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IOT Based Light Automation System

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Abstract : *Electronic &Telecommunication (E&TC) Department of JSPM's Bhivrabai Sawant Institute of Technology & Research (BSIOTR) Wagholi, Pune. Light System involves controlling departmental lighting using the Internet of Things (IoT), allowing for a user-friendly automation system within the department. Instead of switching light manually ON or OFF, this system uses technology for doing it automatically. It enables automatic control of electronic appliances such as fans and lights. In this paper, we have implemented the operation of lights through the Blynk Application to control departmental light automation, allowing users to turn lights ON and OFF as needed. The system primarily utilizes the Raspberry Pi module, a crucial component of our smart light system implementation. It comprises both hardware and software components. The hardware includes Raspberry Pi 3b+ and a Relay Module, while the software utilizes the Python Language to issue commands for turning the lights ON and OFF. Raspberry Pi 3b+ module keeps all electrical Department appliances connected through a single interface for complete smart home system automation. With this setup, there is no need to use the conventional switches, and hence human effort required for the system is comparatively very less.*

Keywords: *Department Light System , Internet of Things (IoT) , User-friendly automation, Raspberry Pi module, Relay Module, Blynk Application.*

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1. INTRODUCTION

Light Automation means to monitor, control and automate all the appliances which are operated using the traditional switch. Automation has become one of the key features in the modern era. The advancement in lighting technology has improved a grate important inside a building sector. There are various numbers of control strategies and methods applied in controlling light systems.

Automation has now replaced many manual controls to control to save energy. Automatic light control system is a reliable system that not only controls the light but also saves energy. [1,2] So current scenario insist towards highly efficient and effective usage of any form of power in educational institutions like College and universities where we use power for our teaching in class room or labs.
It is common practice that most of us leave the class rooms or labs, with Fan and lighting on even if no students or Faculty members are present.[1] All these amounts to unnecessary wastage of power contributing to country energy resource Lot of research been conducted on smart lighting system, where automated lighting system with visitor counters been implemented.

With the integration of Internet of Things (IoT) technology, we're bringing automation to the front, enabling us to effortlessly manage our lighting system in E&TC Department. Raspberry Pi module and utilizing the Blynk Application, our E&TC Department Light

Automation System puts control right at your fingertips. To turn lights on and off with just a tap on your smartphone that's the level of convenience our system offers.

2. LITERATURE SURVEY

Hui, S. C. M. and Cheng, K. K. Y., 2008. Analysis of effective lighting systems for university classrooms, In Proceedings of the Henan-Hong Kong Joint Symposium 2008, 30 Jun-1 July 2008, Zhengzhou, China, pp. 53-64
Lighting system is very important for university classrooms because it affects the learning environment and energy management of the universities. With growing concerns on energy efficiency and increasing demands to enhance the physical environment of classrooms, there is an urgent need to improve the lighting systems. It is found out from our study that effective lighting systems in the local universities in Hong Kong might not be easily achieved as there are certain limitations and constraints such as the lack of teaching spaces.

N. H. Motlagh, S. H. Khajavi, A. Jaribion and J. Holmstrom, "An IoTbased Automatio system for older homes: a use case for lighting system," *2018 IEEE 11th Conference on Service-Oriented Computing and Applications (SOCA)*, Paris, 2018, pp. 1-6.
This research investigates the smart home automation using an intelligent electricity dispatch model. This study focuses intelligent automation in three different ways and making the automated household act smartly at the time of voltage distortion.

Zeebaree, S. R., and Yasin, H. M., "Arduino based remote controlling for home: power saving, security and protection", *International Journal of Scientific & Engineering Research,* 2014 vol. 5, no. 8, pp. 266-272.
This study presented the design, fabrication, and implementation of a portable, user-friendly, and low-cost automation system for SHs based on IoT. The developed IoT@HoMe system can be easily implemented in a real house to allow real-time monitoring of home conditions and control of home appliances.

B. B. Umar and C. F. Kunda-Wamuwi, ``Socio-economic effects of load shedding on poor urban households and small business enterprises in Lusaka, Zambia," *Energy Environ. Res.*, vol. 9, pp. 9_20, Sep. 2019.
In web-based automation all the commands are conducted through Arduino Shield. When microcontroller receives its web pages request, it performs automation just like local automation does. The request is made as similar to the web pages in app-based automation, Arduino shield receive and process request then perform action like done in local automation.

Tsiropoulos, W. Nijs, D. Tarvydas, and P. R. Castello, ``Towards net-zero emissions in the EU energy system by 2050," Publications Of_ce Eur. Union, Luxembourg, Tech. Rep. EUR 29981 EN, 2020
The proposed methodology is bene_cial for electricity saving as it overcomes electricity consumption, which is the main target to achieve as unwanted appliances will be automatically switched off according to given conditions. In addition, proposed technique provides convenient solutions to the user to switch devices from remotely. Users according to their requirements just one click to switch turn it on/off and not need to worry about the appliances at home or of_ce.

W. Li, T. Logenthiran, V.-T. Phan, and W. L. Woo, "A Novel Smart Energy Theft Syste System (SETS) for IoT based Smart Home," *IEEE Internet of Things Journal,* 2019.
The obtained data from the sensors (temperature, humidity, motion, gas, and RFID) can be monitored via MQTT Dash mobile application and Adafruit IO Web via laptops/PC. For security and safety purposes, the user receives notifications on their mobile phones about any abnormal condition at home via the IFTTT server. Control of home appliances can be easily and efficiently conducted by using MQTT/Adafruit IO GUI or through voice commands using Google Assistant.

3. METHODOLOGY

3.1 Block Diagram:

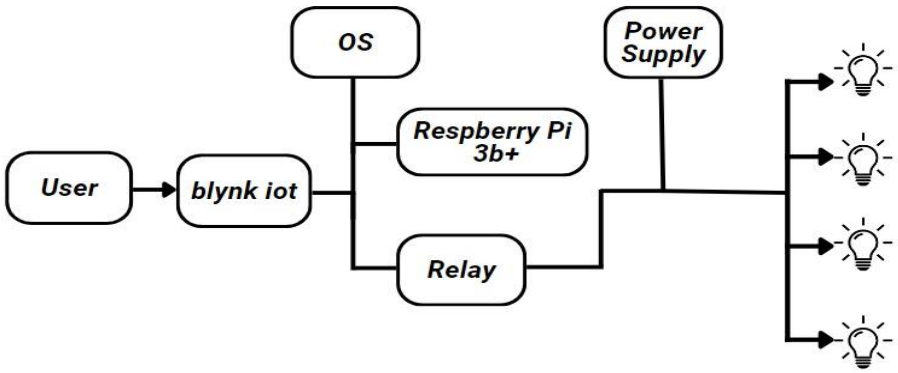

Fig. 1 Light Automation System block diagram

- **Blynk App:** This is a mobile application installed on a user's smartphone. It communicates with the Blynk Cloud platform over Wi-Fi or cellular data. Blynk is a comprehensive software suite that enables the prototyping, deployment, and remote management of connected electronic devices at any scale. Blynk Library is a user-friendly and portable C++ library, that comes pre- configured to work with hundreds of development boards. It implements a streaming connection protocol, allowing for low-latency and bi-directional communication. Whether it's personal IoT projects or commercial connected products in themillions, Blynk empowers users to connect their hardware to the cloud and create iOS, Android, and web applications, analyse real-time and historical data from devices, remotely control them from anywhere, receive important notifications,and much more.
- **Raspberry Pi 3B+:** The Raspberry Pi serves as the main control unit in this setup. It runs an operating system (such as Raspbian) and is connected to the internet via Wi-Fi or Ethernet. The Raspberry Pi is a credit card-sized computer with an ARM processor that can run Linux. This item is the Raspberry Pi 3 Model B, which has 1 GB of RAM, Wi-Fi, Bluetooth 4.1, Bluetooth Low Energy (BLE), an Ethernet port, HDMI output, audio output, RCA composite video output (through the 3.5 mm jack), four USB ports, and 0.1″-spaced pins that provide access to general purpose inputs and outputs (GPIO).
- **Relay Module**: The relay module is connected to the Raspberry Pi's GPIO pins. It receives control signals from the Raspberry Pi to toggle the state of the relay. Relay is an electrically operated switch which uses an electromagnet towards mechanically operating a switch. There are other operating principles such as solid-state relays too. Relay are used in appliances where it is deemednecessary to control a circuit by low power signal or when several circuits need to be controlled by a signal. We want Arduino to control AC powered devices like lamps, fans or other household devices. But because the Arduino operates at5 volts, it cannot directly control these higher voltage devices.
- **Lights:** These are the devices controlled by the relay. They could be any electrical devices, such as LED strips, bulbs, or other appliances.
- **Power Supply:** The power supply provides the necessary electrical power to both the Raspberry Pi and the relay module. Typically, a 5V DC power supply is used for Raspberry Pi and relay module.

3.2 Block Diagram Explanation:

3.2.1 User Interface:

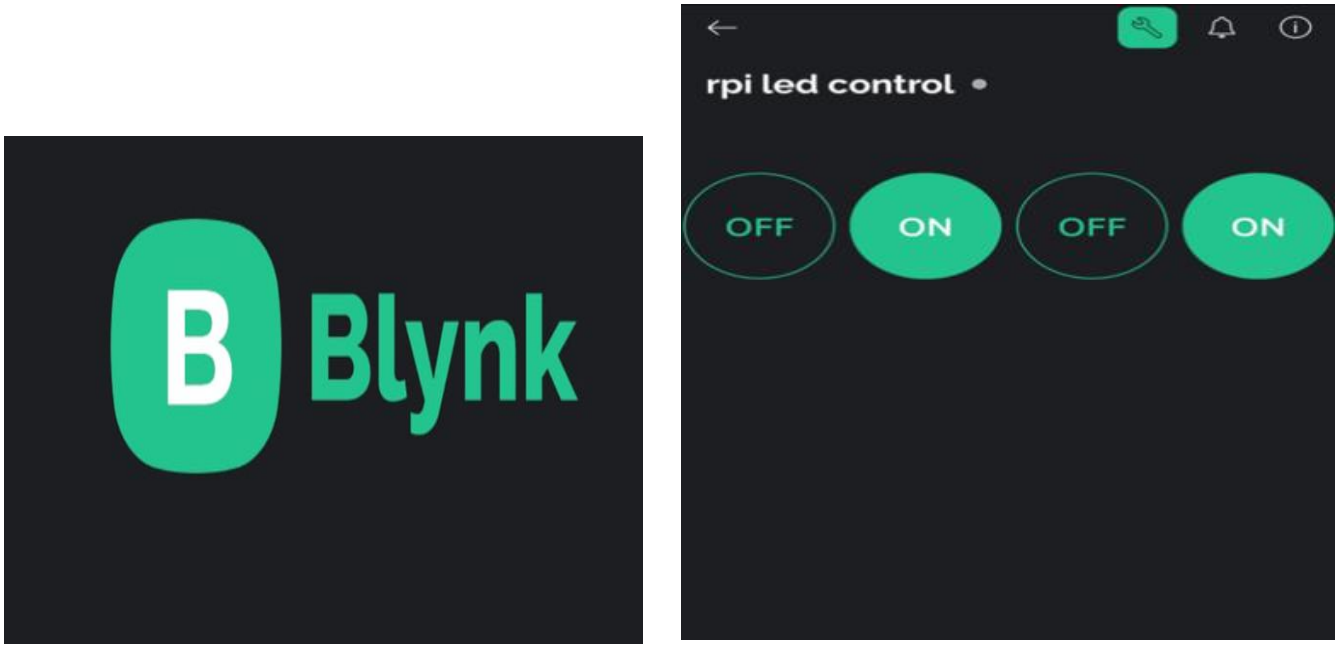

Fig. 2 Mobile App

Blynk are popular platforms for IoT (Inferno of Things) applications. It providing a simply way to connecting hardware devices like Arduino, Raspberry Pie, ES1299, ES32, and others to internet and controlling they remotely using smartphone apps.

- **Cloud Platform:** Blink has a Platform: Blink presented a cloud-based podium where users might invents custom IoT applications without extensive coding acumen. The podium renders drag-and-drop functionality for design the user interface and describe interactions with connected devices.
- **Mobile App**: Blink handed a mobile application for both iOS and Android devices, permitting users to distantly monitor and manage their IoT initiatives. The application furnishes widgets like knobs, sliders, gadgets, and exhibitors to interact with the connected devices.
- **Hardware Compatibility:** Blink sustains a broad array of hardware podiums usually utilized in DIY electronics initiatives, encompassing Arduino, Raspberry Pi, ESP8266, ESP32, Particle devices, and more. It also collaborates with various receptors, operators, and other components customarily utilized in IoT initiatives.
- **Communication Protocols:** Blink maintains several communication protocols, including Wi-Fi, Ethernet, Bluetooth, and GSM, allowing users to link their devices to the internet in assorted methods.
- Blink Cloud: Blink tenders a cloud facility that simplifies the communication between connected devices and the Blink application. Users can craft an account on the Blink Cloud platform and oversee their IoT initiatives from any point with an online connection.
- **Open-Source Libraries:** Blink provides open-source libraries for varied hardware podiums and coding languages, making it simplistic for developers to incorporate Blink functionality into their initiatives.
- **Pricing:** Blink furnishes both gratis and paid blueprints. The complimentary scheme has some curtailments on the number of devices and widgets, while the paid blueprints tender more traits and superior margins.

3.2.2 Raspberry pi :

- **Affordability:** Raspberry Pi board are relatively cheap, making them accessible to a wide audience, including students, hobbyists, and professionals.
- **Small Size:** The Raspberry Pi be about the size of a credit card. This tiny form factor makes it easy to incorporate in various projects.
- **Broad Range of Models:** Over the years, the Raspberry Pi Foundation has released many models, each with different specifications. For example, the Raspberry Pi 4 are a powerful model suit for a wide range of tasks, while the Raspberry Pi Zero is smaller and more basic.
- **General-Purpose Computing:** Raspberry Pi board are can perform a wide range of computing tasks, such as web browsing, word processing, gaming, and etc.
- **GPIO Pins:** Including a set of General Purpose Input/Output (GPIO) pins, which allow for physical interactions with the external world. This make the Raspberry Pi suitable for hardware and electronics projects.
- **Education and Learning:** Raspberry Pi be widely used in educational settings to teach computer science, programming, and electronics.
- **Versatility:** It can be use for a wide variety of applications, including but not only web browsing, gaming, word processing, media playback, home automation, robotics, and etc.
- **Low Power Consumption:** Raspberry Pi board are energy-efficient, making them suitable for applications where power consumption is a concern.

Fig.3 Raspberry pi

3.2.3 Relay:

Working on a principle of an electromagnetic distraction! When a circuit of a relish senses the fault currently, it energizes the electromagnetic field wherever produces a temporary magnetic field. The magnetic field moves the relish armature to open or closing the connections. A tiny powerful relish only has one contract, and a high powerful relish has two contacts to open the switch.

Fig.4 Relay

4. WORK IMPLEMENTATION

4.1.1 Implementation Diagram:

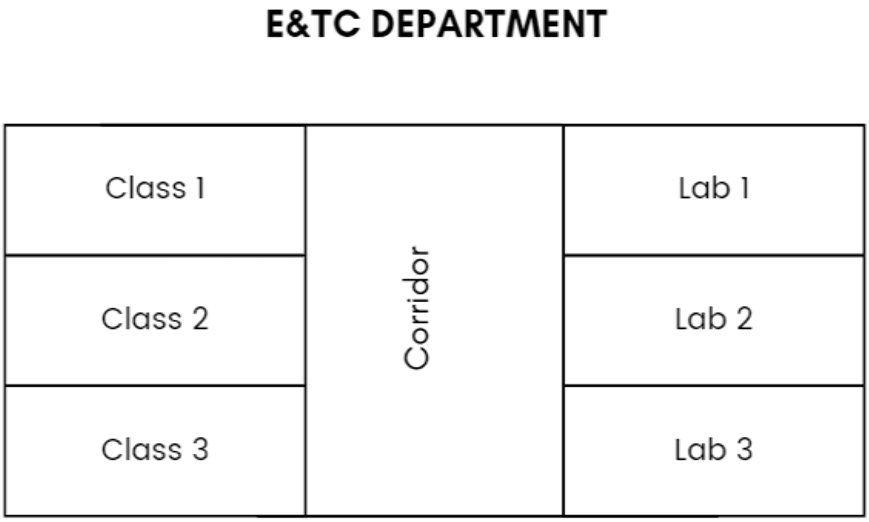

Fig.5 Implementation Diagram

4.2 Simulation

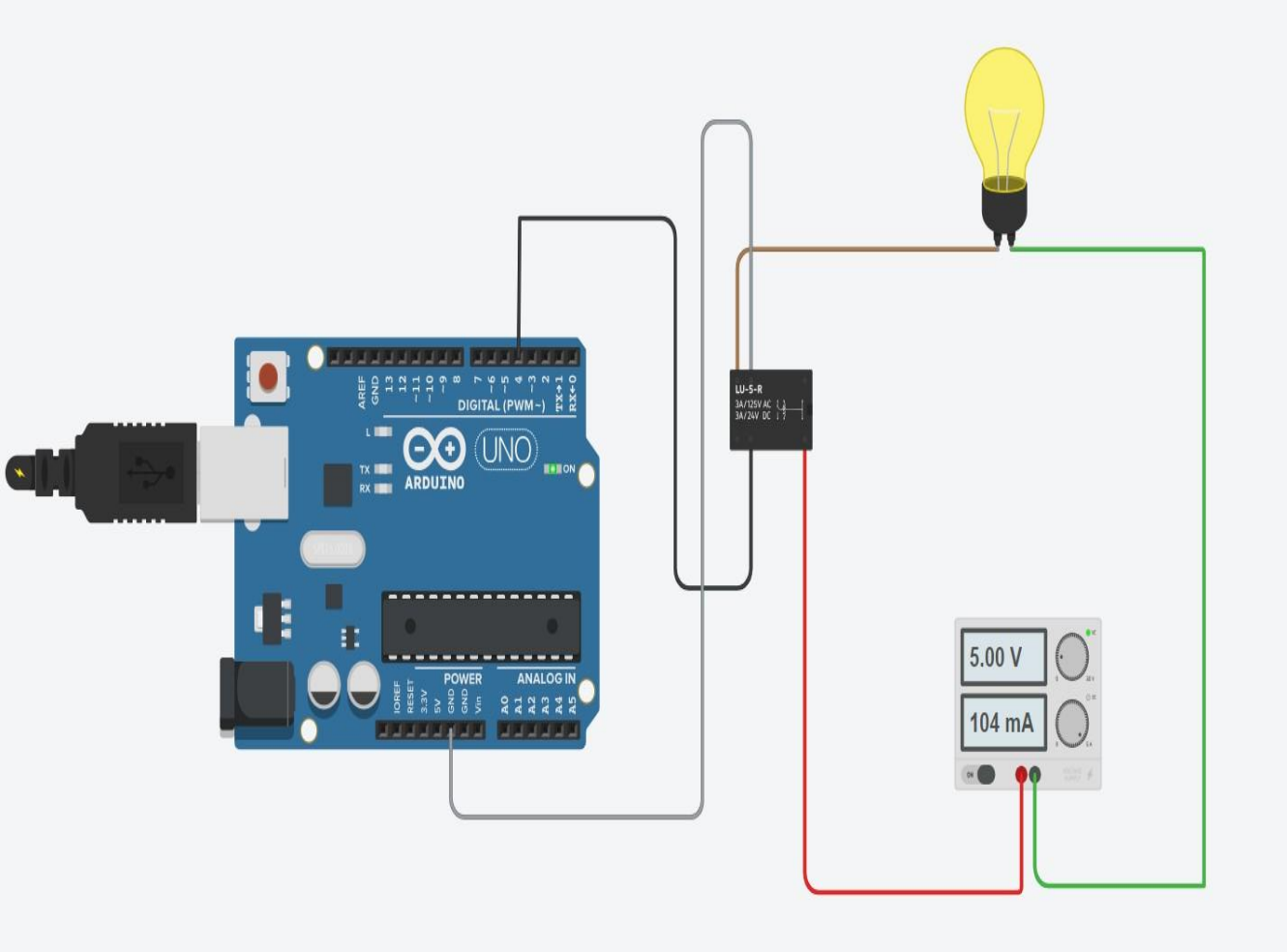

Fig.6 Simulation

In simulation we done all process to run our project on online platform (Tinkarcad). In the process of simulation first we arrange all component as shown in fig. Simulation and this simulation runs successfully. The IoT-based light automation system project is a success, providing benefits in energy savings and user convenience. As IoT technology evolves, the insights from this project will support future smart home automation initiatives. The project has shown advancements in modernizing traditional lighting systems and has identified key findings for home automation. The system offers control over the department's lighting environment, allowing users to customize settings and monitor energy usage for comfort and productivity. It also serves as an educational tool for E&TC students, preparing them for careers in smart systems. The modular design allows for scalability by adding sensors, actuators, and control algorithms as needed. The system provides control and convenience, enhancing comfort and productivity in the department's lighting environment.

The IoT-based light automation system project is a success, providing benefits in energy savings and user convenience. As IoT technology evolves, the insights from this project will support future smart home automation initiatives. The project has shown advancements in modernizing traditional lighting systems and has identified key findings for home automation. The system offers control over the department's lighting environment, allowing users to customize settings and monitor energy usage for comfort and productivity. It also serves as an educational tool for E&TC students, preparing them for careers in smart systems. The modular design allows for scalability by adding sensors, actuators, and control algorithms as needed. The system provides control and convenience, enhancing comfort and productivity in the department's lighting environment.

5. RESULT

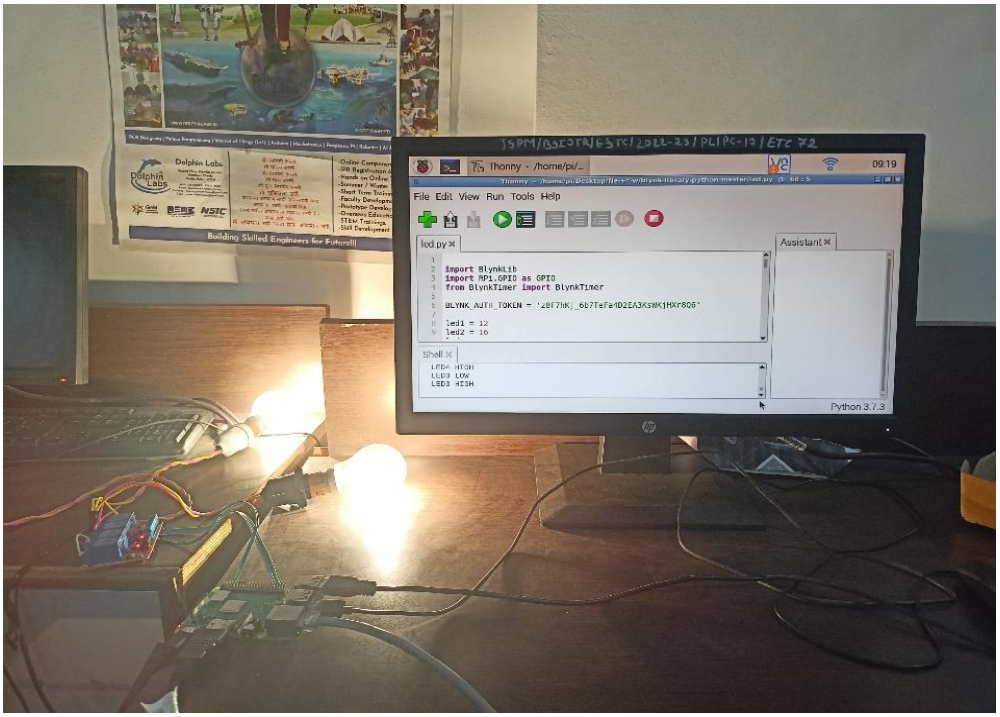

Fig.7 Final Result

Features:

Enhanced Automation: The implemented system demonstrates efficient automation capabilities, adjusting lighting conditions based on various factors such as time of day, occupancy, ambient light levels, and user preferences. This automation enhances user convenience and optimizes energy usage.

Energy Efficiency: Through strategies like dimming, scheduling, and occupancy-based control, the system achieves notable energy savings. Real-time monitoring and adaptive control mechanisms ensure that lights are only active when necessary, leading to reduced electricity consumption and lower utility costs.

Remote Accessibility: Users can remotely access and control the lighting system via IoT connectivity, facilitating convenient management from anywhere with internet access. This feature enables users to adjust settings, monitor energy consumption, and receive notifications about system status or anomalies.

User Interface: A user-friendly interface, such as a web application or mobile app, allows users to interact with the system seamlessly. Users can easily adjust lighting settings, create schedules, and monitor system status, enhancing overall user experience and satisfaction.

Reliability and Stability: The system demonstrates reliability and stability in operation, with robust hardware and software components ensuring continuous performance. Measures such as security protocols, redundancy, and failover mechanisms contribute to system resilience against potential failures or disruptions.

Energy Savings Analysis: Through data analysis and monitoring tools, the system provides insights into energy usage patterns and savings achieved. Users can evaluate the effectiveness of energy-saving strategies and make informed decisions for further optimization.

User Feedback and Satisfaction: Feedback from users indicates a high level of satisfaction with the system's functionality, ease of use, and energy-saving benefits. Users appreciate the convenience of remote access and the system's ability to adapt to their preferences and environmental conditions.

6. SUMMARY & CONCLUSION

In conclusion, the integration of Internet of Things (IoT) technology in our Department Light Automation System has proven to be highly effective in effortlessly managing our lighting system. By utilizing the Raspberry Pi module and the Blynk Application, we've achieved a remarkable level of convenience, allowing users to control lights with just a tap on their smartphones. This smart lighting system not only enhances convenience but also contributes significantly to energy conservation, addressing the prevalent issue of unnecessary power wastage in educational institutions like colleges and universities

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