

A Preliminary Study on Internal Light Shelf System applying IT Technology

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Abstract. The light shelf system, among natural lighting systems, is easy to construct, and its installation costs are low, with the high efficiency of natural lighting. Many research projects in the technology leading to energy savings on the basis of recent IT technology are continuing, and such technology has been proven to be effective after being applied to actual environments. Therefore, I am going to propose a light shelf system among natural lighting systems to save lighting energy consumption. The light shelf system proposed in this study uses a method that satisfies the luminance required by the user through user awareness technology that applies IT technology, and, in the case of luminance that has failed to satisfy the requirements of the user, it satisfies such requirements through lighting control, and such lighting control saves energy by adjusting to steps 1-8 using dimming control instead of the existing on/off control method.

Keywords: User Awareness, Light-Shelf System, Dimming Converter

1 Introduction

The light shelf system, among natural lighting systems, is easy to construct, and its installation costs are low, with the high efficiency of natural lighting. Because of such high efficiency, a variety of experiments and research efforts are now being conducted. Many research projects in the technology leading to energy savings on the basis of recent IT technology are continuing, and such technology has been proven to be effective after being applied to actual environments. Research suggesting solutions to problems of light shelves and efficient energy saving have also been conducted from the perspective of user awareness technology, among IT technology, providing an environment through information and on/off lighting control in response to the requirements of occupants. However, through adjustments of main lights rather than lighting control by an on/off switch, comfort can be provided to occupants, and even the luminance necessary for overall lighting of an indoor space can be secured, as lighting energy savings are achieved.

Therefore, a light shelf system applying user awareness technology and a dimming control system is proposed in this research. Thereafter, I am going to compare the results of a performance evaluation of energy saving of the light shelf system that applies user awareness technology and a dimming control system with that of a light

shelf system that does not apply user awareness technology, while applying a dimming control system in terms of energy saving performance.

2 Light Shelf , User Awareness and Lighting Control

2.1 Light Shelf

The light shelf system is a natural light reflection system that blocks natural light brought indoors and brings light deeply into an indoor space after reflecting light using a light shelf in order to prevent problems such as glare and an extreme imbalance of luminance due to direct rays from the outside. It is a natural lighting system that improves the quality of indoor space and saves lighting energy by evenly distributing indoor luminance. While it is desirable to install a light shelf system in a low position for natural light brought into the indoors, a position higher than eye level of a standing human is more common, in order to prevent glare and to secure the views of the occupants. Light shelves are divided into outdoor type, indoor type, and mixed type light shelves

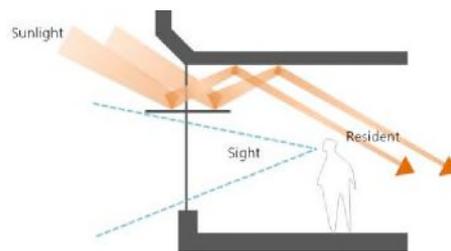


Fig. 1. Principle of the Light Shelf System [1]

2.2 User Awareness

User awareness technology refers to the acquisition of various information on the user, such as name, age, sex, health condition, requirements, providing user-oriented service on the basis of these factors.

2.3 Lighting Control

Dimming control refers to the technology that saves energy by controlling the brightness of lighting for a certain area based on the information from a sensor of luminance and indoor temperature, etc. It creates an indoor environment for the luminance required by the occupants through dimming control for each step.

3 Light Shelf System Applying User Awareness Technology and Lighting Control

The light shelf system that applies user awareness technology and lighting control can set the luminance value required by the user, and the objective of a light shelf system is to satisfy the required illumination value of the user through the light shelf system after collecting the space environment information. In the event it cannot satisfy the required luminance value, it aims to satisfy the required luminance value using lighting control. The system is configured in such a way that, when the tag holder enters the room, the user tag is sensed by the receiver and the luminance value is set by frequently communicating with the luminance sensor. When this set value is transferred to the integration server, the integration server controls the light shelf and dimming lighting. If two or more persons enter the room, the set value of the user who requires a higher luminance value prevails.

The flow of the system is as follow: Once the required luminance of the user is input into the tag, the luminance value is measured by the luminance sensor when the user enters the room with the tag, and then the light shelf starts to operate to satisfy the luminance levels required by the user. If there is any insufficient luminance after the operation of the light shelf, it raises from step 1 up to step 8 through dimming control from the lighting for the area for which the luminance value is lowest. Such a process is repeated in consecutive order.

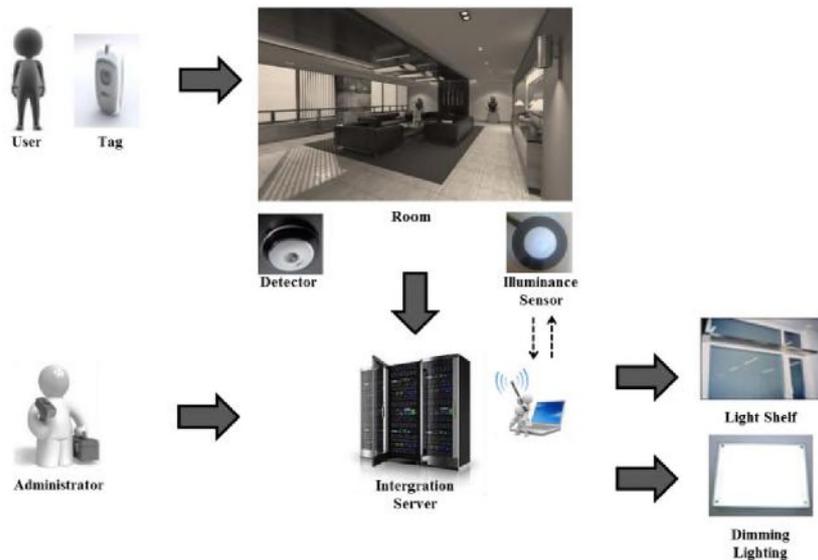


Fig. 2. Light Shelf system Applying User Awareness Technology and Lighting Control Configuration

4 Conclusion

The light shelf system is one of the natural lighting systems designed to reduce the usage of lighting energy in buildings. The installation costs are low and its performance is superior. In the case of the light shelf system proposed in this study, the required luminance can be satisfied to some degree by changing the angle of the light shelf according to the required luminance of the user, and in the case of insufficient luminance, the required luminance can be satisfied through lighting. The efficiency of the light shelf applying user awareness technology can be improved through dimming lighting, and effective energy savings can be achieved as light shelves and lighting can be controlled in response to user needs.

References

- 1.Seo Tae-Won, Lee Heang-Woo, Kim Yong-Seong, A Study on Light-Shelf System using Context Awareness Technology for Energy Saving in Housing Space, Journal of the architectural institute of Korea planning & design Vol.28 No.11, 2012,
- 2.Kim Han-Seong, Kim Kang-Soo, A Study on lighting Energy Conservation in a Small Office Space with Daylight Dimming Control System, Journal of Korean Institute of Illuminating and Electrical Installation Engineers, Vol.17 No.5, 2003
- 3.Sohn, Myung-Gi, Sustainable Design Process of Zero Energy House, Samoo Architects & Engineers Institute of Technology, 2010
- 4.Ahn He-young, Lee Heang-Woo, Kim Yong-Seong, A Study on Light-shelf system based on IT in Housing Space -Focus on Lighting Energy Saving, Journal of the Korean Institute of Educational Architecture and Environment, Vol.13 No.1, 2013
- 5.Kim Bong-Kyun, Kim Jeong-Tai, Scale Model Experiment for Daylighting Performance by Lightshelf Types, Journal of the Korean Institute of Educational Architecture and Environment Vol 5, No.2, 2005
- 6.Lee Heang-Woo, Kim Deuk-Soo, Kim Yong-Seong, Simulation Study on the Performance Evaluation of Light-shelf focused on the Depth of Space and the Dimensions and Angles of Light-shelf, Journal of the architectural institute of Korea planning & design, Vol. 29, NO.3, 2013