Design and Implementation of Air Conditioning System based on Temperature Control Device for Power Saving

T Sri Vignesh[1], S Sudharsan[2], S Sweetlin Packiavathi[3], M Thangamani[4], B Saravana Manikandan[5]

[1,2,3,4] U.G Student, [5]Assistant Professor, Department of Electronics and Communication Engineering,
Karpagam Institute of Technology, Coimbatore

Abstract: *Air conditioners is integral part of almost every building and contribute a significant part in providing sophistication for humans. With exponential increase in use of cooling devices, there is a simultanous increases in electric power dissipation and several problems, such as building related symptoms and sick building syndrome due to air conditioners. Hence there is a need of other ways to minimize the energy consumption and other health related issues. In order to overcome this we have applied a control method to regulate the operation of air conditioning system in offices and wide area based on occupant's thermal comfort as against method based on indoor temperature only. The control signal is based on occupants body temperature which is obtained with the help of sensors (thermistor) and the information is sent to the microcontroller and based on the programmed thermal state the absorbed state is compared and with the compared states the air conditioner temperature is automatically adjusted by the microcontroller and if the state is zero entire circuit will be turned off.*

Keywords: *Air conditioner, Microcontroller, Human thermal comfort, thermistor, power saving*

1. INTRODUCTION

The improvement in technology has caused tremendous increase in providing sophisticated modern facilities, leading to increase usage of appliances like air conditioners to provide comfort to people in homes and offices. The air conditioners are used to provide the comfort to the residents based on thermal comfort. And there is a power dissipation in air conditioners even when turnoff because the compressor only turned off besides the entire circuit.
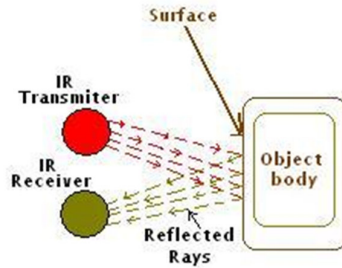
2. Description

2.1 IR Sensor

The main objective of IR sensor is to detect the obstacle. The IR sensor has an IR transmitter and IR reciever. The IR transmitter transmit the signal to the obstacle and the signal is reflected from the obstacle and it is received by the IR receiver.

Consider the obstacle is our body. The IR transmittesr transmit the signal and reflected signal is fall on the IR reciever. The signal is continuously flowing between the IR transmitter and IR receiver. When a signal is cut by a person, the micro controller transmit the signal to increase the number of persons count.

2.2 Themistor Sensor

The sensor is used to detect the temperature inside the room. Here we are using a positive temperature coefficient thermistor (positron) and in this the resistance increases with temperature and the resistance is measured to detect the approximate level of temperature from the resistance value obtained.

2.3 Humidity Sensor

It senses the humidity in the air by means of measuring both moisture and air temperature. The sensor consists of two metal plates and contains nonconductive polymer film placed in between them. The film between the non-conductive polymer collects moisture from the air which is caused by the change in voltage between the two plates .And the voltage range defines the humidity level in air.

2.4 Display

Here we are using Panda will Htc-1 Digital LCD Temperature Humidity meter. Large-character LCD display. It has multi-function that it displays the Temperature, humidity and time simultaneously.

2.5 Microcontroller

All the functions of this system are carried out by AT89C52 controller. This server as a coordinating unit of the system designed.it belong to the 8051 family. It has 8kb of flash programmable and read only memory and 256 bytes of RAM. It has bearance of 1000 write or erase cycles which indicates that the AT89C52 can be erased and re programmed to maximum limit upto 1000 times. It has two timers and extra special function a register. And also there are registers RCAP2H&RCAP2L to configure 16 bit capture and auto reloaded mode of timers.by combining versatile 8 bit cpu with flash on a monolithic chip and the atmel AT89C52 is a powerful microcomputer for provision of high flexibility and cost effectiveness.
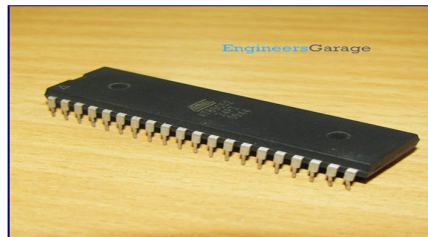
Figure of AT89C52

Fig2.pin diagram of AT89C52

Cite this article as: T Sri Vignesh, S Sudharsan, S Sweetlin Packiavathi, M Thangamani, B Saravana Manikandan. "Design and Implementation of Air Conditioning System based on Temperature Control Device for Power Saving". *International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016*: 434-438. Print.
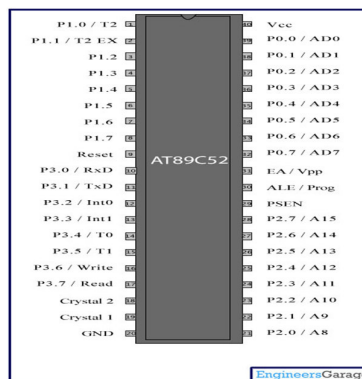
2.6 Features of AT89C52

- Easily Compatible with MCS-51Products
- Endurance of 1,000 Write/Erase Cycles
- Fully Static Operation in range of 0 Hz to 24 MHz
- Three-level Program Memory Lock
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timers.
- Eight Interrupt Sources
- Programmable Serial Channel

3. Control Strategy

The control circuit consists of a 7805 regulator and power circuit unit. The power circuit unit serves as the power source for the entire system. It provides +5V power supply, by converting 240V to a value, which is required by the microcontroller unit and other circuits in the design. The power circuit unit also consists of Step down transformer, Rectifier circuit, Filter circuit, Voltage regulator and an capacitor .The transformer is 230V/12V step down transformer. This 12V AC supply from the transformer is converted into direct current voltage. The output of the rectifier is given to a 4.7pF capacitor while the 7805 regulator used to regulate the output voltage to a fixed value of +5V. And the final output voltage is isolated from any noise and further filtration of the output +5V an additional 100 μF is added at the last. Capacitor is added to enhance power control. The regulator is an electrical control device that either closes or opens electrical contacts in order to enhance or disconnect operation of other devices that are either connected in the same circuit or any another electrical circuit.
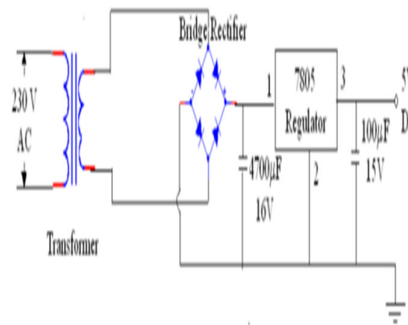

Fig3.control strategy

4. Implementation Diagram

The newly applied power control method for the Air conditioning system controlling human body temperature was designed using the Proteus 7 software. The simulation of this method utilizes the of control logic code formation for states representing the temperature and states are already programmed in the microcontroller and it will automatically adjust the temperature and also gives a signal to the regulator circuit that will entirely control the input current to the circuit and helps in turn off of both compressor and the air conditioner.

persons	Response under Normal body temperature(sec)	Response under body temperature above normal(sec)
1	11.50	11.0
2	11.60	10.56
3	12.30	10.23
4	15.42	12.21
5	16.47	9.95

Cite this article as: T Sri Vignesh, S Sudharsan, S Sweetlin Packiavathi, M Thangamani, B Saravana Manikandan. "Design and Implementation of Air Conditioning System based on Temperature Control Device for Power Saving". *International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016*: 434-438. Print.
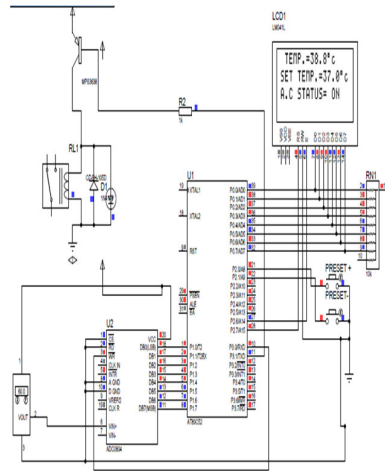
Fig 4. Implementation Diagram

5. Flow Chart
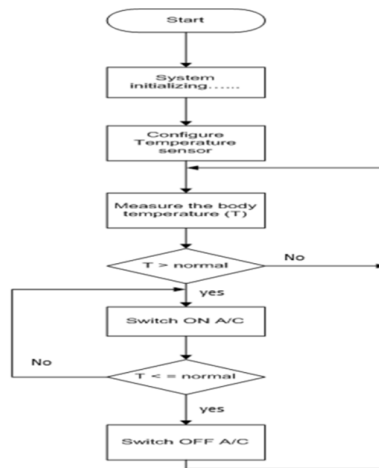
Fig.6.Flow Chart

The processes involved are:

i.   At first the IR sensor detects the person entering the room by reflected signals.
ii.   When the reflected signal is fall on the IR sensor it transmit a message to microcontroller.
iii.   On receiving the signal from IR sensor1 microcontroller will increases the count of person in the room and on receiving the signal from IR sensor2 microcontroller decreases the count of person in the room.
iv.   And next the thermistor sensor send the temperature inside the room and send to the microcontroller.
v.   Next the humidity is measured by humidity sensor and the value is transmitted to microcontroller.
vi.   The values are compared in microcontroller with the programmed levels are the temperature is adjusted based on the programmed level.
vii.   If there no signal from IR sensors and count is zero there exists a state called zero state the air conditioner is turned off.

6. Process Description

•   When the persons enter the room the count and temperature are observed and send to the microcontroller.
•   And the humidity, temperature, count of person accommodated inside room are calculated.
•   On comparing the calculated level with the programmed level state then temperature is adjusted based on it.
•   And based on the programmed level the air conditioner is operated with different climate and season changes.

Table 2. Relationship between   temperature, Resistance, Cooling.

TEMPERATURE (ROOM)	RESISTANCE	COOLING
↑	↑	↑
↑	↑	↑

7. Conclusion

From the above findings and our experimental study we have found that the ac control based on temperature is better than all other types. We can save power and also helps in unwanted run out of air conditioners for a long time. This method is very helpful to save human from several problems including such as building-related symptoms and sick building syndromes due to air conditioners. And besides of only turn off of ac compressor the entire circuit is turned off which helps in reducing effect due to ac gases and other environmental issues.

8. References

1. C. A Danforth, "Why the Weather is Unpredictable," Bates College, 2001.
2. A. Teke and O. Timur, "Assessing the energy efficiency improvement potentials of HVAC systems considering economic and environmental aspects at the hospitals," Renewable and Sustainable Energy Reviews, vol. 33, pp. 224-235, May 2014.
3. E. G. Ochieng, N. Jones, A. D. F. Price, X. Ruan, C. O. Egbu, T. Zuofa, "Integration of energy efficient technologies in UK supermarkets," Energy Policy, vol. 67, pp. 388-393, April 2014.
4. C. David, L. Henrik, M. B. Vad, W. Sven, M. Bernd, P. Urban, B. Thomas, T. Daniel, . P. Alberg, N. Steffen, "Heat Roadmap Europe: Combining district heating with heat savings to decarbonise the EU energy system," Energy Policy, vol. 65, pp. 475-489, February 2014.
5. Lemoine and I. Rudik, "Steering the Climate System: Using Inertia to Lower the Cost of Policy," Social Science Research Network, July 2014.
6. Yzhu and M. Ghosh, "Temperature control, emission abatement and costs: key EMF 27 results from Environment Canada's Integrated Assessment Model," Climatic Change, vol. 123, pp. 571-582, April 2014.
7. K. A. Akpado, C. O. Ezeagwu, A. Ejiofor, A. O. Nwokeke, "Design, Modeling and Simulation of a Microcontroller Based Temperature Control in a Ventilation System," International Journal of Advanced research in Electrical, Electronics and Instrumentation Engineering, vol. 2, pp. 3470-3479, July 2013.
8. J. S. McDonald, "Temperature control using a microcontroller: an interdisciplinary undergraduate engineering design project," Frontiers in Education Conference, Pittsburgh, PA, 1997, pp. 1620-1624.
9. H. A. Sambo, "A microcontroller based automatic room temperature control system, design and implementation," B. Eng. Undergraduate project, Dept. of Elect/Elect. Eng. ATBU, Bauchi, 2004, unpublished.
10. M. H. Kacem, S. Tounsi, R. Neji, "Control of an Actuator DC Energysaving Dedicated to the Electric Traction," International Journal of Computer Applications, vol. 54, pp. 20-25, September 2012.