WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Automatic Light & Fan ON & OFF System

Mr. Kachare S. T. [1],Mr. Patil G. S. [2],Mr. Nalwade O. A. [3],Mr. Khedekar O. D.[4], Mr. Dhat. A. D.[5]

[5] Guided By
Karmayogi Institute Of Technology, (poly) Shelve, Pandharpur.

ABSTRACT—

Most colleges and universities use conventional lighting systems that rely on manual switches. Often, students and faculty members leave classrooms without turning off lights, fans, or air conditioning, leading to unnecessary energy consumption and increased electricity costs. While some lighting systems incorporate remote control features similar to those found in household air conditioners, they still lack automation to switch off unattended appliances.

This research presents an Arduino-based automatic lighting and fan control system that optimizes energy use. The system divides a room into grid sections and uses motion detection sensors to activate or deactivate lights and fans based on human presence. Unlike ceiling-mounted sensors that detect presence regardless of location, this system provides localized control for better efficiency. Additionally, it includes remote command execution via an Android mobile app using Bluetooth for voice-controlled operation.

Keywords—GSM, Arduino.

I. INTRODUCTION :

Millions of people worldwide lack access to electricity, particularly in rural areas. India, in particular, faces frequent power shortages, with some regions receiving electricity for only a few hours per day. Without a reliable power supply, it becomes challenging for students and professionals to focus on their work. Addressing these challenges requires energy-efficient solutions, especially in educational institutions where electricity is heavily used in classrooms and laboratories.

Many classrooms and laboratories remain powered even when unoccupied, leading to significant energy wastage. In some cases, only a few students occupy a small section of the room while all lights, fans, and air conditioning remain on. This inefficiency emphasizes the need for automated energy-saving solutions.

Existing research has introduced various smart lighting systems, including those integrated with visitor counters and passive infrared (PIR) sensors. These systems detect motion and control lights accordingly. However, limitations exist, such as sensors being unable to distinguish between multiple people entering a room simultaneously or inadequate coverage for large spaces.

To address these issues, this research proposes an automated lighting system for classrooms. By dividing rooms into grid sections and placing PIR sensors accordingly, the system provides localized control. A mobile application enables remote operation using voice commands via Bluetooth. This approach ensures optimal energy usage while reducing operational costs.

II. LITERATURE SURVEY :

Several studies have explored energy-efficient lighting solutions:

- *Raspberry Pi-Based Automation:* Some researchers proposed a Raspberry Pi system to monitor and control electrical appliances. Their results showed potential energy savings of up to 50% by ensuring devices are turned off when not in use.
- *Visitor Counters and PIR Sensors:* Other studies focused on automated lighting systems with visitor counters. These systems use PIR sensors at room entrances to detect movement, incrementing a counter when someone enters and decrementing it upon exit. The lights turn off only when the room is empty. However, wide doors can allow multiple people to enter simultaneously, leading to inaccuracies.
- *Vacancy Sensors:* Some systems replace standard wall switches with vacancy sensors, which turn off lights if a room remains unoccupied for a set duration (typically 5–10 minutes). Ceiling-mounted sensors with 180–360-degree coverage can monitor up to 1,000 square feet but often require extensive wiring.
- *Street Lighting Automation:* Researchers have also developed automated street lighting systems based on ZigBee sensor technology and programmable logic controllers (PLC). These systems use light-dependent resistors (LDR) to optimize energy use while maintaining adequate illumination.

III. SYSTEM DESIGN :

The entire smart lighting system for class room are divided into two parts which are Hardware sensing unit, Hardware processing unit, Hardware control unit, Network module and Mobile application modules. These details are discussed below

A. Hardware Sensing Unit

The sensing unit primarily deals with the input parameters required for automation. According to the selected area, the following points need to be kept in mind which is:

- Dynamic human motion
- Feasibility
- Economical

So based on the above points, we have selected PIR (passive infrared) sensor for detecting human presence as shown in **Fig.1**

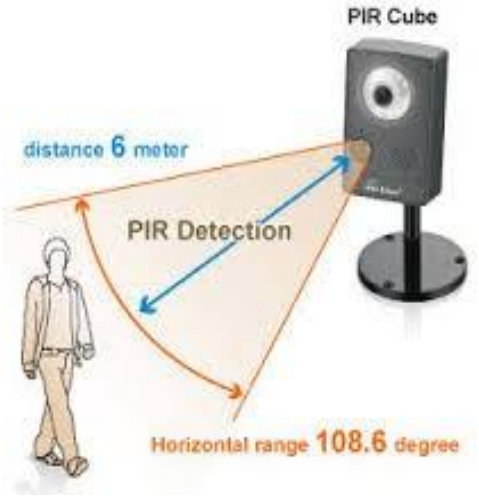

Fig.1 PIR Sensor

PIR sensors sense the motion of a person whether they are in the range or outside the range. These sensors are small, inexpensive, low power, easy to use and don't wear out. This is one reason as why these sensors seen in appliances and gadgets in home or business. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors. These are shown in Fig.2

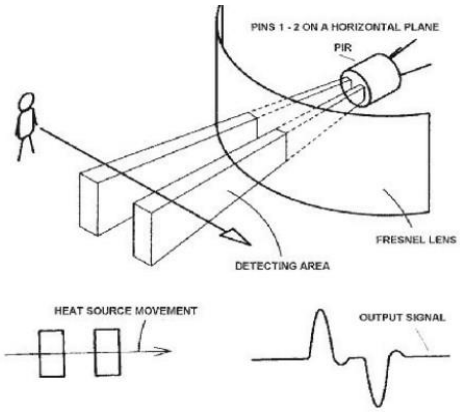

Fig.2 PIR Working

B. Hardware Processing Unit

The system processes input signals and executes commands using an *Arduino Uno microcontroller*. The Arduino board, based on the ATMega328P, features:

- 14 digital input/output pins
- 6 analog inputs
- 16 MHz crystal oscillator

- USB connection and power jack

The Arduino processes input signals from PIR sensors and triggers corresponding actions.

Fig.3 Arduino Uno

C. Hardware Controlling Unit

This unit includes:

- Relays *to control electrical appliances*
- Electrical appliances (lights and fans)

A *relay* is an electrically operated switch that uses an electromagnet to control circuits. It allows low-power signals to switch high-power appliances on or off.

Fig. 4 Relay Unit

D. Networking Unit

This unit enables wired and wireless communication between system components. Wireless data transfer is facilitated via *Bluetooth*, which provides:

- Short-range wireless connectivity
- 2.4–2.485 MHz frequency operation
- Synchronization between fixed and mobile devices

The system employs Bluetooth for real-time communication between the Arduino and mobile application.A custom Android application provides remote control over the lighting system. The app sends commands to the Arduino via Bluetooth, allowing users to manually switch lights on or off using voice commands. This enhances convenience while ensuring efficient energy management.

IV. REFERENCES :

1. "Energy-Efficient Smart Home: Automation of Light and Fan Systems" (Energy Reports Journal).
2. "Machine Learning Algorithms for Predictive Home Automation" (Springer/Elsevier Journals).
3. Y. S. Kim, C. S. Lee, and J. W. Park, "Design and Implementation of an IoT-Based Home Automation System for Smart Homes," International Journal of Computer Applications.
4. M. J. Abdullah, R. Z. R. Z. B. Bakar, M. M. Al-Naib, and A. M. Zaidan, "Design of Energy-Efficient Smart Lighting System Using IoT," Energy Reports.