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Automatic Room Lamp Illumination Control

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ABSTRACT*:* This paper aims in designing a light illumination system which is capable of identifying the human presence using PIR sensor and detecting the light intensity in room using LDR sensor. The system uses LDR sensor for detecting the light level of room and based on that microcontroller control the intensity of light (AC Bulb). The system makes use of a Microcontroller board. The output from PIR sensor is fed as input to the microcontroller. The output of LDR sensor is fed as input to the microcontroller for day or night detection. The microcontroller will continuously compare output from PIR and LDR. This input is fed to microcontroller which automatically initiates the firing angle control of TRIAC and adjusts the power supplied to the lamp with the help of a solid-state switching mechanism. Zero crossing detector is used for smooth operation of the device. The percentage of light illumination will display on LCD. To achieve this task microcontroller loaded program written in embedded C language.

KEYWORDS: Light Control, PIC Microcontroller, PIR Sensor, Light sensor, TRIAC.

I. INTRODUCTION

Our design is a system that uses a microcontroller to maintain the illumination of a lamp by controlling a thyristor. The illumination is maintained by varying the voltage across it. The system uses the concept of firing angle control of thyristors. This input is fed to microcontroller which automatically initiates the firing angle control of thyristors and adjusts the power supplied to the lamp with the help of a solid state switching mechanism .Illumination of a lamp varies depending on the voltage applied to it. In certain specific applications it is necessary to have controlled illumination as per requirement. This system overcomes the faults in the present system and provides a solution for light illumination control mechanism of the lamp. This system is built by using an PIC16F872 microcontroller and based on the principle of firing angle control of thyristors, which in turn can control the illumination of lamp. The input is given to the Microcontroller and ZVS is given as reference. A 16X2 LCD is used for display purpose The power supply consists of a step down transformer 230/12V, which steps down the voltage to 12V AC. This is converted to DC using a Bridge rectifier. The ripples are removed using a capacitive filter and it is then regulated to +5V using a voltage regulator 7805 which is required for the operation of the microcontroller and other components. The LCD display, which displays percentage of the illumination. The firing angle control of thyristors is done by the microcontroller. Based on this input the microcontroller will automatically adjust the power delivered to the lamp through a solid state switching mechanism. Automatic illumination control facilitates the variation of illumination of indoor as well as outdoor lighting based on natural day light existence. Hence by the proposed illumination control scheme, energy consumption can be reduced creating a foot step for energy conservation.

II. LITERATURE SURVEY

1. Several studies have explored the principles and applications of digital PWM techniques in the domain of lighting control. Smith et al. (2017) conducted a comparative analysis of analog and digital PWM methods for light dimming.

2. In the work of Chen et al. (2018), a digital PWM-based lighting control system was developed for dynamic color temperature control in indoor environments.

3. Liu et al. (2019) investigated the impact of digital PWM frequency on flicker perception in LED lighting systems.

4. Wu et al. (2020) developed a digital PWM based lighting control system that utilized a microcontroller for seamless integration with home automation systems.

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5. Zhao et al. (2021) highlighted the issue of color consistency in multi-channel LED lighting systems. Their research focused on developing advanced digital PWM algorithms to ensure consistent color reproduction across different LED channels.

III. DESIGN AND IMPLEMENTAION

This paper aims in designing a system which helps in increasing or decreasing lamp intensity based on human presence and light intensity using PIR and LDR. A Triac and optically isolated Diac (triac driver) based circuit controls intensity of the high voltage 230volts lamp. This system also employs a zero crossing detector **for smooth** operation of lamp intensity. The optical isolation system safeguards the microcontroller-based system from high voltages. An LCD display unit is used, which displays percentage of the light illumination.

"Automatic Room Light Intensity Detection and Control Using a Microprocessor and Light Sensors'' was designed room light intensity control system can be done using PIR and LDR. Microcontroller will monitor the human presence with the help of PIR and light intensity in room with the help of LDR. Based on the sensor output microcontroller will control the light illumination through triac and display the percentage of light illumination on LCD display. Based on the principle of firing angle control of triac, illumination of lamp controlled automatically. To achieve this task microcontroller loaded program written in embedded C language.

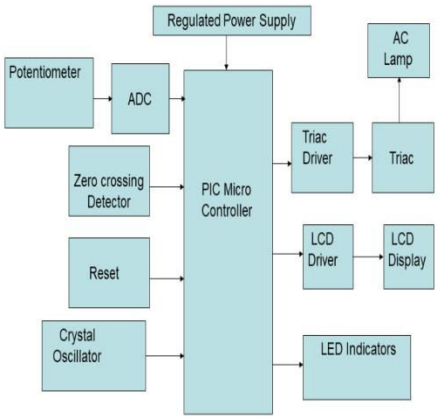

Fig.1 Block diagram

The major building blocks of our design are Regulated Power Supply, PIC Microcontroller, Triac and diac, Zero crossing detector, Crystal Oscillator, PIR, LDR, LCD display, Reset, LED Indicators.

RPS is used for providing 5v DC supply to the microcontroller. PIC Microcontroller will take instructions from PIR sensor and light sensor and controls the gate firing pulses of the triac. Diac is used as Gate firing circuit for the triac. PIR(Pryo Infrared Radiation)Sensor is used to detect the human motion, if human is present, it will switch on the lamp, if not it switches off.LDR(Light Dependent Resistor)is used to measure the illumination. When room illumination is less, the microcontroller will increases the lamp's illumination and if the Room illumination is more, the microcontroller will decreases the lamp's illumination. This can be achieved by PWM technique. By using PWM technique, we can control the firing pulses of traic, which controls the voltage of the lamp. By this we can achieve automatic lamp Illumination control.

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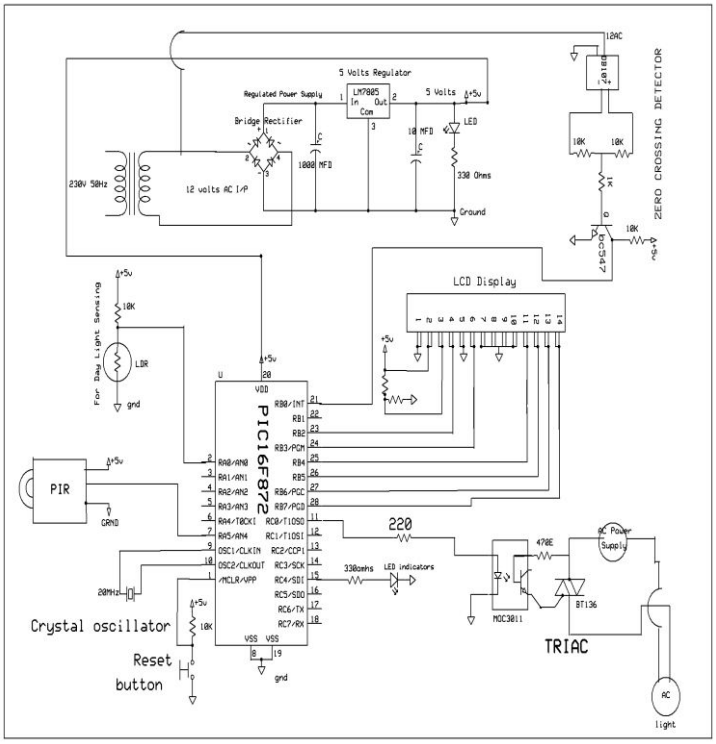

Fig.2 Circuit Diagram

The fig.2 shows the circuit diagram. The PIC Microcontroller has 6 analog pins and 8 digital pins in which the light sensor and PIR sensor are connected to analog pins, LCD is connected to digital pins to display the percentage. Triac circuit is connected to RC0

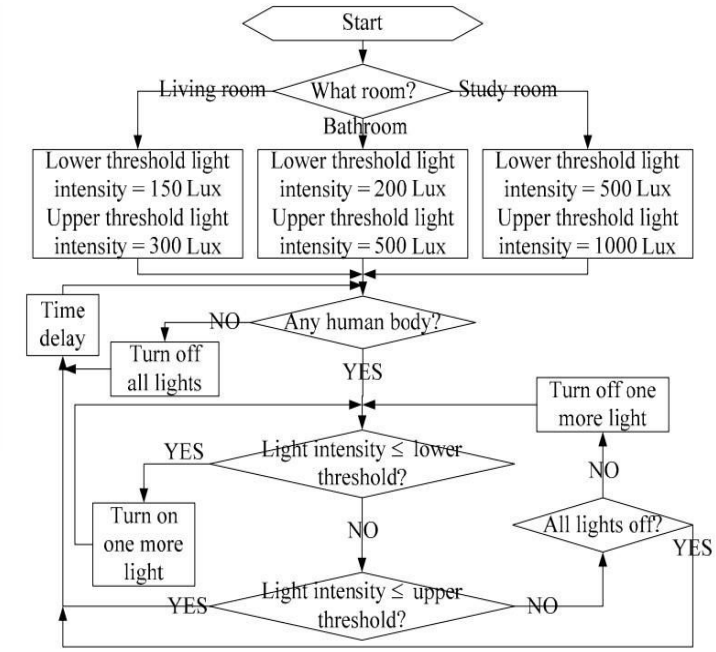

Fig.3 Flowchart

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IV. RESULTS AND DISCUSSION

The figure shows Room Lamp Illumination under 3 modes. They are sunny, cloudy and partly cloudy. When it is a sunny day we do not need 100% lamp illumination so by comparing the indoor and outdoor lightning our design automatically varies the lamp illumination. Similarly in cloudy and partly cloudy days the illumination will be adjusted accordingly.

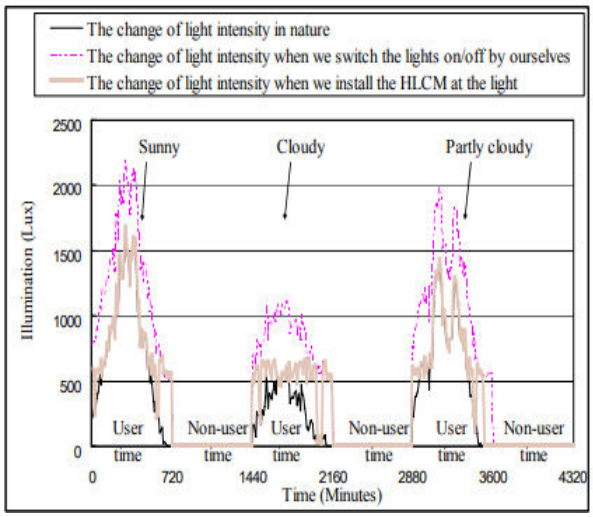
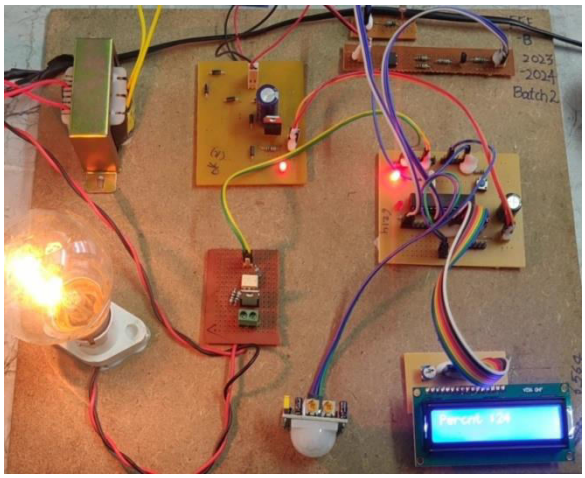


Fig.4 Comparison of lamp illumination in three modes

The fig.5 shows the practical module of our design. The power consumption of the module is very less compared to the power loss due to unnecessary illumination.



V. CONCLUSION

Automatic illumination control facilitates the variation of illumination of indoor as well as outdoor lighting based on natural day light existence. Hence by the proposed multipurpose illumination control scheme, energy consumption can be reduced creating a foot step for energy conservation. Poor lighting results in severe consequences like eye-strains, headaches, accidents due to insufficient lighting or to glare. We can overcome this problem by illumination control. Good lighting, apart from having aesthetic and decorative aspects, reduces accidents, increases the production in the factories and improves the general health of the community due to reduction of eye-strain. By this, we can conclude that by using lamp illumination control with precision technique, we can effectively use electrical energy and reduces the energy crisis.

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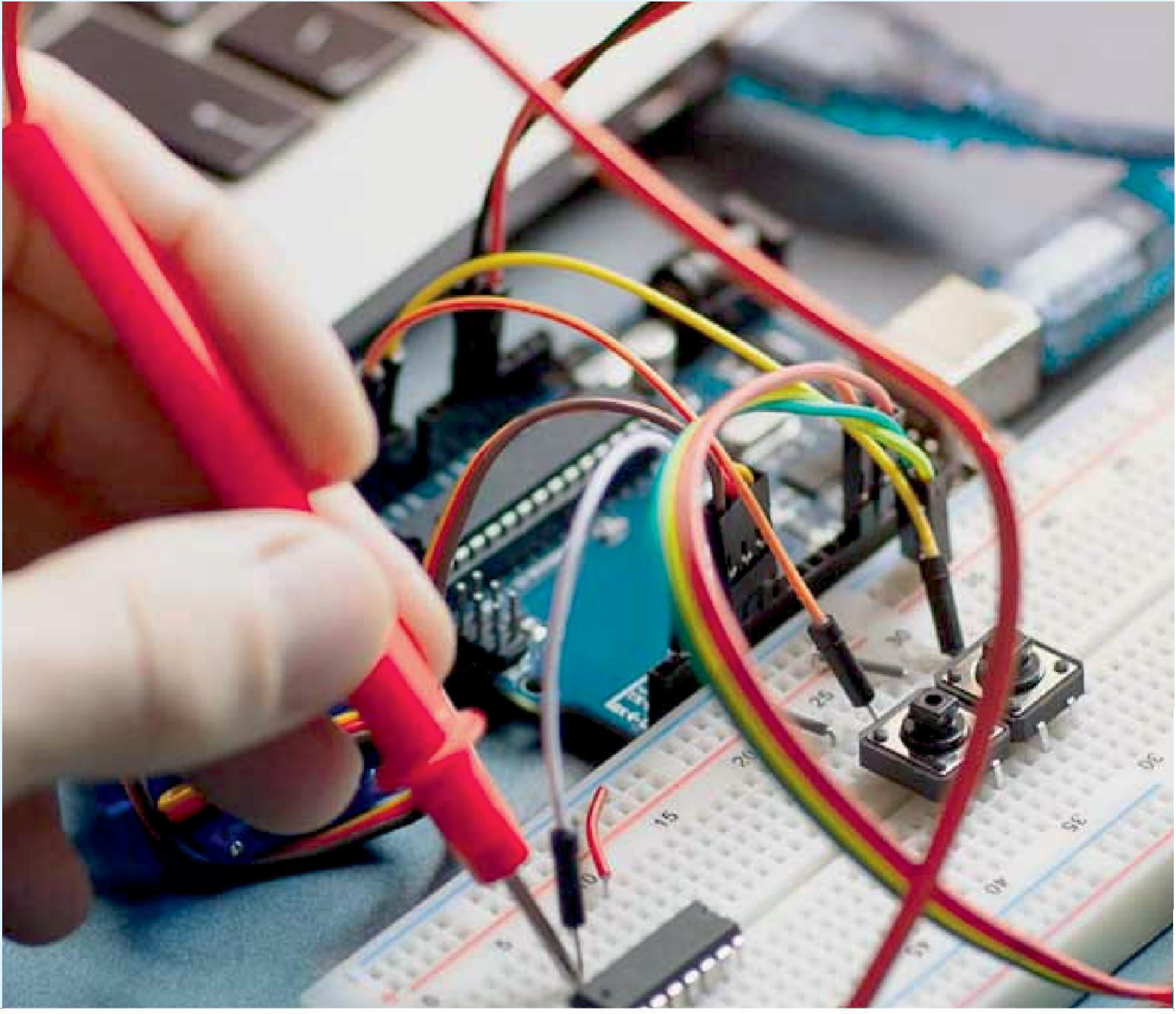

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