International Journal of Research in Engineering, Science and Management
Volume-2, Issue-10, October-2019
www.ijresm.com | ISSN (Online): 2581-5792

Automatic Temperature Based Fan Controller using Thermistor

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***Abstract*: Over the last decade, advances in electronics have made devices smaller, cheaper and faster. This project is about how the speed of a fan can be controlled, based on temperature sensor. It is also a part of smart home application where the fan will gradually increase its speed if the temperature is increasing. In general, home appliance fans need to be operated manually with the help of regulators with the variation of temperature, thus requires a repeatedly extra effort for regulating the fan speed which acts to our agony. So as to reduce this extra effort and to add comfort, it is intended in this paper designing an "Automatic Temperature Controlled Fan". In this project the main intension is to control the fan by heating the sensor, i.e. the thermistor, where the speed of the fan is dependent and controlled by any device's temperature like PC. As the temperature of the device increases or decreases, the speed of fan increases or decreases respectively. So, it can be used mainly as a cooling device. By modifying the circuit slightly, it can also be used to control the room temperature, depending on the property of thermistor. The thermistor used in the circuit here, decreases its resistance with increasing temperature, hence the electrical conductivity also increases, increasing voltage across it, resulting in an increment in the speed of the fan. Thus, it is possible to control the speed of the fan automatically when the device's temperature varies. Experiment can be followed to evaluate whether this circuit can save energy through the use of temperature sensor and thus promote efficiency.**

***Keywords*: Temperature controlled fan, Thermistor**

1. Introduction

Electric fan is one of the most popular electrical devices due to its cost effectiveness and low power consumption advantages. It is a common circuit and widely used in many applications. It is also one of the most sensible solutions to offer a comfortable and energy efficient. In fact, the fan has been long used and still available in the market. Fan can be controlled manually by pressing on the switch button. Where in this method, any change in the temperature will not give any change in the fan speed. Except the usage change the speed of the fan which is manually. So, an automatic temperature control system technology is needed for the controlling purpose in the fan speed according to the temperature changes.

2. Methodology

The circuit presents the design, construction, development and control of automatic switching electric fan. The idea is based on the problem occurs in human's life nowadays by improving the existing technology. The Peripheral Interface Controller (PIC) based automatic fan system is applied to upgrade the functionality to embed automation feature. The electric fan will automatically switch on according to the environmental temperature changes. The circuit is using a microcontroller to control the fan according to the temperature variation. The system measures the temperature from the Integrated Circuit (IC) LM35, where it will control the fan according to the setting values in the programming.

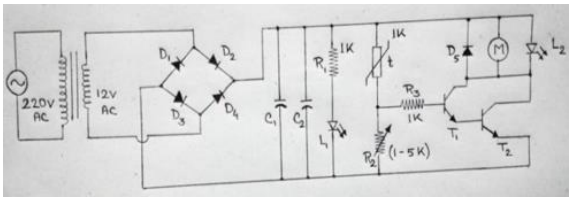

Fig. 1. Circuit diagram of a temperature-controlled fan

3. Fan speed control system components

The Arduino is the heart of the system. It accepts inputs from the temperature sensor, LM35 which allows for the measurement of the current room temperature, then the controller will give the action to maintain the required fan speed. LCD is used to display the fan speed and room temperature. All of these can be summarized in a diagram as shown in Fig. 2.

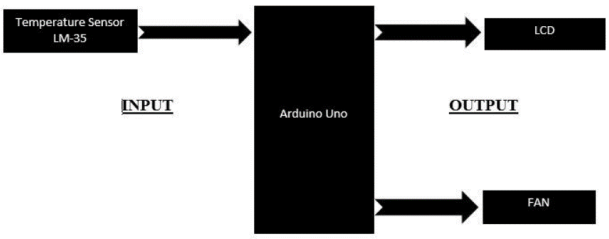

Fig. 2. Block diagram of fan speed control system

4. Sensor description

A. Thermistor

A thermistor is an electronic component that exhibits a large change in resistance with a change in its body temperature. The word "Thermistor" is actually a contraction of the words "Thermal Resistor".

The thermistors, which are to be described herein are ceramic semiconductors and have either large positive temperature coefficient of resistance (PTC) devices or large negative temperature coefficients of resistance (NTC). Both types of thermistors (PTC and NTC) have definite features and advantages which make them ideal for certain sensor applications.

In this circuit, NTC type Thermistor of 1K at25°C is used.

B. Arduino (Microcontroller)

A microcontroller is a computer control system on a single chip. It has many electronic circuits built into it, which can decode written instructions and convert them to electrical signals. The microcontroller will then step through these instructions and execute them one by one. As an example of this a microcontroller could be used to control the fan speed according to the temperature of the room. There are different types of microcontroller, this project focusses only on the Arduino Uno Microcontroller where its pin diagram is shown in fig. 3.

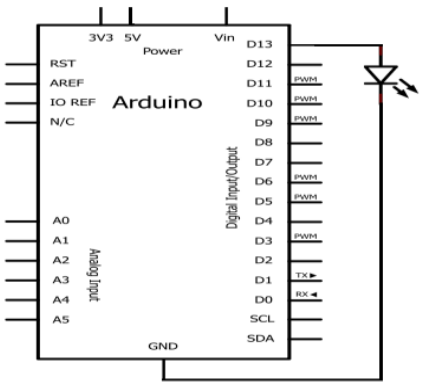

Fig. 3. Pin diagram of Arduino

C. Relay (4 Channel, 5V)

We can control High Voltage electronic devices using relays. A Relay is actually a switch which is electrically operated by an electromagnet. The electromagnet is activated with a low voltage, for example 5 volts from a microcontroller and it pulls a contact to make or break a high voltage circuit.

D. Liquid Crystal Display (LCD)

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

E. Algorithm

1. Set T=0, fan Speed=0 and led=off
2. T=getTemp() // Get current temperature from temperature sensor(i.e., LM 35)
3. Now compare the value of T with range of temperatures and set the fanSpeed according to that

a) if T >= 250C and T <=300C
fan Speed = 25%
b) if T >300C and T <=400C
fan Speed = 50%
c) if T>400C and T <=450C
fan Speed = 75%
d) if T >450C
fan Speed = 100%
led=On

4. End

The LCD is used to measure and show the changes of temperature value. As working principle, the temperature sensor senses the room temperature and displayed it on the LCD. The speed of the fan is controlled according to the room temperature change.

5. Proposed work

The circuit is designed considering simplicity as the first priority and secondly in an economic way. So the components are also taken as simple as possible, which are very cheap in cost and easily available in the market.

The purpose of this circuit is to vary the speed of a fan related to temperature with a minimum parts counting and avoiding the use of special-purpose ICs, often difficult to obtain.

To do so, first of all, a number of Temperature Sensing Circuits are being developed and their characteristics have been studied.

6. Conclusion

The circuit is very simple and easy to build. This paper elaborates the design and construction of fan speed to control the temperature. Moreover, the fan speed will increase automatically if the temperature will increase. As conclusion, the system which is designed in this work performs very well for any temperature change and can be classified as automatic control.

Acknowledgement

We express our special gratitude to our honourable principle Mr. Premkumar, who gave us an opportunity to work on this project. Being the students of Paavai engineering College, it was our pleasure working on this project and it made us learn lot of new things.

I would like to thank our Project guide, Prof. Mr. R. T. Kumaravel, who with her friendly nature helped us to complete this project and guided us continuously. This list would be incomplete without our Head of the Department, Dr. D. R. P. Rajarathnam, who coordinated with us and gave us her valuable time.

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