AUTOMATIC ROOM TEMPERATURE CONTROLLER

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This report is submitted in partial fulfillment of the requirements for the award of Bachelor of Electronic Engineering (Industrial Electronics) With Honours

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Special dedication to my beloved father and mom, my entire sibling and my kind hearted supervisor Engr. Fakrulradzi Bin Idris, and all my dearest friends.

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ABSTRACT

Nowadays, the changing of temperature in Malaysia is unpredictable. However, the usage of product such as fan and air conditioner are not enough to solve this problem because of the operation of the product are manually. Because of that, an automatic product of fan is build. The product is an inexpensive and also gives comfortable to the user. The product is operates automatically based on the changing of room temperature. For the detection of room temperature, a temperature sensor (type: LM35DZ) is used. The temperature sensor will sends signal to microcontroller (model: PIC16F876A) and microcontroller will determine to increase or decrease the speed of the fan based on the received signal from temperature sensor.

ABSTRAK

Perubahan suhu yang berlaku di Malaysia sentiasa tidak menentu. Namun, penggunaan produk seperti kipas dan penghawa dingin kurang mampu menyelesaikan masalah ini kerana ia beroperasi secara manual. Oleh itu, satu produk kipas automatik dibina untuk mengatasi masalah ini. Bukan sahaja murah malah teknologi ini perlulah berkualiti dan mampu memenuhi kehendak dan keselesaan setiap pelanggan. Produk kipas ini beroperasi secara automatik berdasarkan kepada perubahan suhu bilik. Untuk mengesan perubahan suhu bilik, pengesan suhu (jenis: LM35DZ) digunakan. Pengesan suhu ini akan menghantar isyarat pada mikropengawal (model: PIC16F876A) dan mikropengawal akan menentukan tahap kelajuan kipas samaada lebih tinggi, sederhana dan laju berdasarkan isyarat yang diterima daripada pengesan suhu.

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LIST OF ABBREVIATIONS

PCB	-	Printed Circuit Board
NTC	-	Negative Temperature Coefficient
AC	-	Alternate Current (Arus Ulang Alik)
IC	-	Integrated Circuit
DC	-	Direct Current (Arus Terus)
LED	-	Light Emitting Diode
SCR	-	Silicon Controlled Rectifier
ADC	-	Analog Digital Converter
PIC	-	Programmable Interface Circuit
PSM	-	Projek Sarjana Muda

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CHAPTER I

INTRODUCTION

1.1 PROJECT BACKGROUND

Room temperature (also referred to as ambient temperature) is a common term to denote a certain temperature within enclosed space at which humans are accustomed. Room temperature is thus often indicated by general human comfort, with the common range of 22°C (71.6 °F) to 28°C (82.4 °F), though climate may acclimatize people to higher or lower temperatures. For human comfort, desirable room temperature greatly depends on individual needs and various other factors. Because of changing effect of temperature, an automatic control room temperature is needed to solve the problem of uncomfortable for human life.

1.2 PROJECT OBJECTIVES

Due to the problem statement, it's cleared that the objectives of the project is:

1. To design an accurate and sensitive circuit to control the room's temperature according to any changes of temperature. The suitable reference temperature is in the range of 22°C to 28°C.
2. To simulate the simplest temperature controller circuit with specific software.

1.3 PROBLEM STATEMENTS

Room temperature always changes and sometimes it occurs drastically (for example: rainy day at the night). Thus, uncomfortable environment will be happen to the human life. Secondly, human aided control are commonly use but in certain time there are some unexpected matter occur. For this reason, automatic control system is needed. Another that the circuit of automatic control room temperature previously is less stable and less sensitive. Thus the measurement temperature of the circuit is also not accurate.

1.4 SCOPES OF WORK

This project will focus on controlling temperature changing inside a room and speed changing for the fan. Temperature sensor and microcontroller are the main components to execute the task. Thus, the function and operation of temperature sensor (type: LM35DZ) and microcontroller PIC16F876A will be study to accomplish this project. Four conditions of temperature had chosen to implement in this project. A signal from the input (temperature sensor) will be sent to microcontroller and microcontroller will be sent back the action signal to increase or decrease the fan's speed according to the temperature. In order to relate the hardware (temperature sensor and microcontroller) with the software, the understanding of source code that will be create using C compiler like MikroC or MPLAB IDE/PICC-Lite is also important. The function of the compiler is to translate C language commands to HEX machine code.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

Literature Review is important in each project as a base for gathering information necessary to complete the project. All information is gathered from various sources such as:-

1. Journal
2. Books
3. Conference Transcript
4. Thesis
5. Patent
6. Website

After searching through all this various material, all information will be filtered to be related to automatic controlled room temperature. The information that will be focused on this chapter is about some reference circuit of automatic controlled room temperature and its main components that to be used.

2.2 Reference Circuit 1

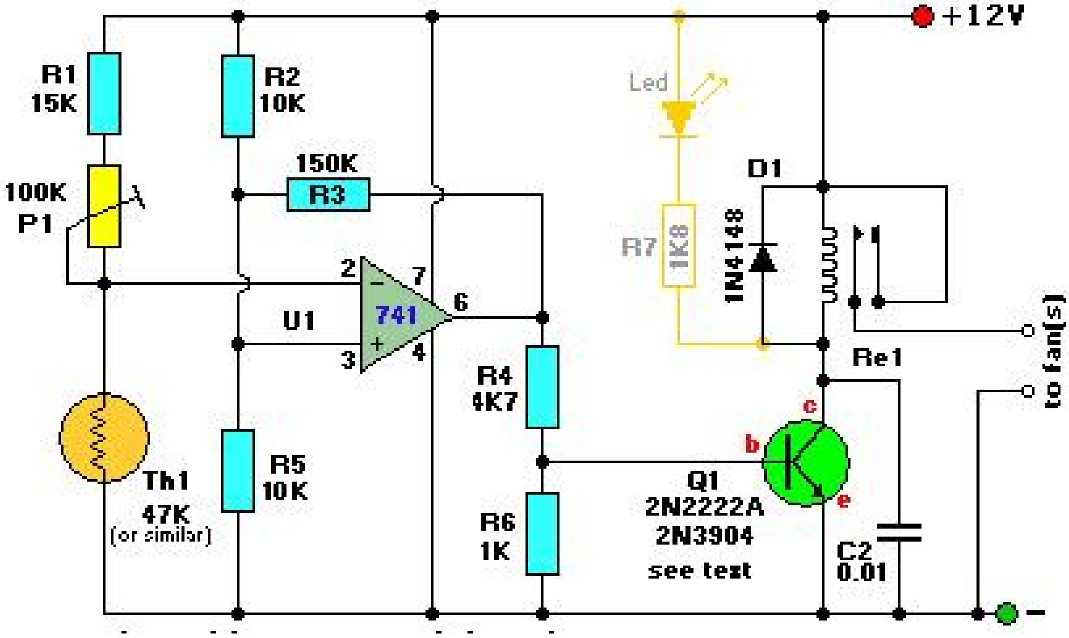

Figure 2.1 Temperature Controlled Auto Fan [1]

Table 2.1 Component list for the circuit

Part	Description	Notes
IC1	LM741 Op-Amp	NE741,µA741, etc.
Q1	2N2222A transistor	See text
D1	1N4148 Diode	1N4001, or others
Th1	50K Thermistor	KC005T in prototype
Re1	12V Relay	RS is 1A
R1	15K, 5% resistor	brown-green-orange
R2,R5	10K, 5% resistor	brown-black-orange
R3	150K, 5% resistor	brown-green-yellow
R4	4K7, 5% resistor	yellow-purple-red
R6	1K, 5% resistor	brown-black-red
R7	1K8, 5% resistor	brown-gray-red
P1	100K Trimmer Pot	Bourns
C1	10uF/25V Capacitor	Electrolytic
C2	0.01uF, Capacitor	Ceramic
Led	Red, 3mm	Light Emitting Diode

Figure 2.1 show a circuit of Temperature Controlled Auto Fan design by Tony Van Roon [1]. This circuit uses one temperature sensor, thermistor 48K made by Fenwal (#197-503LAG-A01). This 48K was measured at exactly 25°C and with 10% tolerance. The resistance increases as the surrounding temperature decreases. Another name for this thermistor is 'NTC'. NTC stands for "Negative Temperature Coefficient" which means when the surrounding temperature decreases the resistance of this thermistor will increase. P1 is a regular Bourns trimmer and adjusts a wide range of temperatures for this circuit. R1 is a 'security' resistor just in case the trimmer pot P1 is adjusted all the way to '0' ohms. At which time the thermistor would get the full 12 volt and it will get too hot [1].

The function of R3 is to feeds a bit of hysteresis back into the op-amp to eliminate relay 'chatter' when the temperature of the thermistor reaches its threshold point. Depending on which application and the type to use for Q1 and Re1, start with 330K or so and the value is adjusted it's downwards until it satisfied. The value of 150K shown in the diagram worked for this circuit. Decreasing the value of R2 means more hysteresis, just don't use more then necessary. Or temporarily use a trimmer pot and read off the value. In this case 120K is suitable fot this circuit. Transistor Q1 can be a 2N2222(A), 2N3904, NTE123A, and ECG123A. Not critical at all. It acts only as a switch for the relay so almost any type will work, as long as it can provide the current needed to activate the relay's coil [1].

For the diode, D1 the 1N4148, acts as a spark arrestor when the contacts of the relay open and eliminates false triggering. For this application the 1N4148 was good enough since the tiny relay that had used was only 1 amp. However, the large variety of diodes can be as next choice for example 1N4001 or something and should be used if your relay type can handle more then 1 amp. This circuit was designed to automatically activate a set of three or four small DC fans to cool a large cool-rib for a 10 Amp power supply. It can be used in a variety of other applications as well [1].

2.3 Reference Circuit 2

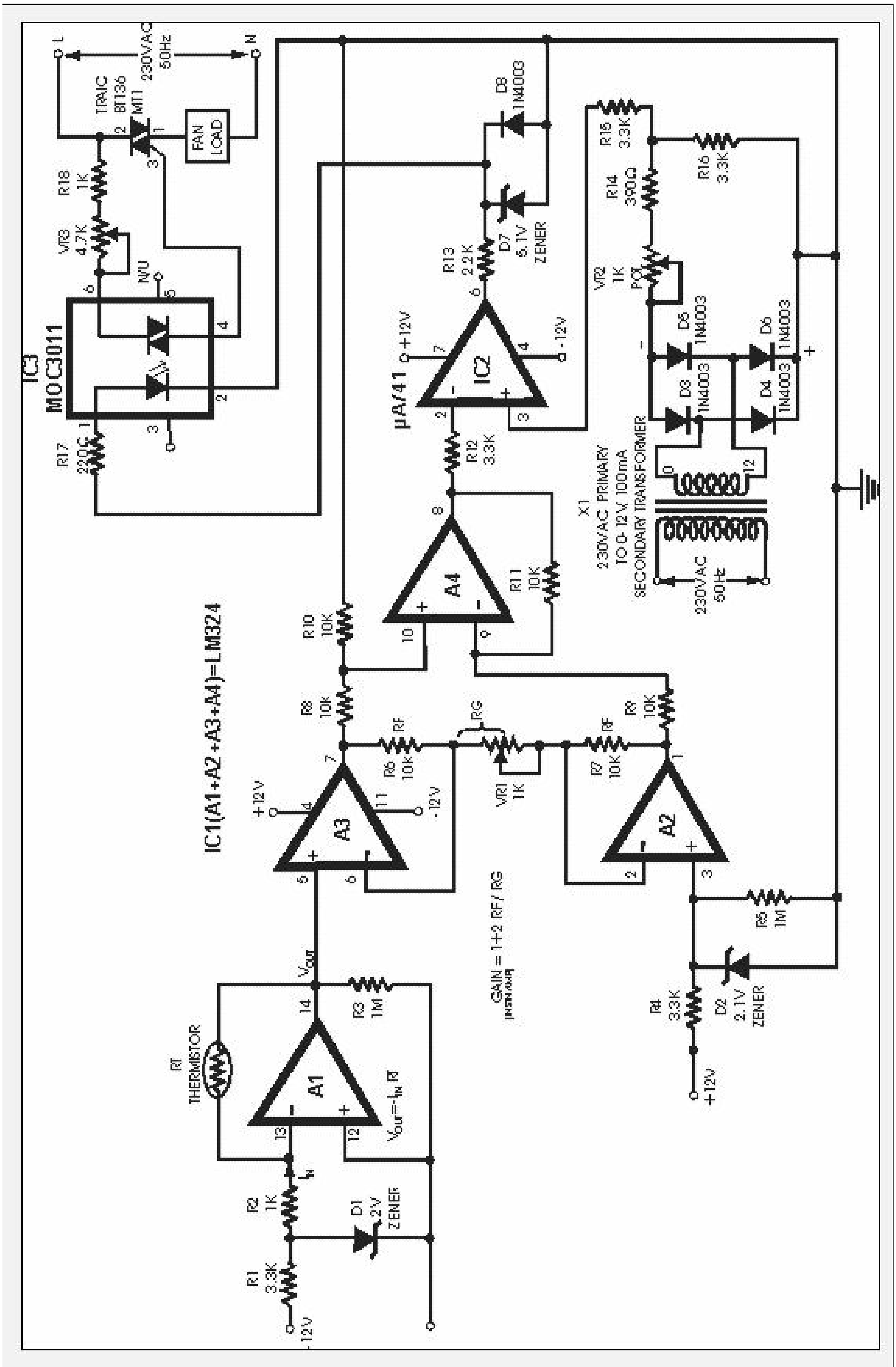

Figure 2.2 Automatic Temperature Controlled Fan

Here (Figure 2.2) is a circuit through which the speed of a fan can be linearly controlled automatically, depending on the room temperature. The circuit is highly efficient as it uses thyristors for power control. Alternatively, the same circuit can be used for automatic temperature controlled AC power control. In this circuit, the temperature sensor used is an NTC thermistor, i.e. one having a negative temperature coefficient. The value of thermistor resistance at 25°C is about 1 kilo-ohm. Op-amp A1 works as current-to-voltage converter and converts temperature variations into voltage variations. Other side**,** Op-amps A2, A3 and A4 work as an instrumentation amplifier to amplify the change in voltage due to change in temperature [2].

The combination of resistor R2 and diode D2 is used for generating reference voltage as we want to amplify only change in voltage due to the change in temperature. Op-amp µA741 (IC2) works as a comparator. One input to the comparator is the output from the instrumentation amplifier while the other input is the stepped down, rectified and suitably attenuated sample of AC voltage. IC2 also functions as a pulse width modulator in this circuit. The output from the comparator is coupled to an optocoupler, which in turn controls the AC power delivered to fan (load) [2].

The circuit has a high sensitivity and the output RMS voltage (across load) can be varied from 120V to 230V (for a temp. range of 22 to 36°C), and hence wide variations in speed are available. VR1 and VR2 can be adjusting to a desired value for any given temperature the speed of fan (i.e. voltage across load). VR1 should be initially kept in its mid position to realize a gain of approximately 40 from the instrumentation amplifier. It may be subsequently trimmed slightly to obtain linear variation of the fan speed [2].