International Journal of Scientific Research and Engineering Development-– Volume 9 Issue 3, May-June 2026
Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

Design and Implementation of a Tamper-Resistant Land Registry System Using Blockchain Technology

Rushika N. Jais*, Prof. Virendra P. Yadav**
*(Department of Computer Science and Engineering, Priyadarshini College of Engineering, Nagpur
Email: rushikajais27@gmail.com)
** (Department of Computer Science and Engineering, Priyadarshini College of Engineering, Nagpur
Email: rushikajais05@gmail.com)

----------**********----------

Abstract:

This study proposes the design and implementation of a tamper-resistant land registry system using blockchain technology. Traditional land record management systems are highly centralized, paper-based, and vulnerable to fraud, manipulation, and data loss. To overcome these limitations, the proposed system leverages blockchain's decentralized architecture, cryptographic hashing, and immutability to ensure secure and transparent storage of land ownership records. Each land transaction is recorded as a block containing owner details, land information, timestamp, and a cryptographic hash linked to the previous block, ensuring integrity and traceability.

The system is implemented using a lightweight blockchain model integrated with a web-based interface developed using Flask and front-end technologies. Smart contract logic is used to validate transactions before adding them to the ledger. The proposed architecture eliminates dependency on centralized authorities, reduces corruption risks, and enhances trust among stakeholders. Experimental results demonstrate that blockchain-based land registry systems significantly improve data security, transparency, and auditability compared to conventional systems.

Keywords —**Blockchain, Land Registry, SHA-256, Tamper-Proof System, Web-Based Application, Data Integrity.**

----------**********----------

I. INTRODUCTION

Land record management plays a crucial role in maintaining legal ownership, supporting economic transactions, and ensuring administrative transparency. Despite its importance, many existing land registry systems continue to rely on conventional approaches that involve centralized control and manual documentation. Such systems often suffer from inefficiencies, delays in verification, and increased dependency on intermediaries, which reduces overall reliability and trust among stakeholders.

Access to land records in conventional systems is often restricted or inefficient, making independent verification difficult. In many situations, stakeholders must rely on intermediaries to confirm ownership details, which increases both time and uncertainty. This limited visibility creates opportunities for issues such as overlapping claims, record inconsistencies, and unauthorized changes, ultimately leading to disputes and legal complications.

Although digitization has improved certain aspects of land record management, centralized digital systems still face several security challenges. These include risks of cyber-attacks, data breaches, and system failures. Since data is stored in a single controlled environment, any compromise can affect the entire system. Therefore, simply digitizing records is not sufficient; a more secure and reliable solution is required.

Blockchain technology introduces a decentralized framework that enhances data integrity and transparency. By storing records in a distributed

ledger and linking them through cryptographic hashing, blockchain ensures that once data is recorded, it cannot be altered without detection. This characteristic makes it highly suitable for applications where trust and security are essential.

This work focuses on building a practical blockchain-based system that prioritizes simplicity and usability while maintaining data security. Unlike approaches that integrate multiple advanced components, the proposed model demonstrates that a streamlined implementation can still achieve reliable and tamper-resistant land record management.

II. NEED OF THE STUDY

The increasing number of land disputes and fraudulent activities in property transactions highlights the need for a secure and transparent system. In traditional setups, records are stored in centralized databases or physical documents, which are vulnerable to tampering, loss, and unauthorized modifications.

Moreover, manual verification processes are time-consuming and inefficient. There is a strong requirement for a system that ensures real-time verification, immutable record storage, and transparent access to land ownership data. Blockchain technology provides a reliable solution by ensuring that once data is recorded, it cannot be altered without consensus from the network participants. This study is essential to demonstrate how blockchain can modernize land registry systems, improve governance efficiency, and reduce corruption in property management systems.

A. Related Work

The use of blockchain in land registry systems has been widely explored in academic research, with numerous studies highlighting its potential to improve transparency and security. Early works primarily focused on the theoretical advantages of blockchain, emphasizing its decentralized nature and resistance to tampering. These studies laid the foundation for understanding how blockchain can be applied to property management systems.

Several researchers have proposed the use of smart contracts to automate land transactions. Smart contracts enable predefined conditions to be executed automatically, reducing the need for manual intervention. While these approaches enhance efficiency, they often introduce complexity and require advanced technical knowledge for implementation. As a result, their adoption in real-world scenarios remains limited.

Other studies have explored multi-layered architectures that integrate blockchain with existing government systems. These models aim to create a hybrid approach that combines the benefits of decentralization with the reliability of traditional databases. However, such systems often face challenges related to interoperability and scalability.

A major limitation in existing research is the lack of emphasis on user interaction and system usability. Many proposed models are complex and difficult to understand for non-technical users. This creates a barrier to adoption, particularly in regions where technical expertise is limited. Additionally, issues such as data retrieval efficiency and system performance are not adequately addressed.

In contrast to existing studies, this work emphasizes a minimal and implementation-oriented approach that reduces system complexity while preserving essential security features. The focus is on demonstrating how a straightforward design can still achieve dependable performance, making the solution more suitable for practical deployment, especially in resource-constrained environments

III. SYSTEM ARCHITECTURE AND METHODOLOGY

The proposed model follows a layered design that organizes system functionality into distinct components, allowing better control over data flow and processing. This structured approach simplifies development and ensures that each part of the system contributes to maintaining consistency, usability, and reliability.

B. Data input layer

The data input layer is responsible for capturing user information, including owner details and land attributes. This data is validated to ensure accuracy and completeness before being processed further. Proper validation mechanisms help in preventing incorrect or incomplete data from entering the system.

C. Blockchain layer

The blockchain layer forms the core of the system, where validated data is converted into blocks. Each block contains transaction details, a timestamp, a hash value, and the hash of the previous block. This structure ensures that all blocks are interconnected, forming a continuous chain that maintains data integrity.

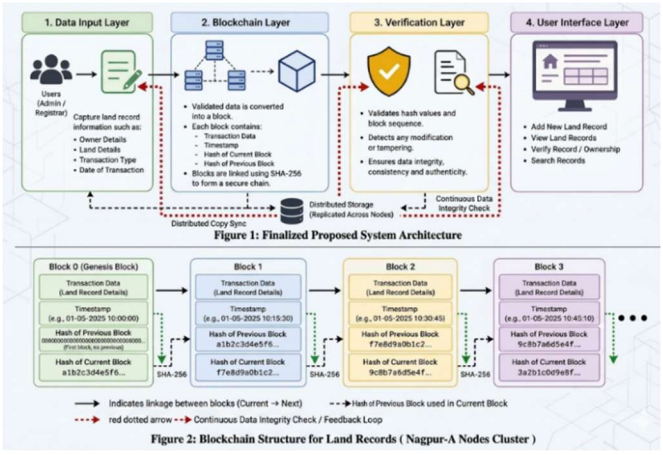

Fig. 1. Blockchain-Based Land Registry System Architecture

D. Verification layer

The verification layer plays a crucial role in maintaining the reliability of the system. It continuously checks the blockchain for inconsistencies by validating hash values and block sequences. Any attempt to modify a block results in a mismatch, which is immediately detected by the system.

E. User interface layer

The user interface layer provides an accessible platform for interaction. It allows users to add new records, view existing ones, and verify ownership details. The integration of these layers ensures that the system achieves a balance between security, performance, and usability.

F. Implementation Details

The implementation of the proposed system involves the integration of frontend and backend technologies to create a functional application. The frontend is developed using HTML and CSS, providing a simple and intuitive interface for users. The design focuses on usability, ensuring that users can easily interact with the system without requiring technical expertise.

The backend is implemented using Python, which handles the core blockchain operations. Python is chosen due to its simplicity and strong support for cryptographic functions. The system includes modules for block creation, hashing, and chain validation, ensuring that all operations are performed securely.

Flask is used as the web framework to connect the frontend with backend processes. It manages user requests and ensures smooth communication between different components. When a user submits data, it is processed by the backend and converted into a block.

Each block is hashed using the SHA-256 algorithm, generating a unique identifier that ensures data integrity. The block is then linked to the previous block, forming a continuous chain. This process ensures that all records are securely stored and cannot be modified without detection.

The system maintains a complete blockchain that can be verified at any time. This implementation demonstrates how blockchain technology can be effectively integrated into a real-world application while maintaining simplicity and efficiency.

G. Security Mechanism

Security is a fundamental aspect of the proposed system, achieved through the use of cryptographic techniques and blockchain principles. The SHA-256 hashing algorithm is used to generate a unique hash for each block, ensuring that even minor changes in data result in a completely different hash value.

The chaining mechanism further enhances security by linking each block to the previous one.

This creates a dependency between blocks, ensuring that any modification in one block affects all subsequent blocks. As a result, tampering becomes highly impractical.

The system also includes a verification process that continuously checks the integrity of the blockchain. By validating hash sequences, the system can detect inconsistencies and prevent unauthorized modifications. This ensures that the data remains reliable and trustworthy. Decentralization is another key feature that enhances security. By distributing data across multiple nodes, the system eliminates single points of failure and reduces the risk of data loss or targeted attacks.

These combined mechanisms create a dependable framework where data integrity is continuously maintained, and any inconsistency is immediately noticeable. This layered protection approach strengthens confidence in the system's ability to preserve accurate and untampered records over time.

H. Results and Discussion

The developed system illustrates how blockchain can be applied to improve the handling of land records in a secure and transparent manner. By maintaining a linked sequence of blocks, the system ensures that all stored information remains consistent and verifiable over time.

One of the key findings is the system's ability to prevent unauthorized data modification. Any attempt to alter a record results in a mismatch in hash values, making tampering easily detectable. This significantly reduces the risk of fraud. The web-based interface enhances user experience by providing a simple platform for data entry and verification. Users can quickly access and verify land records, reducing the need for manual processes and improving efficiency.

The system also improves transparency by providing a clear record of all transactions. This helps in reducing disputes and increasing trust among stakeholders. Even though the current implementation represents a prototype model, it effectively illustrates how such a system can function in a real environment. The observations suggest that the approach can be extended and adapted for broader use with appropriate enhancements.

IV. CONCLUSIONS

This paper presents a blockchain-based land registry system designed to improve security, transparency, and efficiency in land record management. By using SHA-256 cryptographic hashing and blockchain chaining, the system ensures that records remain tamper-resistant and verifiable.

The implementation shows that even a simplified blockchain model can significantly enhance the reliability of land record systems. The system reduces dependency on centralized authorities and improves trust in data handling.

Future enhancements may include large-scale deployment, integration with government databases, and optimization for handling higher transaction volumes. The study highlights blockchain as a practical solution for modern land registry challenges.

ACKNOWLEDGMENT

The authors sincerely thank the Department of Computer Science and Engineering, Priyadarshini College of Engineering, Nagpur, for providing necessary support and facilities. We are especially grateful to Prof. Virendra P. Yadav for his guidance and valuable suggestions throughout this work

REFERENCES

[1] Nakamoto, S. 2008. Bitcoin: A peer-to-peer electronic cash system.
[2] Pilkington, M. 2016. Blockchain technology: Principles and applications. In Research Handbook on Digital Transformations, edited by E. G. Carayannis. Cheltenham, U.K.: Edward Elgar, pp. 225–253.
[3] Zheng, Y., Xie, S., Dai, H., Chen, X., and Wang, H. 2017. An overview of blockchain technology: Architecture, consensus, and future trends. In Proc. IEEE International Congress on Big Data, Honolulu, USA, pp. 557–564.
[4] Konashevych, O. 2020. Constraints and benefits of the blockchain use for real estate and property rights. arXiv preprint.
[5] Shuaib, A., Kaleem, A., and Javaid, N. 2021. Blockchain-based secure framework for land registry system. IEEE Access, 9.
[6] Shahariar, M. S., Islam, K., and Rahman, M. 2023. Blockchain-based land registry system: A secure approach. arXiv preprint.
[7] Biswas, K., and Muthukkumarasamy, V. 2016. Securing smart cities using blockchain technology. In Proc. IEEE International Conference on Smart Cities, pp. 1–7.

[8] Crosby, M., Pattanayak, P., Verma, S., and Kalyanaraman, V. 2016. Blockchain technology: Beyond bitcoin. Applied Innovation Review, 2: 6–19.

[9] Dorri, A., Kanhere, S. S., and Jurdak, R. 2016. Blockchain in internet of things: Challenges and solutions. arXiv preprint.

[10] Underwood, S. 2016. Blockchain beyond bitcoin. Communications of the ACM, 59(11): 15–17.

