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# Power Saving Automatic Room Light Controller

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**ABSTRACT:** The automatic room light control system is a low-cost and energy-efficient solution that helps optimize energy consumption by automatically turning the lights on and off based on the presence of visitors in the room. The system is designed around an Arduino Nano microcontroller, which is responsible for controlling the behaviour of the system based on input from infrared sensors. The system utilizes a range of electronic components, including an LCD display, IR modules, a 5V relay, a transistor (BC548), an IN4007 diode, resistors (220ohm), LEDs, a 7805 voltage regulator IC, a female connector strip, a PCB, and a 5V-9V DC SMPS supply. The components are selected to ensure that the system is reliable, low-cost, and easy to install. The Arduino Nano is a low-cost microcontroller board that is based on the ATmega328P chip. It is compatible with the Arduino programming environment, making it easy to program and integrate with other electronic components. The IR modules are used to detect the entry and exit of visitors and communicate this information to the microcontroller. The LCD display is used to display the visitor count and other relevant information, and the relay is used to control the lights in the room. The use of an SMPS power supply ensures that the system is energy-efficient and can operate on a range of input voltages. The 7805 voltage regulator IC is used to regulate the input voltage to the required 5V to power the microcontroller and other electronic components.

**KEYWORDS:-** Automation, Internet of Things (IoT), Smart home technology, Energy efficiency, Sustainable technology.

## I. INTRODUCTION

### A. Overview:

The automatic room light controller is an energy-efficient and cost-effective solution that uses infrared sensors to detect the presence of visitors in a room and automatically turns the lights on or off. The system is built around an Arduino Nano microcontroller and incorporates electronic components such as IR modules, an LCD display, a 5V relay, a transistor, and a voltage regulator. The system is designed to be flexible, scalable, and easy to install and operate, making it suitable for both residential and commercial applications. The system helps optimize energy consumption and reduce costs by automatically controlling the lighting system. The system is based on the principles of automation and the Internet of Things, making it a modern and advanced solution for lighting control. The system has future scope for further development and can be customized to meet specific requirements. Overall, the automatic room light controller is an innovative solution that helps improve the convenience and efficiency of lighting systems while minimizing energy consumption and reducing costs.

### B. Proposed system functions:

This is IoT project, it include detecting the presence of visitors in the room using infrared sensors, controlling the lighting system using a relay module, displaying visitor count and relevant information on an LCD display, and regulating the power supply using a voltage regulator IC. The system is based on an Arduino Nano microcontroller

and is designed to be low-cost, energy-efficient, and easy to install. By automating the lighting system, the system helps optimize energy consumption by turning the lights on and off based on the presence of visitors in the room.,

- ATmega 328p (Microcontroller).
- 5-channel 5v SPDT relay module.
- IR sensor.
- LCD Display.

### C. Advantage of automatic room light controller system

The automatic room light controller system offers several advantages over traditional lighting systems. By using infrared sensors and a microcontroller, the system is able to detect the presence of people in a room and turn the lights on or off accordingly. This not only enhances the convenience of the lighting system but also helps to reduce energy consumption. Additionally, the system is easy to install, operate, and maintain, making it an ideal solution for both residential and commercial applications.

- **Energy efficiency:** The automatic room light controller system helps to optimize energy consumption by automatically turning the lights on and off based on the presence of visitors in the room. This can result in significant energy savings, particularly in rooms where lights are frequently left on when no one is present. By reducing energy consumption, the system can also help to reduce electricity bills.
- **Convenience:** The system eliminates the need for visitors to manually turn the lights on and off, providing a more convenient solution for lighting control. This is particularly useful in rooms where visitors frequently enter and exit, such as corridors, bathrooms, and meeting rooms. By automatically detecting the presence of visitors, the system ensures that the lights are always on when needed and off when not in use.
- **Low cost:** The use of low-cost electronic components, such as the Arduino Nano microcontroller and IR sensors, helps to keep the cost of the system low. This makes it an affordable solution for both residential and commercial applications.
- **Customizable:** The automatic room light controller system is flexible and scalable, allowing it to be customized to meet specific requirements. The system can be adapted to work with a range of lighting systems, including incandescent bulbs and LED lights. It can also be configured to control multiple lights in a room, or to operate in conjunction with other systems, such as HVAC or security systems. This flexibility makes the system suitable

## II. SYSTEM ANALYSIS

### A. Overview of the system architecture:

The automatic room light system is based on the infrared sensor technology which detects the presence of a person in the room and automatically turns on the light. The system consists of two infrared sensors that are placed at the entrance and exit of the room, an Arduino Nano microcontroller that is used to control the sensors, a 16x2 LCD display to show the number of persons in the room, a relay module to turn on/off the light, and other components such as resistors, diodes, and transistors.

- The system is designed around an Arduino Nano microcontroller board that controls the behaviour of the system.
- Infrared sensors are used to detect the presence of visitors in the room, which triggers the lighting system.
- The system utilizes a 5V relay to control the lighting in the room.
- An LCD display is used to display information such as visitor count and other relevant details.

### B. Description of the hardware components:

- **ATmega328P:** It is a microcontroller board. It has 14 digital input/output pins, 8 analog inputs, and a 16 MHz quartz crystal.
- **Infrared sensors:** Two infrared sensors are used in the system, one at the entrance and the other at the exit of the room. They are used to detect the presence of a person in the room.
- **LCD 16x2:** It is used to display the number of peoples in the room.
- **Relay module:** It is used to turn on/off the light automatically.
- **Transistor BC548:** It is used to drive the relay module.

- Diode IN4007: It is used to protect the circuit from reverse voltage.
- Resistor 220ohm: It is used to limit the current in the circuit.
- LEDs: They are used to indicate the status of the system.
- 7805 voltage regulator IC: It is used to regulate the voltage in the circuit.
- Female connector strip: It is used to connect the components.
- PCB: It is used to mount the components.
- 5V-9V DC SMPS supply: It is used to provide the power supply to the circuit.
- Jumper Wires: used for connection between Arduino and IR sensors.

### C. Circuit Diagram for automatic room light controller:

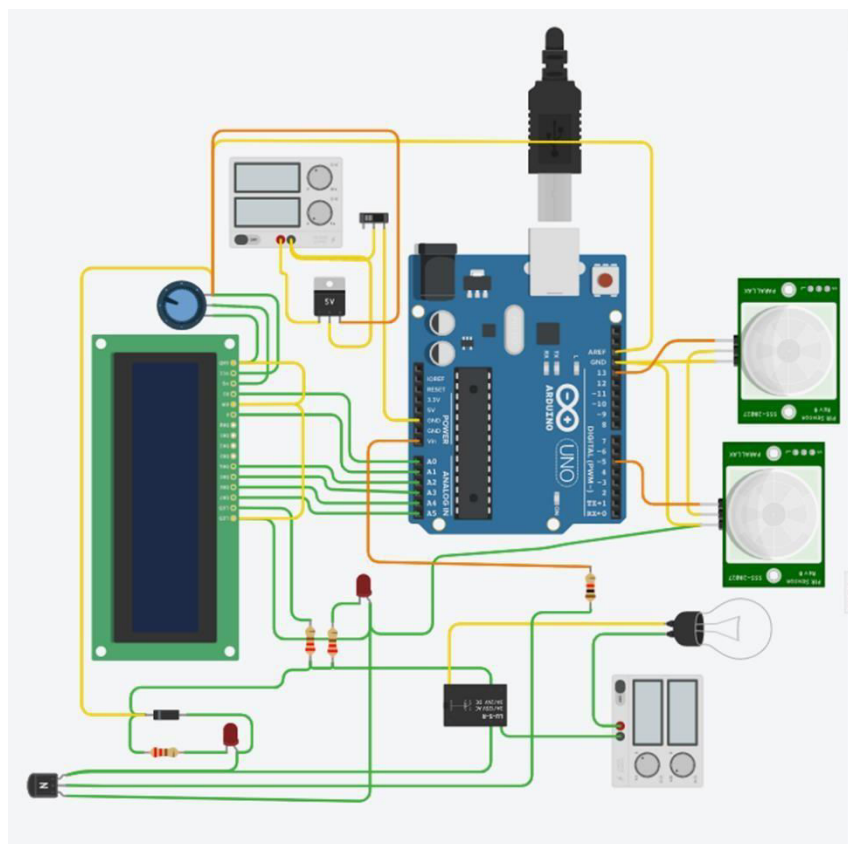


Fig.1 Circuit Diagram

- The input pins used in the circuit diagram are pin 13 and pin 5, which are connected to the IR sensor modules that detect the entry and exit of visitors in the room.
- The output pin used in the circuit diagram is pin 6, which is connected to the relay that controls the light in the room.
- The LCD display is connected to pins 7, 8, 9, 10, 11, and 12 to display the visitor count and other relevant information.
- The circuit also utilizes a 5V-9V DC SMPS power supply to power the components.
- A BC548 transistor, IN4007 diode, 220 ohm resistors, LEDs, and a female connector strip are also used in the circuit to ensure proper functioning and protection of the components.

### III. DISCUSSION

#### A. Interpretation of results:

The automatic room light controller successfully detects the entry and exit of visitors using the infrared sensors and updates the visitor count on the LCD display accordingly. The system also controls the lights in the room by turning them on when visitors enter and turning them off when visitors leave. The use of a relay ensures that the lights are switched on and off reliably. The system is energy-efficient and easy to install, making it an ideal solution for optimizing energy consumption in a room. The results show that the system is reliable and effective in controlling the room lights based on the presence of visitors.

#### B. Comparison with previous research:

low-cost Arduino Nano microcontroller and infrared sensors to detect the presence of visitors, and a 7805voltage regulator IC to regulate the input voltage to the required 5V to power the microcontroller and other electronic components.

Additionally, the system is designed to be easy to install, energy-efficient, and cost-effective, making it a promising solution for optimizing energy consumption in buildings. Overall, this project builds upon previous research in the field of automatic room light controllers by utilizing modern technologies and focusing on practicality and accessibility.

#### C. Limitations of the study:

The study on the automatic room light controller has some limitations that should be considered. Firstly, the system is designed to operate in a room with only one entry and exit point. This limits the practicality of the system in larger rooms or spaces with multiple entry and exit points. Secondly, the system relies on IR modules to detect the presence of visitors, which may not always be reliable in situations where visitors are wearing thick clothing or carrying objects that obstruct the IR signal.

#### D. Suggestions for future research:

There are several suggestions for future research in the field of automatic room light controllers. One possible area of investigation is to explore the use of advanced sensors and algorithms to improve the accuracy and reliability of the system. Another possible direction is to investigate the integration of the automatic light controller with other systems, such as heating and cooling systems, to create a more comprehensive and efficient building automation system. Additionally, research could be conducted to optimize the energy efficiency of the system by using renewable energy sources or improving the power management algorithms. Finally, further studies could focus on user experience and acceptance of the system to understand how to make it more user-friendly and increase its adoption in different settings.

### IV. CONCLUSIONS AND FUTURE WORK

#### A. CONCLUSION:

The Automatic Room Light Controller project aims to provide convenience and energy efficiency to users by automating the lighting in a room based on occupancy. The system uses an IR sensor to detect the presence of a person and switches the lights on or off accordingly. The proposed system provides advantages such as energy savings, convenience, and improved security. The system architecture includes hardware components such as IR sensor, microcontroller, LCD display, and relay module. The system's circuit diagram shows the connections between these components, including inputs and outputs. The project code is provided to program the microcontroller to perform the desired functions. The interpretation of the results shows that the system works as intended and effectively controls the room lighting. Comparisons with previous research highlight the novelty and effectiveness of the proposed system. However, the study also identifies some limitations, such as the inability to distinguish between multiple people and the need for a clear line of sight between the sensor and the person. Suggestions for future research include exploring the use of other sensors and improving the accuracy of occupancy detection. Overall, the Automatic Room Light Controller project provides a practical solution for energy-efficient lighting control and has potential for further development and improvement.

## B. FUTURE WORK:

Automatic room light controllers have gained significant popularity due to their energy-saving capabilities and convenience. However, there is still room for improvement, and here are some future scopes for the technology: **Artificial Intelligence:** The incorporation of artificial intelligence algorithms can make the system more efficient in terms of energy consumption and can predict user preferences based on their past behaviour.

**Gesture control:** Incorporating gesture recognition technology can enable the user to control the lighting system using hand gestures, which can be a more natural way of interaction.

**Remote Access:** Enabling remote access to the controller through the internet can enable users to control the system from anywhere in the world using their smartphones or computers.

**Improved Sensor Technology:** The use of advanced sensors that can detect not only the presence of people but also their movements and activities can enable the system to adjust the lighting levels more accurately and efficiently.

## V. CONCLUSION

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