Chapter 14
Synergizing Edge Computing With Energy Storage and Grid Integration in Electric Vehicles

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ABSTRACT

The automotive and energy industries will undergo a revolution with the integration of edge computing, energy storage systems, and grid integration in electric vehicles (EVs) to improve efficiency and sustainability. In electric vehicles (EVs), edge computing improves data processing by cutting down on latency and band-

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width utilization, allowing for real-time energy management decision-making, and optimizing battery consumption and energy distribution. Energy storage systems (ESS), which provide flexibility and bidirectional flow, are essential for EV energy management. V2G technology supports grid stability and streamlines energy exchange procedures by integrating ESS with grid infrastructure. In this chapter, the strategic advantages of edge computing and grid integration in ESS for EVs are examined, with an emphasis on practical applications' cost savings, environmental effects, and operational efficiency.

INTRODUCTION

The automobile industry has undergone a transformation with the advent of electric cars (EVs), which have improved sustainability, efficiency, and technical innovation. Three main factors—grid integration, energy storage systems (ESS), and edge computing—have an impact on how EVs evolve. This chapter examines how they may work together and change the energy and automobile industries. Edge computing is a revolution in data processing that centres on computation and data storage near data sources. It handles data on the vehicle or adjacent infrastructure points in electric cars, providing benefits including lower latency, less bandwidth use, and real-time decision-making(Minh et al., 2022).

Through the analysis of real-time data from environmental sensors, drivetrain controllers, and battery management systems, edge computing in electric vehicles (EVs) enhances data processing and management. This enhances energy economy, prolongs battery life, and improves responsiveness and adaptability of the vehicle's performance. By swiftly processing massive amounts of data from cameras, LIDAR, and radar systems, edge computing improves autonomous driving, predictive maintenance, and cybersecurity(Li et al., 2022). This reduces decision-making latency and raises the safety and dependability of autonomous electric vehicles (EVs).

In the dynamic and complicated world of electric cars, edge computing allows for real-time analytics and localized decision-making, which improves vehicle performance and makes transportation more robust and efficient. Electric vehicles (EVs) rely heavily on energy storage systems (ESS) to power them and to determine their feasibility, performance, and range. Since ESS innovations directly affect the efficiency, capacity, and lifetime of EVs, they are essential to the successful and broad deployment of EVs. Lithium-ion batteries, which have a long life cycle and high density, are used in modern EV energy storage. Enhancing these qualities, cutting prices, and improving EV range and dependability are the goals of advancements in battery chemistry, design, and production(Mehmood et al., 2021).