

IOT Based Automation of Lighting System Using ESP-32E

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Abstract: - An IoT-based lighting automation system is a smart technology that allows users to control lighting devices through the internet. It uses a microcontroller such as ESP32, relay modules, and Wi-Fi connectivity to operate lights remotely using a smartphone application or web interface. The relay acts as an electrically controlled switch that turns lights ON or OFF based on user commands. When the user sends a command, the microcontroller receives it through the internet and controls the connected lighting load. This system helps reduce energy consumption, improves convenience, and increases efficiency in homes, laboratories, classrooms, and offices by enabling intelligent and remote lighting control.

Key Words: Internet of things (IoT), ESP32, Lighting Automation, Energy Efficient, etc.

1. INTRODUCTION

The rapid advancement of the **Internet of Things (IoT)** has changed the way electrical systems are monitored and controlled. IoT technology allows devices to communicate through the internet, enabling automation and remote operation. In many buildings, traditional lighting systems depend on manual switches, which often leads to unnecessary power consumption when lights or fans remain ON even when not required. This commonly happens in classrooms, laboratories, and offices, resulting in energy wastage.

To overcome this problem, lighting automation using IoT provides a smart and efficient solution. In this system, the **ESP32 microcontroller** is used as the main control unit, and the **Blynk application** acts as the user interface. The ESP32 connects to the internet through Wi-Fi and receives commands from the mobile application. These commands are processed to control a relay module that switches the connected lights or fans ON or OFF.

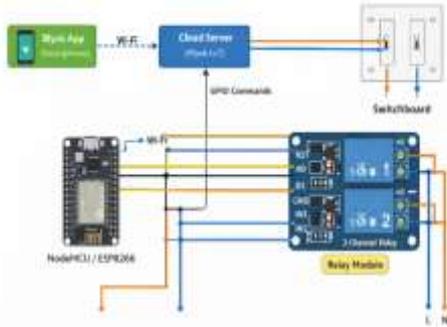
2. Body of Paper

An IoT-based lighting automation system enables remote control and monitoring of lighting devices through internet connectivity. Using an ESP32 microcontroller, relay module, Wi-Fi, and the Blynk mobile application, users can operate lights or fans from anywhere. This system reduces energy wastage, minimizes manual effort, and improves efficiency in homes, laboratories, classrooms, and offices.

2.1 System Architecture

The proposed IoT lighting automation system consists of several hardware and software components. The main components include the **ESP-32E microcontroller**, relay modules, electrical loads such as lights and fans, a Wi-Fi network, and a mobile interface. The ESP-32E microcontroller acts as the central controller of the system. It connects to the local Wi-Fi network and receives commands from the user through the mobile application. The relay module is connected to the microcontroller and works as an electrically operated switch that controls the connected devices.

When the user sends a command from the mobile interface, the signal is transmitted through the internet to the microcontroller. The **ESP-32E** processes the command and activates the corresponding relay, which then switches the connected electrical load such as lights or fans ON or OFF, enabling remote and efficient control of electrical devices.



2.2 Hardware Components

The main hardware components used in the system include:

ESP-32E Microcontroller

The ESP-32E is a Wi-Fi enabled microcontroller used for IoT applications. It provides wireless communication capability and can be programmed using the Arduino development environment.

Relay Module

The relay module acts as an electrical switch that allows the microcontroller to control high voltage loads such as lights and fans.

Lighting Loads

Electrical loads such as tube lights and ceiling fans were connected to the relay outputs for automation.

Wi-Fi Network

The Wi-Fi network allows communication between the mobile device and the microcontroller.

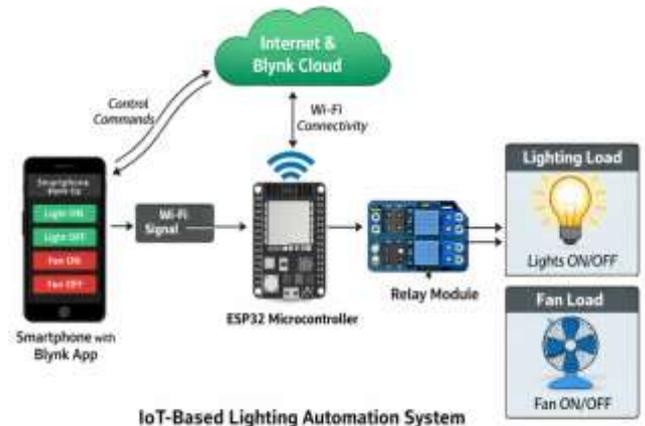
2.3 System Implementation

The automation system was implemented in two laboratories. In the first laboratory, one fan and two lights were connected to the automation system. In the second laboratory, two fans and two tube lights were connected to the controller.

The ESP-32E microcontroller was programmed using the Arduino IDE. The program was written to connect the controller to the Wi-Fi network and receive commands

from the mobile interface. Based on the received command, the microcontroller activates the relay outputs to switch the devices on or off.

The hardware setup was installed in the laboratory and tested under different conditions to ensure proper operation of the system.



3. CONCLUSIONS

The IoT-based lighting automation system provides a smart and efficient method for controlling lighting devices through internet connectivity. By using the ESP-32E microcontroller, relay modules, and a mobile application interface, users can monitor and control electrical loads such as lights and fans remotely. This system helps reduce unnecessary energy consumption and minimizes manual effort in operating electrical devices. It also improves convenience, safety, and efficiency in places such as homes, laboratories, classrooms, and offices. The system is simple, cost-effective, and easy to implement. In the future, additional features such as sensors, automatic scheduling, and energy monitoring can be integrated to enhance the functionality. Therefore, IoT-based lighting automation is an effective solution for modern smart buildings and energy management.

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