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Opinion: Daylight–artificial light integration: Research needs

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Sophisticated systems for integrating daylight and artificial light are gaining interest. Given LED luminaires, only time-based or occupancy-based controls are cost-effective, photosensor-based control is applicable only for window zones and the payback for continuous dimming is not encouraging. LED luminaires themselves are generating immense energy savings, making savings by lighting controls look insignificant. Hence, the focus of controls is now more on qualitative rather than quantitative benefits. Adaptive control of window blinds or glazing is the most desired option for maintaining illuminance uniformity, avoiding glare, and reduced cooling and lighting energy consumption.

When considering the health of occupants along with the enhanced quality of lighting, spectral tuning to match daylight using correlated colour temperature (CCT) as a metric may be desired. Spectral tuning of the light emitted by the luminaire has the potential to take care of the circadian needs of occupants. But is that all? Can we add short wavelength light to the spectrum to act as a stimulant for vitamin D production?

In addition, an automatic dynamic glazing system has the capability of offering the right uniform and glare-free light with significant energy cost reduction. Of course, control systems of this type will be climate-based and hence will be different for different regions. But this may be going too far. Even simple occupancy-based control has the potential to save energy, so the right approach is to first consider occupancy; next comes tuning and finally glazing control.

Looking further into the future, Internet of Things-based systems have the advantage of data collection for future use and also for acquiring data-driven models for efficient management. Here the concern is how to power these systems and manage the batteries. Photovoltaic panels powered by interior lighting could be a source of power for such systems. However, this will call for a new generation of data analytics models.

A high dynamic range (HDR) camera is the most appropriate photometric measurement tool for these control systems. A low-cost camera with machine learning methods can produce the best results in occupancy detection and glare detection. HDR imaging-based evaluation takes the performance evaluation to higher levels.

More research is required in all these areas to get less complicated, cost-effective daylight–artificial light integration systems. In my opinion, there is significant scope for interdisciplinary study to get such systems. Further, there is a requirement for standards setters to consider the use of such controls including commissioning and performance evaluation techniques.

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