A REVIEW ON PRIVATE AND PERMISSIONED LAND RECORD MANAGEMENT SYSTEM USING BLOCKCHAIN

Dr. G. N. Beena Bethel, Professor, Dept. Of Computer Science, Gokaraju Rangaraju Institute of Engineering and Technology.

Amballa Pramod, Student, Dept. Of Computer Science, Gokaraju Rangaraju Institute of Engineering and Technology.

Kamalapur Naveen, Student, Dept. Of Computer Science, Gokaraju Rangaraju Institute of Engineering and Technology.

Beerelli Shiva Kumar, Student, Dept. Of Computer Science, Gokaraju Rangaraju Institute of Engineering and Technology.

Gundeti Benhur Joy, Student, Dept. Of Computer Science, Gokaraju Rangaraju Institute of Engineering and Technology.

Abstract

In response to the challenges inherent in India's traditional land transaction system, our pioneering project endeavors to revolutionize the process through the implementation of a blockchain-based framework. The current system, reliant on registered sale deeds, grapples with issues like a centralized title registry, opacity, delays, fraud, and convoluted intermediaries, resulting in inefficiencies and disputes. Our solution proposes a decentralized title registry on the blockchain, aiming to streamline property transactions by eliminating the necessity for multiple intermediaries. Central to our approach are key features such as the Decentralized Title Registry, which ensures transparency and reduces the risk of fraud. Smart Contracts are employed to automate and enforce contract terms, expediting the overall process. Secure Identity Verification is integrated to enhance the security of transactions, mitigating the risks associated with impersonation or identity fraud. Additionally, our project introduces the concept of Land Sharing, fostering collaborative and efficient land utilization. By leveraging the inherent advantages of blockchain technology, our innovative solution not only addresses the shortcomings of the existing system but also promises a more efficient, secure, and transparent landscape for property transactions in India.

Keywords: Blockchain, Decentralized, Hyperledger-Fabric.

Introduction

In India faces significant challenges in its land administration system, with an estimated 7.7 million people affected by conflicts over 2.5 million hectares of land, jeopardizing investments worth $200 billion. Land disputes, constituting 66% of all civil cases, congest the judicial system, with the Supreme Court handling 25% of its cases related to land disputes, often taking an average of 20 years for resolution. In India, the conventional system of registered sale deeds for land transactions poses challenges such as centralized title registry, lack of transparency, delays, fraud, and complex intermediaries. These issues result in inefficient and time-consuming processes, leading to disputes and inefficiencies in property transactions. Our project proposes a blockchain-based land transaction system to address the shortcomings of the existing system. By establishing a de centralized title registry on the blockchain, we seek to eliminate the need for multiple intermediaries and simplify the process of property transactions. Some of the key features of our solution are Decentralized Title Registry, Smart Contracts, Secure Identity Verification, Land Sharing.
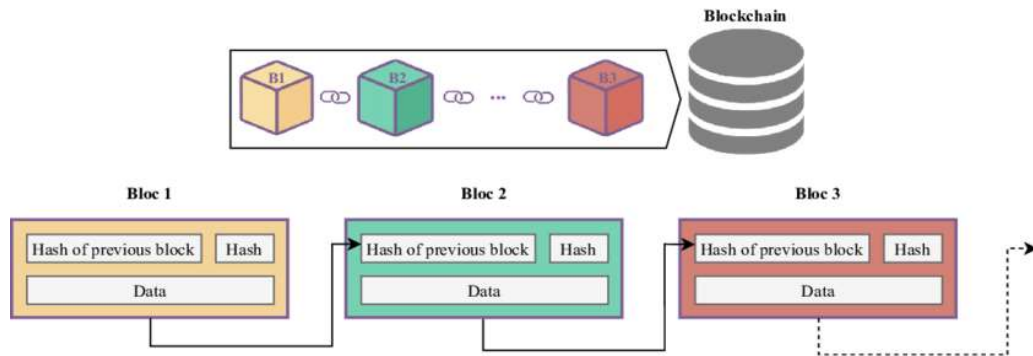
Figure 1: General Structure of a blockchain and its block

Blockchain, a groundbreaking technology, has evolved into a revolutionary force reshaping industries worldwide. Initially conceived as the underlying framework for cryptocurrencies like Bitcoin, its scope has expanded far beyond digital currencies. Blockchain is essentially a decentralized and distributed ledger, a tamper-resistant chain of blocks where each block contains a timestamped record of transactions. This structure ensures transparency, immutability, and security, as each participant holds an identical copy of the ledger. The evolution of blockchain has seen the emergence of smart contracts, self-executing contracts with the terms directly written into code. This feature automates and enforces contractual agreements, reducing the need for intermediaries. Furthermore, blockchain technology has ventured into diverse sectors, including supply chain management, healthcare, and voting systems, offering heightened efficiency and trust. As blockchain matures, scalability and interoperability remain key challenges. Innovations like sharding and layer-2 solutions aim to address scalability, while projects focus on creating protocols facilitating communication between various blockchain networks. The ongoing evolution of blockchain continues to shape a future where decentralized, transparent, and secure systems redefine how we exchange value and information in the digital age.

Land record management systems globally grapple with inefficiencies due to manual and paper-based processes, fostering inaccuracies and delays. Lack of transparency often results in disputes and fraud, eroding trust. Outdated and inaccurate information poses legal challenges, while limited accessibility impedes property transactions and urban planning. These issues underscore the need for technological interventions, such as blockchain, to bring transparency, efficiency, and accessibility to land governance. A hierarchical blockchain model could revolutionize the sector by providing a secure, transparent, and decentralized system, addressing these challenges and promoting sustainable and equitable land management practices at the village, mandal, and district levels.

Literature
Numerous endeavors have been dedicated to advancing the field of blockchain technology, with a particular focus on its applications in various domains. In the realm of land record management, a substantial body of research has emerged, exploring the integration of blockchain to address challenges within traditional systems. Several studies delve into the potential of decentralized title registries, smart contracts, and secure identity verification to enhance transparency, reduce fraud, and streamline property transactions. This ongoing research underscores the growing recognition of blockchain's transformative potential in revolutionizing land administration, offering innovative solutions to longstanding issues in the domain. While blockchain holds immense promise, challenges persist. Scalability issues hinder widespread adoption, with transaction speed and energy consumption concerns. Regulatory uncertainties and interoperability barriers pose hurdles, and the technology's

decentralized nature may clash with existing governance structures. Striking a balance between innovation and addressing these challenges remains a crucial endeavour in the blockchain landscape Kaczorowska et al. (2019) [4] discusses the modernization of land registration systems worldwide through information technology and explores the emerging concept of applying blockchain technology to land registration. While blockchain offers advantages such as increased trust and efficiency, concerns arise due to the irreversible and intermediary-free nature of transactions. The article examines potential benefits, risks, and practical experiences of implementing blockchain in land registration, assessing whether it could replace existing methodologies. Mukne et al. (2019, July) [7] addresses the outdated land ownership record systems prone to fraud and misrepresentation. It proposes a transparent solution using permissioned Blockchain, specifically Hyperledger Fabric, to ensure validation of transactions by all parties involved. The system creates an immutable record history, minimizing fraud possibilities and streamlining documentation through integration with the Interplanetary File System for secure management. Gupta et al. (2019, December) [2] introduces LandLedger, a blockchain-powered land administration system aimed at addressing issues like incomplete records and document forgery in countries such as India. LandLedger utilizes a permissioned blockchain managed by relevant departments like the Registrar's office, Income Tax, and Revenue departments, employing specially designed transactions for property verification, registration, and revocation. The system, implementing Merkle Patricia Tree, ensures efficient ownership verification and property history checking, demonstrating practicality and enhanced features compared to existing practices. Kadam et al. (2020, February) [5] proposes a blockchain-based land records system utilizing a hybrid blockchain network to address challenges in maintaining land records. The government places existing records on the blockchain, while land sales transactions are recorded and verified by authorized miner nodes. The hybrid blockchain, combining public and private features, enhances security, reliability, and transparency, offering an improvement over traditional databases and paper records. Mishra et al. (2021, March) [6] Blockchain offers a comprehensive solution to sectors requiring protection from corruption and human error, with the Land Registry being a prime example. Current systems are outdated, prone to inconsistencies, forgeries, and record loss. Blockchain's transparency, immutability, and traceability can streamline land registration, reducing disputes and allowing direct, authentic land ownership transfers without third-party verification. Samal et al. (2021, July) [9] addresses the inefficiencies and risks in traditional land buying and selling processes, highlighting challenges in digitizing land management systems. To overcome these issues, the authors propose a Blockchain-based approach for secure land record management, utilizing the Ethereum platform. The implementation demonstrates improved speed, transparency, and immutability of records, showcasing the effectiveness of Blockchain technology in this context.

Alam et al. (2022) [1] addresses the challenges in Bangladesh's land titling system, characterized by bureaucratic complexities, fraud, and inefficiency. It proposes a Blockchain-based solution to streamline the process, offering data synchronization, transparency, and immutable record management. The phased adoption model begins with a public Blockchain ledger and evolves into a two-tiered Hybrid Blockchain, aligning with the technological capabilities of the government and the public. The implementation using Ethereum demonstrates reduced travel requirements, cost savings, and improved access to critical information, emphasizing that Blockchain adoption has the potential to enhance Bangladesh's land title digitization efforts significantly. Shahariar et al. (2022, December) [10] proposes a blockchain-based Land Record Management System (LRMS) to digitalize paper-based land records, ensuring privacy, integrity, and facilitating land trading through an advertising agency. It introduces a novel character-to-integer mapping, reducing conversion overhead. Experimental results demonstrate the effectiveness and efficiency of the proposed LRMS, addressing security concerns and improving the land management process. Sahoo et al. (2023) [8] proposes a novel blockchain-based land records management system addressing issues in traditional land registration. The system involves all stakeholders, considers factors like land classification and disputes, and features automated pricing with payment channels. A prototype on Ethereum with ReactJS interface is presented, and

experimental evaluation using Hyperledger Caliper demonstrates feasibility, efficiency, and performance metrics. Junaid et al. (2023) [3] explores the critical role of land registration systems in revenue departments and highlights the vulnerabilities of paper-based, centralized land records, including forgery and corruption. It discusses the potential of Blockchain technology to address these issues, prevent anomalies, and enhance security in land administration. The paper provides comparisons of existing solutions, identifies challenges, and outlines future directions for Blockchain-enabled land management systems.

Proposed Solution

The Land Record Management System proposes a revolutionary approach using Hyperledger Fabric, a private and permissioned blockchain, to transform land transactions. With government bodies, banks, legal entities, and notaries as key stakeholders, the system emphasizes efficiency, transparency, and security. Hyperledger Fabric's controlled environment ensures authorized access and safeguards land information, guaranteeing integrity through cryptographic techniques. Government organizations lead in recording land data, while banks offer a secure platform for property financing. Legal bodies validate transactions using smart contracts, reducing fraud risks, and notaries digitally endorse documents for authenticity. User-friendly interfaces streamline access for officials, bankers, legal professionals, and notaries, reducing paperwork and promoting efficiency. This comprehensive solution addresses traditional land management challenges, combating fraud, enhancing transparency, and automating processes for a secure, transparent, and efficient ecosystem.

Hyperledger Fabric serves as the backbone of our blockchain implementation, offering an open-source framework tailored for enterprise-level applications. Governed by the Linux Foundation, it emphasizes privacy, flexibility, and security. The framework supports permissioned networks, allowing selective participation and ensuring confidentiality. Notable features include a pluggable consensus mechanism, customizable for diverse use cases, and smart contracts, referred to as chaincode, enabling the automation of intricate business logic.

Conclusion

In conclusion, our Hyperledger Fabric-based blockchain solution for land transactions offers a transformative alternative to the conventional system. By decentralizing the title registry, employing smart contracts, ensuring secure identity verification, and introducing features like land sharing, our system aims to streamline property transactions, mitigating delays and enhancing transparency. With the Government and Individuals as key stakeholders, this innovative approach eliminates intermediaries, reducing the risk of fraud. The decentralized nature of the system ensures a more efficient and trustworthy process. Overall, our project seeks to address the existing challenges, bringing about a secure, transparent, and simplified landscape for land transactions.

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