AC Motor Speed Control and RPM Count

SONARGAON UNIVERSITY (SU)

Supervised By

Jannatul Nazrana

Lecturer

Department of EEE

Sonargaon University (SU)

Submitted By

Mehedi Hasan Saikat	**ID: EEE1801013146**
Chiran Tanchangya	**ID: EEE1801013185**
Md. Tangirul Islam	**ID: EEE1801013103**
Md. Suit Rana	**ID: EEE1801013089**
Md. Shamim	**ID: EEE1801013119**

Department of Electrical & Electronic Engineering (EEE)
Sonargaon University (SU)
147/I, Panthapath,
Dhaka-1215, Bangladesh

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Declaration

It is declared hereby that this thesis paper or any part of it has not been submitted to anywhere else for the award of any degree.

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Mehedi Hasan Saikat **Chiran Tanchangya**

.... …..

Md. Tangirul Islam **Md. Suit Rana**

....

Md. Shamim

Under Supervision of

....

Jannatul Nazrana

Lecturer

Department of EEE

Sonargaon University (SU)

<u>Certification</u>

This is to certify that this project entitled "**AC Motor Speed Control And RPM Count**" is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Sonargaon University (SU) in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

<u>Supervisor</u>

....

Jannatul Nazrana

Lecturer

Department of Electrical and Electronic Engineer (EEE)

Sonargaon University (SU)

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ABSTRACT

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 read out and a memory for storage. Digital tachometers are more common these days and they provide numerical readings instead of dials and needles. This device is an embedded system; it is built using a microcontroller, an alpha-numeric LCD module and an infrared system to detect the rotation of the fan whose speed is being measured. The infrared system generates the pulses from the fan which will be sent to the microcontroller and the pulses will be counted; the reading is displayed on the liquid crystal display (LCD module) in revolution per minute (RPM). It is a low cost digital tachometer that can display exact speed reading based on how fast an object is rotating.it adopts the Use infrared transmitter and receiver as the technology behind the speed detection. It can be used in various applications. It can measure the speed of rotating objects (examples of rotating objects include: a bike tire, a car tire, a ceiling fan, or any other motor) in the most accurate form possible. In automotive, it is used as a gauge showing the speed (RPM) of the engine shaft that is driving the transmission, usually in thousands of rotations per minute.

Dedicated To

Our Parents

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LIST OF ABBREVIATIONS

DC	Direct Current
AC	Alternating Current.
LCD	Liquid Crystal Display
IR	Infrared Receiver
IC	Integrated Circuit
LED	Light Emitting Diode
PCB	Printed Circuit Board

CHAPTER 1

INTRODUCTION

1.1 Introduction

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 read out and a memory for storage. Digital tachometers are more common these days and they provide numerical readings instead of dials and needles.

1.2 Objective

The main objective of this project are given bellow,

- Crucial importance for measuring the rotating speed of the shaft or the motor in every vehicle.
- This device enables the driver of the motor vehicle to track the rotating speed and with that to adjust throttle and the gear to the driving conditions
- Make AC motor speed control.
- Make an Electronic circuit for AC motor Speed control

1.3 Methodology

- Collection of information from books and internet.
- Discuses with our Supervisor sir.
- Select project topics
- Collection of component from local market.
- Collect structure board from Partex shop.
- Start Hardware making.
- Start software making.

1.4 Major Components used in this entire project

- PIC16F73 Microcontroller
- Crystal 16mhz
- LCD display
- Capacitors
- Some resistor
- Diode
- Voltage Regulator (7085)
- Connector
- Transformer
- Some wires
- Soldering lead and etc.
- Sample PCB and model board

1.5 Project Outline

Chapter-2: Describes all the hardware devices and power supply to the project.

Chapter-3: Describes the block diagram, working procedure, connection diagram and explanation.

Chapter-4: Reviews the results found through the project and provides a discussion on the findings.

Chapter-5: Specified the limitations of the project, provides the future works that may be approached and conclusion.

1.6 Summary

Firstly we discuss about project, Digital Tachometer then we discuss about Objective and methodology of this project. Lastly we discuss about project outline in this chapter.

CHAPTER 2

THEORY OF THE PROJECT

2.1 Microcontroller

Microcontrollers are integral part of embedded systems. A microcontroller is basically cheap and small computer on a single chip that comprises a processor, a small memory, and programmable input-output peripherals. They are meant to be used in automatically controlled products and devices to perform predefined and pre-programmed tasks. To get a better idea of what actually is a microcontroller; let's see an example of a product where microcontroller is used. A digital thermometer that displays the ambient temperature uses a microcontroller which is connected to a temperature sensor and a display unit (like LCD). The microcontroller here takes the input from temperature sensor in raw form, process it and display it to a small LCD display unit in a human readable form. Similarly a single or multiple microcontrollers are used in many electronic devices according to requirement and complexity of applications.

2.1.1 Uses of Microcontrollers

Microcontrollers are used in embedded systems, basically a variety of products and devices that are combination of hardware and software, and developed to perform particular functions. A few examples of embedded systems where microcontrollers are used, could be – washing machines, vending machines, microwaves, digital cameras, automobiles, medical equipment, smart phones, smart watches, robots and various home appliances.

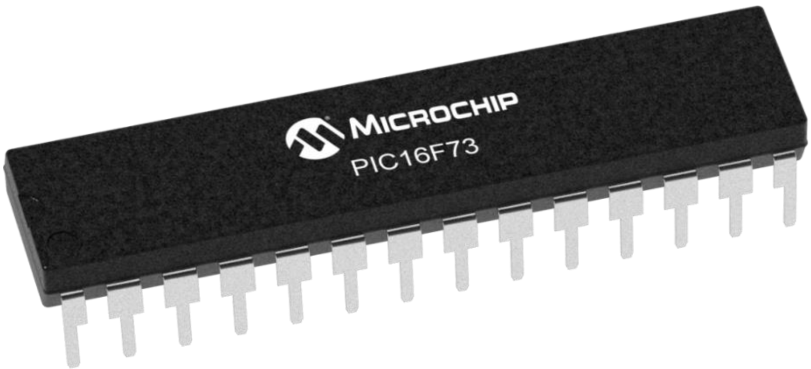

Figure 2.1.1: Microcontroller

2.1.2 Benefits of Using Microcontrollers

Microcontrollers are used to employ automation in embedded applications. The major reason behind immense popularity of microcontrollers is their ability to reduce size and cost of a product or design, compared to a design that is build using separate microprocessor, memory and input/output devices.

As microcontrollers have features like in-built microprocessor, RAM, ROM, Serial Interfaces, Parallel Interfaces, Analog to Digital Converter (ADC), Digital to Analog Converter (DAC) etc. that makes it easy to build applications around it. In addition, microcontrollers' programming environment offers vast possibilities to control the different types of applications as per their requirement.

2.1.3 Different types of Microcontrollers

There is a wide range of microcontrollers available in the market. Various companies like Atmel, ARM, Microchip, Texas Instruments, Rennes's, free scale, NXP Semiconductors, etc. manufacture different kinds of microcontrollers with different kinds of features. Looking into various parameters like programmable memory, flash size, supply voltage, input/output pins, speed etc. one can select the right microcontroller for their application.

Let's have a look to these parameters and different types of microcontrollers according to these parameters.

Data bus (Bit Size):

When classified according to the bit-size, most of the microcontrollers range from 8-bit to 32 bit (higher bit microcontrollers are also available). In an 8-bit microcontroller its data bus consists of 8 data lines, while in a 16-bit microcontroller its data bus consists of 16 data lines and so on for 32 bit and higher microcontrollers.

Memory:

Microcontrollers need memory (RAM, ROM, EPROM, EEPROM, flash memory etc.) to store programs and data. While some microcontrollers have inbuilt memory chips while others require an external memory to be connected. These are called embedded memory microcontrollers and external memory microcontrollers respectively. Inbuilt memory size also varies in different types of microcontrollers and generally you would find microcontrollers with memory of 4B to 4Mb.

Number of Input/Output Pins:

Microcontrollers vary according to the number of input-output pin sizes. One can choose a specific microcontroller as per the requirement of application.

Instruction Set:

There are two types of instruction sets - RISC and CISC. A microcontroller can use RISC (Reduced Instruction Set Computer) or CISC (Complex Instruction Set Computer). As name suggests, RISC reduces the operation time defining the clock cycle of an instruction; while CISC allows applying one instruction as an alternative to many instructions.

Memory Architecture:

There are two types of microcontrollers – Harvard memory architecture microcontrollers and Princeton memory architecture microcontrollers.

Here are some popular microcontrollers among students and hobbyists.

8051 series of microcontrollers (8-bit)

AVR microcontrollers by Atmel (At tiny, At mega series)

Microchip's PIC series microcontrollers

Texas Instruments' microcontrollers like MSP430

ARM Microcontrollers

2.1.4 Features of Microcontrollers

Microcontrollers are used in embedded systems for their various features. As shown in the below block diagram of a microcontroller, it comprises of processor, I/O pins, serial ports, timers, ADC, DAC, and Interrupt Control.

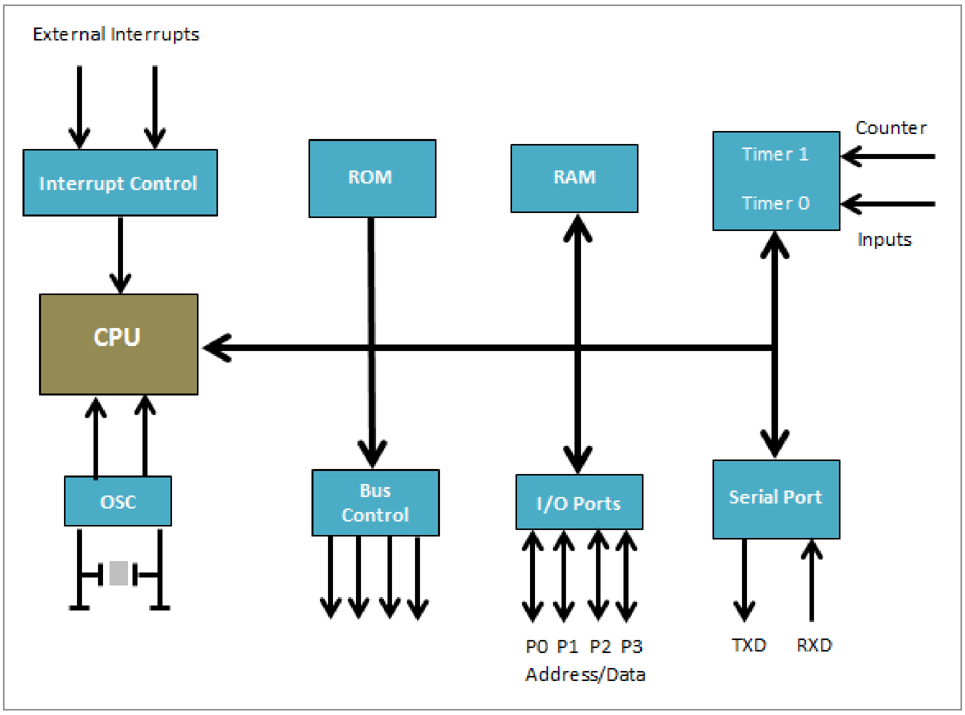

Figure 2.1.4: Block diagram of Microcontroller.

2.1.5: Microcontroller PIC16F73 Pin Diagram

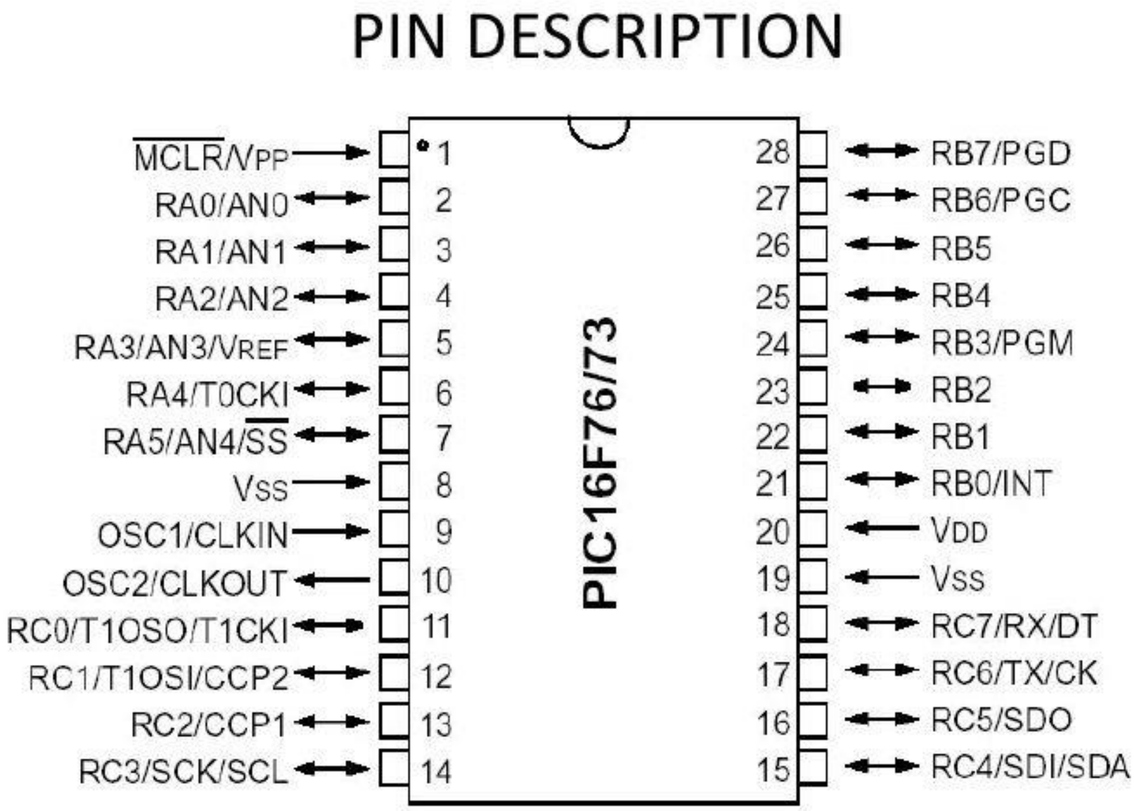

Figure 2.1.5: Microcontroller PIC16F73 Pin Diagram.

2.2 LCD Display (2 Line 16 Carriers)

The liquid-crystal display has the distinct advantage of having a low power consumption than the LED. It is typically of the order of microwatts for the display in comparison to the some order of mille watts for LEDs. Low power consumption requirement has made it compatible with MOS integrated logic circuit. Its other advantages are its low cost, and good contrast. The main drawbacks of LCDs are additional requirement of light source, a limited temperature range of operation (between 0 and 60° C), low reliability, short operating life, poor visibility in low ambient lighting, slow speed and the need for an AC drive.

For our project we use 16x2 LCD display

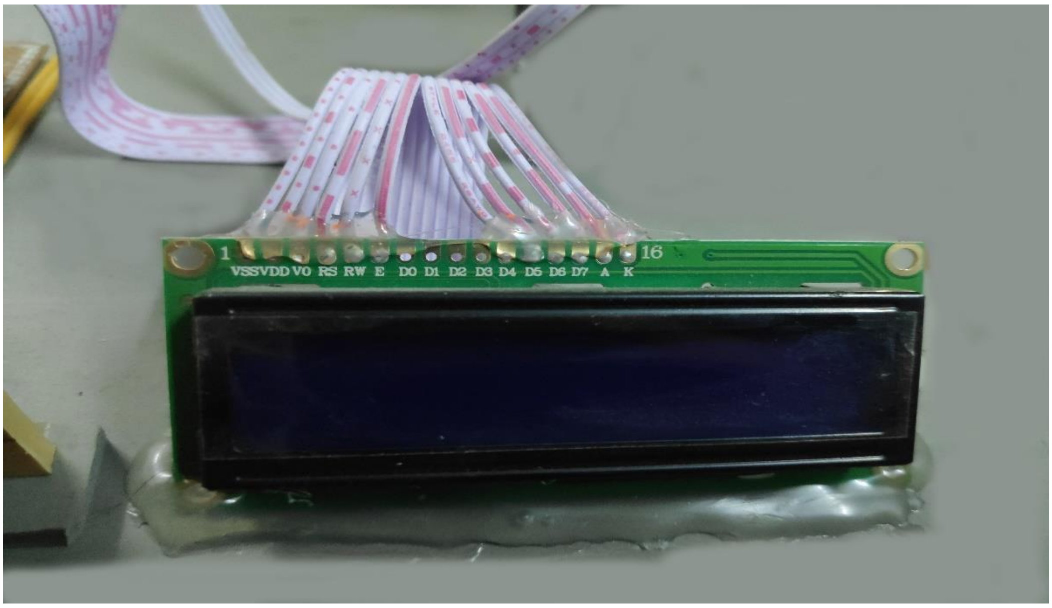

Figure 2.2: LCD display

The 16x2 LCD used in this experiment has a total of 16 pins. As shown in the table below, eight of the pins are data lines (pins 7-14), two are for power and ground (pins 1 and 16), three are used to control the operation of LCD (pins 4-6), and one is used to adjust the LCD screen brightness (pin 3). The remaining two pins (15 and 16) power the backlight. The details of the LCD terminals are as follows:

2.2.1 LCD Display Pin Description:

Terminal 1	VSS
Terminal 2	VDD
Terminal 3	Vo
Terminal 4	Register Select (RS)
Terminal 5	Read/Write (RW)
Terminal 6	Enable (EN)
Terminal 7	DB0
Terminal 8	DB1
Terminal 9	DB2
Terminal 10	DB3
Terminal 11	DB4
Terminal 12	DB5
Terminal 13	DB6
Terminal 14	DB7
Terminal 15	A
Terminal 16	K

2.3 Relay

A relay is **an electrically operated switch**. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

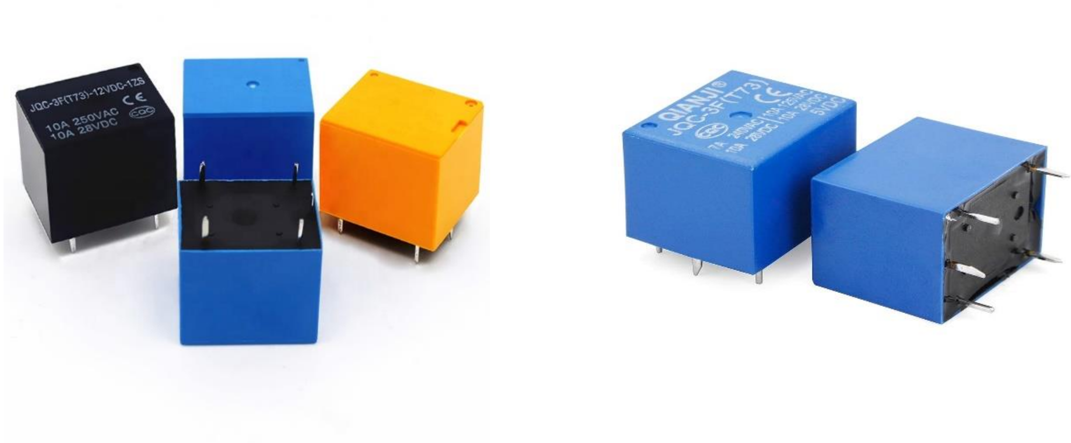

Figure 2.3: Relay

2.3.1 Working Principle of Relay

It works on the principle of an electromagnetic attraction. When the circuit of the relay senses the fault current, it energies the electromagnetic field which produces the temporary magnetic field.

This magnetic field moves the relay armature for opening or closing the connections. The small power relay has only one contacts, and the high power relay has two contacts for opening the switch.

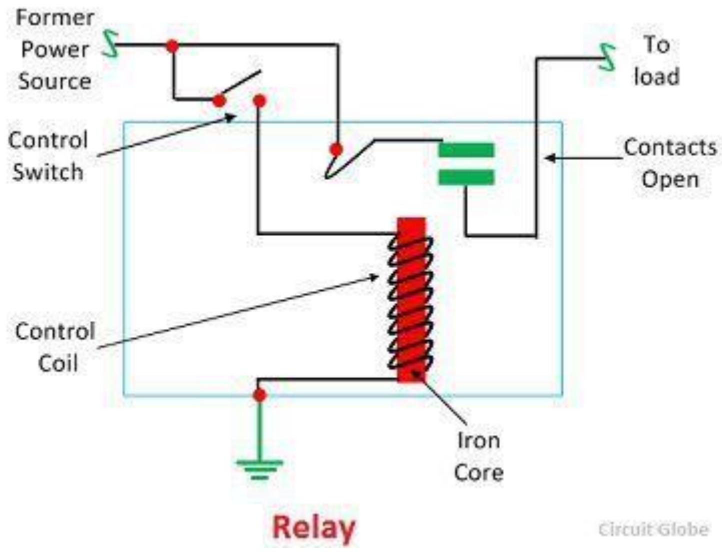

Figure 2.3.1: Relay Structure.

The inner section of the relay is shown in the figure below. It has an iron core which is wound by a control coil. The power supply is given to the coil through the contacts of the load and the control switch. The current flows through the coil produces the magnetic field around it.

Due to this magnetic field, the upper arm of the magnet attracts the lower arm. Hence close the circuit, which makes the current flow through the load. If the contact is already closed, then it moves oppositely and hence open the contacts.

2.3.2 Uses of Relay

Relays are used to **provide time delay functions**. They are used to time the delay open and delay close of contacts. Relays are used to control high voltage circuits with the help of low voltage signals. Similarly they are used to control high current circuits with the help of low current signals.

2.4 Crystal Oscillator

A crystal oscillator is an electronic oscillator circuit which is used for the mechanical resonance of a vibrating crystal of piezoelectric material. It will create an electrical signal with a given frequency. This frequency is commonly used to keep track of time for example: wrist watches are used in digital integrated circuits to provide a stable clock signal and also used to stabilize frequencies for radio transmitters and receivers. Quartz crystal is mainly used in radio-frequency (RF) oscillators. Quartz crystal is the most common type of piezoelectric resonator, in oscillator circuits we are using them so it became known as crystal oscillators. Crystal oscillators must be designed to provide a load capacitance.

Figure 2.4: Crystal Oscillator

2.5 Step down transformer

Transformers are devices that change (transform) the voltage of power supplied to meet the individuals needs of power consumers. It uses the principle of electromagnetic induction to change the voltage (alternating difference) from one value to another whether smaller or greater. A transformer is made of a soft iron coil with two other coils wound around it, but not connected with one another. The iron coils can either be arranged on top of another or be wound on separate limps of the iron core. The coil to which the alternating voltage is supplied is known as primary winding or primary coil while. The alternating current in the primary winding produces a changing magnetic field around it whenever an alternating potential is supplied. An alternating current is in turn produced by the changing field in the secondary coil and the amount of current produced depends on the number of windings in the secondary coil. There are two types of transformers, namely: Step down and Step up transformers. Generally, the difference between them is the amount of voltage produced, depending on the number of secondary coils. In a step-down transformer is one who secondary windings are fewer than the primary windings. In other words, the transformer's secondary voltage is less than the primary voltage. So, the transformer is designed to convert high-voltage, low-current power into a low-voltage, high current power and it is mainly used in domestic consumption.

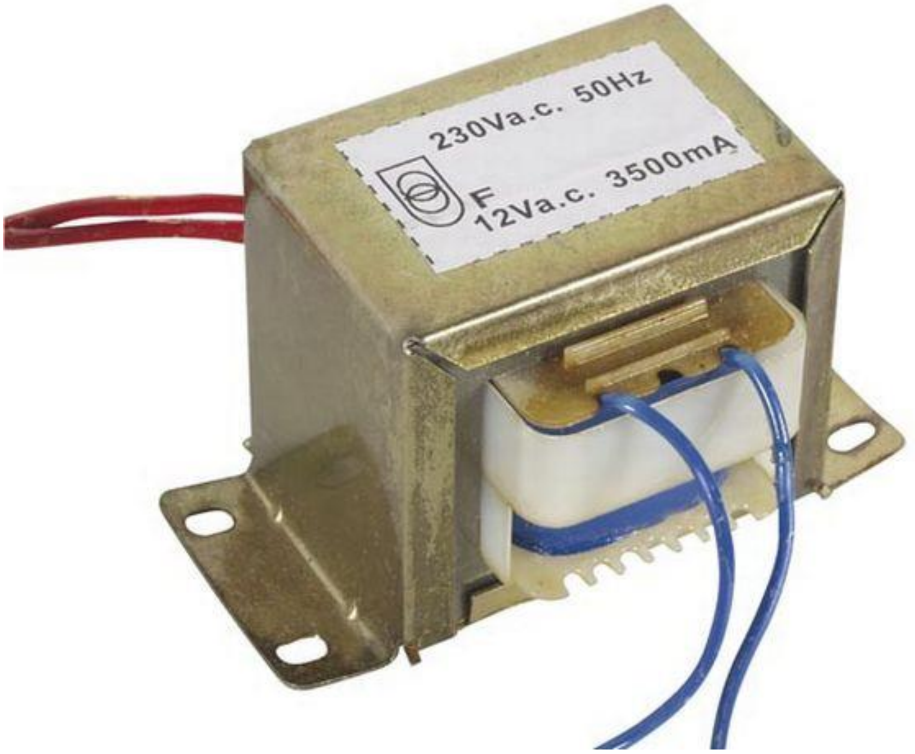

Figure 2.5: Transformer

2.6 Capacitor

Capacitor is a passive electronic component or device capable of storing charge with a certain voltage level across two conducting plates or surfaces, separated by an insulating material or dielectric substance.

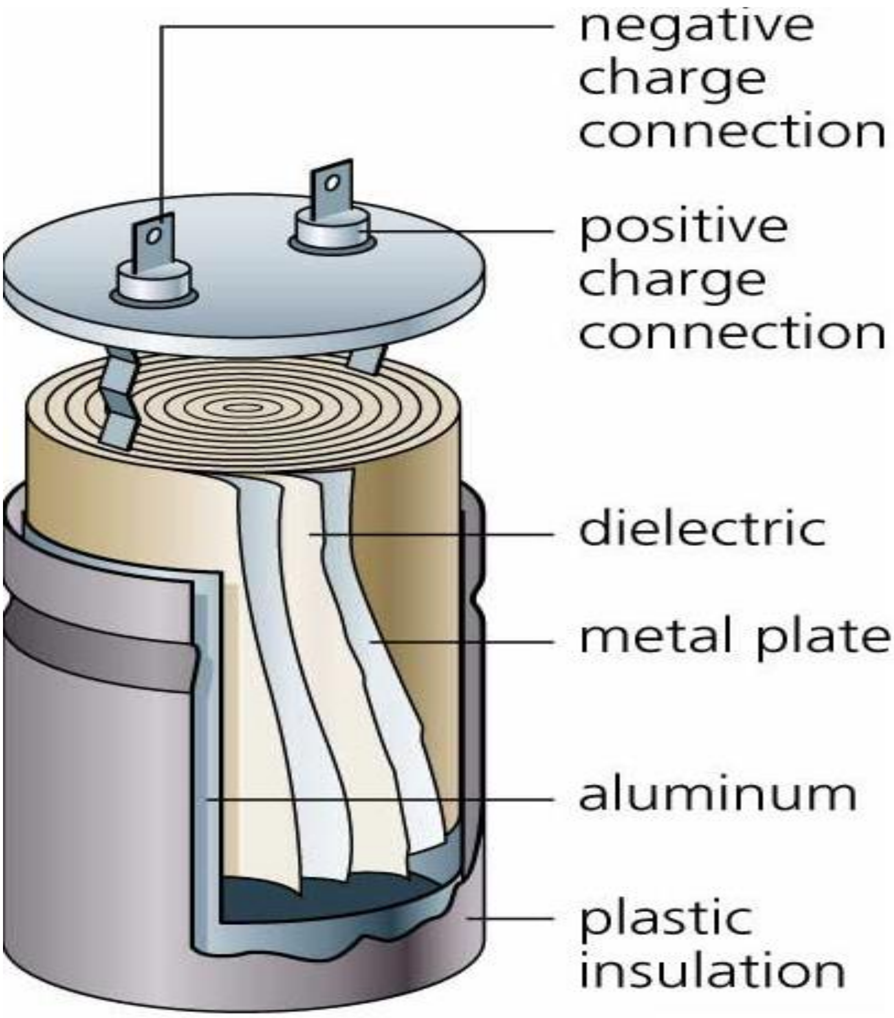

Figure 2.6: Capacitor Construction

2.7 Resistor

Electricity flows through a material carried by electrons, tiny charged particles inside atoms. Broadly speaking, materials that conduct electricity well are ones that allow electrons to flow freely through them. In metals, for example, the atoms are locked into a solid, crystalline structure (a bit like a metal climbing frame in a playground). Although most of the electrons inside these atoms are fixed in place, some can swarm through the structure carrying electricity with them. That's why metals are good conductors: a metal puts up relatively little resistance to electrons flowing through it. Plastics are entirely different. Although often solid, they don't have the same crystalline structure. Their molecules (which are typically very long, repetitive chains called polymers) are bonded together in such a way that the electrons inside the atoms are fully occupied. There are, in short, no free electrons that can move about in plastics to carry an electric current. Plastics are good insulators: they put up a high resistance to electrons flowing through them.

This is all a little vague for a subject like electronics, which requires precise control of electric currents. That's why we define resistance more precisely as the voltage in volts required to make a current of 1 amp flow through a circuit. If it takes 500 volts to make 1 amp flow, the resistance is 500 ohms (written 500 Ω). You might see this relationship written out as a mathematical equation:

$$V = I \times R$$

This is known as Ohm's Law for German physicist Georg Simon Ohm (1789–1854).

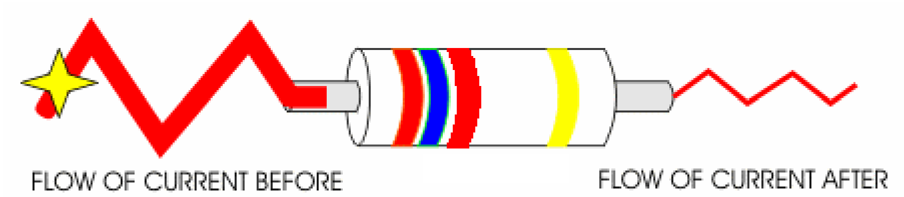

Figure 2.7: Resistor Working Principle

2.8 Diode

A diode is a device which only allows unidirectional flow of current if operated within a rated specified voltage level.

A diode only blocks current in the reverse direction while the reverse voltage is within a limited range otherwise reverse barrier breaks and the voltage at which this breakdown occurs is called reverse breakdown voltage. The diode acts as a valve in the electronic and electrical circuit. A P-N junction is the simplest form of the diode which behaves as ideally short circuit when it is in forward biased and behaves as ideally open circuit when it is in the reverse biased. Beside simple PN junction diodes, there are different types of diode**s** although the fundamental principles are more or less same. So a particular arrangement of diode**s** can convert AC to pulsating DC, and hence, it is sometimes also called as a rectifier.

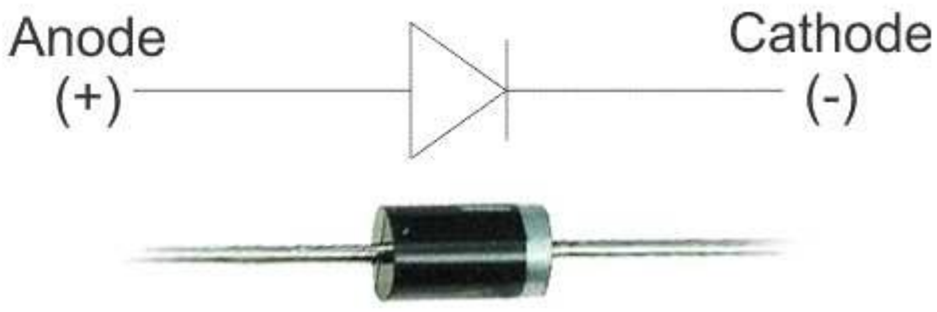

Figure 2.8: Diode

2.9 Voltage Regulator (7085)

A voltage regulator is used to regulate voltage level. When a steady, reliable voltage is needed, then voltage regulator is the preferred device. It generates a fixed output voltage that remains constant for any changes in an input voltage or load conditions. It acts as a buffer for protecting components from damages. A voltage regulator is a device with a simple feed- forward design and it uses negative feedback control loops. There are mainly two types of voltage regulators: Linear voltage regulators and switching voltage regulators; these are used in wider applications. Linear voltage regulator is the easiest type of voltage regulators. It is available in two types, which are compact and used in low power, low voltage systems.

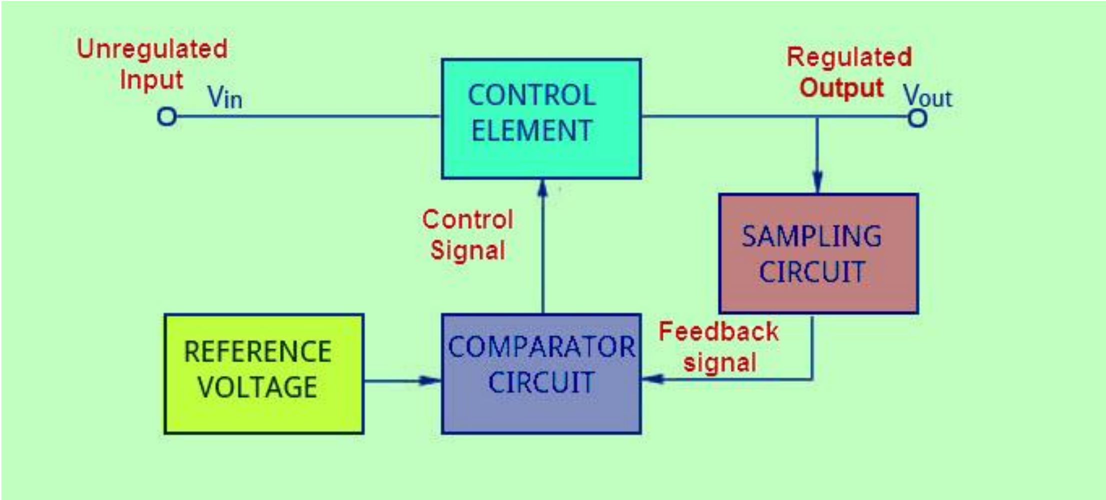

Figure 2.9: Block Diagram of Voltage Regulator Working.

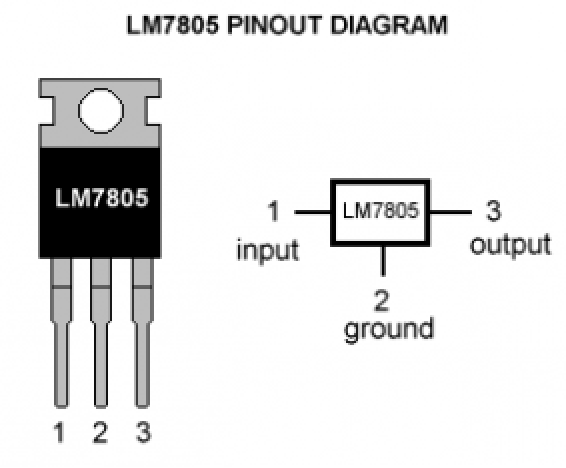

Figure 2.9.1: LM 7805

2.10 IR Sensor

An **Infrared sensor** is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation.

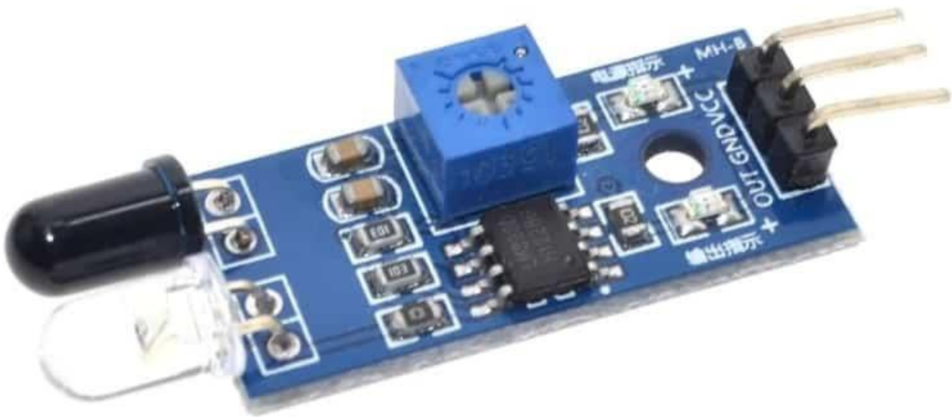

Figure 2.10: IR Sensor.

These types of radiations are invisible to our eyes, which can be detected by an infrared sensor. The emitter is simply an IR LED (**Light Emitting Diode)** and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

2.10.1 Uses of IR Sensor

IR sensors are now widely used in **Motion detectors**, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests. In a defined angle range, the sensor elements detect the heat radiation (infrared radiation) that changes over time and space due to the movement of people.

Infrared technology is widely used for commercial purposes for:

- Night vision devices.
- In astronomy, to detect objects in the universe by telescopes and solid-state detectors.
- In military activities for missile tracking.
- In art restoration to analyze paintings and discover hidden painting layers.
- For tracking nanoparticles in living organisms.

2.11 Temperature Sensor

A temperature sensor is **a device used to measure temperature**. This can be air temperature, liquid temperature or the temperature of solid matter. There are different types of temperature sensors available and they each use different technologies and principles to take the temperature measurement.

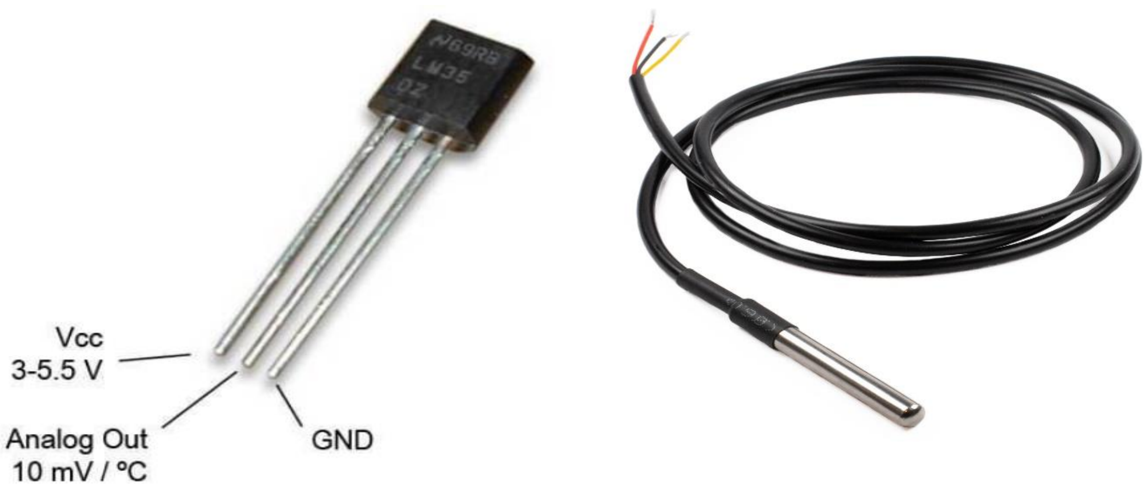

Figure 2.11: Temperature Sensor.

2.12 DIAC

A DIAC is a full-wave or bi-directional semiconductor switch that can be turned on in both forward and reverse polarities.

The name DIAC comes from the words **DI**ode **AC** switch. The DIAC is an electronics component that is widely used to assist even triggering of a TRIAC when used in AC switches and as a result they are often found in light dimmers such as those used in domestic lighting. These electronic components are also widely used in starter circuits for fluorescent lamps.

❖ Understanding DIAC Working with Application Circuits

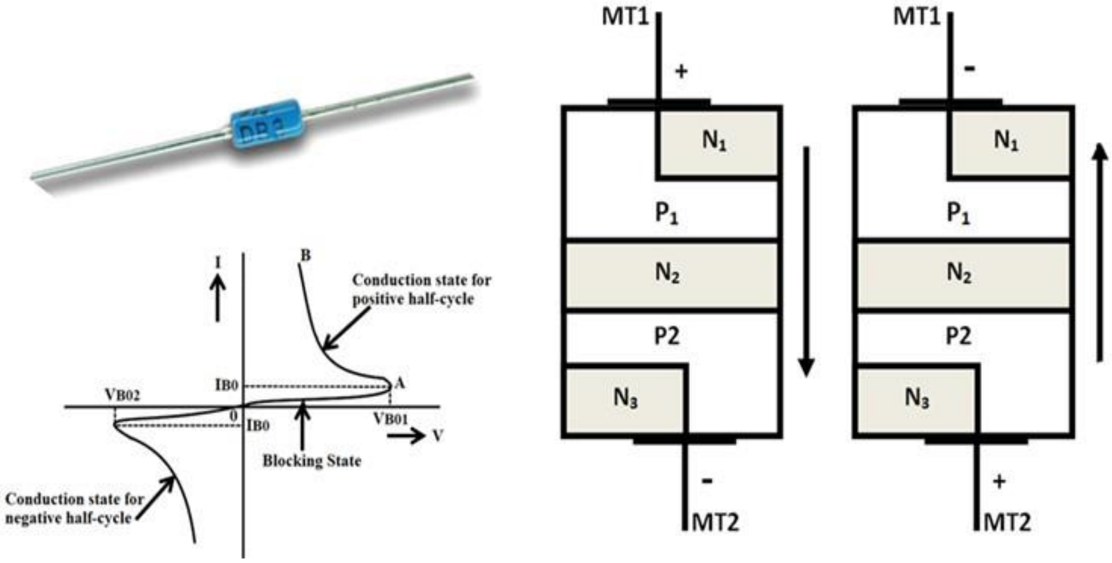

Figure 2.12: DIAC Working with Application Circuits

2.12.1 DIAC Construction

The construction of DIAC will be quite similar to the structure of the transistor, but they have some differences like the DIAC does not have any base terminal, all the three layers have the same amount of doping and it delivers symmetrical switching properties in both the polarities of the applied voltage.

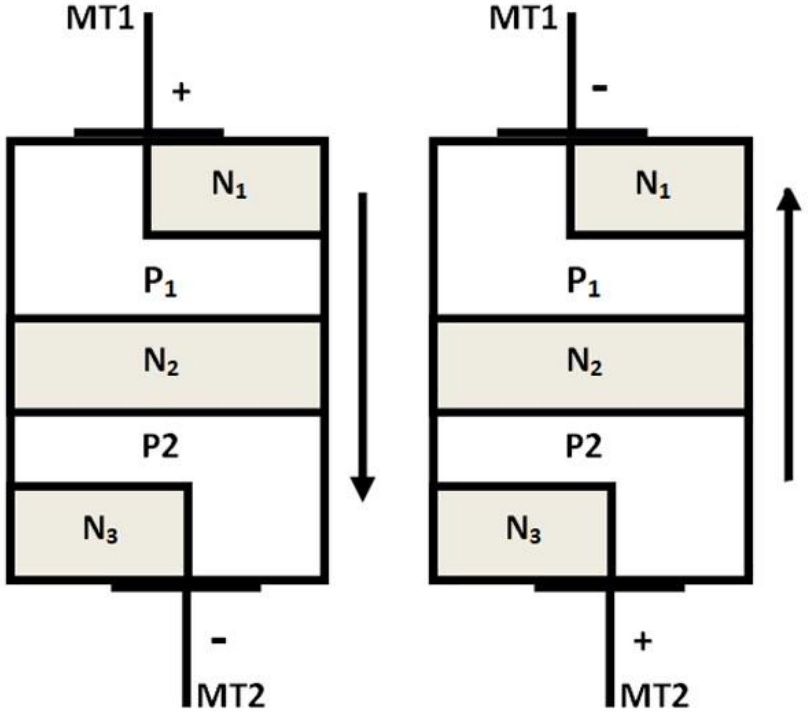

Figure 2.12.1: **DIAC Construction**

The above diagram shows the typical **construction of the DIAC**. As mentioned earlier the DIAC has two terminals namely MT1 and MT2 and it can **deliver current flow in both directions**. The DIAC is made of a five-layered structure; the layers closer to the terminals are the combination of both positive and negative layers. When the voltage is passed to the terminals the layer with respective polarity to the voltage gets activated, this combination of both the polarities helps in operating the DIAC in both the directions

2.12.2 DIAC Working Principle

The above image shows the clear operation of the DIAC with respective to the polarities. Consider the MT1 terminal to be positive, then the P1 layer near MT1 will be activated, so the conduction will be taking place in the order of P1-N2-P2-N3.

When the current is flowing from MT1 to MT2 the junction between P1-N2 and P2-N3 are Forward Biased and the junction between N2-P2 is reverse biased.

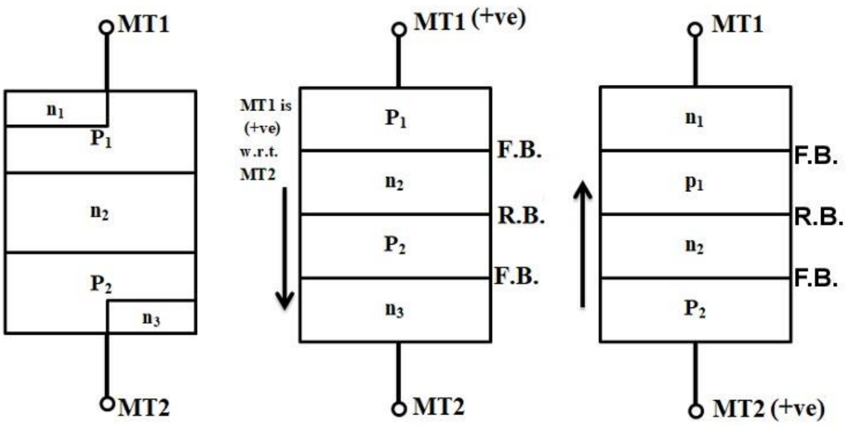

Figure 2.12.2: DIAC Working Principle.

Similarly, if we consider MT2 terminal to be positive, then the P2 layer near MT2 will be activated and the conduction will be taking place in the order of P2-N2-P1-N1. The current will be flowing from MT2 to MT1 and the junctions between P2-N2 and P1-N1 are forward biased and the junction Between N2- P1 is reverse biased. Hence the conduction will be possible in both the directions.

2.13 TRIAC

A **TRIAC** is defined as a three terminal AC switch which is different from the other silicon controlled rectifiers in the sense that it can conduct in both the directions that is whether the applied gate signal is positive or negative, it will conduct. Thus, this device can be used for AC systems as a switch.

❖ Understanding TRIAC Working with Application Circuits

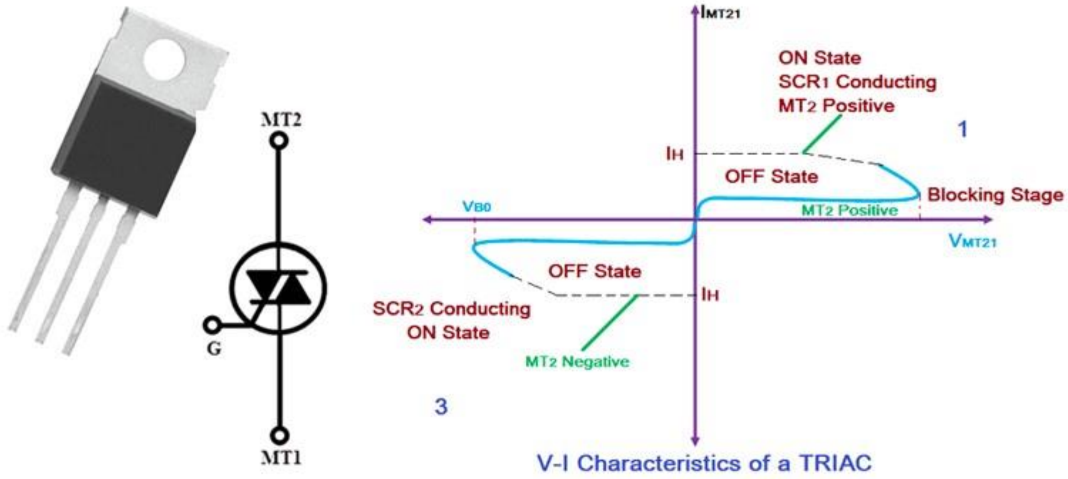

Figure 2.13: TRIAC – Symbol, V-I characteristics curve.

2.13.1 TRIAC Construction

The below shows the structure of the TRIAC, it is a four-layer device that consists of six doping regions. The gate terminal is designed in a way to have ohmic contact with both N and P regions, which helps the device to get triggered with both positive and negative polarities.

TRIAC can go to conduction state if the applied voltage is equal to the breakdown voltage, but the most preferred way of turning on a TRIAC is by providing a gate pulse, either positive or negative. If the gate current is high, a very small amount of voltage is enough to turn on the TRIAC.

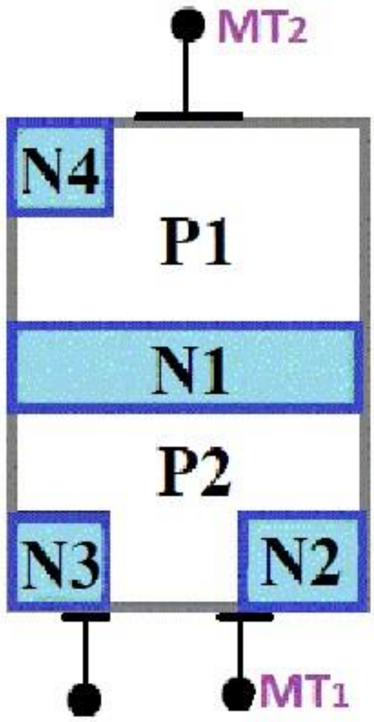

Figure 2.13.1: TRIAC symbol.

As the TRIAC is bidirectional and has an ability to get turned on with both the polarities to the gate pulse it can operate in four different types of modes of operation as listed below

1. MT2 is positive with respect to MT1 with a gate polarity positive with respect to MT1.

2. MT2 is positive with respect to MT1 with a gate polarity negative with respect to MT1.

3. MT2 is negative with respect to MT1 with a gate polarity negative with respect to MT1.

4. MT2 is negative with respect to MT1 with a gate polarity positive with respect to MT1.

CHAPTER 3

System Design and Development

3.1 Project Flow Chart

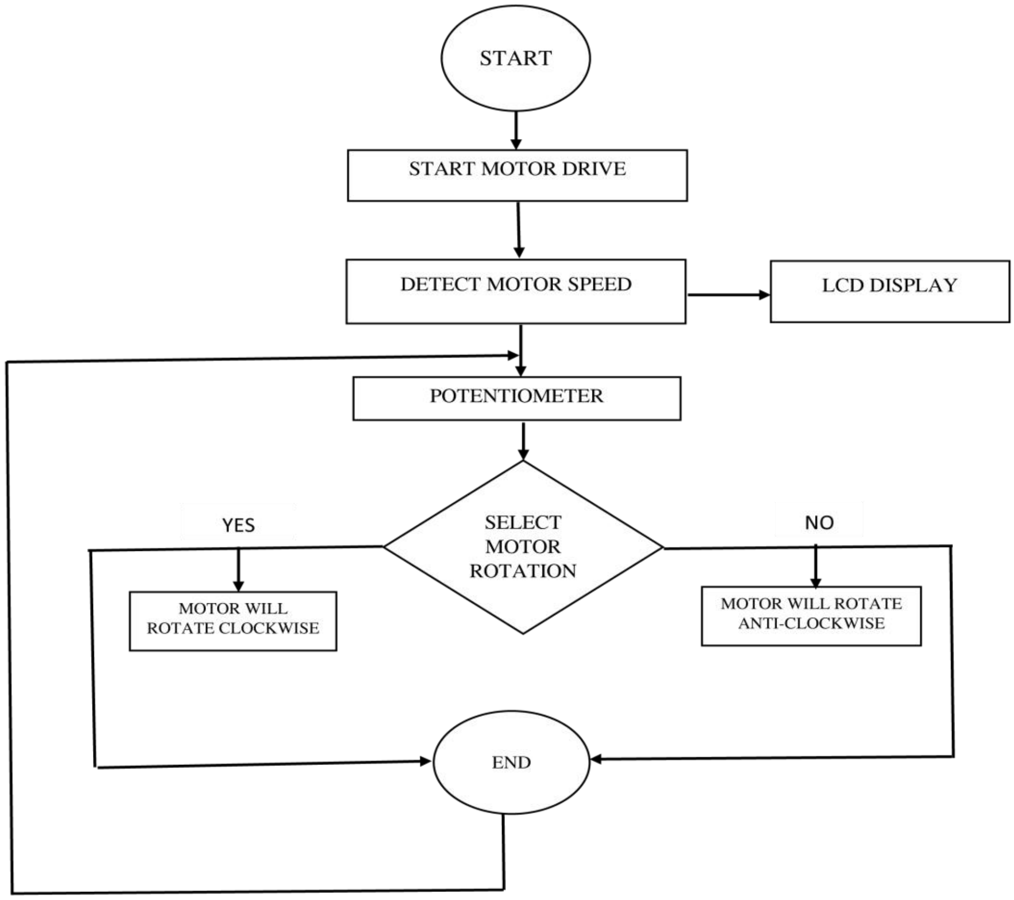

Figure 3.1: Project Flow Chart

3.2 Working Function of Our Project

Firstly, we supply 220V AC in Step down Transformer .Then the transformer step down the voltage 12V AC. Then the AC Volt Convert 12V Dc by using **Full wave center tapped Rectifier circuit**. We connect a capacitor to convert pulsating Dc to Pure Dc. It goes to the input pin of voltage regulator 7805. At output pin of this regulator we get a constant 5V DC which is used for different devices in this project (Like Microcontroller, LCD Display, IR Sensor etc.)

Thermistor type temperature sensor is connected microcontroller pin number 2. It provide analog signal to microcontroller then microcontroller convert it digital signal and send it to LCD display.

IR sensor connected to microcontroller pin number 11 which send Digital signal to microcontroller. We connect a crystal oscillator in pin number 9 and 10 which generate clock pulse to active microcontroller. We use 16X2 LCD display which has 16 pins. Its 4, 6,11,12,13 & 14 pin is connected with microcontroller.

There is Two Relay used for Motor forward & reverse rotation. The motor will run forward rotation when the relay switch is off and the motor will run reverse rotation when the switch is ON.

The condition of forwarding rotation, 220V AC positive terminal connects to the motor running terminal and capacitor connected between common and running terminal.

The condition of Reverse rotation, 220V AC positive terminal connected to motor Starting terminal and capacitor connected between common and starting terminal.

Variable Resistor (Potentiometer) is attached to a knob. The knob controls the gate current of the TRIAC, through a circuit consisting of a DIAC and a capacitor. This gate current controls the current flowing through TRIAC. Thus the speed of the motor is controlled.

3.3 Block Diagram of Hardware Implementation

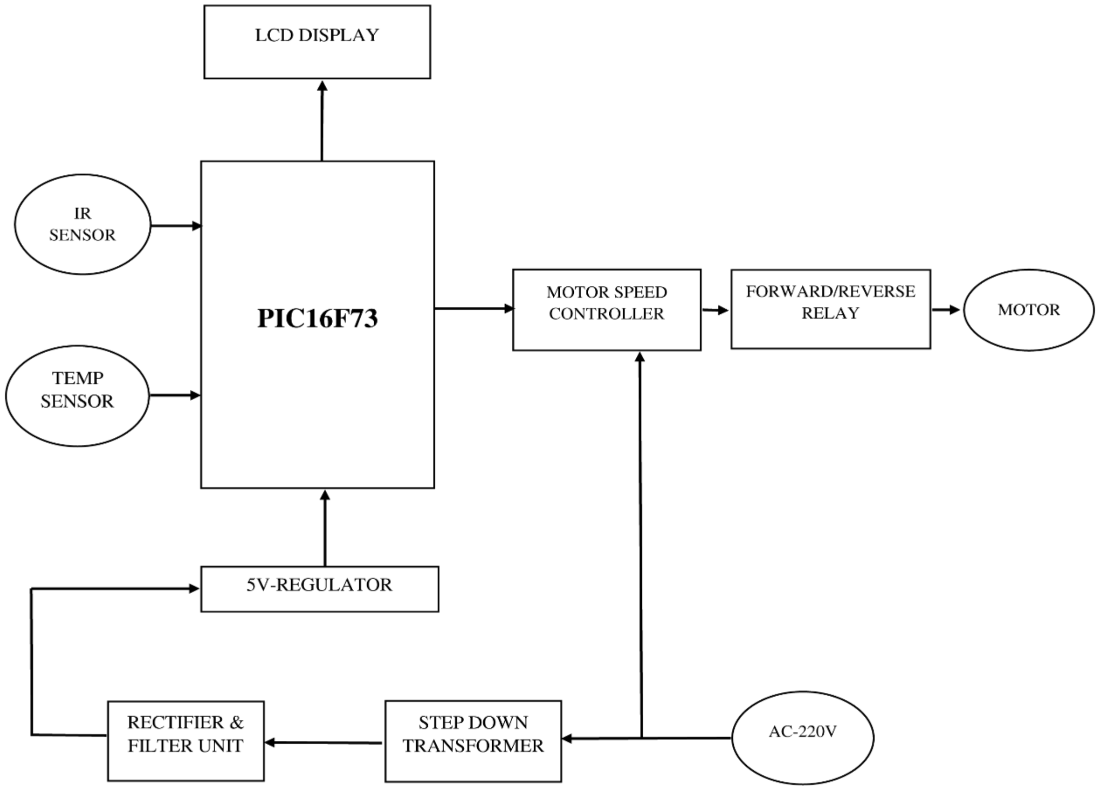

Figure 3.2: Block Diagram of Hardware Implementation.

3.4 Circuit Diagram of Whole System

This is just a modification of the above digital tachometer using PIC16f73. A 16×2 LCD module is used here for displaying the output. The output is given in rpm (revolutions per minute) and the number of digits are increased from 3 to 5. This circuit can display up to 10200 rpm.

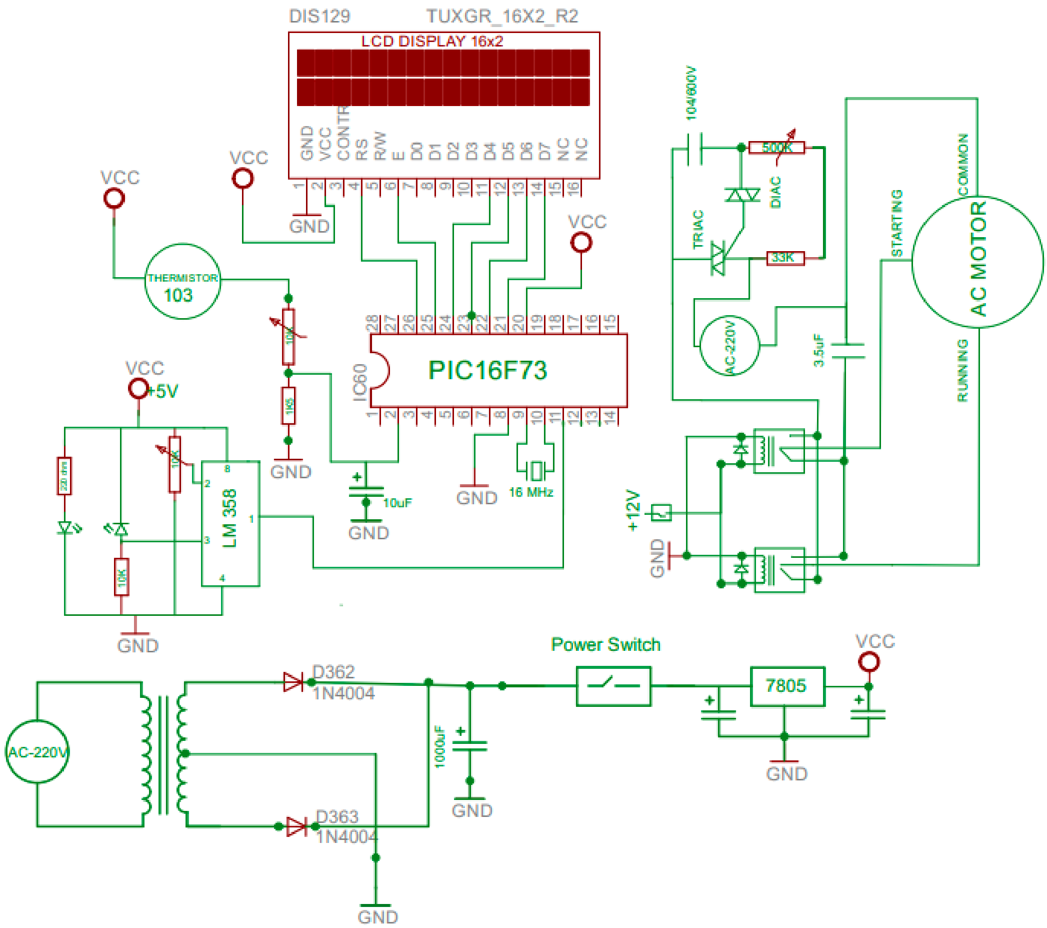

Figure 3.3: Connection Diagram of AC Motor RPM Count.

3.5 Summary

Firstly, we showed the block diagram. Then we discuss about connection diagram and explanation. And lastly we briefly discuss about working procedure in this project.

CHAPTER 4

RESULT AND DISCUSSIONS

4.1 Introduction

Result is the output of any project. Result presents the success of a project. We find out the successful result of this project by different experiment.

4.2 Cost Analysis:

SL	Equipment	QUENTITY	PRICE
1	Microcontroller PIC16F73	1 pcs	450
2	AC motor	1 pcs	750
3	Step-down transformer	1 pcs	250
4	LCD Display	1 pcs	320
5	IR module	1 pcs	120
6	Relay 12v	2 pcs	120
7	Temperature Sensor	1 pcs	200
8	Capacitor 3.5uF	1 pcs	50
9	7805 Voltage Regulator	1 pcs	20
10	TRIAC	1 pcs	50
11	DIAC	1 pcs	20
12	Capacitor- 1000uF,470uF	3 pcs	50
13	Power switch	1 pcs	20
14	PVC board	1 pcs	500
15	Potentiometer	1 pcs	50
16	Register	4 pcs	15
17	Diode	2 pcs	20
18	Connecting wire	some	100
Total Price			3105

4.3 Project Overview

In the figure: 4.2, we can see, the system is off. Now we need to start the system.

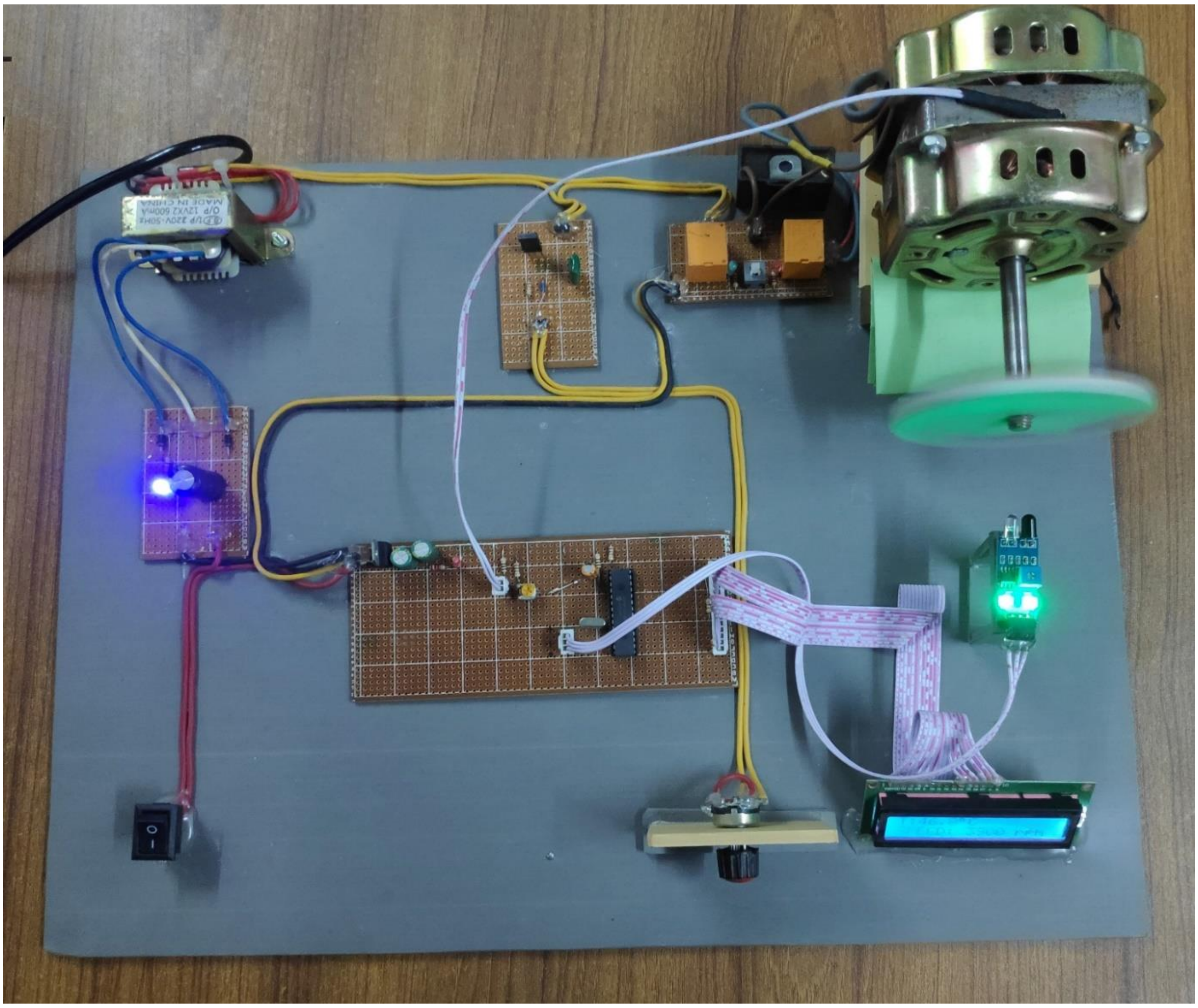

Figure 4.3: Project Overview

4.3.1 Before Start The system

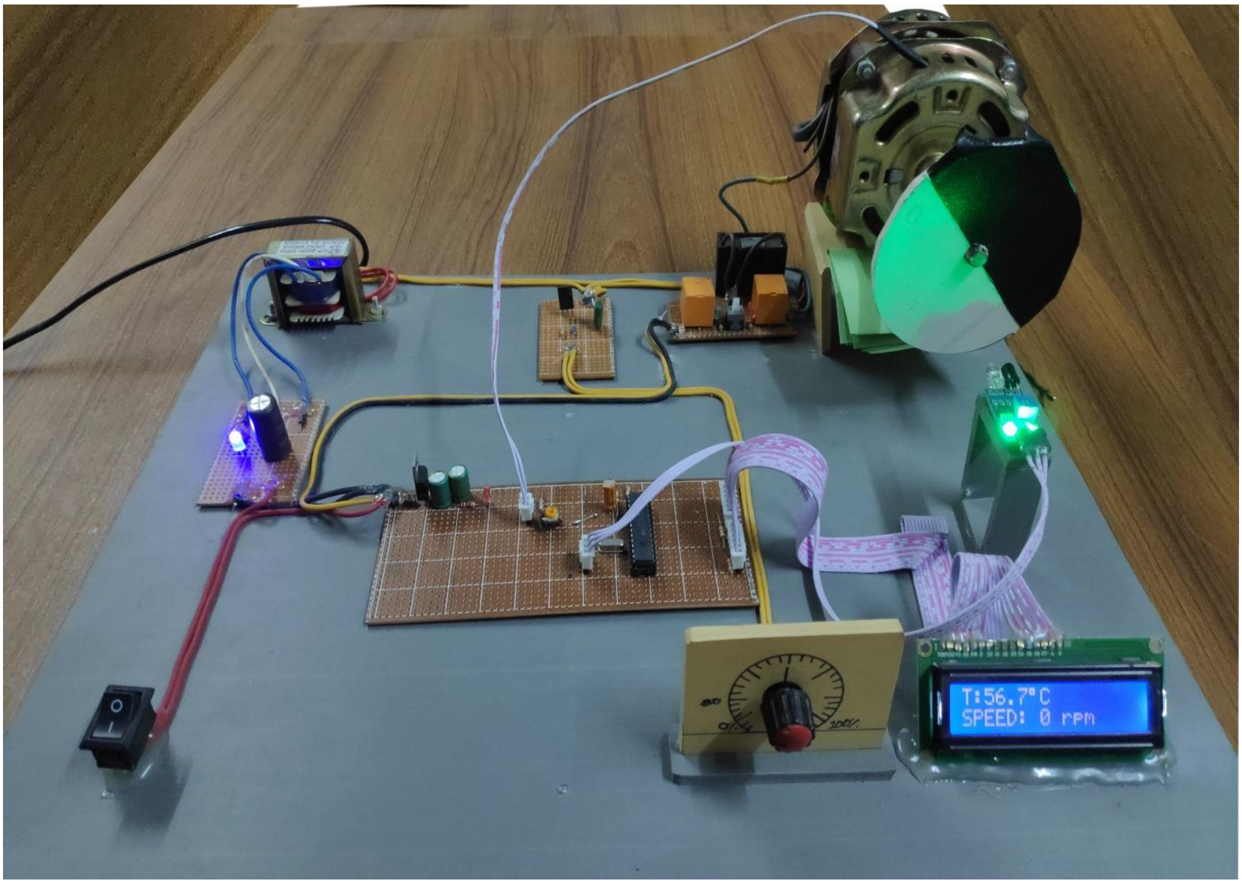

Figure 4.3.1: Before Start The system.

4.3.2 After Start The system

In figure 4.3.2, we can see, the motor is rotating and the motor speed controller circuit measure it and send it to microcontroller and the microcontroller shows it on LCD display.

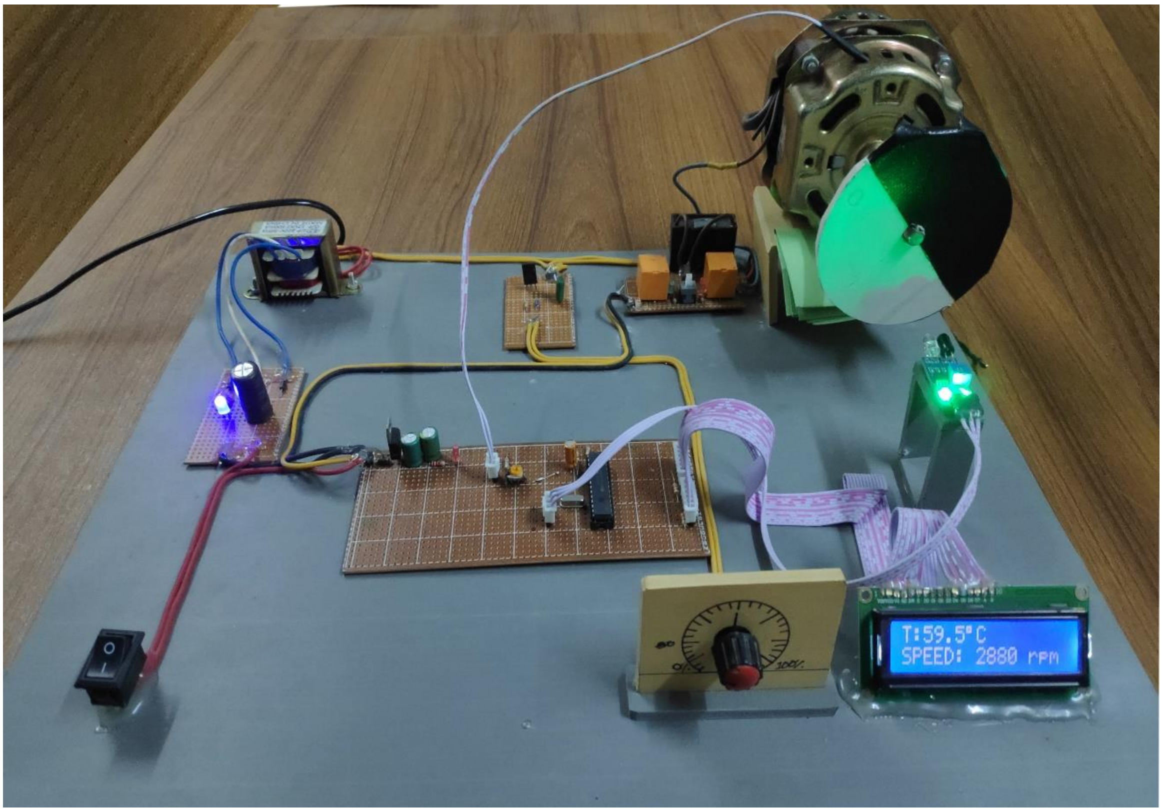

Figure 4.3.2: After Start The system

4.4 AC motor speed control diagram

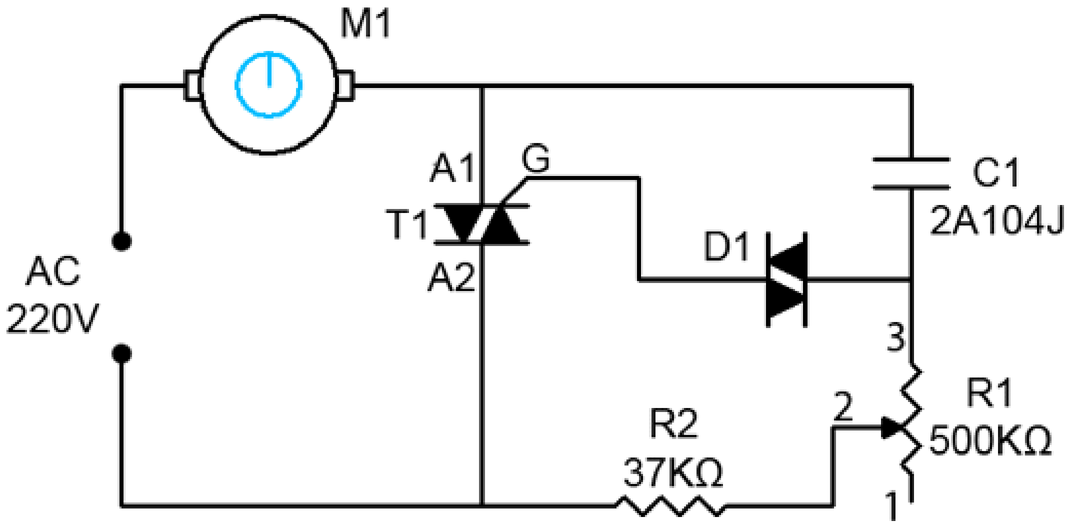

Figure 4.3: AC Motor Speed Control Diagram.

4.5 Discussion

To design, Construct and design analysis of the circuit is the basic purpose of our project. Our project work is already completed. The constructed circuit is very nicely working. At first we done a project, then we used this concept in this project by studying books, searching internet, discussing with my teacher.

Finally, we overcome this problem and complete my project.

4.6 Summary

Firstly we discuss about Control the system, use then show the project setup, and after we showed the project when it’s working. And lastly we discuss about discussion.

CHAPTER 5

CONCLUSIONS

5.1 Conclusions

This is an ongoing project. This project gives basic idea of how Digital Tachometer. We use Digital Tachometer system as a prototype for measuring motor speed. It also provide a security and easy for motor speed controlling. This project based on and microcontroller platform both of which are Free Open Source. So the implementation rate is inexpensive and it is reasonable by a common person. The system has been successfully designed and prototyped to measuring motor speed. We have shown a simple prototype in this project but in future it can be extended too many other regions.

5.2 Limitations of the Work

In our project, we use microcontroller, which is easy to calibrate. But, there is not so many output ports in this controller. If we use any other board like Adriano Mega, we can add many other features.

5.3 Future Scopes

There are a lot of scopes to develop in this project like we can use LASER instead of motor controlling circuit.

Reference

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[5] Sedra and Smith, Microelectronic Circuits, fourth edition, Oxford University Press, 1998

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[8] International Journal of Computer Theory and Engineering, Vol. 2, No. 1 February, 2010 1793-8201

Appendix

```
#include <16F73.h>

#include <flex2_lcd.c>


#define MPWM PIN_C0


int16 Count,Frequency,RPM;

float tp=23.5;


#int_timer2

void t2_isr(void)

{

 Count = get_timer2();

 OneSecondGone = true;

 Frequency = Count;

 RPM= (Count * 60);

}


////////////////////////////////////////////////////////////////////////////////

void main()

{

 setup();

  while(TRUE)
```

```
 {

   if (OneSecondGone)
   {
     lcd_gotoxy(1,1);
     printf(lcd_putc, "T:%2.1f%cC       ",tp,223);

     lcd_gotoxy(1,2);
     printf(lcd_putc, "SPEED: \%lu rpm    ",RPM );

     set_ADC_channel(0);
     delay_ms(1);
     tp = read_adc();

    OneSecondGone = false;
   }

 }
}
//////////////////////////////////////////////////////////////////////////////
//----------------------        end void main()      ------------------------//
//////////////////////////////////////////////////////////////////////////////
```

```
void setup (void)
{



  lcd_gotoxy(1,1);
  printf(lcd_putc, "   WELCOME TO   ");
  lcd_gotoxy(1,2);
  printf(lcd_putc, "      SU       ");
  delay_ms(1500);

  lcd_gotoxy(1,1);
  printf(lcd_putc, " SUBMITTED BY:  ");
  lcd_gotoxy(1,2);
  printf(lcd_putc, "    SAIKAT      ");
  delay_ms(1500);

  lcd_gotoxy(1,1);
  printf(lcd_putc, "    CHIRON      ");
  lcd_gotoxy(1,2);
  printf(lcd_putc, "    TANGIRUL    ");
  delay_ms(2000);

  lcd_gotoxy(1,1);
  printf(lcd_putc, "    SHAMIM      ");
  lcd_gotoxy(1,2);
```

```
   printf(lcd_putc, "    SUIT        ");
   delay_ms(2000);

}

////////////////////////////////////////////////////////////////////////////////

}
```