TEMPERATURE CONTROLLED FAN USING ARDUINO

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ABSTRACT In present scenario, availability of electricity is found to reach crucial stage. To protect and safeguard one’s future we need to save the energy. As a slogan suggest “One unit saved is one unit generated”. The project is a standalone automatic fan speed controller that controls the speed of a fan when the temperature is greater than the threshold value. Use of embedded technology makes this closed loop feedback control system efficient and reliable. Arduino microcontroller allows dynamic and faster control. It is very compact as it is constructed by using few components and can be interfaced for several applications including air-conditioners, water-heaters, snow-melters, ovens, heat-exchangers, mixers, furnaces, incubators, thermal baths and veterinary operating tables. Arduino microcontroller is the heart of the circuit as it controls all the functions. The temperature sensor LM35 senses the temperature and converts it into an electrical signal, which is forwarded to the microcontroller. The microcontroller drives transistor to control the fan speed. This project uses regulated 9V, 1A power supply. This project is useful in process industries for maintenance and controlling of boilers temperature.

Keywords: Arduino, LM35, PWM, Temperature, Cooling.

INTRODUCTION

With the microcontroller is mainly a single chip microprocessor suited for control and automation of advancement in technology, intelligent systems are introduced every day. Everything is getting more sophisticated and intelligible. There is machines and processes. Today, microcontrollers are used in many disciplines of life for carrying out automated tasks in a more accurate manner. Almost every modern-day device including air conditioners, power tools, toys, office machines employ microcontrollers for their operation. Microcontroller essentially consists of Central Processing Unit (CPU), timers and counters, interrupts, memory, input/output ports, Analog to digital converters (ADC) on a single chip. With this single chip integrated circuit design of the microcontroller the size of control board is reduced and power consumption...
is low. This paper presents the design and simulation of the fan speed control system using PWM technique based on the room temperature. A temperature sensor has been used to measure the temperature of the room and the speed of the fan is varied according to the room temperature using PWM technique. The duty cycle is varied from 0 to 100 to control the fan speed depending upon the room temperature, which is displayed on Liquid Crystal Display.

Pulse Width Modulation, or PWM, is a technique for getting analog results with digital means. Digital control is used to create a square wave, a signal switched between on and off. This on-off pattern can simulate voltages in between full on (5 Volts) and off (0 Volts) by changing the portion of the time the signal spends on versus the time that the signal spends off. The duration of “on time” is called the steady voltage between 0 pulse width.

To get varying analog values, we change, or modulate, that pulse width. If we repeat this on-off pattern fast enough with an LED for example, the result is as if the signal is a steady voltage between 0 and 5v controlling the brightness of the LED. In the graphic below, the green lines represent a regular time period. This duration or period is the inverse of the PWM frequency.

**Need of Arduino**

The beauty of microcontrollers is that, we get very precise control over the peripherals which are connected to it. In this project the user just need to input the threshold temperature in the program, the microcontroller will take care of rest of the function. There are tons of non-microcontroller based automatic temperature controller projects available around the internet, such as using comparator and transistors. They are very simple and they do work well but, the problem arises while calibrating the threshold level using preset resistor or potentiometer. We have a blind idea while calibrating it and the user may need to do trial and error method to find the sweet spot. These problems are overcome by microcontrollers, the user just need to enter the temperature in Celsius in this project, so no need for calibration.

This project can be used where internal temperature of circuit need to be stabilized or saving it from overheating.

When the room temperature reaches the threshold temperature the fan turns on and turns off when the room cools down. So, it’s basically an automated process.

**SYSTEM CONFIGURATION**

It is important to stress out the fact that heat is a normal by product of an electronic component or an entire electronic assembly that is under operation. This is the reason why electronic components are designed and built to withstand specific and certain levels of heat. However, excessive levels of heat results in overheating than in turn, result in damages to an electronic component. One common but specific effect is material degradation. The changes in the physical and chemical properties affect the performance or in other words, the operation and function of an electronic component. There are technical and non-technical, as well as direct and indirect ways for preventing overheating. one of the simplest ways to reduce heat in the central electrode of a SET is by increasing its area and thickness. Doing so would increase the heat flowing from electron gas to phonons. It would also reduce thermal boundary resistance, thus
reducing the resistance of the central electrode to thermal flow and allowing it to become resistant to too much heat to a certain extent. Another solution is the application of different enabling technologies for efficient cooling.

**Components Description**

**Arduino:**

Microcontroller: the ATmega328p is the Arduino brain. Everything on the Arduino board is meant to support this microcontroller. This is where you store your programs to tell the Arduino what to do. Digital pins: Arduino has 14 digital pins, labelled from 0 to 13 that can act as inputs or outputs. When set as inputs, these pins can read voltage. They can only read two states: HIGH or LOW. When set as outputs, these pins can apply voltage. They can only apply 5V (HIGH) or 0V (LOW).

**Arduino IDE:**

We use the software Arduino IDE to implement this project. How to control the output and the input.

**Temperature Sensor (LM35):**

LM35 is a temperature measuring device having an analog output voltage proportional to the temperature. It provides output voltage in Centigrade (Celsius). It does not require any external calibration circuitry. It is a 3-terminal sensor used to measure surrounding temperature ranging from -55 °C to 150 °C.

**IC Motor Driver (L293D):**

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction.

- Can be used to run Two DC motors with the same IC.
- Speed and Direction control is possible
- Motor voltage $V_{cc2}$ ($V_s$): 4.5V to 36V
- Maximum Peak motor current: 1.2A
- Maximum Continuous Motor Current: 600mA
- Supply Voltage to $V_{cc1}$($V_{ss}$): 4.5V to 7V

**DC 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. Larger DC motors
are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills.

**Battery:**

Batteries are a collection of one or more cells whose chemical reactions create a flow of electrons in a circuit. All batteries are made up of three basic components: an anode (the '-' side), a cathode (the '+' side), and some kind of electrolyte (a substance that chemically reacts with the anode and cathode). When the anode and cathode of a battery is connected to a circuit, a chemical reaction takes place between the anode and the electrolyte. This reaction causes electrons to flow through the circuit and back into the cathode where another chemical reaction takes place. When the material in the cathode or anode is consumed or no longer able to be used in the reaction, the battery is unable to produce electricity. At that point, your battery is "dead."

![Fig.1. Connection for temperature controlled fan using Arduino](image)

**BLOCK DIAGRAM FOR TEMPERATURE CONTROLLED FAN USING ARDUINO**

Temperature sensor LM35 senses the temperature and converts it into an electrical (analog) signal, which is applied to the ATmega328 microcontroller of Arduino UNO Board. The analogue value is converted into digital value. Thus, the sensed values of the temperature and speed of the fan are compared with the threshold value and when temperature exceeds threshold value the fan starts rotating.
Installing code to Arduino:

To read an analog input you use the function analogRead() and for a digital input you use digitalRead().

The code for the proposed project is as shown:

```cpp
int x=0;

void setup()
{
    PinMode (A0, INPUT);
    PinMode (8, OUTPUT);
    PinMode (7,OUTPUT);
}

void loop()
{
```
\[ x = -40 + 0.488155 \times (\text{analogRead(A0)} - 20); \]

if (x>38) {
    digitalWrite (8,HIGH);
    digitalWrite (7,LOW);
} else{
    digitalWrite (8,LOW);
    digitalWrite (7,LOW);
}

Delay(10);

RESULT

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. 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.

![Fig.3. Temperature Controlled Fan Using Arduino.](image-url)
CONCLUSION

The beauty of microcontrollers is that, we get very precise control over the peripherals which are connected to it. In this paper the user just need to input the threshold temperature in the program, the microcontroller will take care of rest of the function. There are tons of non-microcontroller based automatic temperature controller projects available around the internet, such as using comparator and transistors. They are very simple and they do work well but, the problem arises while calibrating the threshold level using preset resistor or potentiometer. We have a blind idea while calibrating it and the user may need to do trial and error method to find the sweet spot. These problems are overcome by microcontrollers, the user just need to enter the temperature in Celsius in this project, so no need for calibration. This paper can be used where internal temperature of circuit need to be stabilized or saving it from overheating. We are connecting a CPU fan as output. This setup can be used to control the internal ambient temperature of an enclosed circuit. When the threshold temperature is reached the fan turns on. When the temperature goes below threshold temperature fan turns off. So it’s basically an automated process. We connected a relay for controlling devices which runs on mains voltage such as table fan. When the room temperature reaches the threshold temperature the fan turns on and turns off when the room cools down. This may be the best way for saving power and this can be heaven for lazy people who wish others to switch the fan ON when they feel warm.

REFERENCES