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AI-Optimised Green Roof Drainage Systems – Designing smart water retention systems for urban buildings

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Abstract

Green roofs are part and parcel of promoting city sustainability since they prevent storm water runoff, reduce the urban heat island effect and increase biodiversity. However, they have an issue with their drainage being optimized in dynamic urban environments characterized by unpredictable weather conditions. The complexities cannot always be tackled through traditional drainage engineering that is based on static models and manual calculations. This paper explores what artificial intelligence (AI) and especially machine learning algorithms could contribute to the improvement of green roof drainage systems. The secondary quantitative data of various green building projects will be used to evaluate the potential of AI to increase water storage, minimize runoff and optimize drainage capacity. Comparative evaluation reveals that AI-fuelled strategies are outperforming traditional strategies in terms of the provision of high adaptability, real-time optimisation and eco-system friendliness. The paper looks into the prospect of combining AI and Internet-of-Things (IoT) sensors to support real-time data capture, thereby empowering adaptive and proactive drainage strategy.

Key findings indicate that AI models, such as artificial neural networks and long short-term memory networks, surpass traditional models in predicting drainage performance across diverse conditions. The study concludes with recommendations to improve data quality, enhance AI model adaptability and promote the adoption of AI-driven solutions for green roof implementation, supporting climate-resilient and sustainable urban development.

Keywords: Green Roofs, Artificial Intelligence (AI), Drainage Optimisation, Machine Learning, Storm water Management