Advanced Science and Technology Letters
Vol.69 (Architecture and Civil Engineering 2014), pp.39-42
http://dx.doi.org/10.14257/astl.2014.69.10

Basic Suggestion to Select Proper Location of Illumination Sensor for Establishing the Lighting Control System in Residential Space

Juil Park[1.1], Heangwoo Lee[1.2], Yongseong Kim[2.1]

[1]The Graduate School of Techno Design, Kookmin University, Jeongneung-dong, Seongbuk-gu, Seoul, 136-702, KOREA
[2]School of Architecture / The Graduate School of Techno Design, Kookmin University, Jeongneung-dong, Seongbuk-gu, Seoul, 136-702, KOREA
ju2r@daum.net[1.1], moonup2001@nate.com[1.2], yongkim@kookmin.ac.kr[2.1]

Abstract. Recently, there are needs of measures to save energy consumption as well as eco-friendly energy management and development. Due to increased interest in lighting control which takes a large energy consumption, more studies on the lighting control system are being carried out. Therefore, the purpose of this study is to analyze the illumination for each depth of indoor space by daylight through the test bed, suggest the efficient location of illumination sensor for lighting control and verify its performance.

Keyword: Light Control, Illumination Sensor, Optimum Position, Energy Saving

1 Introduction

1.1 Purpose of study

Due to recent emphasis on energy issues, there are needs of measures to save energy consumption as well as eco-friendly energy management and development. Especially, the consumption of lighting energy in buildings accounts for a large portion of total energy consumption so that more studies regarding lighting control are being carried out, but domestic studies on lighting control system focus on the analysis of illumination through the simulation, and only the analysis of illumination is being carried out at the selected position of lighting sensor.

Therefore, the purpose of this study is to provide preliminary data to find the optimal position of illumination sensor and verify its performance by placing illumination sensors in the test bed, measuring and analyzing data for establishing the lighting control system.

ISSN: 2287-1233 ASTL

1.2 Method and procedure of study

This study is carried out in the following order. First, the theoretical consideration on preceding studies on the selection of proper location of illumination sensors for reducing the energy consumption is carried out. Second, illumination sensors are placed in the test bed and the external illumination value by artificial sunlight is measured. The vertical and horizontal distances between sensors, winter solstice, summer solstice and vernal equinox and autumnal equinox are set as major variables of the experiment. Third, the measured values from the experiment are analyzed to draw the conclusion and select optimal position of illumination sensors.

2 Consideration of lighting control technologies

2.1 Sensor-related technologies for lighting control

As the concept of future-oriented active lighting, the lighting control system is the advanced lighting control which provides the lighting function and creates various lighting environments and functions by detecting movements and environmental characteristics in a space which requires high-quality lighting and providing proper lighting for circumstances and events automatically. Such lighting technology can be classified into energy saving lighting control, emotional lighting control, and converged smart lighting.

2.2 Illumination standard for lighting control

Illumination is the light intensity on a certain surface expressed as the light velocity on the surface. Lux is used as its unit. The illumination standard in Korea is suggested as KS A 3011, and it is classified according to the type of activity as shown in Table 1. In this study, 400 lx is set as the standard for lighting control.

Table 1. KS A 3011 illumination standard

Type of activity	Range of illumination(lx)	Lighting method on working space
Carry out visual performance against high luminance or for a large object	150-200-300	Lighting on working space
Carry out visual performance against normal luminance or for a small object	300-400-600	
Carry out visual performance against low luminance or for a very small object	600-1000-1500	

3 Perforated evaluation of lighting control according to the position of illumination sensors

3.1 Overview of test bed for performance evaluation

In order to select the optimal position of illumination sensors to be verified in this study, the best bed as shown in Table 2 and Figure 1 is established. On/off control of 5 indoor lightings can be done with specific indoor sensor value, and 400lx presented above is set as the standard for on/off control.

Table 2. Overview of test bed

Overview of test bed	
	Room size : 9m(W) * 6.6m(D) * 2.5m(C)
	Window size : 2.2m(W * 1.8m(H) / texture : pair glass 12mm(3mm+6mm+3mm)

3.2 Setting the measurement position of illumination for performance evaluation

4 lightings are installed in the test bed for performance evaluation at each position of illumination sensors for lighting control, and 24 positions for the measurement of illumination are set for lighting control.

3.3 Method to select proper location of illumination sensor for establishing the lighting control system

In this study, lighting control is carried out according to 24 set positions for the measurement of illumination before selecting the proper position of illumination sensors for establishing the lighting control system in residential space, and it is determined whether the standard illumination of 400 lx is satisfied or not after lighting control is carried out according to the each position of illumination measurement. Also, the amount of lighting energy usage according to lighting control is calculated.

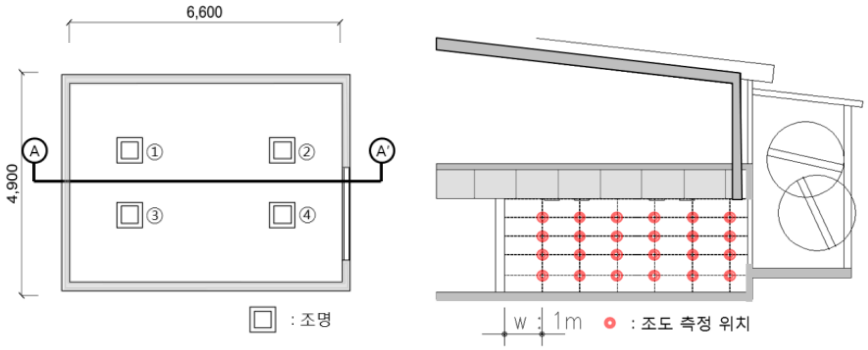

Fig. 1. Position of indoor lighting/Position of sectional illumination measurement

4 Conclusion

This study is the preliminary study regarding the selection of proper position of illumination sensors for establishing the lighting control system in residential space, and the test bed is established, the result of performance evaluation is compared and analyzed to select the proper position of illumination sensors for lighting control. However, the performance evaluation is carried out only for the sectional position of illumination measurement based on skylight for setting the scope in this study, and the position of illumination sensors on the indoor plane is not considered. This part is the limit of this study, and it should be improved through studies in future.

References

1. U.K. Park, T.J. Park, K.M. Kang, S.Y. Lee, D.S. Song, The Validation adn Proposal of Interior Daylight Illuminance Equation 2013
2. H.J. Park, J.H. Kim, J.J. Lee, A Study on the Illuminance Sensor Location Optimization for Lighting Control System by Using Daylight of Apartment Housing,
3. J.E. Lee, A.S. Choi, A Study of Luminous Environment for Standard Illuminance in Residential Areas, 2005.05
4. E.S. Song, Design and Implementation of Energy-Saving Lighting Control System Based on Wireless Sensor Networks, 2013
5. D.H. Kim, H.J. Kang, S.K. Lim, T.K. Kang DALI Lighting Control Wired communication technology trend analysis for electrical energy saving

