

# Chapter 5

## Edge Computing: A Guide to Achieving Sustainable Living

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### ABSTRACT

*Data processing near the network edge solves decentralized cloud infrastructures. Without time-consuming transfers to centralized data centers, edge computing processes and analyzes data locally. Network processing at the edge minimizes latency when transferring or sharing data with remote servers. Reduced data center processing improves real-time application speed, latency, and energy savings. Edge computing makes AI and IoT devices work without cloud load. Energy is saved by offloading computation to edge devices. Edge computing selectively processes and consolidates data at the network edge and sends only relevant data to the cloud. Strategic data transmission conserves network capacity and benefits the environment. Edge data storage eliminates big data centers and reduces their environmental effect*

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*from construction, maintenance, and cooling. Automotive, healthcare, smart cities, and industrial automation benefit from edge computing architectures.*

## **1.1. INTRODUCTION**

Edge computing has attracted a lot of attention recently as a revolutionary technology that overcomes the drawbacks of conventional centralized cloud computing. It enables quicker response times, less network congestion, and improved privacy by distributing computing resources to the network edge, closer to data sources and end-users. It has become essential to IoT, smart cities, autonomous vehicles, and many other emerging applications due to these benefits. Although edge computing has excellent performance and efficiency advantages, its effects on sustainability are coming under closer scrutiny. Energy use, resource use, and carbon footprint have become crucial issues as the count of edge devices multiplies and the amount of data information generated at the edge soars. A comprehensive strategy for resource management and sustainability is essential to maximizing the capacity of computing while reducing its negative effects on the environment. This work presents a comprehensive analysis of how edge computing and sustainability interact. It highlights the most recent studies, approaches, and best techniques for designing, deploying, and using sustainable practices. This work is intended to promote knowledge of how edge computing can be utilized to obtain sustainable resource utilization, reduce energy use, and minimize e-waste.

The primary areas of emphasis in this work encompass:

1. This section explores architectures and designs for energy-efficient edge computing, employing techniques such as dynamic resource allocation, workload consolidation, and energy harvesting to find new ways to reduce power consumption in edge devices.
2. Edge-based resource management and workload optimization: Effective distribution and utilization of resources are a priority for sustainable development. This section explores intelligent resource management algorithms and techniques, load balancing strategies, and adaptive workload distribution in a way that guarantees optimal resource utilization and prevents over provisioning.
3. This section highlights edge computing applications that enable sustainable solutions, such as real-time environmental monitoring, intelligent energy management, precise agriculture, and efficient transportation systems. It examines how computing at the edge contributes to various sustainability goals.

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