Abstract

In the face of escalating concerns regarding climate change and environmental sustainability, the imperative to monitor and regulate energy consumption has gained paramount importance. Buildings, being significant contributors to overall energy usage, warrant focused attention, especially when confronting the complexities of heritage protection and assessing energy performance through non-destructive ways in existing structures. This research endeavors to tackle these challenges through the introduction of an innovative and user-friendly approach for estimating energy performance in heritage buildings, utilizing readily accessible tools: smartphones and data-driven algorithms. By harnessing the computational power of smartphones and deploying machine learning algorithms to capture essential geometrical attributes, this novel workflow showcases its capacity to accurately estimate a building's energy performance. This practical solution eliminates the necessity for costly computational resources and specialized expertise, making energy performance assessments more accessible and feasible while protecting heritage values. The research findings underscore the efficacy of this method as a part of retrofit measures for heritage buildings, even when using limited and fundamental geometric data, thereby enhancing the accessibility and utility of energy performance evaluations. This workflow holds significant promise for a diverse range of stakeholders, including researchers, architects, property owners, and government agencies. It empowers them with real-time, precise insights into the energy performance of existing structures. Consequently, this research constitutes a pivotal stride toward bolstering sustainable energy management practices and furnishes a tangible avenue for ameliorating the adverse environmental impact associated with buildings.

Keywords: Building energy consumption, heritage buildings, data-driven methods, Energy Audit, Poland