Motion-Activated Lighting Control System

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Introduction

- This project involves creating a smart lighting control system that responds to motion using PIR (Passive Infrared) sensors and the ESP32 microcontroller.
- The system controls three lights:
  - Two connected via relays.
  - One directly controlled through a GPIO pin.
- A web server hosted on the ESP32 enables remote control, allowing users to toggle between automatic and manual modes.

Objectives

- To create a motion-sensitive lighting system with three PIR sensors, each controlling a corresponding light.
- To implement a system where:
  - Two lights are controlled via relays.
  - One light is controlled through an ESP32 GPIO pin.
- To provide a web interface for remote control of lighting modes (Auto, On, Off) using a smartphone or computer.

Components

1. **ESP32 Microcontroller**: Central processing unit for IR sensor data, relay control, and web server hosting.
2. **PIR Sensors (3)**: Detect motion in three zones, triggering respective lights.
3. **Relays (2)**: Switch two of the three lights on and off.
4. **LED/Light Bulbs (3)**: Illuminate based on motion detection.
5. **Wi-Fi Network**: Connects the ESP32 for remote access to the web server.

System Design and Implementation

Circuit Design

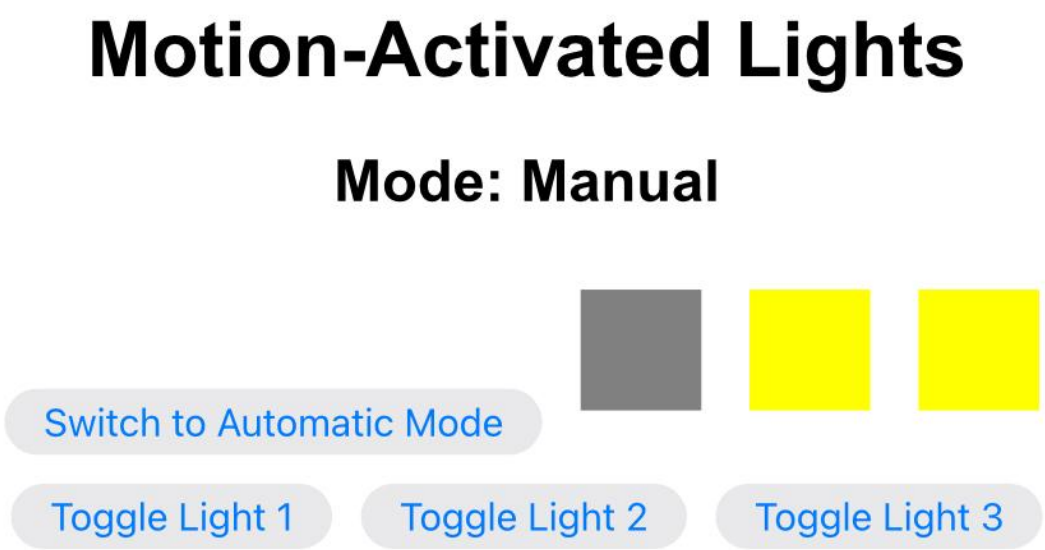
- **IR Sensors**: Output pins connected to GPIO pins on ESP32.
- **Relays**: Controlled by ESP32 GPIO pins with external power.
- **Direct GPIO Control**: One light is managed directly without a relay.

Software Design

- Wi-Fi setup for web server hosting.
- Web interface for mode control (Auto, On, Off).
- Motion detection triggers lights based on sensor input.

Results

- **Motion-Activated Lighting**: Each light turns on briefly when motion is detected in its zone.
- **Remote Control**: Web interface enables flexible and user-friendly light mode management.
- **Reliability**: Stable Wi-Fi connectivity supports uninterrupted remote access.



Conclusion

- This project successfully demonstrates a smart, motion-sensitive lighting system.
- The system leverages IR sensors, relays, and a web interface for efficient and versatile lighting control.
- Suitable for home or industrial applications, with potential improvements like:
  - Real-time updates using WebSocket.
  - Energy optimization for better efficiency.

Thank you!