A Minor Project

On

TEMPERATURE BASED FAN SPEED CONTROL & MONITORING

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF

BACHELOR OF TECHNOLOGY

(ELECTRONICS & COMMUNICATION ENGINEERING)

FEB-JUL 2021

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

GURU NANAK DEV ENGINEERING COLLEGE LUDHIANA

(An Autonomous College Under UGC ACT)

GURU NANAK DEV ENGINEERING COLLEGE, LUDHIANA

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I hereby certify that the work which is being presented in the Project entitled "TEMPERATURE BASED FAN SPEED CONTROL AND MONITORING" by "ADITYA ANAND" in partial fulfillment of requirements for the award of degree of B.Tech. (Electronics and Communication Engineering) submitted to the Department of Electronics and Communication Engineering at GURU NANAK DEV ENGINEERING COLLEGE, LUDHIANA is an authentic record of my own work carried out during a period from February to July. The matter presented in this project has not been submitted by me or anybody else in any other University / Institute for the award of B.Tech Degree.

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This is to certify that the above statement made by the candidate is correct to the best of my own knowledge.

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The Minor Project Viva–Voce Examination of_____ has been held on _____ and accepted.

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ABSTRACT

Today this modern era is world of technology and we cannot achieve anything in this field until or unless theoretical education acquired in classroom is effectively wedded to its practical approach. Doing four weeks training at Guru Nanak Dev Engineering College, Ludhiana helps me in better understanding and implementation of theoretical knowledge that I gained. During This period, I have studied various concepts about Minor Project. I learned Arduino language which is integral part of designing applications. We studied about the desktop applications both theoretical as well as practical and also learned the programming and how to create a desktop application and hardware implementation for temperature-based fan control & monitoring using Arduino.

ACKNOWLEDGEMENT

We are highly grateful to Dr. Sehajpal Singh, Principal, GNDEC, Ludhiana, for providing us this opportunity to carry out Minor Project at Guru Nanak Dev Engineering College, Ludhiana. We express gratitude to Dr. Narwant Singh Grewal (HOD, ECE) for their intellectual support.

We would like to express our deep sense of gratitude and thank profusely to Pf. Chahat Jain, Pf. Gurpurneet Kaur and Pf. Daljit Singh at Guru Nanak Dev Engineering College, Ludhiana who instructed us and assisted us during this period. We also thanks to the programming department for provision of excellent all the latest equipment's and resources for us to utilize. Minor Project here was itself true learning experience which is going to help us immensely in our career.

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CHAPTER-1 INTRODUCTION

1.1 OVERVIEW

Electronic and Electrical environment with respect to this context is any environment which consists of appliances such as street lights, water level control, security alarm etc. A remotely accessible environment is an environment in which each appliance can be accessed automatically and controlled using software as an interface, which includes a Programming and web application. Such remotely accessible systems are already available in the market, but have a number of drawbacks as well. This paper aims to perform a survey of all the existing systems and compare these systems with this system. The paper will also compare and contrast all the systems and look at their various features and disadvantages. A wide variety of options are available for the automation. The system proposed provides three means to control the street light, water level of tank and security alarm. The real time monitoring has been an important feature that can be used in the campus automation systems. As a change in the status of the devices occurs, the user can be informed in real time. The user commands are transferred to a server which is usually done by indicators. This can help control the devices. Arduino is used as a communication medium to help establish connection. The system makes use of a Arduino microcontroller for home and office appliances control.

1.2 USER REQUIREMENTS ANALYSIS

Arduino Uno Arduino is an open-source physical platform based on microcontroller board having the ATmega32 series controllers and Integrated Development Environment for writing and uploading codes to the microcontroller. It has input and output pins for interaction with the outside world such as with sensors, switches, motors and so on. To be precise 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. It can take supply through USB or we can power it with an AC-to-DC adapter or a battery Arduino acts as the processing module of the system. It takes input from the Ultrasonic sensor, process the data and gives the output to LEDS directly.

Temperature-controlled fan using Arduino. With this circuit, we will be able to change the fan speed in our home or any place according to the room temperature and also display the temperature and fan speed changes on a 16x2 LCD display. To do this we will be using an Arduino UNO Board, LCD, DHT11 sensor Module, and DC fan.

Figure 1 Temperature based fan

1.3 OBJECTIVES OF THE PROJECT

In the electronics world we want to make the human life comfortable. Therefore the home automation system is very essential. Fan speed controller is one of the parts of the home automation system. The main objective of this project is to develop an low cost, user friendly automated temperature-controlled fan regulator which reduces power consumption and also assist physically challenged or older peoples so, they can able to control the speed of fan from their locations.

CHAPTER-2 PROJECT DESIGN

Temperature Based Fan Speed Control & Monitoring with Arduino and LM35 Temperature Sensor. The microcontroller controls the speed of an electric fan according to the requirement & allows dynamic and faster control and the LCD makes the system user-friendly. Sensed temperature in Celsius Scale and fan speed in percentage are simultaneously displayed on the LCD panel. The project is very compact and uses a few components only. The project will help to save energy/electricity. It can be implemented for several applications including air-conditioners, water heaters, snow-milters, ovens, heat-exchangers, mixers, furnaces, incubators, thermal baths and veterinary operating tables.

2.1 METHODOLOGY

Circuit diagram of the temperature-based fan speed control and monitoring is shown in Fig. 1. It is built around Arduino Uno board (Board1), 16×2 LCD (LCD1), temperature sensor LM35 (IC1) and few other components. Arduino is at the heart of this circuit as it controls all the functions.

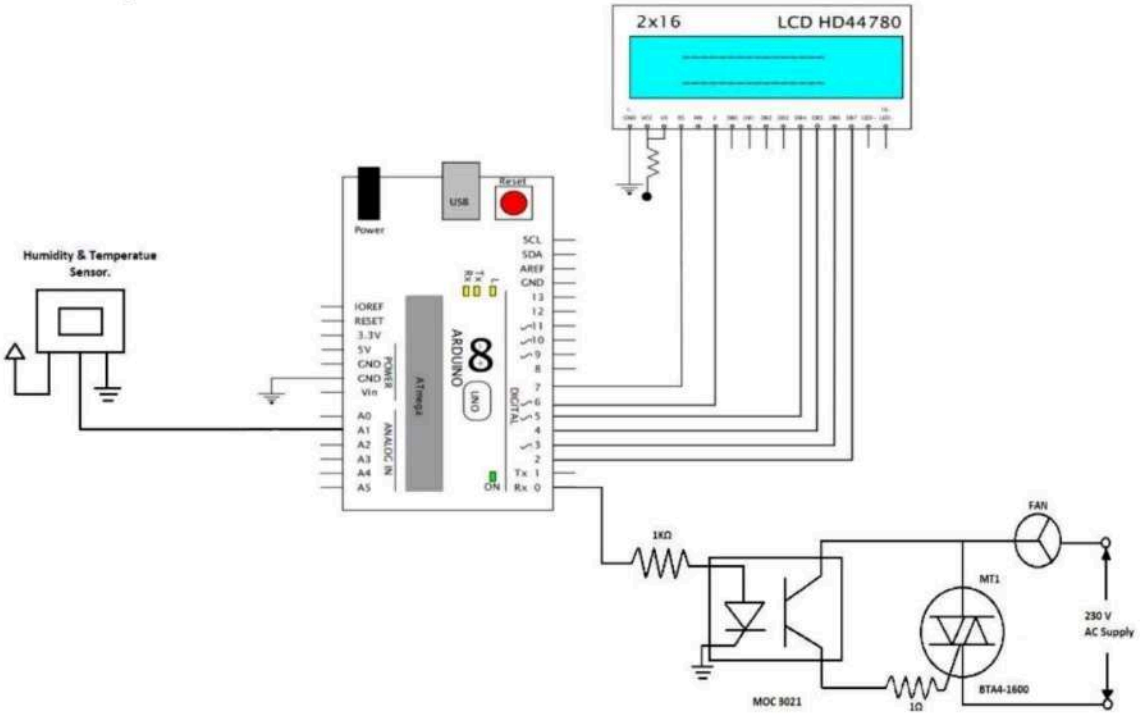

Figure 2.1: Circuit Diagram

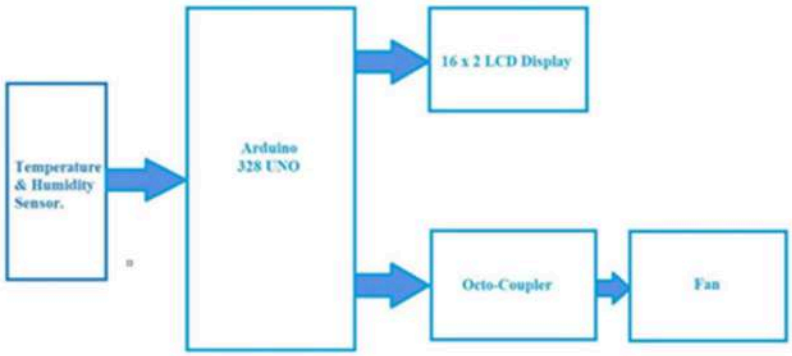

Figure 2.2: Block Diagram.

Block diagram of the proposed concept the above Fig 2 represents the block diagram representation of the proposed concept. The temperature sensor is interfaced with Arduino to fetch the data of temperature in the room. The data is processed if the temperature is high fan speed is more relatively if the temperature is low fan speed is low. Moreover, if the temperature is below the threshold set then fan will be in off condition. The data related to temperature; fan speed is displayed on the LCD for user interaction. The fan speed is controlled relatively with the temperature using PWM pins available on the Arduino.

2.2 SOFTWARE

Software for the automatic temperature controller and monitor circuit is written in Arduino programming language. Arduino Uno is programmed using Arduino IDE software. ATmega328P on Arduino Uno comes with a pre- programmed boot loader that allows users to upload a new code to it without using an external hardware programmer. Connect Arduino board to the PC and select the correct COM port in Arduino IDE. Compile the program (sketch). Then select the correct board from Tools Board menu in Arduino IDE and upload the sketch to Arduino through standard USB port.

2.3 ARDUINO

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board -- you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.

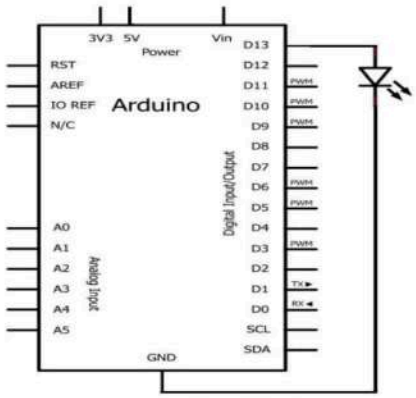

Figure 2.3: Pin Diagram of Arduino Specifications

Micro-controller: ATmega328
Operating Voltage: 5V
Input Voltage (recommended): 7-12V
Input Voltage (limits): 6-
Digital I/O Pins: 14 (of which 6 provide PWM output)
Analog Input Pins: 6 DC
Current per I/O Pin: 40 mA
Current for 3.3V Pin: 50 mA

2.4 DHT11 Temperature and Humidity sensor

Figure 2.4: DHT 11 Temperature and Humidity sensor

This DHT11 Temperature and Humidity Sensor features a calibrated digital signal output with the temperature and humidity sensor capability. It is integrated with a high-performance 8-bit microcontroller. Its technology ensures the high reliability and excellent long-term stability. This sensor includes a resistive element and a sensor for wet NTC temperature measuring devices. It has excellent quality, fast response, anti-interference ability and high performance.

Specifications:

- Operating Voltage: 3.5V to 5.5V.
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data.
- Temperature Range: 0°C to 50°C.
- Humidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit.
- Accuracy: ±1°C and ±1%

2.5 TRIAC

The triac has three terminals namely Main Terminal 1(MT1), Main Terminal 2 (MT2) and Gate (G) as shown in figure. If MT1 is forward biased with respect to MT2, then the current flows from MT1 to MT2. Similarly, if the MT2 is forward biased with respect to MT1, then the current flows from MT2 to MT1.

2.6 OPTO COUPLER

Specifications:

- Input Diode Forward Voltage: 1.25V
- Collector-Emitter Voltage: 80V (max)
- Collector Current: 50mA (max)
- Cut-off frequency: 80 kHz
- Rise Time: 18us
- Fall Time: 18us
- Available as 4-pin DIP through hole and also as SMT package

2.7 LCD DISPLAY (Liquid Crystal Display)

This component is specifically manufactured to be used with microcontrollers, which means that it cannot be activated by standard IC circuits. It is used for displaying different messages on a miniature liquid crystal display. it can display messages in two lines with 16 characters each. Also, it can display all the letters of alphabet, Greek letters, punctuation marks, mathematical symbols etc. Fig. 3 illustrates LCD (2 x 16 characters) and its connection.

Specifications:

- Operating Voltage is 4.7V to 5.3V
- Current consumption is 1mA without backlight
- Alphanumeric LCD display module, meaning can display alphabets and numbers
- Consists of two rows and each row can print 16 characters.
- Each character is built by a 5×8-pixel box
- Can work on both 8-bit and 4-bit mode
- It can also display any custom generated characters
- Available in Green and Blue Backlight

2.8 STEPDOWN TRANSFORMOR (230V -12V)

Figure 2.5: Stepdown Transformer (230V -12V)

Here, NP is primary winding turns = 30000
NS is secondary winding turns = 150

VP is voltage at the primary winding of the transformer = 240V
VS is the voltage at the secondary of the transformer =
VS = (VP * NS)/NP = 240*150/3000 = 12V

2.9 VOLTAGE REGULATOR

Figure 2.6: Voltage Regulator Specifications

Input voltage range 7V- 35V
Current rating I_c = 1A
Output voltage range V_{Max} = 5.2V ,V_{Min} = 4.8V

2.10 DIODE (1N 7007)

Specifications:

- Maximum Recurrent Peak Reverse Voltage 1000V.
- Maximum RMS Voltage 700V.
- Maximum DC Blocking Voltage 1000V.
- Average Forward Current: 1.0A.
- Peak Forward Surge Current: 30A.
- Maximum Instantaneous Forward Voltage: 1.0V.

2.11 OPERATION

Temperature sensor DHT11 Temperature and Humidity sensor senses the temperature and converts it into an electrical (analog) signal, which is applied to the ATMega328 microcontroller of the Arduino UNO Board. The analog value is converted into a digital value. Thus, the sensed values of the temperature and speed of the fan are displayed on the LCD. When the temperature exceeds 30°C the fan starts rotating. A low-frequency pulse-width modulation (PWM) signal, whose duty cycle is varied to adjust the fan's speed is used. An inexpensive, single, small pass transistor can be used here. It is efficient because the pass transistor is used as a switch.

CHAPTER-3 DEVELOPMENT AND IMPLEMENTATION

3.1 WORKING PRINCIPLE

The temperature-based fan speed control system can be done by using an electronic circuit using an Arduino board. Now Arduino board is very progressive among all electronic circuits, thus we employed Arduino board for fan speed control. The proposed system is designed to detect the temperature of the room and send that information to the Arduino board. Then the Arduino board executes the contrast of current temperature and set temperature based on the inbuilt program of the Arduino.

The outcome obtained from the operation is given through the o/p port of an Arduino board to the LCD display of related data. The generated pulses from the board which is further fed to the driver circuit to get the preferred output to the fan.

3.2 TEMPERATURE SENSOR

DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc… to measure humidity and temperature instantaneously. DHT11 humidity and temperature sensor is available as a sensor and as a module.

Fig.3.1 DHT sensor

3.3 Liquid Crystal Display

The LCD is a dot matrix liquid crystal display that displays alphanumeric characters and symbols. 16X2 LCD digital display has been used in the system to show the room temperature. Liquid Crystal Display screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

Fig.3.2 16x2 LCD

3.4 LCD Pin Description

Table 1 LCD Pin Description

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	V cc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3

11		DB4
12		DB5

Temperature based fan speed controller

13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

3.5 CIRCUIT DIAGRAM

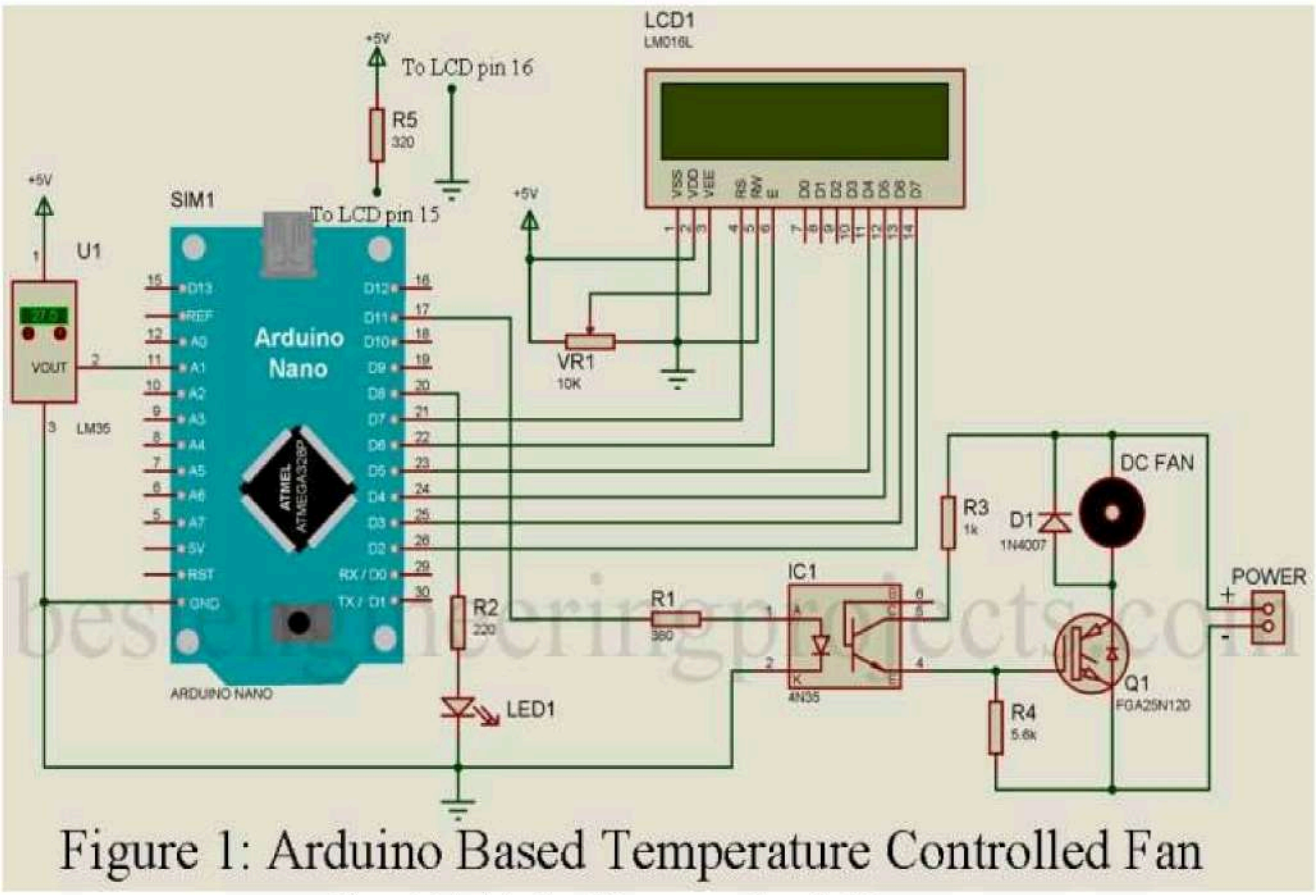

Figure 1: Arduino Based Temperature Controlled Fan

Figure 3.3 Arduino based Temperature Controlled Fan

3.6 SOFTWARE PART OF THE PROJECT

Table 2 Program of the Project

```
#include<dht.h>
#include<LiquidCrystal.h>
LiquidCrystal lcd(7, 6, 5, 4, 3, 2);

#define dht_dpin 12
dht DHT;

#define pwm 9

byte degree[8] =
          {
           0b00011,
           0b00011,
           0b00000,
           0b00000,
           0b00000,
           0b00000,
           0b00000,
           0b00000
          };
void setup()
{
 lcd.begin(16, 2);
 lcd.createChar(1, degree);
 lcd.clear();
 lcd.print("   Fan Speed  ");
 lcd.setCursor(0,1);
 lcd.print("  Controlling ");
 delay(2000);
 analogWrite(pwm, 255);
 lcd.clear();
 lcd.print("Circuit Digest ");
 delay(2000);
}
void loop()
{
  DHT.read11(dht_dpin);
  int temp=DHT.temperature;
  lcd.setCursor(0,0);
```

```
  lcd.print("Temperature:");
 lcd.print(temp);
  lcd.write(1);
  lcd.print("C");
  lcd.setCursor(0,1);
  if(temp <26 )
    {
     analogWrite(9,0);
     lcd.print("Fan OFF          ");
     delay(100);
    }
 else if(temp==26)
    {
     analogWrite(pwm, 51);
     lcd.print("Fan Speed: 20%   ");
     delay(100);
    }

     else if(temp==27)
    {
     analogWrite(pwm, 102);
     lcd.print("Fan Speed: 40%   ");
     delay(100);
    }

 else if(temp==28)
    {
     analogWrite(pwm, 153);
     Lcd.print("Fan Speed: 60%   ");
     delay(100);
  }
  else if(temp==29)
    {
     analogWrite(pwm, 204);
     lcd.print("Fan Speed: 80%    ");
     delay(100);
    }
     else if(temp>29)
    {
     analogWrite(pwm, 255);
 lcd.print("Fan Speed: 100%   ");
     delay(100);
 }
    delay(3000);
}
```

CHAPTER-4

4.1 CONCLUSION

Arduino based temperature-controlled fan is implemented. Thus, here fan speed has been controlled by using Pulse Width Modulation and Arduino board according to the temperature sensed by the help of Temperature and Humidity Sensor (DHT11). The idea of the project is to change the fan temperature automatically. PWM technique is found to be the best technique for controlling the fan speed using the sensed temperature. The system is working properly. The speed of fan depends on the temperature and there is no need for regulating the fan speed manually again and again.

4.2 FUTURE SCOPE

1. We can monitor more parameters like humidity, light and at the same time control them.
2. We can send this data to a remote location using mobile or internet.
3. We can draw graphs of variations in these parameters using computer.
4. When temperature exceeds the limit, a call will be dialed to the respective given number by an automatic Dialer system.

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