Chapter 9
Enhancing Blue-Green Infrastructure With Smart Technology:
Cybersecurity and IoT Integration in Urban Development

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ABSTRACT

Urbanisation is rapidly transforming cities across the globe, especially in India, where urban areas are expanding at an unprecedented pace. This growth brings challenges such as environmental degradation, water scarcity, flooding, and increased pollution. To tackle these issues, urban planners are adopting sustainable development strategies like blue-green infrastructure (BGI), which integrates water management (blue) and vegetation (green) to create resilient and liveable urban environments. The integration of smart technology and the Internet of Things (IoT) into BGI offers innovative solutions for efficient monitoring and management of urban ecosystems. Smart sensors and devices enable real-time data collection and analysis, leading to better decision-making and resource optimisation. However, this technological advancement introduces cybersecurity concerns that must be addressed to protect data integrity and ensure the reliability of urban systems. This article delves into the technical aspects of enhancing BGI with smart technology, explores the role of IoT integration, discusses cybersecurity challenges, and provides suggestions for

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successful implementation, including emerging technologies like energy harvesting and digital twin frameworks for real-time optimization.

INTRODUCTION

Urbanisation across the globe, particularly in rapidly growing nations like India, has brought about significant challenges such as environmental degradation, water scarcity, flooding, and pollution. These challenges necessitate the adoption of sustainable strategies, one of which is Blue-Green Infrastructure (BGI). BGI integrates water management (blue) and vegetative areas (green) to promote resilience and livability in urban environments (Fletcher et al. 2003). The introduction of smart technology and IoT into BGI frameworks has created new opportunities for enhanced urban ecosystem management but also raised cybersecurity concerns. This paper explores the technical integration of IoT within BGI, the associated cybersecurity risks, and recommendations for efficient, secure implementation.

BLUE-GREEN INFRASTRUCTURE IN URBAN DEVELOPMENT

Blue-Green Infrastructure (BGI) refers to the blending of natural water systems (blue) and vegetative areas (green) within urban landscapes to mitigate environmental challenges. The systems involved include rivers, lakes, green roofs, urban forests, and wetlands. BGI aims to replicate natural hydrological processes to manage stormwater, reduce flood risks, mitigate urban heat islands, improve air quality, and enhance biodiversity. The environmental benefits of BGI are significant. For instance, stormwater management is improved by reducing surface runoff and promoting infiltration and evapotranspiration. The Rational Method quantifies runoff using the equation 1:

$Q = C \times I \times A$ (equation 1)

Where Q is the runoff volume, C is the runoff coefficient, I is rainfall intensity, and A is the catchment area. Reducing the runoff coefficient (C) through increased green space can significantly lower the risk of flooding (Fletcher et al. 2013). This is particularly crucial in urban areas where the prevalence of impermeable surfaces exacerbates flooding. Moreover, BGI is highly effective in mitigating the Urban Heat Island (UHI) effect, where urban areas experience significantly higher temperatures than rural surroundings. Vegetative elements like trees and green roofs can lower ambient temperatures through shading and evapotranspiration, reducing energy de-