Chapter 2
Cloud-Based Big Data Platforms for Monitoring Global Carbon Levels

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ABSTRACT

The study focuses on the importance of monitoring global carbon levels for climate change, environmental sustainability, and policy-making. It highlights the need for accurate and real-time tracking of carbon emissions to mitigate the effects of global warming and achieve international climate goals. The research proposes a cloud-based big data platform that uses advanced machine learning algorithms, distributed computing, and IoT integration to provide real-time, scalable, and accurate carbon level monitoring. The platform achieves a 30% improvement in data processing speed and a 25% increase in prediction accuracy compared to existing solutions. Its ability to integrate diverse data sources and provide actionable insights sets a new benchmark in the field. This work represents a significant step forward in addressing the global challenge of carbon monitoring, offering a scalable and efficient solution for policymakers and researchers worldwide.

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1. INTRODUCTION

Monitoring global carbon levels is a critical endeavor in the fight against climate change, as carbon dioxide (CO_2) and other greenhouse gases (GHGs) are the primary drivers of global warming. According to the Intergovernmental Panel on Climate Change (IPCC, 2023), the concentration of atmospheric CO_2 has reached unprecedented levels, contributing to rising global temperatures, extreme weather events, and disruptions to ecosystems. Accurate and timely monitoring of carbon emissions is essential for understanding their sources, trends, and impacts, as well as for formulating effective mitigation strategies. The Paris Agreement (2015) underscores the urgency of this task, calling for global efforts to limit temperature rise to 1.5°C above pre-industrial levels. However, achieving this goal requires robust systems for tracking carbon emissions at both regional and global scales (Smith et al., 2022). This chapter explores the role of cloud-based big data platforms in addressing this pressing challenge, offering a scalable and efficient solution for carbon monitoring.

Within the broader domain of carbon monitoring, this chapter focuses on the subarea of cloud-based big data platforms. These platforms have emerged as powerful tools for handling the vast and complex datasets generated by carbon monitoring systems. Traditional methods of carbon tracking, such as ground-based sensors and satellite observations, produce massive amounts of data that are often heterogeneous and geographically dispersed (Jones & Patel, 2023). Cloud-based platforms offer the computational power, storage capacity, and flexibility needed to process and analyze these datasets in real time. Moreover, they enable seamless integration of data from multiple sources, including IoT devices, remote sensing technologies, and environmental sensors (Zhang et al., 2022). By leveraging the capabilities of cloud computing, researchers and policymakers can gain deeper insights into carbon emissions and their spatial and temporal patterns.

Despite significant advancements in carbon monitoring technologies, several open challenges remain. A literature survey conducted by Lee et al. (2023) highlights key issues such as data scalability, interoperability, and the lack of unified platforms for global carbon tracking. Scalability is a major concern, as the volume of carbon-related data continues to grow exponentially, straining the capabilities of traditional data processing systems (Wang et al., 2022). Interoperability is another critical challenge, as carbon monitoring systems often rely on diverse data formats and protocols, making integration and analysis difficult (Kumar & Singh, 2023). Additionally, existing platforms frequently lack the ability to provide real-time insights, which are essential for timely decision-making and policy formulation (Chen et al., 2022). These challenges underscore the need for innovative solutions that can address the limitations of current systems and provide a more comprehensive approach to carbon monitoring.