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Dual Compressor Controller

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ABSTRACT
The cooling systems have a variety of ways. The various methods of cooling systems are based on coverage area. A very large number of industrial processes use air as a cooling medium, either directly or indirectly. For example air conditioning, it is the process of removal of heat from a confined space, thus cooling the air, and removing the humidity. This process is mainly used to achieve a more comfortable interior environment, typically for humans or animals. However, the technique of air conditioning is also used to cool or dehumidify rooms filled with heat-producing electronic devices, such as computer servers, power amplifiers etc. It is a very common process in which the air in a room, or a whole building, is cooled in order to maintain a comfortable environment for its occupants. This paper aims at cooling system by load sharing of compressor using multiple machine. This method shares the load of one machine if it crosses certain threshold by switching it OFF and switching ON the other machine. Thus, sharing improve the efficiency as well as save power. The switching ON-OFF and setting the threshold is done by programming using a PIC microcontroller. The temperature levels are indicated on LCD and all the changes are also indicated on the display.
Keywords - Compressor, Air conditioning, PIC Microcontroller, NTC sensor, LCD

I. INTRODUCTION

The proposed system comes under embedded domain. The main purpose of dual compressor controller is that when one compressor is not capable of handling the load, the second compressor will start and both compressors will cut out at the lowest set point. Since it is a dual compressor controller there is cycling of compressor so that there is no excess load on one compressor. It is dual compressor controller with separate set points, differentials and time delays for each compressor and the range of the compressor is 0^{o} C to 99^{o}C. **.**In this paper, we have shown that when two identical compressors are operating in regions, there exists an ideal point at which it is best to switch from each compressor equally sharing the load to one compressor. Constant watch on the surrounding temperature with the help of sensors keeps the system alert even with slight change in temperature. The efficiency of a one compressor tends to decrease and affect the overall efficiency of the entire system. So, it is used in the systems that have dual compressors that operate in parallel to meet the aggregate cooling requirements of the system. Parameters are selected such as set point, differential time, time delay between dual compressor and individual compressor to turn ON or OFF and general mode of operation for this controller for better system. This system can be used where an object is required to be heated, cooled or both and to remain at the target temperature (Set point), regardless of the changing environment around it. So, temperature controller is main factor in this system so that it maintain a desired temperature at a required value. Using dual compressor makes the system longer life span. These controllers are used in a wide variety of industries to manage manufacturing processes or operations such as food storage, food processing, packaging machines, thermos-forming machines, etc.

II. LITERATURE SURVEY

Chad larrabee, Ingersoll Rand company[1], The Maganize for ENERGY EFFICIENCY in Compressed Air, Pneumatics, Blower and Vaccum Systems have used multiple compressor which are aligned and have differentals and set points to elimate waste and raised pressure by remote connectivity but multiple compressor can only be used in industrial use.Koji hirano, et.al. [2], have a conference on development of a high efficiency dual compressor for air conditioner. They have dual compressor that can stop one of two cylinders according to necessary capacity but they have not consider the set point of two compressor and there time delay of switch ON or OFF.

III. PROBLEM IDENTIFICATION

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The main problem identified is that the temperature of big areas cannot be controlled by single compressor and load on single compressor leads to shorter life of it. So, addition of compressor along with various parameters makes the system more reliable, energy efficient, nearly accurate. The parameter such as continues switching ON and OFF of the compressors will damage the system which will be hazardous to the environment, for that time delay is required in the compressor and between the compressor by using relay. If the system fails how will we get to know that the system as fail for that we have use buzzer for the indication of the system failure. For more detail to be display on the screen we have used LCD (16x2) display instead of 7 segment. Suppose one compressor cannot achieve lower set point then other compressor will ON after some set value of time this is also one of the parameters required in this system. This small things that need to be taken care of or for better performance in the system we have various parameter included in this system. This paper show an overview and effects of the dual compressor controller.

IV.PROPOSED METHODOLOGY

Block diagram consist of two section first is power supply section and second is PIC microcontroller section. In power supply section as shown in the fig. (1) We have step-down transformer which will give 12V from 230V. Rectifier converts 12V AC to 12V pulse DC and filter will remove the unwanted frequency signal and provide pure DC from pulse DC. Voltage Regulator will maintain constant DC voltage to the device. Now, in PIC microcontroller we have NTC sensor (Range -55^{0}C and 200^{0}C) which will sense the temperature of the surrounding and give the output to the microcontroller. Two compressor are used to overcome the load effect in single compressor. LED's are used for indicating each compressor turn off and on time and also indicating failure of the system. We have four switches for ON, OFF, SET, RESET and lastly LCD (16x2) for display desired temperature and various parameters.

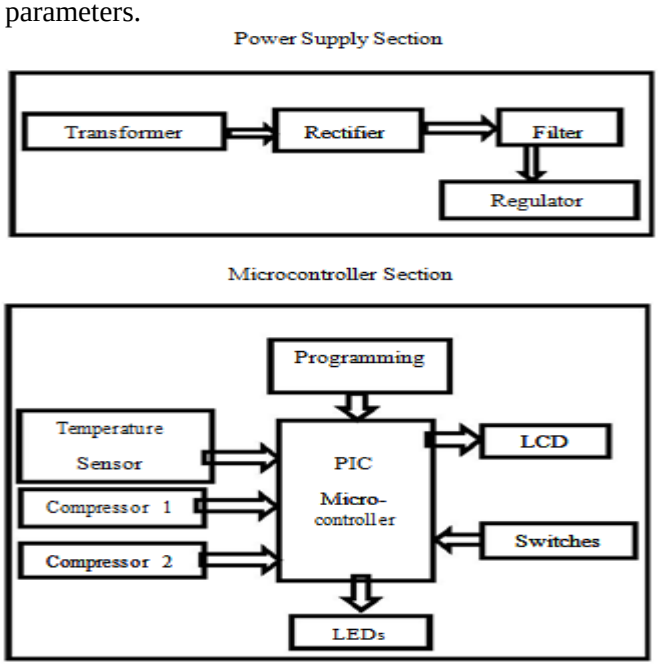

Fig.1 The block diagram of dual compressor controller

The fig. (2) Shows the working principle of the dual compressor controller. It shows that how two compressors will share the load among themselves to keep the temperature under control. This system will have 3 operating zones i.e. average heating zone extreme heating and extreme cooling zone. We can set the value at which we need to maintain the temperature. The blue horizontal line in the above figure shows the set point value. Once the temperature is set the system will sense the current temperature of the surrounding area.

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Then the temperature of the surrounding will be compared with the set value. Depending upon temperature is at set temperature or not the microprocessor decides to turn on one or two compressors at a time. Two red lines in the above figure shows that both the compressors are ON; while green line shows that only one compressor is ON.

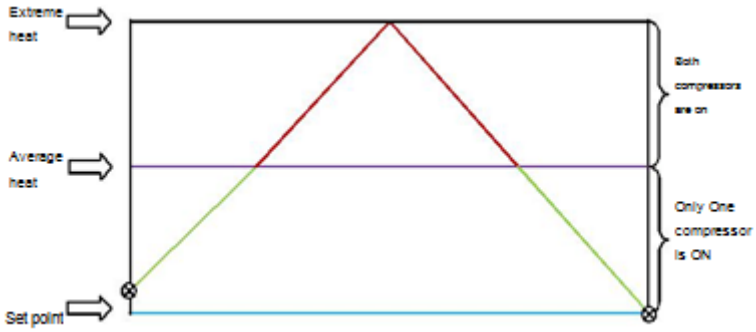

Fig.2 The working principle of two compressor controller

If the temperature is more or less than the set value but below the average heat then any one compressor will be turned on and if the temperature is more than the set value but goes beyond the average heat then both the compressors will be turned on. Suppose the temperature is set at particular value and surrounding temperature is more than the set value then any one compressor will be turned on. As soon as the temperature reaches to the set point it will turned off (at blue line). If one compressor isn't able to bring the temperature near to the set point and it goes above the average heat due to intense heat emitted by human body or devices (above violet line) then both the compressors will be turned on to bring down the temperature. Once the temperature is below average heat any one of the compressor is turned off.

In case of temperature going below the set point at this time both the compressors will remains turned off till temperature increases above the set point again (above blue line) and the operation cycle continues.

LEDs

V. SOFTWARE IMPLEMENTATION

OrCAD is a software tool for electronic design (EDA). This is mainly for electronic design engineers and technicians to create electronic schematics and print circuit board layout. OrCAD capture provides main schematic editing experiences, but does not remain there. It is highly integrated with OrCAD PCB editor for physical PCB design, OrCAD PSpice for angle /mixed-signal simulation, OrCAD PCB SI for signal integrity analysis and planning, and OrCAD CIS (Component Information System) for component optimization, selection, and variant design, greatly extending the schematic design process.

Embedded C contains a set of language extensions for the C programming language. Embedded C is for microcontroller based. For embedded application, it is required to optimally use the resources, make the program code efficient, and satisfy real time constraints, if any considering all such feature of Embedded C language, it is suitable for using in our proposed method. Thus, for programming Embedded C is used

VI. CONCLUSION

This proposed system can be considered as nearly accurate temperature controller. Load sharing increases the life span of the compressor significantly. In addition to that instant on and off of the compressor can be avoided by giving differential time to each compressor.

Dual compressor is highly effective in maintaining the varying temperature conditions and can stop one of the two compressors according to the necessary capacity. Due to this it can achieve increase of 3% to 5% and can reduce average power consumption by significant percent.

This is highly adaptive system. The flexibility of adding parameters or number of compressors as per the requirement. Precision in humidity and temperature control, coupled with substantial energy savings, make a dual compressor controller a practical choice for many homeowners and industries.
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