Chapter 7
Optimized Approaches in Data Security and Privacy Using IoT Devices for Smart Cities

Sonu Sharma
http://orcid.org/0009-0004-3836-590X
Poornima University, Jaipur, India

Nikhil Kumar Goyal
http://orcid.org/0009-0007-4532-8033
Poornima University, Jaipur, India

ABSTRACT

This chapter presents a comprehensive analysis of methods for securing IoT networks in smart cities, addressing the technical, operational, and regulatory challenges unique to these environments. It begins by exploring the foundational role of IoT in enhancing urban efficiency, connectivity, and sustainability. Security threats, including device vulnerabilities, unauthorized access, and privacy breaches, are examined, highlighting the limitations of traditional models. Advanced solutions such as cryptographic techniques, secure connectivity, and distributed authentication are discussed. Privacy-preserving data processing approaches like differential privacy, federated learning, and secure multi-party computation are explored, ensuring a balance between data protection and system performance. The chapter also emphasizes the significance of AI and ML in threat detection, anomaly analysis, and proactive response. Edge and fog computing are highlighted for their potential in reducing latency and enhancing data privacy.

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INTRODUCTION TO SMART CITIES AND IOT SYSTEMS

Defining Smart Cities

The idea of smart cities provides an incredibly new perspective on urban development and implementation of modern digital technology and data analytics to enhance well-being of resident; manage their resources effectively; and, promote environmental sustainability. (Albino et al., 2015) As a result, the concept of smart cities empowers a radical model for urban development Smart cities leverage their network of systems to increase operational efficiency, reduce the environmental footprints and support economic growth in your face of the urbanization challenges. The base for smart city achievement is the use of various sensors, communication networks and advanced analytics platforms for collecting and interpreting data in real time from areas ranging from traffic control, waste systems, distribution of power. By analyzing real-time information, cities obtain insights which facilitate agile decision making, enhanced service management and more robust urban resilience in change.

What makes smart cities different at its heart is not just a question of technological advancement itself. With the element of social, economic, and environmental factors it aims at constructuring societies that are inclusive, networked, and resilient to change. To realize this comprehensive vision, concerted effort in the country's public authorities, leaders in industry, educational interests and the locals themselves is needed, which in turn promotes an atmosphere of constant innovation and advancement.

Role of IoT in Smart City Infrastructure

The IoT is the backbone of smart cities allowing easy gathering, distribution, and analysis of data across the urban fabric. Subordinated streetlights, smart meters and other IoT also comprise the core systems that enable smart city networks (Alomair & Poovendran, 2014). The output of the data streams of these devices provide immediate and detailed analysis for urban environments ranging from the environmental factors such as air quality and cost of energy to operational facts such as traffic flows and emergency management.

When IoT connections are integrated into smart city infrastructure, cities get to benefit from a variety of benefits which include better public safety, effective energy consumption, superior transportation networks, and less environmental load. To provide another example, IoT empowered traffic lights can adjust their time-sequences in a instant based on the actual traffic situation that eases the traffic jam condition, thereby reducing the environmental footprint. Moreover, smart water networks which apply IoT can allow automatic detection of leaks, optimization of water sup-