

Chapter 1

A Cyber–Physical Systems and the Smart City Vision: A Comprehensive Guide

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ABSTRACT

The process of urban areas' transformation into smart cities with the help of Smart Cyber-Physical Systems (SCPS) is one of the most defining trends of modern urbanism. It requires a multifaceted perspective of smart cities, thereby evaluating the facets of SCPS intently concerning the complexities of their integration in urban structures while exploring their influence that transcends the domains of social sciences and economics, which has become crucial. In this context, smart cities are constructed as integrated systems at the crossroads of the digital and the physical: they sustain, facilitate, and improve the performance of the city's functions and living environment. The importance of technological environments in orientation and close consideration of SCPS reveals the functions in gathering data, immediate analysis, and decision-making processes of urban management. The interconnection

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of the Internet of Things (IoT), artificial intelligence (AI), and big data analytics considering their impact and the creation of sustainable enhancing the quality of public services.

INTRODUCTION

In the rapidly urbanizing world, the smart city is a new important strategy to meet the complex challenges of urbanization. Smart cities make use of cutting-edge technologies in enhancing the quality of life of citizens, achieving sustainability, and bringing about operational efficiency in urban services. At the very epicentre of this transformative vision lies Smart Cyber-Physical Systems, which embeds computation and communication capabilities in physical processes in a bid to render environments smart and responsive. SCPS is at the heart of the paradigm of the smart city, facilitating real-time monitoring, data collection, and analysis that inform decision-making and efficient resource management. These are followed by the IoT, AI, big data analytics—of which these three, when combined, form the backbone for smart city infrastructure. SCPSs empower cities with seamless integration of technologies in order to optimize operations and reduce costs while enhancing the overall urban experience.

The relevance of smart cities and SCPS in contemporary urban planning is very high. In the process, as the population of the urban areas continues to surge, conventional methods of city management are proving inadequate to address issues such as traffic, pollution, energy supply, and resource supply. Smart cities present a proactive way of handling these emerging challenges by infusing technology into making urban spaces more livable, efficient, and sustainable. SCPS also falls within the trends of global digitization and sustainability of urban planning. The contribution to the broader goals—that is, mitigation of climate change, resilient economy, and social equity—is what these systems can do to support smart infrastructure development. SCPS can be used to bring greater adaptability to cities while ensuring a better quality of life for their residents.

This chapter is an all-in-one tutorial about the overlap between cyber-physical systems and smart city vision. It covers aspects related to foundational concepts, technological frameworks, social implications, economic dimensions, and environmental sustainability of SCPS within smart cities. The chapter thus tries to analyze through these different facets how SCPS can be harnessed toward making urban environments smarter, more efficient, and definitely more sustainable.

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