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Energy Efficient Lighting System

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ABSTRACT: This project presents a smart and energy-efficient home automation system focused on controlling lighting and fans using IoT-based solutions. With the increasing need for power conservation and convenience in modern homes, our system offers users the ability to manage their home appliances remotely via the Sinric Pro mobile app. The setup includes automatic and manual control features for lights and fans, ensuring efficient energy usage and enhanced user comfort. This solution is low-cost, easy to install, and scalable, making it suitable for smart homes and energy-conscious environments.

KEYWORDS: Arduino Uno, MPU6050, Automatic Turn Indicator, Relay Module, Led Signaling, Road Safety

I. INTRODUCTION

Home automation systems are transforming the way we interact with our living spaces, offering convenience, efficiency, and control like never before. This project focuses on a light-efficient home automation system that enables remote and automatic control of lights and fans. With the help of the **Sinric Pro platform**, users can monitor and operate connected appliances through their smartphones from anywhere in the world.

The main goal is to reduce unnecessary power consumption and promote smart energy usage. Whether it is turning off unused lights or controlling the fan speed based on conditions, the system is designed to be both user-friendly and efficient. It also serves as a foundation for expanding into more advanced smart home solutions in the future.

II. LITERATURE REVIEW

In recent years, IoT-based home automation has gained popularity due to its energy-saving potential and convenience. Multiple studies and prototypes have explored automation using Wi-Fi, Bluetooth, and cloud-based control platforms. Projects using Arduino, Raspberry Pi, and NodeMCU have demonstrated the feasibility of remote control of home appliances. However, many systems lack real-time control, voice integration, and user-friendly mobile apps. Our project builds upon these concepts and integrates **Sinric Pro**, which provides seamless app and voice control (via Alexa/Google Assistant), cloud sync, and secure communication—offering a more robust and accessible solution.

III. METHODOLOGY

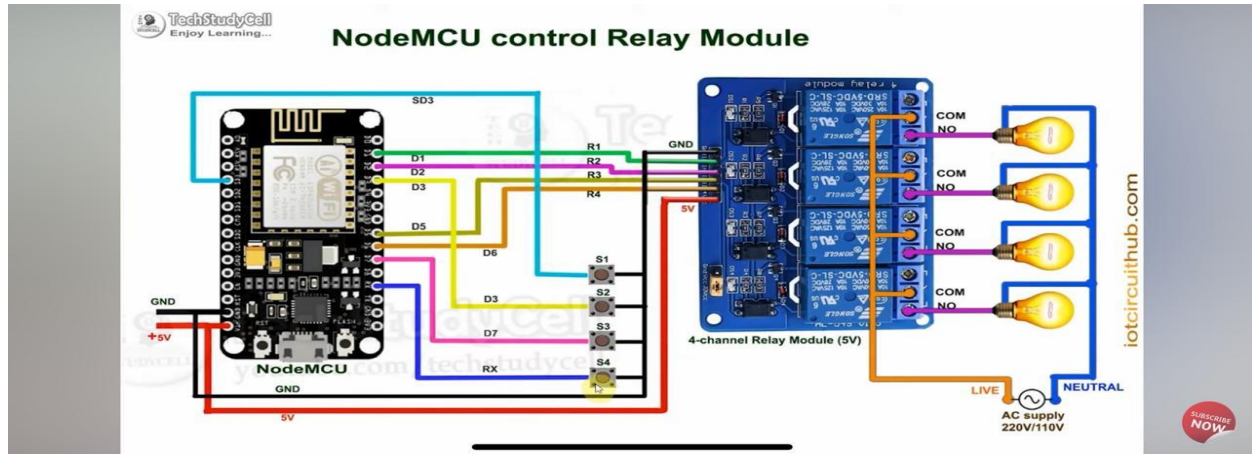
The system is designed to control lights and fans through Wi-Fi using the **NodeMCU (ESP8266)** microcontroller. The mobile app (Sinric Pro) sends control signals via the internet, which are interpreted by the NodeMCU to turn appliances ON or OFF. The fan and lights are connected to relays which act as switches. A combination of manual control (via app) and automation (like time-based or motion-based triggers) can be applied.

Steps:

1. Initialize the Sinric Pro platform and connect the NodeMCU.
2. Configure the devices on Sinric Pro dashboard.
3. Link Sinric Pro to Amazon Alexa or Google Assistant (optional).
4. Code and flash the NodeMCU with Wi-Fi credentials and device IDs.
5. Connect relay modules to fan/light circuits.
6. Monitor and control via app or voice.

7. Circuit Design:

The NodeMCU is connected to a relay module that acts as an intermediary between low-voltage signals and high-voltage appliances. The relays are triggered based on digital output pins from the NodeMCU. Lights and fans are wired through these relays, allowing control via the app.

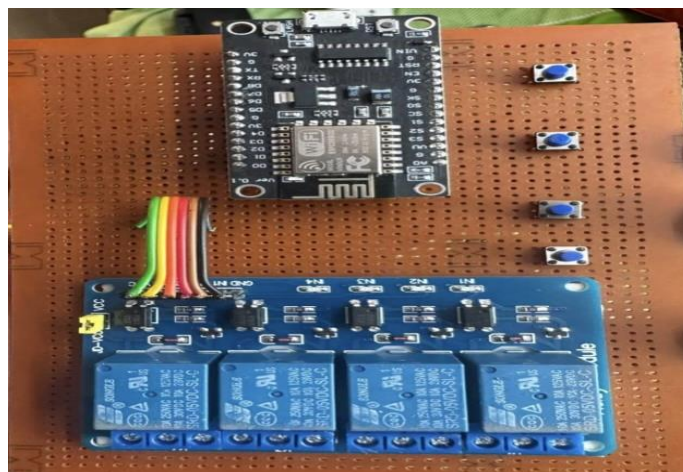


8. Working:

When a user presses a button on the Sinric Pro app (or uses a voice command), the request is sent to Sinric Pro's cloud server. The server communicates with the NodeMCU via Wi-Fi. Depending on the received command, the NodeMCU switches ON/OFF the appropriate relay, controlling the appliances accordingly.

3.3 Algorithm Implementation

- Start
- Connect NodeMCU to Wi-Fi
- Initialize Sinric Pro API
- Register device handlers (light, fan)
- Wait for cloud commands
- On receiving command:
 - If "turn ON light" → activate relay 1
 - If "turn OFF light" → deactivate relay 1
 - If "turn ON fan" → activate relay 2
 - If "turn OFF fan" → deactivate relay 2
- Repeat steps 5–6 indefinitely



IV. RESULT& DISCUSSION

The system successfully demonstrated real-time control of both lights and fans via the Sinric Pro mobile application. The response time between command and execution was minimal, and the setup remained stable during testing. It was observed that:

- Energy usage was optimized by reducing idle appliance usage.
- Remote access added convenience and safety.
- Voice control integration worked smoothly with Alexa.

Limitations include the dependence on internet availability and initial configuration complexity for non-technical users.

V. CONCLUSION

This project achieved the goal of creating a light-efficient home automation system with app-based and potential voice control. Using Sinric Pro, users can control home appliances remotely, promoting energy conservation and ease of use. The system is scalable, cost-effective, and a good starting point for larger smart home implementations.

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