

SMART REGULATOR

Automatic Room Temperature Monitoring and Controlling with Power saving approach

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Abstract- Our main goal is to design a “SMART REGULATOR” which reduces the human effort. This instrument regulates the speed of the fan automatically according to the room temperature and the user defined set point temperature. It will also display the room temperature. If the temperature is less than the set point temperature or exactly equal to the set point temperature then the fan is in off state and when the temperature of the room is greater than the set point temperature then the fan is in on state and the speed of the fan will vary proportionally according to the logic written in the program which depends on the difference between the present room temperature and the set point temperature. This regulator also counts the number of person entering in the room and also leaves from the bidirectional single door room. It will also display that number. If the number is zero that means no person present in that room or the room is empty, then it will disconnect the power supply of the room automatically and which save our power as well which is a very important in recent days. When one person entering in the room then it will again connect the power supply of that room automatically, this reduces the human effort.

Keyword- *Automatic Control, Fan speed control, Human, Power Consumption, Visitor Counter*

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I. INTRODUCTION

Today human's lives are totally technology based. From the early morning to the late night human needs technology. "TECHNOLOGY" - this word is derived from Greek word "technology", the 'techno' is an art, skill or craft and the 'loggia' is the study of something or branch of knowledge of a discipline. With the advancement in technology, human life is more comfortable like never before. There is almost no place that you can go where technology hasn't been used. Technology affects our daily lives in everything that we do. This paper is developed a regulator which reduces the human effect. Temperature of the room is varying time to time within a day. Like temperature of the mid night is greater than the early morning. So we have to adjust our fan speed manually according to room temperature. This regulator done this job automatically according to set point value which is different for different human being and it is set by user itself. Once the set point is set by the user is regulate the fan speed without human interaction.

And another thing is the electricity. Today energy saving is a big challenge for us. We use energy everyday at home, at school, at work, and even when you're playing. By saving energy you're helping to save the world's energy resources like coal, gas, oil and water and you're also saving money on your utility bills and making a better environment for everyone. Think about what would happen if there wasn't

enough energy, there would be no light to turn on when it got dark, there would not be any hot water for the shower or heat for your house in the winter, no gas or oil to drive the car, so there are lots of reasons we should save energy. So we have to save our electricity. We can do it by proper use of energy, like the lights and television use electrical energy, so when you leave the room, shut them off. This regulator saves the energy by cutting our power supply of the room when the room is empty. It's a big challenge for everyone.

II. EXPERIMENTAL SET-UP

Here we use an IR sensor pair to detect the human who enter or exit from a single bidirectional door of a room. Inside the controller we developed a up-down counter which increment its count value when any person enter inside the room and also decrement the count value when any person leaving from the room and display the number which tells us the number of peoples are present inside the room at that moment. When that number is equals to zero that means room is empty and controller cuts the total power supply of that room and whenever one person enter inside the room, it connect the power supply of the room, by this way we saved our energy without human interaction.

In the second part of that regulator is controlling the fan speed according to the room temperature and user defined set point temperature. In this part we use temperature sensor which sense the room temperature and then it fed to the controller followed by signal conditioning unit. Here user can provide the temperature value at which user want to switch off the fan and the temperature at which user want maximum speed of the fan. If user does not provide any temperature value then it takes by default temperature range which is average human

comfortable temperature range. If the room temperature is less than the lower temperature value set by the user then it switched off the fan and if the room temperature is equal to or gather than upper temperature value set by the user then it make the fan speed at maximum point i.e. 100%. If the room temperature is present in between the lower and upper temperature range then regulator take the difference between the user set temperature and the room temperature and according to this, it vary the fan speed as per the programming.

III. WORKING PRINCIPLE

The block diagram of the system is shown in the figure 1.

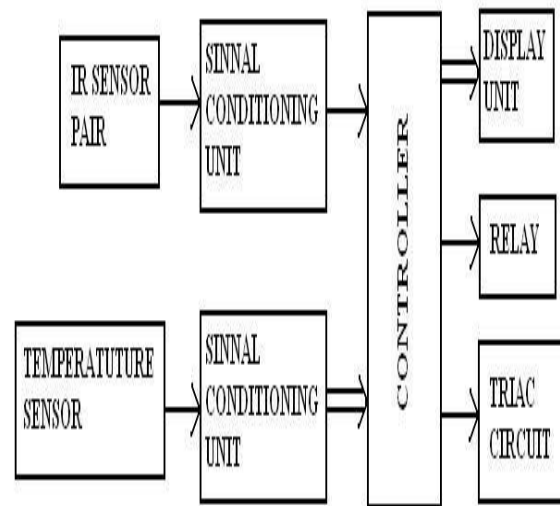


Figure1:- Block diagram of the set-up

IR sensor pair is used to detect the number of person entering into or leaving from the room. In normal state IR transmitter transmit infrared radiation and the receiver part received that radiation and gives an output. When an object such as human passing in front of it, then the object breaks the field which the sensor has determined as the “normal” state. Normally

without any state change the IR sensor pair gives output logic 1 but when a person passing in front of it, sensor pair gives output logic 0. Signal conditioning unit is used to make the voltage level for logic 0 and logic 1 stable and also invert the logic level because many controllers having low level triggered interrupt. Signal conditioning unit consists of an op-amp IC LM324 and shown in the figure2.

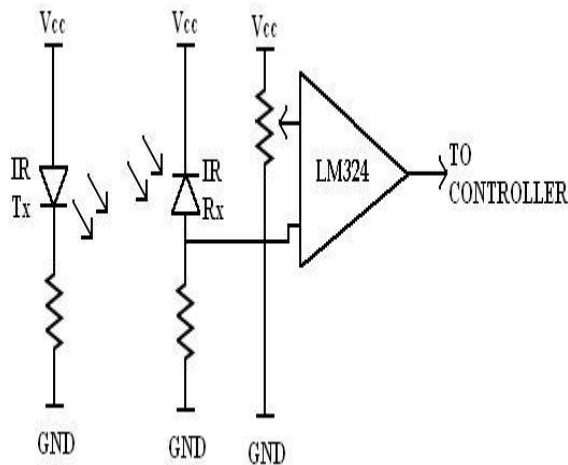


Figure2:- Signal conditioning unit for IR sensor pair

Inside the controller we always monitor the count value, when the count value is equals to zero then by using relay we cut the total power supply of the room and also when the count value is equals to 1 then we activate total power supply of the room.

In another part, we use temperature sensor to monitor the room temperature is LM35. The LM35 series sensors are precision integrated-circuit temperature sensors whose output voltage is linearly proportional to the Celsius (centigrade) temperature. We use this sensor because it requires no external calibration since it is internally calibrated. It provides output 10mV for each degree of centigrade temperature. Here the signal conditioning unit consists of amplifier to amplify the output voltage and analog to digital converter to

convert the analog signal into equivalent digital data which is readable to the controller. The controller generated a pulse-width modulation signal for controlling power. The term duty cycle describe the proportion of ‘on’ time to the regular interval or period of time; a low duty cycle corresponding to low power, because the power is off for most of the time.

The TRIAC circuit is used for speed control of the fan. A SCR is a unidirectional device as it can conduct from anode to cathode only and not cathode to anode. A triac can, however, conduct in both the direction. A triac is thus a bidirectional thyristor with three terminals. It is used extensively for the control of power in ac circuits. Triac is the word derived by combining the capital letters from the words TRIode and AC. When in operation, a triac is equivalent to two SCRs connected in anti parallel. Triac can conduct in both the directions, the terms anode and cathode are not applicable to triac. Its three terminals are usually designated as MT1, MT2 and the gate by G as in a thyristor. With no signal to signal to gate, the triac will block both half cycles of the ac applied voltage in case peak value of this voltage is less than the break over voltage of V_{BO1} or V_{BO2} of the triac.

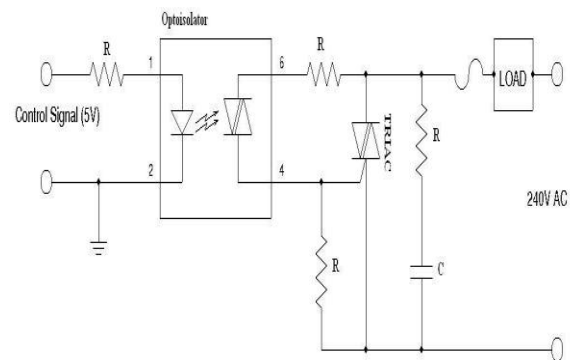


Figure 3: TRIAC circuit for Power control

Here an optoisolator is used to make no direct connection between 240V supply with our system to protect our system. This device

consists of gallium arsenide infrared emitting diodes optically coupled to a monolithic silicon detector performing the function of a Zero Voltage Crossing bilateral Triac driver.

IV. EXPERIMENTAL RESULT

Visitors inside the room	Set point Temperature	Room temperature	Fan Speed
Empty	$X^{\circ}C$	Any temperature	OFF Condition.
Non empty	$X^{\circ}C$	$X^{\circ}C$	OFF Condition
Non empty	$X^{\circ}C$	$< X^{\circ}C$	OFF Condition
Non empty	$X^{\circ}C$	$> X^{\circ}C$	According to Prog

V. CONCLUSIONS

In this way our system monitors and controls the room temperature as well as saves our power consumption which is very important in recent days. If we gather all features of our system then this are as follows:

- It will regulate the speed of the fan proportionally according to the room temperature and as well as it control the temperature of the room
- It will display the temperature of the room
- The set point of this instrument is given by the user. So it will work according to the user defined range.
- It will count the number of people enter in or leave from the room and also it will display that value.
- Automatic power on-off is done according to the status of the room whether the room is empty or not which also reduces our power consumption.

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ABOUT AUTHOR



Soumya Roy is currently pursuing M.Tech in Instrumentation and Control from the University of Calcutta. He holds a gold medal as he topped his B.E in AEIE with Hons. from the University of Burdwan. His research work involves microcontrollers based system, embedded system and automation.