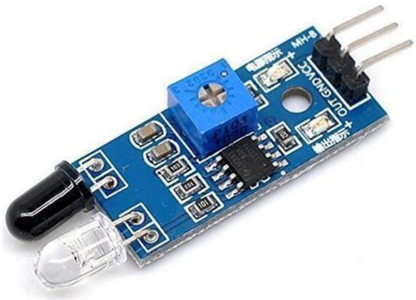

Fig4.5 Active IR Sensor

b.Passive IR Sensor

The term passive refers to the fact that PIR devices do not radiate energy for detection purposes. They work entirely by detecting infrared radiation (radiant heat) emitted by or reflected from objects.

Fig4.6 Passive IR Sensor

They are most often used in PIR-based motion detectors. PIR sensors are commonly used in security alarms and automatic lighting applications.

In this project we used an Active Infrared Sensor.

4.3 LIQUID CRYSTAL DISPLAY(LCD)(16*2)

4.3.1 What is Liquid-Crystal Display?

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly,[1] instead using a backlight or reflector to produce images in color or monochrome.[2] LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden.

For instance: pre-set words, digits, and seven-segment displays, as in a digital clock, are all good examples of devices with these displays. They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement.

For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character negative LCD will have a black background with the letters being of the same color as the backlight. Optical filters are added to white on blue LCDs to give them their characteristic appearance.

4.3.2What is the LCD 16×2?

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc.

These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

4.3.3 LCD 16×2 Pin Diagram

The 16×2 LCD pin-out is shown below:

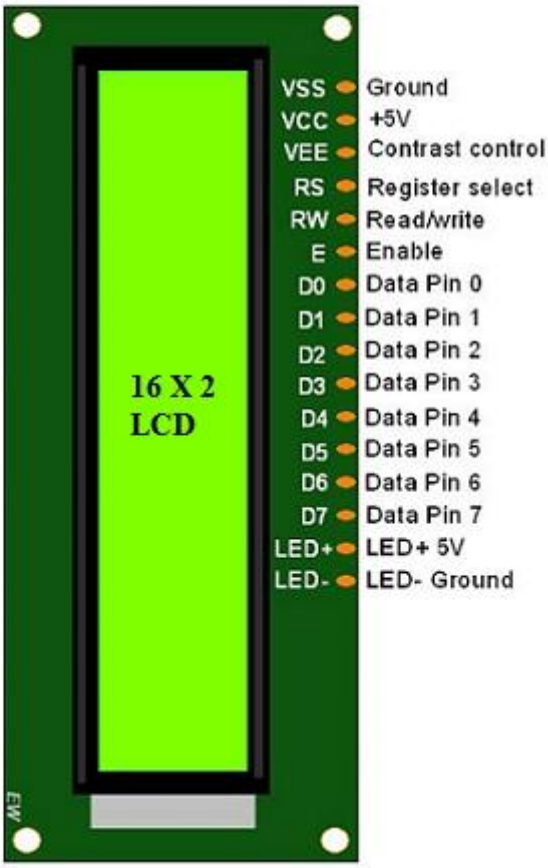

Fig4.7LCD Pin Diagram

- Pin1 (Ground/Source Pin): This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.
- Pin2 (VCC/Source Pin): This is the voltage supply pin of the display, used to connect the supply pin of the power source.
- Pin3 (V0/VEE/Control Pin): This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
- Pin4 (Register Select/Control Pin): This pin toggles among command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1(0 = data mode, and 1 = command mode).
- Pin5 (Read/Write/Control Pin): This pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or 1 (0 = Write Operation, and 1 = Read Operation).
- Pin 6 (Enable/Control Pin): This pin should be held high to execute Read/Write process, and it is connected to the microcontroller unit & constantly held high.
- Pins 7-14 (Data Pins): These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode.

- In 4-wire mode, only four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller unit like 0 to 7.
- Pin15 (+ve pin of the LED): This pin is connected to +5V.
- Pin 16 (-ve pin of the LED): This pin is connected to GND.

4.3.4 Features of LCD16x2

The features of this LCD mainly include the following.

- The operating voltage of this LCD is 4.7V-5.3V.
- It includes two rows where each row can produce 16-characters.
- The utilization of current is 1mA with no backlight
- Every character can be built with a 5×8 pixel box
- The alphanumeric LCDs alphabets & numbers
- Is display can work on two modes like 4-bit & 8-bit
- These are obtainable in Blue & Green Backlight
- It displays a few custom generated characters.

4.3.5 Registers of LCD

A 16×2 LCD has two registers like data register and command register. The RS (register select) is mainly used to change from one register to another. When the register set is ‘0’, then it is known as command register. Similarly, when the register set is ‘1’, then it is known as data register.

a.Command Register

The main function of the command register is to store the instructions of command which are given to the display. So that predefined tasks can be performed such as clearing the display, initializing, set the cursor place, and display control. Here commands processing can occur within the register.

b.Data Register

The main function of the data register is to store the information which is to be exhibited on the LCD screen. Here, the ASCII value of the character is the information which is to be exhibited on the screen of LCD. Whenever we send the information to LCD, it transmits to the data register, and then the process will be starting there. When register set =1, then the data register will be selected.

4.3.6 (16×2) LCD Commands

The commands of LCD 16X2 include the following.

- For Hex Code-01, the LCD command will be the clear LCD screen
- For Hex Code-02, the LCD command will be returning home
- For Hex Code-04, the LCD command will be decrement cursor
- For Hex Code-06, the LCD command will be Increment cursor

- For Hex Code-05, the LCD command will be Shift display right
- For Hex Code-07, the LCD command will be Shift display left
- For Hex Code-08, the LCD command will be Display off, cursor off
- For Hex Code-0A, the LCD command will be cursor on and display off
- For Hex Code-0C, the LCD command will be cursor off, display on
- For Hex Code-0E, the LCD command will be cursor blinking, Display on
- For Hex Code-0F, the LCD command will be cursor blinking, Display on
- For Hex Code-10, the LCD command will be Shift cursor position to left
- For Hex Code-14, the LCD command will be Shift cursor position to the right
- For Hex Code-18, the LCD command will be Shift the entire display to the left
- For Hex Code-1C, the LCD command will be Shift the entire display to the right
- For Hex Code-80, the LCD command will be Force cursor to the beginning (1st line)
- For Hex Code-C0, the LCD command will be Force cursor to beginning (2nd line).
- For Hex Code-38, the LCD command will be 2 lines and 5×7 matrix.

4.4 Breadboard

A breadboard, or protoboard, is a construction base for prototyping of electronics. Originally the word referred to a literal bread board, a polished piece of wood used when slicing bread.[1] In the 1970s the solderless breadboard (a.k.a. plugboard, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these.

Because the solderless 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, solderless breadboards are also popular with students and in technological education.

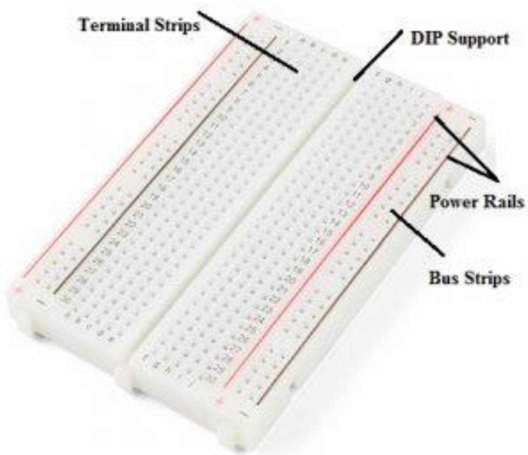

Fig4.8 Breadboard

Older breadboard types did not have this property. A stripboard (Veroboard) 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).

Compared to more permanent circuit connection methods, modern breadboards have high parasitic capacitance, relatively high resistance, and less reliable connections, which are subject to jostle and physical degradation. Signaling is limited to about 10 MHz, and not everything works properly even well below that frequency.

4.5 Potentiometer

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider.[1] If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat.

The measuring instrument called a potentiometer is essentially a voltage divider used for measuring electric potential (voltage); the component is an implementation of the same principle. Potentiometer is commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers, for example, in a joystick. Potentiometers are rarely used to directly control significant power (more than a watt), since the power dissipated in the potentiometer would be comparable to the power in the controlled load.

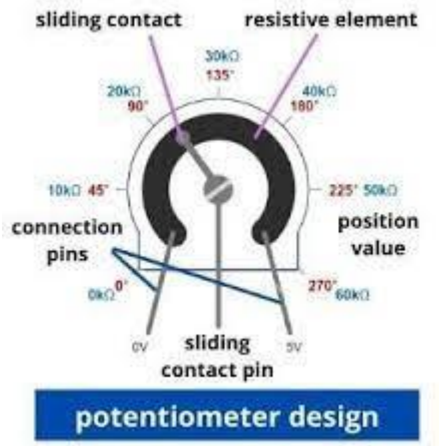

Fig 4.9 Potentiometer

A **Rotary potentiometer (Pot)** is a three-terminal device that employs a resistive element and a rotating contact to form an adjustable voltage divider. If only two terminals are used, one end of the element and the adjustable contact, it acts as a variable resistor or rheostat.

4.6 PUSH BUTTON

Fig4.10 Push Button

A push-button (also spelled pushbutton) or simply button is a simple switch mechanism to control some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal .The surface is usually a flat or shaped to accommodate the human finger or hand, so as to be easily depressed or pushed.

Buttons are most often biased switches, although many un-biased buttons (due to their physical nature) still require a spring to return to their un-pushed state. The "push-button" has been utilized in calculators, push-button telephones, kitchen appliances, and various other mechanical and electronic devices, home and commercial.

4.7D.C. Motor

A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

Fig 4.11 DC Motor

DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills.

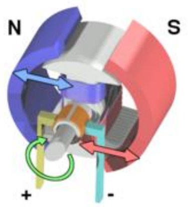

Fig 4.12 Working of DC Motor

"N" and "S" designate polarities on the inside axis faces of the magnets; the outside faces have opposite polarities. The + and - signs show where the DC current is applied to the commutator which supplies current to the armature coils.

CHAPTER 5: ARDUINO UNO CODE

```
#include <LiquidCrystal.h>

int E=11,rs=12,d4=5,d5=4,d6=3,d7=2;

LiquidCrystal lcd(rs, E, d4, d5,d6,d7);

#define sensor 10

#define start 9

int delay1()

{

//unsigned int long k;

 int i,j;

unsigned int count=0;

for(i=0;i<1000;i++)

{

for(j=0;j<1000;j++)

{

if(digitalRead(sensor))

{

count++;

while(digitalRead(sensor));

}

}

}

return count;

}
```

```
void setup()
{
pinMode(sensor, INPUT);
pinMode(start, INPUT);
pinMode(2, OUTPUT);
lcd.begin(16, 2);
  lcd.setCursor(0,0);
lcd.print("Tachometer");
delay(2000);
digitalWrite(start, HIGH);
}
void loop()
{
unsigned int time=0,RPM=0;
lcd.clear();
lcd.print(" Please Press ");
lcd.setCursor(0,1);
lcd.print("Button to Start ");
while(digitalRead(start));
lcd.clear();
lcd.print("Reading RPM..");
time=delay1();
lcd.clear();
lcd.print("Please Wait…");
RPM=(time*12)/3;
```

```
delay(2000);

lcd.clear();

lcd.print("RPM=");

lcd.print(RPM);

delay(5000);

}
```

CHAPTER 6: CIRCUIT DIAGRAM AND CONNECTIONS

6.1 CIRCUIT DIAGRAM

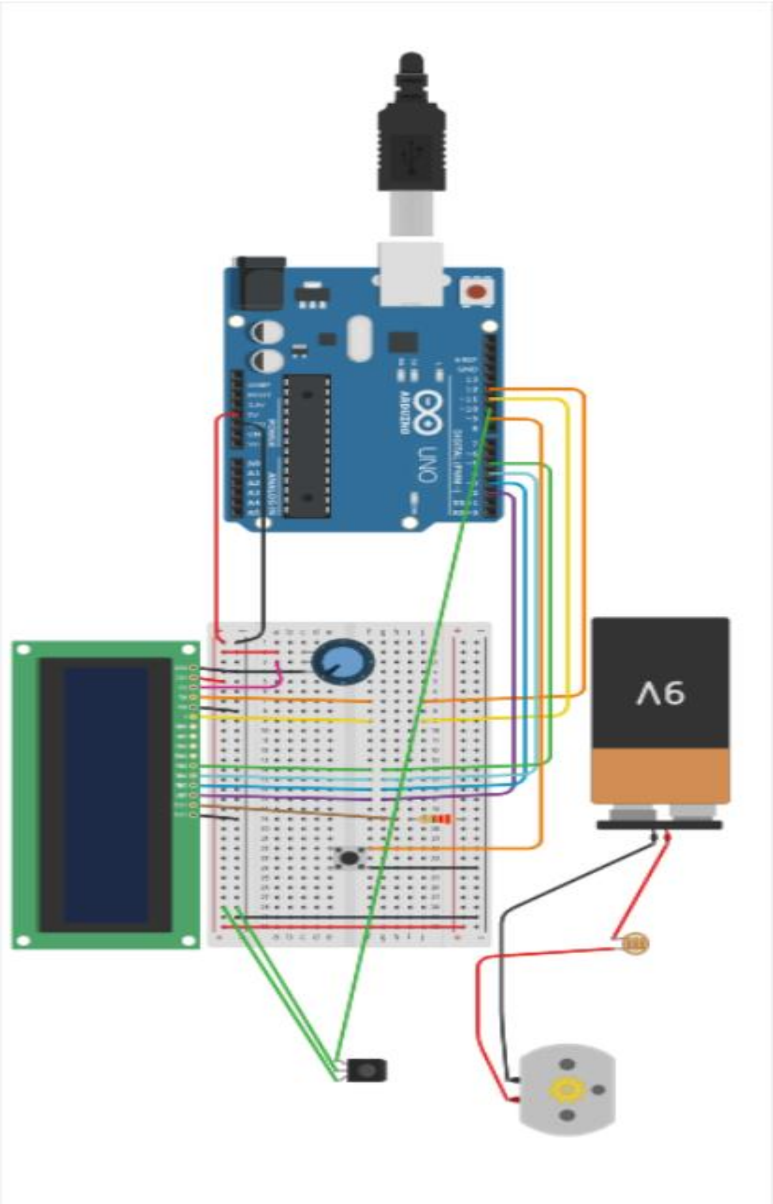

Fig6.1 Circuit Diagram of Non-Contact Digital Tachometer

6.2 CONNECTIONS

- IR sensor module output pin is directly connected to pin 10.
- Vcc and GND are connected to Vcc and GND of arduino on Breadboard.
- A 16x2 LCD is connected with arduino in 4-bit mode.
- Control pin RS, RW and En are directly connected to arduino pin 12, GND and 11.
- Data pin D4-D7 is connected to pins 5, 4, 3 and 2 of arduino.
- A push button is also added in this project.
- When we need to count RPM we press this button to start this Arduino Tachometer to count RPM for five seconds.
- This push button is connected to pin 9 of arduino with respect to ground.
-

We designed the complete circuit on an online platform Tinkercad:

https://www.tinkercad.com/

CHAPTER 7: RESULT AND CONCLUSION

7.1 RESULT

We have designed the circuit to work with least error. We have checked the circuit up to the primary level and it is successfully capable to determining the speed of the motor. Whenever any rotating motor is detected within the range of the circuit, the input starts to flow to the arduino board and thus resulting in its speed detection. Complete circuit is verified and tested.

7.2 CONCLUSION

The tachometer circuit is a digital innovative device that is active in measuring the speed of a rotating object. In this modern world all industries have motors whose speed has to be monitored properly. This device is nothing but a simple electronic digital transducer. Normally, it is used for measuring the speed of a rotating shaft. The number of revolutions per minute (rpm) is valuable information for understanding any rotational system. We have tried maximum in bringing up this contactless tachometer. This is low cost and gives proper output. Therefore, the circuit of our paper was designed and implemented and the speed of the motor is displayed on the LCD display every second.

REFRENCES

1. M.Ehikhamenle, and B.O. Omijeh, “Design and Development of a Smart Digital Tachometer Using At89c52 Microcontroller.” American Journal of Electrical and Electronic Engineering, vol. 5, no. 1 (2017): 1-9. doi: 10.12691/ajeee-5-1-1.

2. F. Barrero, J.V. Torrellas, E. Galvan and L.G. Franquelo, “Design of a High Precision Digital Tachometer for Speed and Position Measurement,”15th Design of Circuits and Integrated Systems Conference, Montpellier-Le Corum, France, Nov 21-24, 2000.

3. Sergio Gonzalez-Duarte, Jorge Antonio Cardona-Soto, Carlos Omar Seanez-Hernandez, Esteban Rubio-Ochoa and Jessica Hieraldin Aguirre-Fernandez, “Characterization and Validation of Telemetric Digital Tachometer based on Hall Effect Sensor,” International Electronic Conference on Sensors and Applications, 1-16th Jun, 2014.

4. Cariappa P K, Shwetha A, Pooja D, Sudharani B T, Geetha M N, “Contact-Less Tachometer,” International Journal of Engineering Research & Technology (IJERT), ISSN: 2278- 0181, NCESC - 2018 Conference Proceedings, Volume 6, Issue 13, Special Issue-2018.

5. S.M.Ferdous, Mohammad Rokonuzzaman, Sayedus Salehin, Arifa Ferdousi, Tanvin Hossaine, “Design and Implementation of a Linear IC Based Low Cost Digital Tachometer for Laboratory and Industrial Application,”

6. Salice Peter, Naveen N M, Nidheesh M N, SwethaAnnu James, Seril Joseph, “Design of a Contactless tachometer,” International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 3, Issue 2, Feb 2014.

7. Prateek Mishra, Shikhar Pradhan, Siddhartha Sethiya, Vikas Chowdhary, “Contactless Tachometer with Auto Cut Off,” International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 04 Issue: 04, Apr -2017.

8. A.S.M. Bakibillah, Muhammad Athar Uddin, Shah Ahsanul Haque. Design, Implementation & Performance analysis of a low cost Opical Tachometer. IIUC Studies. Vol 7, p 107- 116.Dec 2011.

9. TinkerCad for simulating the project:

https://www.tinkercad.com/

10.M.S Word 2010 for preparing the PROJECT REPORT.