DESIGN AND DEVELOPMENT OF A CONVENIENT AIR-CONDITIONAL ROOM

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ABSTRACT

This project is to design and development of a convenient air conditional room. A convenient air conditional room means the room's condition is ready for anyone that wants to use the room. This also means that the air conditional controller can be self adjusted according to the need of a person even though the air conditional is controlled by the building centralized system. So, the objective of this project is to design a convenient room which the temperature and humidity can be controlled or self adjusted. The programmable integrated circuit (PIC) or microcontroller is needed to make the circuit work according to the specifications given. So, the main components of this circuit are PIC, temperature and humidity sensor. The PIC is used because it can be programmed according to certain conditions by using a various source code. The temperature sensor which is LM 35 is used as a comparator to sense the inputs of the room temperature while HSM-20G is used as the humidity sensor and PIC16F877A is used as the microcontroller

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ABSTRAK

Projek ini bertujuan membina sebuah bilik penghawa dingin yang mudah dan mempunyai persekitaran yang kondusif. Sebuah bilik yang kondusif bermaksud bilik tersebut bersedia untuk digunakan apabila seseorang ingin menggunakan bilik itu. Ianya juga bermaksud penghawa dingin di dalam bilik itu boleh dikendalikan dengan sendiri mengikut kehendak individu walaupun alat penghawa dingin tersebut dikawal oleh pusat kawalan bangunan. Oleh yang demikian, objektif projek ini adalah untuk mereka cipta sebuah bilik yang boleh di mana suhu dan kelembapannya boleh di laras. Untuk itu, PIC diperlukan untuk menjadikan litar berfungsi mengikut ketetapan yang telah diberi. PIC digunakan kerana ianya boleh diprogram mengikut keperluan semasa dengan berpandukan kepada kod program.Selain daripada itu alat pengesan suhu dan kelembapan digunakan sebagai komponen utama. Alat pengesan suhu yang digunakan adalah LM 35 manakala HSM-20G digunakan sebagai alat pengesan kelembapan dan PIC yang digunakan adalah PIC16F877A.

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LIST OF ABBREVIATIONS

PIC – Programmable Integrated Circuit

LCD - Liquid Crystal Display

PCB – Printed Circuit Board

W - Single Accumulator

LED – Light Emitting Diode

PWM – Pulse Width Modulation

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CHAPTER I

INTRODUCTION

1.1 Introduction

The Introduction chapter is explained about the whole project which includes the synopsis, objectives, problem statement, scopes of work, methodology and expected result of the project. Each part in this chapter is explained briefly so that the whole project can be easily understood and the Chapter 2 which is Literature Review is discussed more detail about the project and components involve.

1.2 Project Introduction

By using centralized air-conditional system, it can save the cost for installation and maintenance. However, the standard setting room environment can not suit to everybody. So this project is about design and develop a low budget of self-adjusted room condition controller circuit by using microcontroller to control room's temperature and humidity to suit everybody that use the room.

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1.3 Project Objective

The objectives of this project are to design control circuits using microcontroller and to control room's temperature and humidity. This project is also to solve the discomfort situation in a room that using centralized air conditioner system.

1.4 Problem Statement

When people enter an air-conditional room in a building that using centralized air-conditional system, they cannot simply adjust the temperature because the temperature is controlled fully by the system. Hence, this situation will make someone feel uncomfortable with the current temperature where somebody want hotter and others want colder temperature. Discomfort can occur if the indoor climate is too warm, too cool or draughty. Somebody also maybe could easily feel unwell because of the current temperature where these conditions can irritate the eyes, nose and throat. Besides that, electrical equipment dries the air and static build up around a computer screen also attracts dust.

A comfortable temperature for sedentary work is between 20 and 24 degrees C, with relative air humidity (the water content in the air) between 40% and 60%. Hence, this project will solve above problems and will make thing better where the room condition can be self-adjusted. So user can adjust the temperature and moisture of the room according to their need to change the room environment.

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1.5 Scopes of Work

The scopes of this project are the circuit constructed is used to control the temperature and humidity of an air-conditional room. Besides that, the device is working effectively in a small room and it can be applied to an air-conditional room that uses the centralized air conditional system.

1.6 Methodology

The methodology for this project is divided into five phases. First phase is literature review. This phase consists of study on the project circuit as well as the main components involve. The advantages and the disadvantages of the components also are analyzed and studied. Second phase is about the software. In this phase, the temperature and humidity controller circuit is designed in suitable software. The source codes for the PIC microcontroller also are written using software.

The third phase is about constructing the hardware. For this phase, all of the components are assembled and constructed on the breadboard first. After the circuit had been tested and has met its objective specifications, it is implemented on the printed circuit board. The next phase is combining the software and hardware part. This phase need a PIC board to integrate both software and hardware. The final phase in this methodology part is results and analysis. All the important data that had been found out during the project are gathered so that the analysis towards the project can be made.

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1.7 Expected Result

The prototype is been expected to be able function properly according to its specifications by using microcontroller that can be used to adjust the centralized air-conditional room's temperature and moisture to suit every person that enter the room. This system is implemented onto the room in a building that using centralized-air conditional system as this system developed by using low-cost materials.

1.8 Conclusion

This chapter is an initial step of this report. All the parts in this Introduction Chapter are explained briefly and the detail explanation about the project components is explained in Chapter 2 which is Literature Review where all the research had been made and discussed.

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CHAPTER II

LITERATURE REVIEW

2.1 Introduction

The previous chapter only discuss a little about this project. So the literature review need to be done to make this project relevant and on the right track. A literature review is a body of text that aims to review the critical points of current knowledge on a particular topic. So, this chapter reveals the research that had been analyzed especially about the main components that are used in this project which are temperature and humidity sensor, the Programmable Integrated Circuit (PIC) and also the softwares used to design the circuit.

2.2 Room Temperature and Humidity Controller

The room's temperature and humidity controller is self adjusted controller which is supported by the microcontroller to make it able to be function. With this feature, the room temperature and humidity can be easily adjusted by anyone that enters the room to suit them. The circuit for this controller consists of 3 main components which are PIC microcontroller, temperature sensor and humidity sensor.

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2.3 Temperature

Temperature is a degree of hotness or coldness the can be measured using a thermometer [2]. It is also a measure of how fast the atoms and molecules of a substance are moving [2]. Temperature is measured in degrees on the Fahrenheit, Celsius, and Kelvin scales. A convenient operational definition of temperature is that it is a measure of the average translational kinetic energy associated with the disordered microscopic motion of atoms and molecules [2]. The flow of heat is from a high temperature region toward a lower temperature region. The details of the relationship to molecular motion are described in kinetic theory [2].

On the macroscopic scale, temperature is the unique physical property that determines the direction of heat flow between two objects placed in thermal contact [1]. If no heat flow occurs, the two objects have the same temperature; otherwise heat flows from the hotter object to the colder object [1]. For a solid, these microscopic motions are principally the vibrations of its atoms about their sites in the solid [1]. For an ideal monatomic gas, the microscopic motions are the translational motions of the constituent gas particles [1]. For a multi atomic gas, vibration and rotational motion should be included too [1].

The temperature defined from kinetic theory is called the kinetic temperature [1]. Temperature is not directly proportional to internal energy since temperature measures only the kinetic energy part of the internal energy, so two objects with the same temperature does not in general have the same internal energy [1].

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2.3.1 Temperature Sensor - The LM35

The Figure 2.1 below shows the temperature sensor of LM35 which is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in °C) [3]. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling [3]. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range [3].

There are 3 reasons why LM35 is used to measure temperature. The reasons are it can measure temperature more accurately than using a thermistor, the sensor circuitry is sealed and not subject to oxidation [11]. The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified [4]. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy [4].

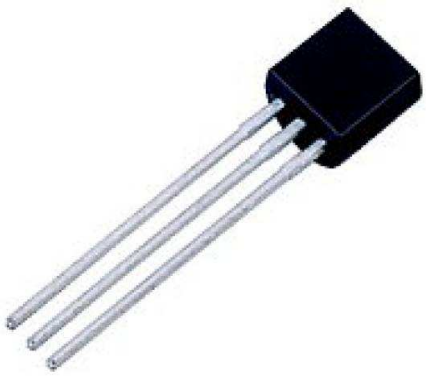

Figure 2.1: Temperature sensor – LM35

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The LM35 is rated to operate over a −55° to +150°C temperature range, while the LM35C is rated for a −40° to +110°C range (−10° with improved accuracy) [4]. The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are available in the plastic TO-92 transistor package [4]. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package [4].

2.3.2 Mechanisms of LM35

The LM35 sensor has an output voltage that is proportional to the Celsius temperature and the scale factor is .01V/^{o}C [5]. Besides that, the LM35 does not require any external calibration or trimming and maintains an accuracy of +/-0.4 ^{o}C at room temperature and +/- 0.8 ^{o}C over a range of 0 ^{o}C to +100 ^{o}C [5]. Another important characteristic of the LM35 is that it draws only 60 micro amps from its supply and possesses a low self-heating capability [5]. The sensor self-heating causes less than 0.1 ^{o}C temperature rises in still air [5].

2.3.3 Applications of LM35

The LM35 can be applied easily in the same way as other integrated-circuit temperature sensors [13]. It can be glued or cemented to a surface and its temperature will be within about 0.01°C of the surface temperature [13]. This presumes that the ambient air temperature is almost the same as the surface temperature; if the air temperature were much higher or lower than the surface temperature, the actual temperature of the LM35 die would be at an intermediate temperature between the surface temperature and the air temperature [13].

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