

Chapter 5

Synergizing Edge– Fog Architectures With AI and Blockchain for Sustainable and Intelligent Connectivity

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ABSTRACT

The intelligent and sustainable transportation with the help of networks have been enhanced the combination of Edge-Fog Computing, Artificial Intelligence, and Blockchain technology. Edge computing and Fog computing are used in the decentralization of formats that lessens the latency and bandwidth consumption when data

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is being processed; AI on the other hand is also used in enhancing real-time decision making on the network edge. Blockchain brings security, fairness, and trust into the systems which are based on decentralization. This has the ability to revolutionize smart city, healthcare, IoT and other industries with issues to do with scalability, efficiency and security. However, some issues that are still open include the issue of compatibility, power usage and privacy issues. The adoption of such technologies generates the potential shared pro and common benefits to enhance innovation and efficiency in line to achieve sustainable development in several aspects area and design intelligent and secured system in the future.

INTRODUCTION

Background and Motivation

In the current world of fast growing technology and its ever increasing adoption, the need for high-speed, dependable and scalable connectivity is more than ever. With the greater number of connected devices, the IoT, smart cities, and industrial automation, the cloud-based infrastructures are unable to manage the huge amount of data (Chataut et al., 2023; Anandaram et al., 2026; Ahmad et al., 2024). Centralized cloud computing systems are quite beneficial in many cases and can be used effectively to solve many problems, but they do have one major disadvantage – latency and bandwidth problems which become especially crucial when real time data processing is needed (Abughazalah et al., 2024; Krishna et al., 2024). This has resulted to architectures like the edge & fog computing architectures that enhance computation & storage at the vicinity of the data source in order to reduce complexities, delay, increase efficiency & reliability (Sabireen & Neelanarayanan, 2021). Edge computing augments the computing infrastructure to the device level or recent nodes, whereas fog computing adds a layer just below the cloud computing to provide a more distributed and effective architecture (Singh and Kaushik, 2023; Kumar et al., 2025).

As the need for higher speed and efficiency of the networks rises (Narooka et al., 2025a; Narooka et al., 2025b), the role of AI and Blockchain technologies became an important element of the upcoming network evolution (Mukherjee & Pradhan, 2021; Xue et al., 2024; Singh and Kaushik, 2023). Very large amount of data may be processed with the help of artificial intelligence, moreover making decisions easier, as well as improving operations real time basis, leading to an important element of edge & fog computing. While on the other hand, blockchain facilitates a decentralized and secure method to store and transmit data further helpful in increasing trust in distributed systems. Further they possess the capacity of enabling

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