Chapter 9
The Role of 6G in Empowering Smart Cities Enabling Ubiquitous Connectivity and Intelligent Infrastructure

Hitesh Mohapatra
https://orcid.org/0000-0001-8100-4860
School of Computer Engineering, Kalinga Institute of Industrial Technology (KIIT), Bhubaneswar, India

ABSTRACT

Wireless communication is advancing, leading to 6G networks. These networks will reshape society with unprecedented connectivity and intelligence. 6G is key for future smart cities, integrating terahertz communication, ultra-low latency, and AI-driven networks. This will create hyper-connected cities where real-time data supports systems like autonomous vehicles, energy management, and public safety. 6G research shows its potential for ultra-reliable communication, immersive experiences like extended reality, and widespread sensing, crucial for smart city applications. However, challenges like technical issues, data privacy, and regulations need addressing. This chapter proposes a 6G-enabled smart city model using IoT, AI, and edge computing to improve urban operations. It explores dynamic network slicing, intelligent resource allocation, and edge AI processing to meet latency and bandwidth needs. The chapter concludes by emphasizing collaboration and strategic planning to overcome challenges, ensuring 6G technologies foster sustainable urban growth.

DOI: 10.4018/979-8-3693-8029-1.ch009

1. INTRODUCTION

1.1. Brief Overview of 6G Technology and Its Potential Impact

The appearance of 6G technology can be considered as a sophisticated step forward in the develop of the wireless communication services, provided that the reports which claim for the improvements compared to the previous generation of the 5G networks seem to be quite realistic. Hence it is predicted that 6G is destined to be in the middle of the development of connected environments as societies rely on digital structures to solve multifaceted urban issues (Trichias et al., 2024). This next-generation network technology will not only be about the speed and the capacity but will be defined by the integration of artificial intelligence (AI), edge computing and the Internet of Things (IoT) to create smarter, efficient systems. At the center of these innovations is the desire to achieve maximum potential of the smart cities concept, where connectivity and intelligent decisions are expected to seamlessly create sustainable and resilient city (Mahmood et al., 2020).

Over the last few years, the concept of smart cities has become the central area of focus in the debates about urbanization and sustainability. Today's cities face several problems that include population density, pollution, resources, and security among others. Current approaches and technologies, despite having their utility, can be lack scalability, flexibility and real-time performance (Yrjölä et al., 2023). The emerging 6G is set to overcome these barriers and offer the base on which cities are smart, connected and can learn and adapt in actual time. An exciting development to note regarding the 6G is the forecast of the network to work at terahertz band, which promises data transfer speed beyond imagination, among other benefits. This level of integration is needed for new use cases like autonomous transport, telemedicine and extended reality beyond the vehicle, respectively. Furthermore, 6G is expected to welcome AI at the heart of the network that also support the malleable offering of resources, fall preventive workmanship, and upgraded safety measures (Inomata et al., 2021). The integration of these technologies in 6G will therefore result into cities that are not only connected but also self-sufficient.

In addition to these, 6G creates opportunities for equity and inclusion in the delivery of services digitally as well. However, there is an opportunity of reducing the 'digital divide' where knowledge and use of information and services are not restricted to the well-off citizens. Some of the Intelligent urban systems that can be supported by 6G could include, for instance, public health monitoring that occurs in real-time, adaptive energy grids as well as smart governance systems that are in direct response to population needs (Antón-Haro et al., 2024). However, the processes of moving to the 6G smart cities are not without various challenges. Those questions, which are connected with data protection, security, and ethical aspects

Self-Organized Future Mobile Communication Networks: Vision and Key Challenges

Ali Diaband Andreas Mitschele-Thiel (2016). *Handbook of Research on Next Generation Mobile Communication Systems (pp. 321-359).*
www.irma-international.org/chapter/self-organized-future-mobile-communication-networks/136564