

Chapter 4

Blockchain and IoT for Secure Carbon Credit Transactions: A Decentralized and Transparent Approach

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ABSTRACT

The carbon credit market is among the significant factors in addressing climate change because it enables organizations to balance out their carbon footprint. The conventional carbon credit schemes, however, are plagued by inefficiencies, obscurity, forgery risk, and excessive verification costs. This research delves into the use of blockchain and the Internet of Things (IoT) to improve the security, efficiency, and transparency of carbon credit transactions. This chapter focuses on the issues with

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existing carbon credit markets and proposes a new system based on smart contracts, which automatically validates and authenticates transactions. The proposed system increases trust by eliminating middlemen and simplifying the process of carbon credit issuance through automation. The chapter also considers real-world uses, such as case studies on IBM Energy Blockchain Lab, and Everledger, to showcase how powerful blockchain and IoT can be in assisting with sustainability.

1. INTRODUCTION

1.1 Background

Climate change is one of the most pressing challenges of the 21st century, driven primarily by greenhouse gas (GHG) emissions. These emissions contribute to rising global temperatures, extreme weather events, and environmental degradation. International agreements such as the Kyoto Protocol and the Paris Agreement aim to combat climate change by promoting sustainable practices and reducing carbon footprints (Zhang & Zhao, 2020).

The carbon credit system is a key mechanism in this effort, allowing businesses to offset their emissions by investing in verified environmental projects. However, traditional carbon credit markets face major inefficiencies, including a lack of transparency, fraud, and slow verification processes (Kumar & Singh, 2023). Most existing systems rely on centralized registries and third-party auditors, leading to high costs, data manipulation risks, and credibility issues (Peterson, 2022). Challenges such as double counting and misrepresentation further weaken trust in the system, reducing its effectiveness in mitigating climate change (Rejeb et al., 2023).

Emerging technologies like blockchain and the Internet of Things (IoT) offer promising solutions. Blockchain's decentralized ledger ensures immutable, tamper-proof records, eliminating fraud risks and enhancing transparency (Zhao & Li, 2024). IoT sensors provide real-time monitoring of carbon emissions, improving data accuracy and credibility (Boumaiza & Maher, 2024). Integrating these technologies can create an automated, secure, and efficient carbon credit system, transforming the way emissions are tracked and traded.

1.2 Problem Statement

While carbon credit markets can be helpful, there are a few problems with how they are structured today:

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