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A DCV performance in IAQ services during COVID-19: a study of the contractor in Malaysia

Abstract

Purpose: Demand-controlled ventilation (DCV) plays a significant role in human life by providing safe, reliable and cost-effective services that are environmentally friendly and enhance occupant satisfaction and building energy efficiency. Significant decisions are made at the early stages of building sector DCV systems, requiring effective tools to avoid measurement errors and failures in Volatile Organic Compound (VOC) generation. The continuous upgrading of this sector is necessary to respond to technological advances, environmental changes and increased ventilation demands. Integrating indoor air quality (IAQ) and machine learning algorithms (MLA) proves promising, as the scope of DCV typically does not extend beyond the footprint of the building; it does not encompass IAQ within a Corona Virus Disease 2019 (COVID-19) infection risk information. Therefore, integrating IAQ with MLA provides a comprehensive overview of the building sector's DCV systems. However, this integration poses challenges, particularly in DCV activities, as they are among the most complex systems involving numerous processes critical for making important decisions. This study aims to identify how digitalized construction environments can integrate DCV into their processes. Design/methodology/approach: This study reviews the literature on integrating IAQ with MLA systematically, aiming to analyze the DCV need for this integration and its benefits. It proposes a direction for a conceptual framework, simulation and causal explanation of the problems using the bootstrapping technique and Cronbach's alpha factor analysis to establish the requirement for facilitating specific ventilation control processes to be incorporated into the system approaches in managing infection prevention and energy efficiency in the building sector's DCV system. Findings: This study proposes a conceptual framework for analyzing IAQ within a COVID-19 context and MLA embedded in systems that may impact DCV practices. The conceptual framework comprises six key constructs: virus detection, occupant ventilation behavior, DCV energy consumption, diagnostic evaluation, temperature perception cluster and indoor environmental quality. The conceptual framework underscores the importance of early integration of DCV in the design phase to identify alternative methods to cogenerate, monitor and optimize DCV. Originality/value: So far, this study advances the knowledge of how digitalized construction environments can ensure DCV delivery. The testing results highlight four significant relationships between the constructs of strategies and the constructs of occupant-density factors in the Malaysian dataset within the existing conceptual framework. Hence, the framework designed for developed countries or US companies can enhance IAQ ventilation strategy options in Malaysia's G7 contractor

companies. A future study can validate the framework across the design phase with different construction stakeholders.

Keywords

COVID-19; DCV; Digitalized construction environments; MLA; Optimization