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International Journal For Research in  
Applied Science and Engineering Technology



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# **INTERNATIONAL JOURNAL FOR RESEARCH**

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

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**Volume: 4    Issue: VII    Month of publication: July 2016**

**DOI:**

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# **Design and Implementation of Microcontroller Based Motor Controller with Temperature Sensor**

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**Abstract:** *The objective of this project is to reduce the unwanted power used in electrical equipment's for sensitive, less tolerant and power loss problems. This Project presents the design and simulation of a motor speed control system, based on temperature using Pulse width Modulation Technique and to improve the usage of power and to increase the life time of electrical machines. In such case, the motor will be controlled by a temperature sensor based PIC Microcontroller. Motor can be adjusting by the speed, based on ambient temperature. By the setting value of temperature, speed of the motor varied (real time applications). It reduces the machine speed so automatically unwanted energy usage reduces up to 20%of energy approximately. In such case, the unwanted energy will be saved. The simulation of the system has been done and simulation output taken based on Proteus and Lab view software.*

**Keywords :** *Maximum Power Point Tracking (MPPT), Variable Voltage Variable Frequency (VVVF), Pulse Width Modulation (PWM), Resistance Temperature Devices (RTD),Pulse Width Modulation (PWM)*

## **I. INTRODUCTION**

Aim is to design a microcontroller based induction motor controller with heat sensor. This design is mainly applied to a 1phase induction motor which will function automatically in adjusting the speed according to the ambient temperature. This design is mainly applied to a motor/fan which will function automatically in adjusting the speed according to the ambient temperature. Besides that, it is also said to be more energy saving as the speed of the motor depends on the ambient temperature based on the system and hence no extra power is needed to drive the motor at higher speed which is not necessary at low ambient temperature. The design is expected to be simple yet can be functional. In order to accomplish this aim, there are several objectives to be achieved.

Induction motors are the most widely used motors for in most Powered home Appliances. Simple and rugged low cost, design, low maintenance and direct connection to an AC power source and the main advantages of an AC induction motor. When power is supplied to an induction motor at recommended specifications, it runs at its rated speed. However, many applications need variable speed operation. One of them is a fan. This report presents a design Of a Pic Microcontroller ATMEGA328P Based Motor Controller with Heat Sensor which is used to vary the speed of a motor.

The Microcontroller Based Motor Controller with Heat Sensor project aims to design a controller that varies the speed of the motor with respect to the ambient temperature. This controller will be embedded as an addit ion to a stand motor. The speed of the motor is expected run in low speed at low ambient temperature and vice versa. A phase control method is chosen to be used for this design. The power delivery to the motor is controlled by the firing angle of a Triac where it will control the AC power supply. When the ambient temperature is sensed, temperature sensor produces an output voltage to the microcontroller.

The microcontroller acts as a digital signal processing (DSP) body where it will convert the analogue voltage into digital form and compare with the pre-set values. After that, it generates a signal and sends it to trigger the triac. The triac is used to control the switching the phase control circuit and hence, the firing time of the Triac can be controlled.

With the controlled of firing time of the Triac, the input power to the motor can be controlled as well. Besides that, a circuit is also included in this project. The circuit acts as a switch to activate or deactivate the motor. This motor will be speed controlled based on PWM technic. In this method to controlled unwanted energy will be consumed.

## **II. SYSTEM MODEL**

The fig 2.1 showing of proposed system shown below. In this method the induction motor speed changes, based on temperature. In the proposed system, the input reference temperature is given to microcontroller, the controller programming to base on reference temperature. The controller can be changed the speed of motor.

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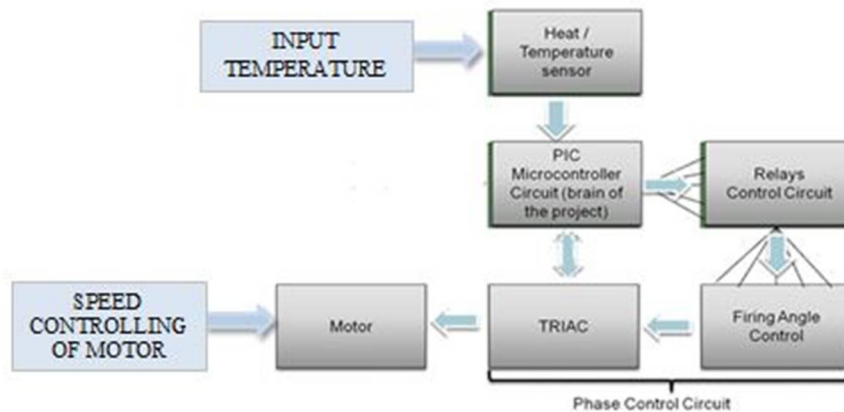
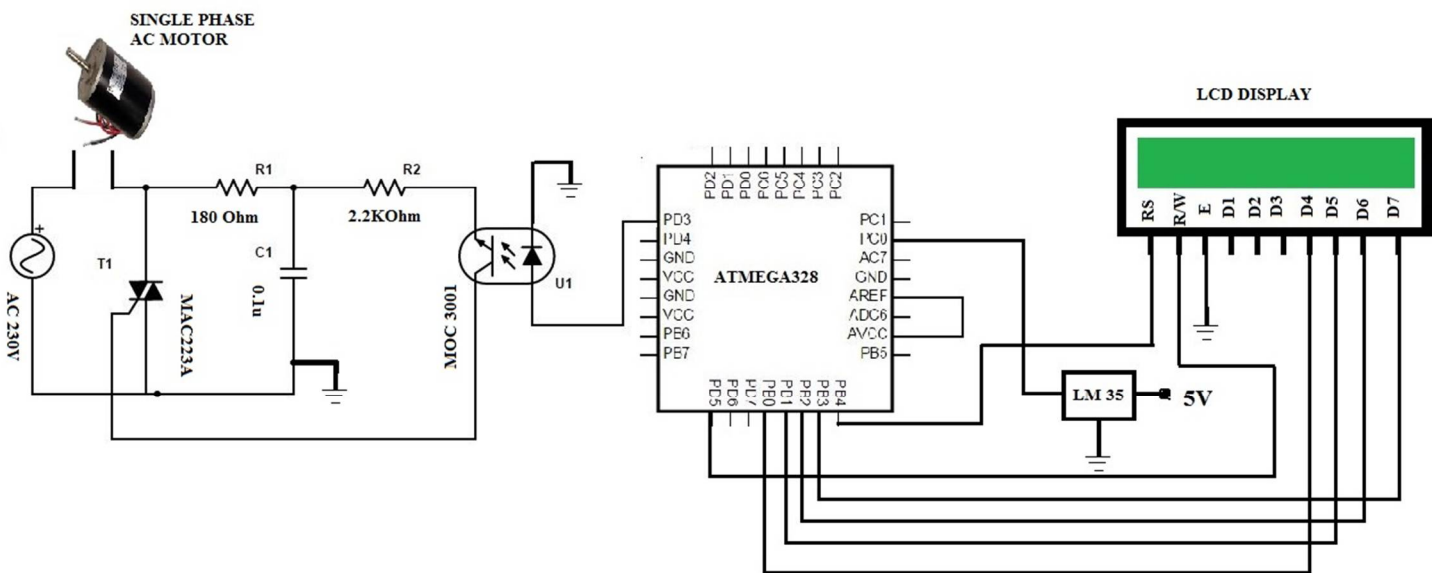


Fig 2.1 System Block diagram

As discussed in the earlier section, the speed of a stand fan is independent of the ambient temperature; hence there will be wastage of power. Besides that, each motor has its own lifespan. The lifespan of a stand fan motor is the total number of revolution made. As the motor speed does not change with the ambient temperature, there might be extra revolution (high speed in low ambient temperature) and hence the lifetime of a motor will be shortened. This project consists of several steps. First is to set the desired highest and also the lowest temperature and some of the preset values into the microcontroller. Next as the system is on, the ambient temperature will then be sensed by the temperature sensor. The output of the sensor will then feed to PIC Microcontroller.



2.2 Circuit diagram

The PIC Microcontroller will generate the desired output signals which are correspondent to the difference ambient temperatures by comparing the output voltage from the temperature sensor with the preset values. These output signals will then be sent to the firing angle control circuit to trigger certain relay to control the firing angle of the Triac. Therefore, the average power supply to the motor will be varied; hence, speed of the motor can be controlled. This project will be improving the speed controlling of induction motor this method we are implementing temperature sensor used to regulate the speed based upon various industrial applications. This controlling using temperature based speed changing of induction motor. So speed will be decreases based of power consumption will be increased so the cost of unit is reduced and life time of motor is increased

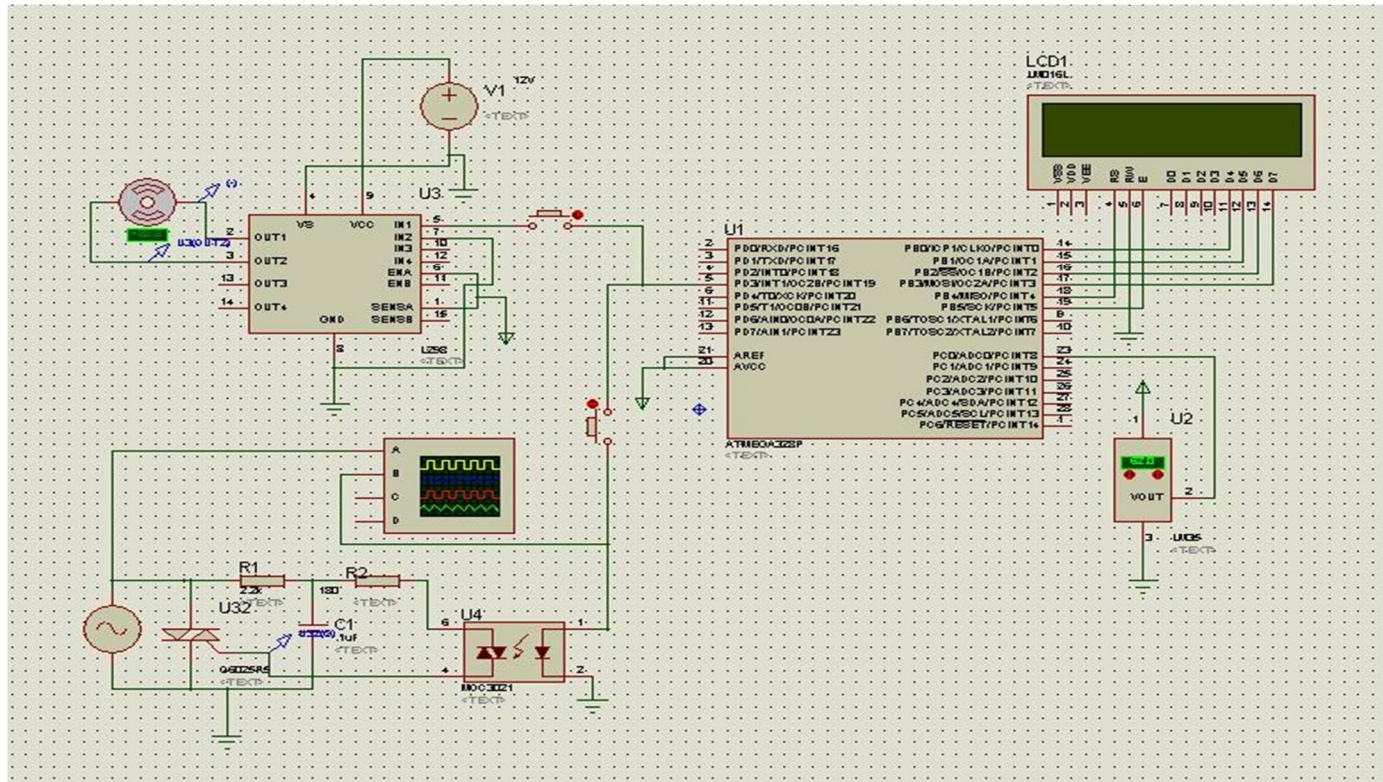
### III. SOFTWARE SIMULATION AND RESULT

The software simulation result will be shown in fig 3.1. This system can be controlled a single controller it can controller can

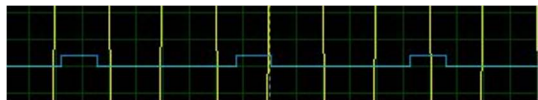


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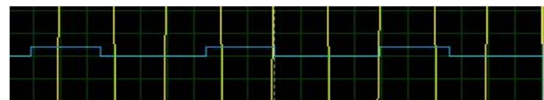
controlled AC/DC motor speed varied based on LM35 temperature sensor output.



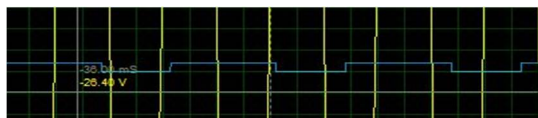
3.1 AC/DC MOTOR WORKING SIMULATION DIAGRAM



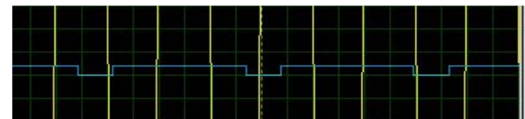
A. Wave form for 25°C



B. Wave form for 50 °C



C. Wave form for 75°C



D. Wave form for 85°C

PWM technic used to controlling the speed of the motor. In AC motor can get the pulse signal in ATMEGA controller pin no 5. That PWM pulse given to opto-coupling unit that opto-coupling unit convert light energy. The pin no 1,2 is incoming LED unit .The light can ON/OFF based on digital Pulse. The output of opto-coupler is connected internally one LDR unit .that LDR works the light ON the LDR resistance is Low .So current passing to trigger the Triac gate to turn ON the Triac. Pulse not came the LED not ON, and then LDR resistance is very high so current not passing to the Triac circuit so Triac is not triggered then motor is not on.

DC motor that pulse given to Driver IC. The driver IC externally +5V Power given that pulse based the Voltage of Motor is adjusted automatically. That driver circuit automatically reducing voltage based upon the PWM technic to controlling the speed.

### IV. APPENDIXES

#### PIC MICROCONTROLLER ATMAL EMBED C CODE

```
#include <LiquidCrystal.h>
```

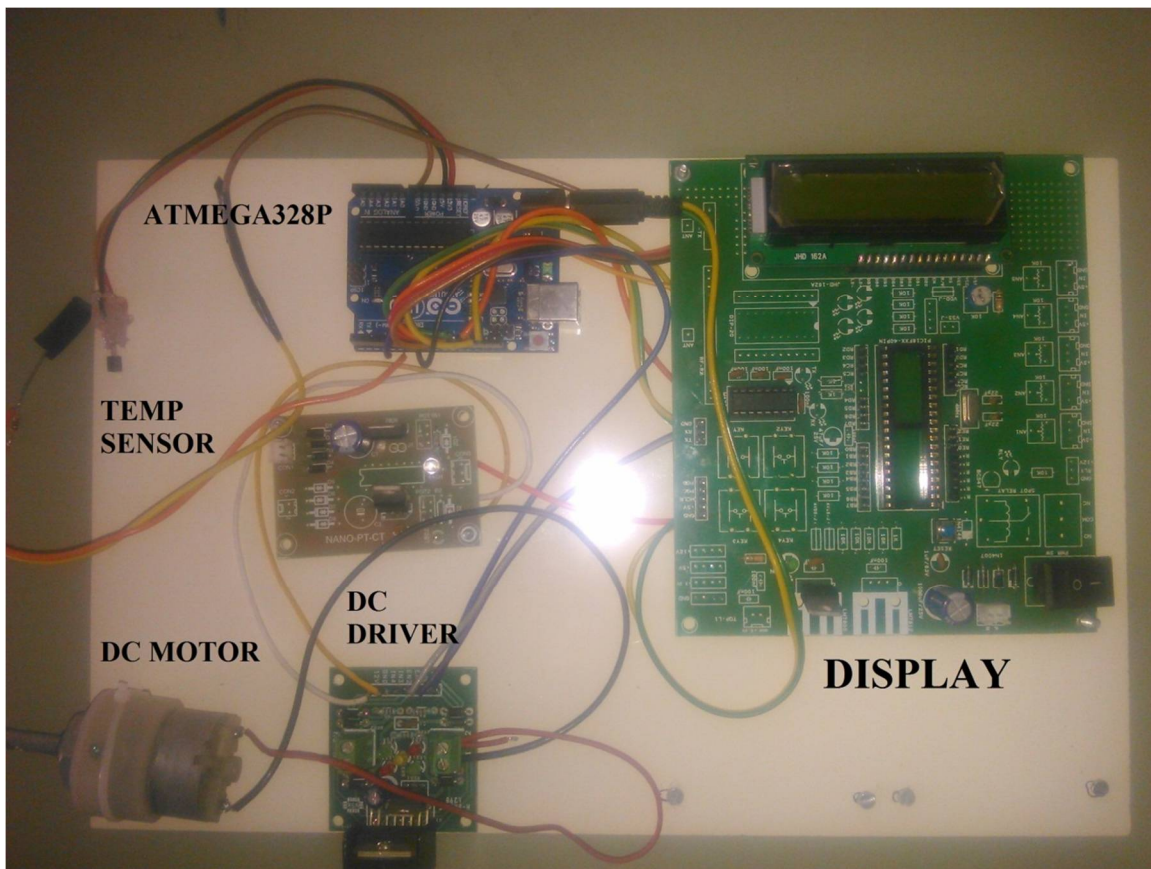
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```
LiquidCrystal lcd(12,13,8,9,10,11);
int previous_temp,current_temp;
int temp,temp1;
int temperature=A0;
int motor=3;
void setup()
{
  pinMode(temperature,INPUT);
  pinMode(motor,OUTPUT);
  lcd.begin(16,2);
  lcd.setCursor(0,0);
  lcd.clear();
  analogReference(EXTERNAL);
}
void loop()
{
  temp_calc();
  lcd.setCursor(0,0);
  lcd.print("TEMPERATURE:");
  if(previous_temp<100)
  lcd.print(0);
  if(previous_temp<10)
  lcd.print(0);
  lcd.print(previous_temp);
  if(previous_temp<25)
  analogWrite(motor,previous_temp*2);
}
void temp_calc()
{
  previous_temp=0;
  for(int i=0;i<5;i++)
  {
    temp=analogRead(temperature);
    temp1=map(temp,0,1023,0,500);
    current_temp=temp1;
    if(current_temp>previous_temp)
    {
      previous_temp=current_temp;
    }
  }
}
```

This code in Embedded C Language it will be converted into hexa File using Arduino software and upload the hexa code to that ATMEGA 328P IC chip

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## V. HARDWARE AND RESULT

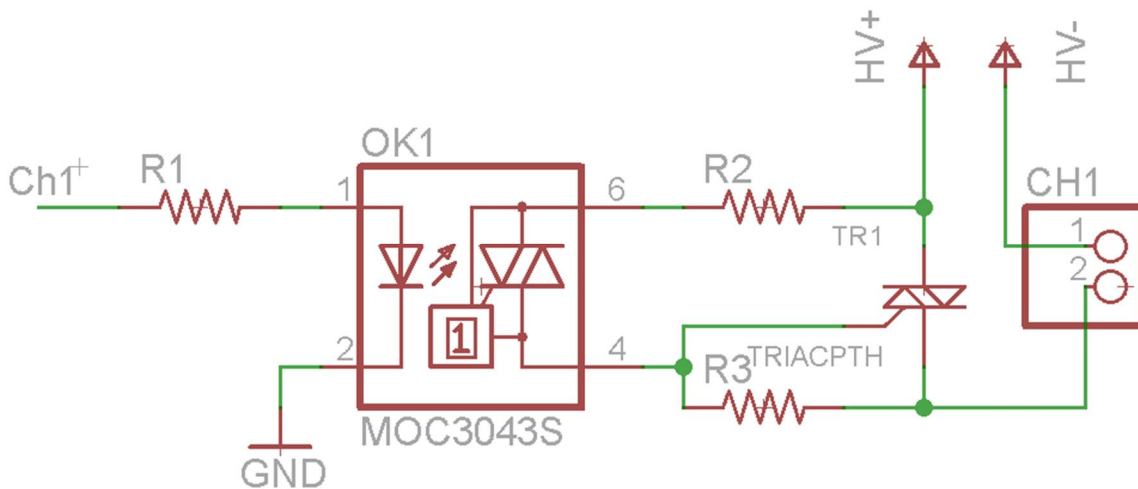


5.1. Block diagram hardware kit

### A. Motor Rating

Dc Motor: Range: 12 to 24 V Dc , Rpm :- 110 rpm

Ac Motor: Range: 230V AC/50 Hz , Rpm :- 1200 rpm



5.2 Triac and Opto-coupler units

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### B. Calculation

Temp :- 25 ° C

Ac/dc Motor Off condition

Temp :- 35 ° C

Ac Motor :- motor run at 205rpm

Dc Motor :- motor run at 40rpm

Temp :- 45 ° C

Ac Motor :- motor run at 435rpm

Dc Motor :- motor run at 65rpm

Temp :- 55 ° C

Ac Motor :- motor run at 620rpm

Dc Motor :- motor run at 73rpm

Temp :- 65 ° C

Ac Motor :- motor run at 825rpm

Dc Motor :- motor run at 85rpm

Temp :- 75 ° C

Ac Motor :- motor run at 1170rpm

Dc Motor :- motor run at 96rpm

Temp :- above 75 ° C

Ac Motor :- motor run at 1200rpm

Dc Motor :- motor run at 110rpm

### C. Tabulation

TEMPERATURE	DC MOTOR SPEED (RPM)	AC MOTOR SPEED (RPM)
BELOW 25°C	0	0
35°C	40	205
45°C	65	435
55°C	73	620
65°C	85	825
75°C	96	1170
Above 75°C	110	1200

5.3 Temperature Vs AC/DC Motor (RPM)

## VI. CONCLUSION

A Project design speed control of Motor based on temperature using PWM technique is proposed in this paper. The simulation of the system is working properly and the design is appropriate according to the modern needs and technology. The speed of Motor depends on the temperature and there is no need for regulating the speed manually. Various graphs have been plotted to show the varying relationships between different parameters. PWM technique is found to be appropriate for controlling fan speed according to temperature.



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