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Home Lighting Installation Using Smart Home System

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Abstract

Based on the results of a study on *the Effect of Electronic Medical Records* (*EMR*) *on the Level of Service Quality in Outpatients at Toto Kabila Hospital in 2025*, it can be concluded that the quality of service is considered very good by the majority of patients. This is reflected in the five dimensions of *SERVQUAL*, which show a high level of satisfaction, with the implementation of *EMR* receiving positive appreciation (92% very good, 8% good). *EMR* has been proven to increase efficiency, accelerate access to information, improve data accuracy, and strengthen communication between health workers. The results of the t-test showed that four dimensions (Tangibles, Responsiveness, Assurance, Empathy) had a significant positive effect, while Reliability had a significant negative effect. As a suggestion, *Toto Kabila* Hospital needs to conduct routine evaluation of the *EMR* system and strengthen the network infrastructure. Continuous training for health workers is also important so that the use of *EMR* is more optimal. Further research is suggested to add the perspective of health workers and indicators of the rate of medical errors to make the results more comprehensive. Educational institutions are expected to integrate a curriculum based on health information technology so that graduates are ready to face the era of digitization of health services.

Keywords: Smart home, smart lighting, automation, energy efficiency.

INTRODUCTION

The development of smart home technology is rapidly advancing alongside the integration of electronic devices through internet networks (Hui et al., 2017; Risteska Stojkoska & Trivodaliev, 2017). One of the key components in a smart home system is the lighting system, which can be controlled automatically or manually through an Internet of Things (IoT)-based application (Gao, 2025). This system allows users to adjust lighting as needed both from inside the home and remotely, using a smartphone device or voice control. With this automation, users not only gain comfort and convenience but are also able to increase energy efficiency and optimize home security. Smart lighting offers various advantages compared to conventional lighting systems, including occupant detection to turn lights on or off, as well as light intensity settings based on environmental conditions (Chiradeja et al., 2023; Widartha et al., 2024; Soheilian et al., 2021; Dinmohammadi et al., 2025). Additionally, this system can reduce energy consumption by up to 50% through the use of motion sensors and natural light data (Widartha et al., 2024). The implementation of smart lighting systems also contributes to enhancing

user comfort by adjusting lighting based on individual activities and preferences (Soheilian et al., 2021).

The use of a smart home-based lighting system is expected to be an innovative solution in supporting energy saving and creating a more environmentally friendly residence (Pohl et al., 2021). The Internet of Things (IoT) is the concept of connecting various devices and physical objects with the internet to enable remote communication and control (Zhang, 2020). A microcontroller (ESP8266 or ESP32) acts as the brain of the system, connecting to the WiFi network and controlling the actuator (relay or smart switch) (Lee, 2023). A Light Dependent Resistor (LDR) is used to detect the intensity of light in a room so that the system can automatically adjust the brightness (Subeesh, 2021). The relay or smart switch functions to turn the lights on and off electrically (Ahamed, 2023). The Smart Home App acts as the user interface to remotely control and monitor the status of the lights (Al-Ali, 2019). The implementation of this system not only supports energy efficiency but also plays an essential role in increasing occupant comfort through automation that is adapted to their activity patterns (Islam, 2022). Additionally, the smart lighting system can be integrated with other systems in the smart home to create a more coordinated and efficient ecosystem (Thungtong, 2021).

Previous studies have shown that *IoT*-based smart lighting has significant potential in reducing energy consumption, but limitations remain in terms of adaptability and user integration. For instance, Ryu and Kim (2019) demonstrated that *IoT*-enabled lighting systems can reduce unnecessary electricity usage through sensor-based automation, but their work lacked emphasis on user experience and real-time customization. Similarly, Singh et al. (2021) highlighted improvements in household energy efficiency through *IoT* integration, yet their study revealed challenges in system scalability and compatibility with existing home infrastructures. This research addresses those gaps by designing a smart lighting system that combines Light Dependent Resistor (LDR) sensors, microcontrollers (ESP8266/ESP32), and mobile applications to create adaptive, user-friendly, and energy-efficient lighting. The novelty lies in integrating real-time environmental detection with remote accessibility to enhance not only efficiency but also household security.

The objective of this study is to develop a practical smart home lighting model that balances automation and user control. The expected benefits include reducing household energy consumption, increasing convenience, and supporting sustainable living practices that are highly relevant for modern urban communities.

METHOD

This research uses a case study approach by applying a smart lighting system in a smart home. The stages of the method used include:

Analysis of electricity and lighting needs is carried out to identify the lighting needs of each room, including the calculation of electrical power, number of lights, and optimal installation location, based on lighting standards that are appropriate for the comfort of residents. Hardware installation is carried out with the installation of hardware such as smart lights, motion sensors, and automatic switches. System integration with smart home applications involves integrating the lighting system with *IoT*-based applications, allowing remote control, lighting schedule settings, and real-time monitoring of energy consumption via smartphones or tablets.

Working Steps

1) Prepare tools and materials.
2) Frame according to the picture.
3) Connect the power source (MCB ON).
4) Bardi smart switch program via cellphone
5) Press the 1 on button on the smartphone.
6) Press the 2 on button on the smartphone.
7) Press button 1 on the smartphone again.
8) Press button 2 again on the smartphone.
9) Disconnect the power source (MCB OFF).
10) The experiment is complete.

RESULT AND DISCUSSION

The results of the study show that:

1) Energy efficiency: the smart lights can be controlled automatically to save energy by adjusting the light sensitivity and operating schedule.
2) Convenience and Flexibility: Users can control the lighting of smart home applications or voice commands using virtual assistants such as google assistant or amazon alexa.
3) Security: The system can be integrated with motion sensors to detect the presence of a person and turn the lights on or off automatically.

Discussion

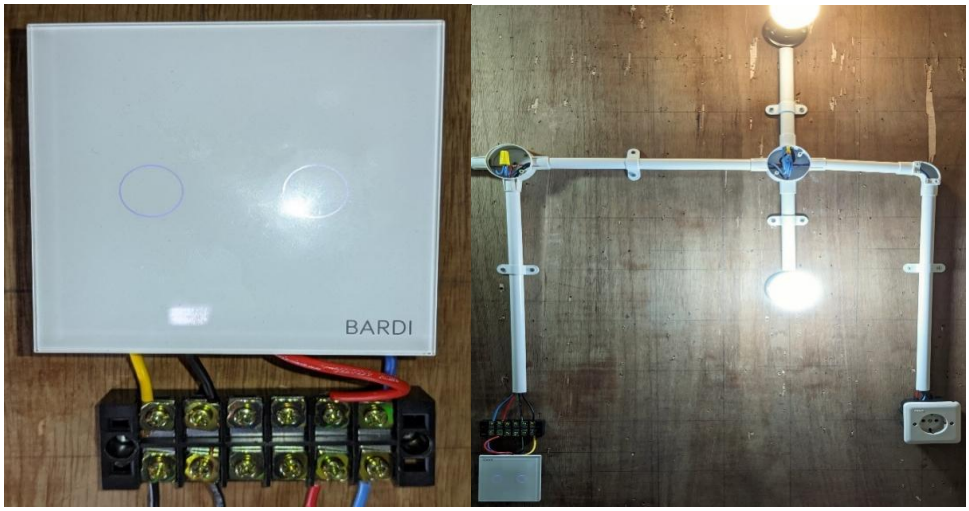

Figure 1. Light Installation

Smart home-based home lighting installation is an implementation of Internet of Things (IoT) technology that allows users to control the lighting system automatically or manually through digital devices such as smartphones, tablets, and sound systems. This system not only improves comfort and energy efficiency, but also provides an additional layer of safety for the occupants of the home.

The Smart Home system is an automated system designed to provide comfort and security for home residents. This system makes it easier to operate electrical equipment, so that the use of electrical energy becomes more efficient. In addition, this programmed system allows homeowners to feel safe even when they are not at home, because it is able to protect against the threat of fire or theft without having to hire guards or security guards.

Smart Home technology works by integrating various sensors that are installed at home and controlled by central tools such as PLCs, Smart Relays, Microcontrollers. Although the implementation of the system requires more costs, the design provides real benefits, one of which is to increase the selling value of the house

Currently, there are many choices of smart home packages from various brands, complete with electronic devices that can be directly installed throughout the house. However, the price is relatively expensive. For homeowners who have a limited budget, using smart relays as a system control center is a good alternative. Smart relays can be installed side by side with MCBs (Miniature Circuit Breakers) in the house, and can be used to distribute electrical loads through distribution panels.

Houses that use smart home systems certainly require more expensive costs. For this reason, smart home design must benefit homeowners. One of them is that smart home design is believed to increase the value and selling price of the house (smartcube-ksa.com).

Smart Home System is an implementation of modern technology in the field of household automation that aims to improve efficiency, security, and comfort. This system not only provides physical comfort by facilitating the operation of electrical appliances, but also provides a sense of psychological security for the occupants of the house.

The use of technologies such as sensors, microcontrollers, PLCs (Programmable Logic Controllers), and smart relays shows that these systems work in an integrated and intelligent manner. The system will automatically respond to certain conditions, such as turning off the power when no one is home, or setting off an alarm when an intruder is detected

An efficient smart home design should consider the specific needs of the user, the scale of the home, and the available budget. Therefore, the system is highly flexible and can be adapted to individual needs. The use of smart relays specifically offers a cost-effective solution for smart home systems, without having to purchase expensive product packages from specific companies.

In addition, integration with MCBs (Miniature Circuit Breakers) is also important in ensuring safe and controlled distribution of electrical power. This is an added value in the smart home system because it not only regulates comfort, but also pays attention to the electrical safety aspect in the home.

With the advancement of Internet of Things (IoT) technology, smart home systems in the future have the potential to be controlled through mobile devices or even artificial intelligence (AI) systems to predict the habits of home residents, making this system more sophisticated and personalized.

CONCLUSION

The implementation of smart home-based lighting systems provides significant benefits in terms of energy efficiency, convenience, and household security, making it a promising innovation in daily life. The advancement of *IoT* technology has made these systems easier to adopt and integrate, offering users greater control and sustainability. However, to maximize their potential, further research is recommended to focus on optimizing interoperability with other smart home devices, enhancing user-friendly interfaces, and addressing challenges such as data security, system scalability, and affordability. These efforts will ensure that smart lighting systems not only improve efficiency but also become more accessible and reliable for a broader range of households.

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