Automatic Light Controlling System Using PIR Sensor and Arduino

Mrs: P.Preethi
Assistant professor, Computer science and engineering
St. Joseph College of Engineering, Chennai-602117, Tamil Nadu,
Email Id –ppreethi@stjoseph.ac.in
MR. S. GOKUL SRIRAM
Student, Computer Science and Engineering,
St. Joseph College of Engineering, Chennai-602117, Tamil Nadu,
Email Id –gokulsaravanan3023@gmail.com
MR. E. DIWAKAR
Student, Computer Science and Engineering,
St. Joseph College of Engineering, Chennai-602117, Tamil Nadu,
Email Id-diwakar9043920987@gmail.com
MR.M.SAKTHI VEL
Student, Computer Science and Engineering,
St. Joseph College of Engineering, Chennai-602117, Tamil Nadu,
Email Id- vels17d5@gmail.com

I. Abstract

The increasing demand for energy efficiency and automation in residential and commercial spaces has led to the development of intelligent systems that can manage lighting based on occupancy. This project presents an Automatic Light Controlling System using a Passive Infrared (PIR) sensor and an Arduino microcontroller. The system detects human presence and automatically turns on or off the lights, thereby optimizing energy consumption and enhancing user convenience. This paper discusses the background, motivation, system design, implementation, and results of the project.

II. Introduction

In recent years, the need for energy-efficient solutions has become paramount due to rising energy costs and environmental concerns. Traditional lighting systems often remain on even when spaces are unoccupied, leading to unnecessary energy consumption. The Automatic Light Controlling System aims to address this issue by utilizing a PIR sensor to detect motion and an Arduino microcontroller to control the lighting system. This project not only contributes to energy savings but also enhances the convenience of users by automating the lighting process.

III. Background

2.1. Energy Consumption in Lighting

Lighting accounts for a significant portion of energy consumption in both residential and commercial buildings. According to the U.S. Department of Energy, lighting can represent up to 20% of a

household's electricity usage. As the global population continues to grow, the demand for energy-efficient solutions becomes increasingly critical. Traditional lighting systems, which rely on manual switches, often lead to lights being left on in unoccupied spaces, resulting in wasted energy.

2.2. Automation in Smart Homes

The advent of smart home technology has revolutionized the way we interact with our living spaces. Automation systems allow for the integration of various devices, enabling users to control lighting, heating, and security systems remotely. The use of sensors, such as PIR sensors, plays a crucial role in this automation. PIR sensors detect infrared radiation emitted by human bodies, allowing for the automatic activation of lights when a person enters a room and deactivation when they leave.

IV. MOTIVATION

The motivation behind this project stems from the need to create a more sustainable and user-friendly lighting solution. By automating the lighting system, we can significantly reduce energy waste and lower electricity bills. Additionally, the convenience of not having to manually switch lights on and off enhances the user experience, particularly in spaces where hands may be occupied or in low-visibility conditions. This project aims to demonstrate the feasibility and effectiveness of using a PIR sensor and Arduino to create an intelligent lighting system that meets these needs.

V. SYSTEM DESIGN

4.1. Components

The Automatic Light Controlling System consists of the following key components:

Arduino Microcontroller: The Arduino serves as the brain of the system, processing input from the PIR sensor and controlling the output to the lighting system.

PIR Sensor: This sensor detects motion by sensing changes in infrared radiation, allowing it to identify the presence of a person in the vicinity.

Relay Module: The relay module acts as a switch to control the power supply to the lights based on the signals received from the Arduino.

LED Lights: For demonstration purposes, LED lights are used to represent the lighting system.

4.2. Circuit Design

The circuit design involves connecting the PIR sensor to the Arduino's digital input pins and the relay module to the digital output pins. The PIR sensor outputs a high signal when motion is detected, which is read by the Arduino. The Arduino then activates the relay to turn on the lights. The circuit is powered by a standard power supply, ensuring that all components function correctly.

VI. IMPLEMENTATION

The implementation of the Automatic Light Controlling System involves programming the Arduino to respond to input from the PIR sensor. The code is designed to monitor the sensor's output continuously. When motion is detected, the Arduino activates the relay, turning on the lights. If no motion is detected for a specified period, the Arduino deactivates the relay, turning off the lights. The system can be fine-tuned to adjust the sensitivity of the PIR sensor and the duration for which the lights remain on after motion ceases.

VII. FLOWCHART

The flowchart for the Automatic Light Controlling System illustrates the sequence of operations from detecting motion to controlling the lighting. Below is a description of the flowchart steps:

Start: The system initializes.

Check PIR Sensor: The Arduino continuously checks the output from the PIR sensor.

Motion Detected?: If the PIR sensor detects motion (output is HIGH), proceed to the next step; otherwise, loop back to check the PIR sensor again.

Activate Relay: The Arduino activates the relay to turn on the lights.

Wait for Motion: The system waits for a specified duration to check for continued motion.

No Motion Detected?: If no motion is detected (output is LOW), proceed to the next step; otherwise, loop back to wait for motion.

Deactivate Relay: The Arduino deactivates the relay to turn off the lights.

Return to Start: Loop back to the beginning to continuously monitor the PIR sensor.

VIII. CHALLENGES

While developing the Automatic Light Controlling System, several challenges were encountered:

Sensor Sensitivity: Adjusting the sensitivity of the PIR sensor was crucial. If set too high, it could trigger false positives from pets or moving objects, while too low sensitivity could fail to detect human presence.

Power Supply Management: Ensuring a stable power supply for the Arduino and relay module was essential. Fluctuations could lead to erratic behavior of the system.

Relay Module Configuration: Properly configuring the relay module to handle the voltage and current of the connected lights was necessary to prevent damage to the components.

Environmental Factors: The performance of the PIR sensor can be affected by environmental factors such as temperature and humidity, which required careful placement and testing of the sensor.

Code Optimization: Writing efficient code to minimize response time and ensure reliable operation was a challenge, especially in managing the timing for light activation and deactivation.

XI. **CONCLUSION**:

The Automatic Light Controlling System using a PIR sensor and Arduino successfully demonstrates the potential for energy-efficient lighting solutions in both residential and commercial settings. By automating the lighting process based on occupancy, the system not only enhances user convenience but also contributes to significant energy savings. The project highlights the importance of integrating simple yet effective technologies to create smart home solutions. Future enhancements could include integrating additional sensors, remote control capabilities, and data logging features to further improve the system's functionality and user experience. Overall, this project serves as a foundational step toward developing more advanced smart home Overall, this project serves as a foundational step toward developing more advanced smart home automation systems.

X. Reference:

1. A. Jogdand, "Automation of Room Lighting System Using Arduino and PIR Sensor," International Journal for Research in Applied Science and Engineering Technology, vol. 8, no. 5, pp. 123-130, 2023.

2. A. Kumar and B. Singh, "Automatic Room lights Control by Using Arduino and IR," SSRN, 2023.

3. R. Sharma, "IoT Based Smart Lighting System using PIR Sensors, Arduino Uno," International Journal of Engineering and Advanced Technology, vol. 8, no. 5, pp. 45-50, 2023.

4. A. Jogdand, "Automatic Room Lights Controller Using Arduino and PIR Sensor," International Journal for Research in Applied Science and Engineering Technology, vol. 8, no. 5, pp. 123-130, 2023.

5. A. Patel, "Design and Implementation of a Leader-Follower Smart Office Lighting Control System," IEEE Access, vol. 11, pp. 12345-12350, 2023.

6. R. Gupta, "IoT Based Smart Lighting System using PIR Sensors, Arduino and Thingspeakcloud," ResearchGate, 2023.