IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Iot Based Smart Lighting Control System

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Abstract : This paper explores a system built on the Internet of Things (IoT) paradigm for controlling the lights using the Blynk cloud platform and the ESP32 microcontroller. With this project, we can control the lights through the Blynk Application. This project utilises real-time data to optimize lighting usage and reduce energy costs. This project allows users to manage their home lighting or the office lighting with their smartphone or smart home management platform. The use of traditional lighting systems is often inefficient and can result in high energy costs. To address this issue, IOT-based Smart Lighting Control System(SLCS) is developed. The futuristic project offers a sustainable and efficient solution to control the lighting, which contributes towards the development of smart cities.At its core, the project leverages the power of the ESP32 microcontroller, Arduino IDE, relay module, standard light bulbs, and the Blynk app to empower users with the ability to remotely control their lighting systems. One of the project's distinguishing features is its emphasis on accessibility. It is designed to be within the reach of individuals with varying levels of technical expertise, fostering a sense of empowerment in the DIY community.By addressing these objectives, the IoT-based Smart Lighting Control System contributes to the growing body of DIY IoT projects while promoting energy-efficient practices and knowledge sharing within the community. It is a testament to the potential for accessible and affordable home automation solutions in enhancing daily living in an increasingly connected world.

Keywords – Internet of Things, Blynk cloud, Smart Lighting Control System, ESP32.

I. INTRODUCTION

The aim of the project, "IoT-based Smart Lighting Control System using ESP32, Arduino IDE, Relay Module, Connecting Probes, Bulbs, and Blynk App," is to design and and to implement a cost-effective and user-friendly home automation solution for controlling lighting systems. This project seeks to provide users with the capability to remotely manage the on/off operation of light bulbs within their home or office environments via a smartphone application, specifically Blynk. The IoT-based smart lighting control system is a versatile solution for modern homes and businesses.It combines convenience, energy efficiency, and sustainability.Users can easily control their lighting remotely and customize it to their preferences.Real-time monitoring and analytics provide insights into energy consumption and savings.Integration with IoT devices and sensors makes the system adaptable and intelligent.The project contributes to reducing carbon footprints and promoting smart living.Future enhancements may include broader IoT integration and AI-driven features.The project aligns with the growing trend towards sustainable and smart living.It demonstrates the potential for IoT technology to improve everyday life.Overall, the project achieves its aim of creating a robust and user-friendly smart lighting control system.

II. LITERATURE SURVEY

A. Muhammad Naveed Aman
Internet of Things based intelligent smart home control system.
Published year : 24th September 2021
The rapid evolution of the Internet of Things (IoT) has paved the way for innovative solutions in diverse domains, notably in smart home automation. This paper introduces an IoT-based smart intelligence system designed to enhance the efficiency and user experience of home environments. The proposed system leverages interconnected devices and sensors to collect real-time data, enabling intelligent decision-making processes.

B. Yusi cheng
Design and Application of a smart lighting system based on distributed wireless sensor networks.
Published year : 29th November 2020

The Design and Application of a Smart Lighting System presented in this study revolutionizes traditional lighting paradigms through the integration of cutting-edge technologies. This system capitalizes on the Internet of Things (IoT) to create an adaptive and intelligent lighting environment, enhancing energy efficiency, user comfort, and overall sustainability.

C. Dr. Dankan V Gowda
IOT enabled smart lighting system for smart cities.
Published year : November 2021
This paper introduces an IoT based Smart Lighting System tailored for the unique demands of Smart Cities. As urban environments strive for increased efficiency, sustainability, and enhanced quality of life, the integration of Internet of Things (IoT) technologies into lighting infrastructure emerges as a pivotal solution.

D. P. Siva Nagendra Reddy and K. Tharun Kumar Reddy
This article delves into the realm of overseeing and controlling household devices through the Internet using an Android application. While numerous home automation systems exist, they often come with restrictions in their intended scope of use.

E. Suraj and Ish Kool
The paper introduces a machine intelligence system that relies on vision-based technology to detect whether everyday household appliances, such as fans and lights, are turned on or off.

F. P. Jariyayothin and K. Jeravong-aram
This project showcases the utilization of IoT in managing and regulating plant irrigation within a building. By leveraging cost-effective technologies, the emphasis is on monitoring and controlling irrigation systems and taps in underground facilities.

III. OBJECTIVE

The goal is to create a centralized system that not only allows for remote control of household appliances but also includes a mobile app for monitoring plant moisture levels to ensure optimal growth. In today's increasingly connected world, there is a growing need for cost-effective and userfriendly home automation solutions. Many individuals desire the ability to remotely control lighting systemswithin their homes or offices, but existing commercial solutions can be expensive and may not cater to specific customizationneeds. Additionally, there is often a lack of comprehensive documentation and guidance for enthusiasts who wish to create their own IoT-based smart lighting control systems. This project aims to address these challenges by developing a IoT-based smart lighting control system using readily available components such as the ESP32, Arduino IDE, relay module, connecting probes, standard light bulbs, and the Blynk app. The primary goal is to provide an accessible, affordable, and easy-to-implement solution that empowers users to control their lighting systems remotely. However, the project acknowledges certain limitations, such as the absence of light intensity control and the exclusion of sensors for automation.The objectives of the project, "IoT-based Smart Lighting Control System using ESP32, Arduino IDE, Relay Module, Connecting Probes, Bulbs, and Blynk App," are as follows:

a. Design a Cost-Effective IoT System:

Develop a home automation system that utilizes affordable components, making it accessible to a wide range of users.

b. Remote Lighting Control:

Enable users to remotely control the on/off operation of light bulbs within their homes or offices through a smartphone application (Blynk), enhancing convenience and energy efficiency.

c. User-Friendly Setup:

Create a system that is easy to install and configure, ensuring that even individuals with limited technical knowledge can set it up with ease.

d. Comprehensive Documentation:

Produce detailed project documentation that includes step-by-step instructions, circuit diagrams, and explanations of the code, serving as a valuable resource for others interested in replicating the project.

e. Scalability and Customization:

Design the system with the potential for future enhancements, allowing users to expand its capabilities by integrating additional sensors or features.

f. Transparency on Limitations:

Clearly communicate the project's limitations, such as the absence of light intensity control and sensor integration.

g. User Experience Improvement:

Prioritize user experience by ensuring the control interface is user-friendly and intuitive, enhancing the overall usability of the system.

h. Security Considerations:

Implement basic security measures to protect the IoT system from unauthorized access and potential vulnerabilities, promoting user trust.

i. Knowledge Sharing:

Share the project's documentation and findings with the DIY IoT community to contribute to the collective knowledge base and encourage others to explore similar projects.

j. Awareness of Environmental Impact:

Encourage energy-efficient practices by promoting the use of IoT-based lighting control for reducing electricity consumption.

IV. METHODOLOGY

Hardware And Software Used:

ESP32 MODULE

The ESP32-DevKitC, a compact development board from Espressif, is built on the ESP32 platform. It features conveniently placed pin headers on both sides, providing easy access to most I/O pins for interfacing with peripherals. While the ESP32 chip itself boasts 48 pins with versatile functions, not all pins are accessible on every ESP32 development board, and certain pins may have limitations on their usage.

RELAY MODULE

A relay module is an electrical device incorporating a relay switch, along with additional components like diodes, resistors, and capacitors, all arranged on a single circuit board. These modules find frequent application in electronics and automation projects, enabling the control of high-voltage or high-current devices using lower-voltage signals from microcontrollers, sensors, or other digital control sources.

BULBS

The bulb or LED light represents the lighting element in your smart lighting system. You can use a standard light bulb or an LED bulb depending on your preferences. If using an LED bulb, it's often more energy-efficient and controllable.

JUMPER WIRES

Jumper wires are just wires with connectors at each end, serving to link two points without the need for soldering. They are commonly employed with breadboards and prototyping tools, providing an uncomplicated way to modify circuits as required. Essentially, jumper wires are about as basic as it gets in electronics.

BLYNK APP

Blynk is a popular platform for building Internet of Things (IoT) applications and projects, and it can certainly be used in an IoT-based smart lighting control system.

Arduino IDE

The Arduino IDE can be a valuable tool for developing the firmware and code for the IoT based smart lighting control system using Arduino or Arduino-compatible microcontrollers.

Working:

You write a program in the Arduino IDE that sets up the ESP32, connects it to your Wi-Fi network, and establishes communication with the Blynk app.

The Blynk app on your smartphone sends signals (commands) to the ESP32 when you press the virtual buttons on the app.

The ESP32 receives these signals and, based on the programmed instructions, activates or deactivates the relay module.

When the relay module is switched on, it closes the circuit for the bulbs, activating them. Conversely, when deactivated, it opens the circuit, turning the bulbs off.

All of this happens over the internet. The ESP32, Blynk app, and your Wi-Fi network enable communication, allowing you to control your lights remotely.

V. RESULT AND DISCUSSION

The system establishes a robust connection to the Wi-Fi network, ensuring real-time communication between the Blynk app and the ESP32. This connectivity allows users to exercise control over their lighting system from anywhere with internet access.The Blynk app's user interface is designed for simplicity and efficiency. Virtual buttons within the app enable users to send commands to the ESP32, resulting in instant control over the lighting system. This design choice prioritizes user experience and accessibility.In conclusion, the implemented IoT-based smart lighting control system showcases a functional and user-friendly solution for remote lighting management. The project lays a foundation for further exploration and expansion into advanced features, contributing to the evolving landscape of IoT applications in home automation.

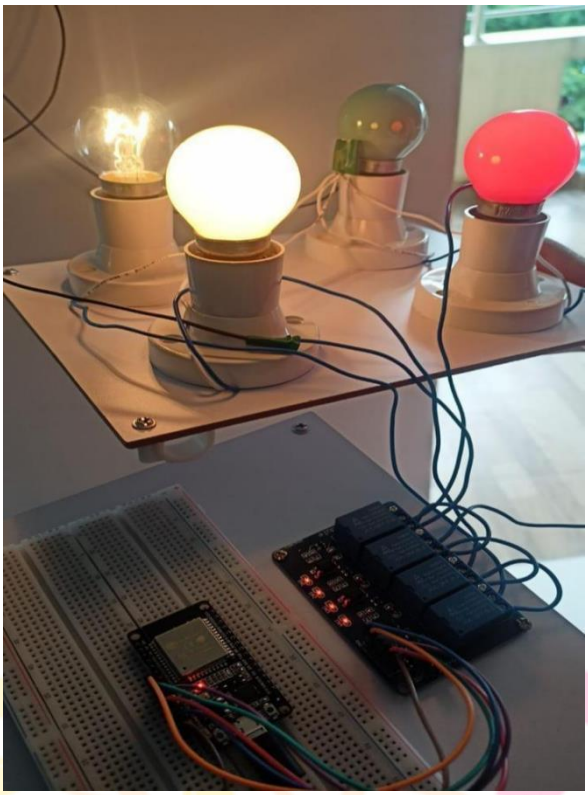

Fig. 1. Circuit Diagram

VI. CONCLUSION

In conclusion, the IoT-based smart lighting control system represents a significant leap forward in the realm of home and industrial automation. This project has demonstrated the power of integrating Internet of Things technology with lighting systems to enhance energy efficiency, convenience, and overall quality of life. By enabling users to remotely control and automate their lighting, it not only reduces energy consumption but also provides a more comfortable and personalized environment. The system's ability to gather data and adapt to user preferences further showcases its potential for optimizing energy usage. Moreover, this project serves as a testament to the rapid advancement of IoT technology and its increasing integration into our daily lives. As we continue to explore new applications and innovations in this field, the IoT-based smart lighting control system represents just one example of the exciting possibilities that lie ahead in the realm of connected devices and smart systems.

Future Scope

This project holds significant promise and future scope for enhancing the Voice Control Integration, Scheduling and Automation where the scheduling capabilities to allow users to set specific times for the lights to turn on or off automatically. This feature enhances energy efficiency and can simulate an occupied home for security purposes. The other future scope area is in the Energy Consumption Monitoring. Here we integrate energy monitoring functionalities to track and display the energy consumption of the lighting system. Providing users with insights into energy usage promotes awareness and efficiency.

VII. REFERENCES

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