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Automatic Temperature Control Using PIC Microcontroller

Aditya Srivastava; Anuj Upadhyay; Tanya Sharma & Vishal Srivastava

INTRODUCTION

Air conditioning system is the system which monitors the room temperature and controls the circulation of the fresh air inside the room. If the temperature of the room goes high sufficient enough to make one feel hot then the air conditioning system should be able to circulate cool air inside the room. Similarly if the temperature of the room falls sufficient enough to make one feel cold then the air conditioning system should circulate warm air inside the room. If the room temperature is neither hot nor cold then the system should stay in low power mode to prevent from the considerable loss of the power.

As the name implies the main purpose of this project is to devise a system whose sole purpose is to condition or maintain the temperature within the predefined limits. Thus this system proves to be useful to be used as a Air Conditioning System inside room, offices, departmental stores etc. Apart from that it can also be used in various industrial applications such as to control the temperature in boilers, refrigerator, AC computers and Laboratories etc.

PROJECT CYCLE

- Determining the requirement of the system.
- Designing the system architecture.
- Selecting the operating system.
- Choosing the development platform.
- Coding the application and optimizing the code.
- Verification of the software on the host system.
- Circuit designing.
- PCB layout.
- Device test.

OBJECTIVES

The main objective of this project is to devise a Temperature Controlled Automatic Air conditioning System.

GENERAL OBJECTIVES

Following are the general objectives of this project:

i. To measure the temperature of the room.
ii. To display the temperature in LCD.
iii. To maintain or condition the temperature of the room.
iv. To monitor temperature of the room e.t.c

LITERATURE REVIEW

Air conditioning system is a system which is used to condition the air inside the room despite the variations in the weather condition. A typical air conditioning system should be able to turn on/off either heating element or cooling element so as to condition the room. Basically, we can combine cooling elements and heating elements to form an air conditioning system. But one of the essential feature that an air conditioning system should have is that it should be automatic.

Power supply system in Shanghai area is an important part of the country. JinShan power supply company has responded to the call of energy-saving, and is active in energy-reducing actions. In order to improve energy-efficient power transmission, JinShan power supply company made efforts to design the energy saving units and promote fine environment management by using air-conditioning. According to statistics of China's total building energy consumption increased year by year, the total air-conditioning usage in the proportion from 9% at late 1970s up to 23.5% in recent years. The cooling and heating air conditioning energy consumption can account for 35% of the total state energy use. In hope of designing an automatic control equipment to use in the substation, the method and centralized management system of the air conditioning and ventilation system by using Programmable Logic Controller (PLC) was introduced.

HISTORY

There has been a lot of work in this field i.e.in the design of automatic air conditioning system. A lots of commercial products are readily available in the market. The discovery of the the air conditioning system came in practice after engineer Willis Haviland Carrier discovered one in 1902 A.D. Since then there has been numerous types of air conditioning system developed by different peoples. Since works done by those peoples is too numerous to mention, we just want to remark their work at this point.

SOFTWARE REQUIREMENT SPECIFICATION

HARDWARE COMPONENTS

- One PCB
- PIC 16F877A micro controller
- Crystal Oscillator
- VOLTAGE REGULATOR 7805
- Relay
- LM 35

SOFTWARE COMPONENT

- PROTEUS SOFTWARE is used for the simulation of circuit
- CODING USED**:** Embedded C Language with the implementation of Keil Software

METHODOLOGY

This project entitled "AUTOMATIC TEMPERATURE CONTROL USING PIC MICROCONTROLLER" is essentially a project based on the applications of embedded system. In this project we have used various hardware elements like microcontroller,sensor,LCD,etc and various other circuit elements. In the design of the system using above hardware elements we have been supplemented by various software packages for coding, debugging, and simulating the design. The various processes involved in the design is explained below:

Selection of Processor

There are numbers of processors available in the market. These processors are of different capacity and are used for different purposes. If the application involves large data processing task the general purpose microprocessor is preferred. While if the application is control oriented and require very few data processing then microcontroller is used. Also both microprocessor and microcontroller of different capacity(i.e.speed,storage,data width etc) are readily available. We have to select the processor as per our requirement. For example: If we can accomplish our task using 8- bit microcontroller then we won't need a 32-bit microcontroller. Using a 32-bit microcontroller for 8-bit

applications is just a wastage of money and storage capacity.

Since our project is based on embedded system design philosophy, we have used PIC 16F877A,which is an 8-bit microcontroller.

Coding

One of the important task in the embedded system design is using the appropriate programming language to program the microcontroller. We had many choices to do so. We might have used assembly language and high level programming languages like C,C++,Java, C# etc. Programming in assembly is tedious and time consuming. But the code generated by assembler is fast to execute. On the other hand programming in high level language is easy but code generated by high level language is slower to execute. In our project we have chosen C programming language for our target system. Here, we traded speed for ease.

Coding is one part. But to store the program on ROM or to execute the program on microcontroller we require machine code. Therefore it is necessary to convert program written in C to machine code(or HEX code).In our project we have used Keil Microvision software to accomplish this task.

Component Selection

In our project we have used various other components apart from microcontroller. Basically, we need a Liquid Crystal Display(LCD) device to output the data from microcontroller and display. In our project we have used LM016L LCD. In order to read temperature we require temperature sensor. In our project we have used LM35 temperature sensor. This real worls is analog. The temperature sensed by temperature sensor is analog in nature. But the microcontroller is the digital device and it can only process digital data. So we need to convert analog data to digital form. For this we requireAnalogtoDigital Converter(ADC) and in case of our project we have used ADC0804.To provide power supply to all the components used in this system we have used LM 7805 which is a 5V three terminal voltage regulator IC. To interface the motor control circuit with the microcontroller we cannot connect it directly. It is because the motor circuit may interfere with the operation of microcontroller and might eventually damage it. To overcome this problem we have used optocoupler 4N35.The basic function of optocoupler is to isolate two separate circuits with different power supplies electrically.

Simulation

Design of embedded system is a very complicated job. A successful operation of the designed system at a very first time is often rare. Also if the designed system malfunction then there might be loss of money. Thus before actually designing the system in the real time have used various simulation tools to check the validity of our design. For this we have used various simulation softwares(or simulators).Various simulators available in market are Proteus,Multisim,ElectronicsWorkbench MPLAB,Matlab,ORCAD,etc. Regarding our project we have mostly used Proteus software.

PCB Layout Design

After successfully simulating the designed system we have to bring it in the real time so as to perform the required function. Designing pcb layout manually is time consuming. So we have used software to convert the required schematic layout to PCB layout. In our project we have used Livewire PCB Wizard. After successfully etching the required layout we placed the components in their respective position and soldered their pins. Finally our project was be ready.

WORKING DISCRIPTION

The temperature sensor gives the analog output voltage based on the temperature of the room. This analog voltage is fed to the A/D converter. The A/D converter then converts the analog input voltage from the temperature sensor into equivalent binary bits. The converted binary data from the A/D converter is applied to microcontroller. The microcontroller reads binary data from A/D converter, convert it to suitable form and performs different operations based on the value of temperature read from A/D converter. The LCD is used to display the data given by microcontroller. Microcontroller can turn on dc fan through the optocoupler if required. We have used led as prototype model for heater. If appropriate condition is met microcontroller can turn on heater(i.e. LED).

In this system, if the temperature read is in between 20-25 degree celcius, it is considered normal state. In this condition both fan and heater are off but the temperature and status is displayed in LCD. If the temperature of the room is greater that 25 degree celcius it is considered to be a situation to turn on fan and turn off heater. If the temperature of the room is in between 25-30 degree celcius it is considered as a situation to turn on fan with speed of level one. In this level,appropriate temperature and status is displayed on the LCD. If the temperature of the room is in between 30-35 degree celcius it is considered as a situation to turn on fan with speed of level two. In this level,appropriate temperature and status is displayed on the LCD. If the temperature of the room is greater than 35 degree celcius it is considered as a situation to turn on fan with speed of level three. In this level,appropriate temperature and status is displayed on the LCD. If the temperature of the room is less that 20 degree celcius it is considered to be a situation to turn on Heater and turn off fan. If the temperature of the room is in between 10-20 it is considered as a situation to turn one heater on with heat of level one.In this level,appropriate temperature and status is displayed on the LCD. If the temperature of the room is in between 0-10 it is considered as a situation to turn two heater on with heat of level two.In this level,appropriate temperature and status is displayed on the LCD.

APPLICATIONS

There are many applications of the automatic air conditioning system. Followings are the different sectors where the automatic air conditioning systems are used:

i. Home
ii. Banks
iii. Departmental stores
iv. Hotels
v. Offices
vi. Laboratory etc

LIMITATIONS

All projects have their own limitations. We have tried our best to achieve the goal but our project also has some limitations which are as follows:

i. It cannot read negative temperature.
ii. It cannot be use for large hall.

FUTURE SCOPE

The goals of this project were purposely kept within what was believed to be attainable within the allotted timeline. As such, many improvements can be made upon this initial design. That being said, it felt that this design represents a functioning miniature scale method which could be replicated to a much larger scale. The following recommendations are provided as ideas for future expansion of this project:

i. Changeable temperature limits can be applied by adding matrix keypad.
ii. High precision sensors such as Platinum Wire can be used.This makes it possible to measure more range of temperature.
iii. Multiple sensors can be used to provide air conditioning over wider area.

CONCLUSION

Here by we come to the end of our minor project **"AUTOMATIC TEMPERATURE CONTROL USING PIC MICROCONTOLER".**This paper has presented a means of controlling temperature of a room(or any other system).This system helps to maintain the temperature within a limit. This system is very marketable because of its simplicity, low cost, low power consumption and small size. It can also be used in various industrial applications such as to control the temperature in boilers, refrigerator, AC computers and Laboratories.

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