A Basic Model Proposal of Smart Lighting Control applying Location Awareness

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Abstract. Lighting control systems are being studied in a variety of areas to save electric power energy consumed by indoor lighting. However, the existing lighting control systems have limitations in that it is difficult to achieve fundamental energy saving because they either use manual methods or are based on a collection of environment-oriented information. Thus, this study proposes a basic model of a smart lighting control system that utilizes user-oriented information, the principal user of the space, by using location awareness technology.

Keywords: Smart Lighting Control System, Location Awareness Technology, Energy Saving

1 Introduction

The energy consumption for indoor lighting has been gradually increasing with the development of various kinds of industries. However, as the increase in power consumption for lighting causes concerns over limited resources and with which economic burdens are involved, efforts in energy saving plans are required. Therefore, fundamental methods of energy saving are pointed out as important research projects in a variety of areas, and active technology development is being attempted in major advanced countries.

This paper pays close attention to the point that there are fundamental elements of wasting energy in the lighting control methods currently developed and used. I believe that there needs some improvement in the manual lighting control methods that occupy most of today's lighting control methods. Therefore, the major objective of this study is to propose an efficient control method for saving indoor lighting energy, and it will propose a basic model of the smart lighting control system that applies location awareness technology.

2 Investigation into the Technology and Proposal of a Smart System

2.1 Investigation into a Lighting Control System

Today, artificial lighting is being operated using various control methods to provide a comfortable lighting environment in indoor spaces. The most generally used method is the on/off control method through switch operation. Other than that, the automatic on/off control system utilizing a motion recognition censor and an LED dimming system providing phased luminance are being commercialized. Recently, the LED dimming system based on photo sensor, which provides lighting after sensing the luminance of lights brought into the indoors during the day, has been developed and commercialized. If you look into this area, you might know that the tendency of the overall technology development of lighting control systems lies in automation and intellectualization.

Table 1. Types and Features of the Lighting Control System

	Control Method	Contents
On/Off System	switch-type manual control	- It can be operated by the manual operation of the user. - It is most used because of its cheap price and easy installation.
Sensor System	It controls lighting by on/off control after judging whether the user is in the room by sensing motion in a space.	- It automatically controls the on/off of lighting after sensing in real time whether the user is in the room in a space. - Its usefulness is low because it judges whether there is any person in the relevant space.
Dimming System	method of providing luminance step-by-step	- While installation costs are high, it can easily secure comfort in the light environment. - It provides an energy saving effect with a phased luminance setting. - It is possible to create customized staging according to various situations.
Sensor-based Dimming System	controls luminance through dimming after sensing whether there is a user in the room and luminance brought in from outside	- Linked system between sensor technology and dimming - Combined method of manual and automatic controls - Various applications are available depending on the Algorithm construction method.

The control method most widely used in a lighting control system is the on/off control method utilizing the manual operation of a switch, and that most recently

introduced is the sensor-based dimming system. After analyzing the two control methods in terms of energy efficiency, the following limitations may be observed:

As the on/off method can be controlled only by the manual operation of the space user, it is difficult to expect any fundamental saving effect. Additionally, as the provision of luminance cannot cope with the diversity of situations, it is inevitable that it causes some energy loss.

The sensor-based dimming system has overcome the shortcomings of the on/off method and secured a certain amount of energy efficiency. However, as the scope of information detection is limited to motion sensing and luminance brought in from outside, there is a limitation in that it is difficult to cope with detailed situations, and especially the saving effect of lighting energy during the night is very low. Thus, in order to efficiently cope with power consumption, the scope of information detection of sensors should be widened and the capacity to effectively cope with more situations is required. As the consumption of artificial lighting is especially concentrated during the night, it is necessary that a model to reduce energy consumption during the night is proposed.

2.2 Investigation into a Location Awareness System

I suggest the application of location awareness technology to supplement the limitations of sensor-based dimming systems. If location awareness technology is utilized, as the location information of the user in a space is analyzed in real time and connected to an intelligent response, higher energy savings compared to sensor-based dimming systems can be realized. Additionally, as it is possible to reasonably respond to various situations, it can achieve high satisfaction of users in terms of the quality of the light environment.

2.3 Proposal of a Basic Model of a Smart Lighting Control System

This study adopted the method of collecting principal user-oriented information while maintaining the usefulness of collecting environment-oriented information in order to propose a new model for smart lighting control systems. This is because, as the provision of a comfortable environment is always related to user demand, the system can achieve fundamental energy savings if information is actively collected and responded to in real time. Furthermore, as the amount of additionally required luminance is controlled by dimming, the performance of energy saving and high user satisfaction can be expected.

4 Conclusion and Future Tasks

The main results of this study can be summarized as follows:

First, the major types of lighting control systems are the on/off system, sensor system, dimming system, and sensor-based dimming system. The most widely used

type is the on/off type, and the best performing type is the sensor-based dimming system. However, both types show fundamental limitations in terms of energy saving.

Second, a smart lighting control system can realize maximized energy savings by collecting information through sensors and actively and reasonably responding to various situations. The main process of the smart system is performed by repeating the process of detection of information and analysis thereof through an algorithm, and presenting a proper response. References

Third, in order to improve the energy saving effect of a smart lighting control system, the scope of information collected through sensors should be expanded from being environment-oriented to user-oriented. Thus, this study proposes a basic model of a smart lighting control system that applies location awareness technology.

This study has pointed out the limitations of the lighting control types that have been used to date in terms of energy consumption efficiency and proposed a new model able to reform the problems by linking to up-to-date IT technology. The IT technology these days is developing at high speeds, and it can be utilized as an effective solution to the energy saving problem. Therefore, it is necessary that research relating to an integrated system for energy saving in buildings is conducted through active investigation into technology in subsequent studies. I believe that specific solutions to reduce energy used in night lighting and research linking user awareness

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