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Automated blind control based on glare prevention with dimmable light in open-plan offices

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This paper presents a simulation study of the control of automated venetian blinds for open-plan office spaces. It is reported that a cut-off strategy in which the slat angle of the blind is determined to cut direct sunlight is not sufficient to avoid glare. Therefore, in this study, a glare prevention control is proposed where the slat angle is repeatedly altered the glare degree is calculated to be less than the glare index limit. For predicting glare degree, a metric called PGSV (Predicted Glare Sensation Vote), developed by us, is used. To obtain the PGSV, the average luminance of window area including blind slats and outside view seen between the slats is calculated. For electric lighting control, this study focuses on daylight reflected on the ceiling, which can reduce the required amount of light from lighting. The illuminance of ceiling surface provided by light from window areas is calculated. This electric light control integrated with blind control only needs input from rooftop sensors and no indoor photo-sensors. It is suitable for offices using partitions which block light from the windows. The glare prevention method proposed in this paper shows greater slat angle than cut-off strategy. However, it can reduce power consumption for lighting by approximately 30% in typical open-plan offices in Tokyo. Also, it provides 46-50% of working hours when the occupants are satisfied with the outside view.

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