(REVIEW ARTICLE)

Advancements in blockchain technology for real estate transactions

Manomurthy S *, Subrahmanya K S and Tejas H N and Vinay K

Department of MCA, SJB Institute of Technology, Bangalore -60.

Abstract

Real estate transactions are notorious for their inefficiencies, lack of transparency, and susceptibility to fraud. Recent strides in blockchain technology present promising remedies for these long-standing issues. This paper provides a thorough examination of three innovative approaches to applying blockchain in real estate transactions. The methodologies explored encompass a decentralized approach using private blockchain, a permissioned blockchain-based solution for document processing, and a real estate transaction platform built on blockchain technology. Each approach is scrutinized for its methodologies, advantages, disadvantages, and potential applications. This review underscores the transformative potential of blockchain in streamlining real estate transactions, fostering transparency, and curbing fraud within the industry.

1. Introduction

Blockchain is a shared digital system where computers across a network securely record and verify transactions. At its core, blockchain operates on principles of transparency, immutability, decentralization, cryptographic security, and consensus mechanisms. Each transaction is kept in a block, connected to previous ones, creating a linked digital chain. hence the term "blockchain". This structure ensures that past records can't be altered without affecting the entire chain., making a data stored in blockchain will be immutable. As a decentralized system, blockchain has no single control point, making it resistant to hacks or changes. Additionally, : It relies on security methods and agreement systems to keep the data safe and trustworthy, ensuring of integrity and trustworthiness of a ledger. With its cryptographic security features, blockchain provides an high level data protection, safeguard sensitive information through un authorization of access or manipulation. Beyond its original application in the cryptocurrencies like Bitcoins, the blockchain technology has emerged as disruptive forces with a far-reaching implication across through various industrie, which including finance, health care, and real estate. Use the enter key to start a new paragraph. The appropriate spacing and indent are automatically applied.

1.1. Real Estate Transactions

- Real estate transactions play an major role in the global economy, encompassing the buying, selling, leasing, and financing of properties. These transactions involve complex processes, including property search, negotiation, contract drafting, due diligence, title verification, and closing. The real estate market is characterised by large sums of money, multiple parties, legal complexities, and lengthy transaction times. Traditional real estate Trade activities are usually inefficient, opaque, and susceptible to fraudulent practices, leading to delays, disputes, and increased costs. Inefficiencies in the process can arise from manual paperwork, redundant intermediaries, legacy systems, and disparate data sources. Moreover, the lack of transparency in

* Corresponding author: Manomurthy S

property transactions can undermine trust between buyers, sellers, and intermediaries, hindering market liquidity and efficiency. Given the significant financial and legal implications involved in real estate transactions .The Blockchain technology will hold immense promise in revolutionising real estate transactions by providing transparent , security , and effective platform for recording, verifying, and executing property transactions

- Revolutionizing Real Estate with Decentralized Blockchain Transactions: The proposed methodology aims to transform real estate transactions by adopting a decentralized approach leveraging blockchain technology. This system utilizes blockchain as the underlying infrastructure to record and manage transactions, ensuring cryptographic security, transparency, immutability, and decentralization through a distributed ledger. This allows for direct peer-to-peer transactions, reduce the need for middle man like brokers and escrow agents, thereby streamlining processes and reducing costs. The inherent transparency of blockchain provides all participants with visibility into transaction history, fostering trust and mitigating fraud. Furthermore, several things are automated by smart contract transactions, from execution to payment settlements, enhancing efficiency and ensuring timely completion.
- This decentralized model stands in stark contrast to traditional centralized approaches, which suffer from intermediary dependence, opaque processes, a higher risk of fraud and disputes due to vulnerability to tampering, and inefficiencies stemming from reliance on legacy systems and manual paperwork.
- The advantages of the decentralized approach are significant: enhanced transparency and accountability, improved security through cryptographic mechanisms, the elimination of intermediaries to reduce costs, the creation of an immutable audit trail for compliance and due diligence, and efficient settlements through smart contract automation. Ultimately, this methodology promises a more secure, transparent, efficient, and cost-effective.

1.2. Advantages of the Decentralized Approach

- Enhanced Transparency: By recording transactions on distributed ledger can be visible for all network participants, the decentralized approach promotes transparency and accountability, reducing risk of fraud activities and disputes.
- Improved Security: The cryptographic security mechanisms Built into blockchain systems to protect the accuracy of data integrity and confidentiality of transaction data, safeguarding it against non-authorized access.
- Elimination of Intermediaries: Decentralization Removes the involvement of middlemen, such as brokers and escrow agents, streamlining the transaction procedure and reducing associated costs.
- Immutable Audit Trail: Transactions recorded through blockchain create an immutable audit trail of property ownership and transaction history, facilitating regulatory compliance and due diligence.
- Efficient Settlements: Smart contracts coded on the blockchain, automate and streamline the settlement process, reduces the time and complexity of real estate transactions Comparative Table: Blockchain Approaches on Real Estate Transactions

2. Proposed Methodology

The proposed methodology for revolutionizing real estate transactions involves the adoption of a decentralized approach leveraging blockchain technology. In this methodology, Due to its distributed and leaderless design it is harnessed to address inefficiencies, lack of transparency, and susceptibility to fraud inherent in traditional real estate transaction processes..

- Intermediary Dependence: In traditional centralized real estate transactions, intermediaries such as brokers, agents, and escrow companies play a central role in facilitating transactions. These intermediaries oversee various aspects of the transaction process, including property listings, negotiations, and contract execution.
- Opaque Transaction Processes: Centralized real estate transactions often lack transparency, as transaction records and processes are controlled by centralized platforms. Participants may have less visibility to the transaction history or may need to rely on intermediaries for information.
- Risk of Fraud and Disputes: Centralized systems are susceptible to fraud, manipulation, and disputes, as transaction records may be vulnerable to tampering or unauthorized access. Participants may face challenges in verifying the authenticity of information and ensure the durability of transactions.
- Legacy Systems and Inefficiencies: Traditional centralized real estate transactions may rely on legacy systems, manual paperwork, and redundant processes, leading to inefficiencies, delays, and increased costs. These legacy systems may hinder innovation and limit the adoption of new technologies to streamline transactions

3. Blockchain Approaches on Real Estate Transactions

3.1. Innovative and Secure Decentralized Approach to Real Estate Transactions

- Hyperledger Fabric: Hyperledger Fabric is a permissioned blockchain framework that allows organizations to build private, consortium, or public blockchains for different use cases, which including real estate transactions. It provides features such as permissioned access, high scalability, and modular architecture, making it suitable for enterprise-grade applications. In the context of real estate transactions, Hyperledger Fabric make sure that only Approved user can access and confirm transactions to improve security and privacy.
- BigchainDB: BigchainDB is a blockchain database designed for storing and managing large volumes of data. It combines the benefits of traditional distributed databases with blockchain technology, offering features like immutability, decentralization, and high throughput. In the context of realestate transactions, BigchainDB provides a scalable and efficient platform for recording property ownership, transaction history, and other relevant data on the blockchain, facilitating transparency and auditability.

3.2. Permissioned Blockchain-Based Solution to Document Processing

- Implementation of permissioned blockchain technology: This methodology involves the deployment of a permissioned blockchain network specifically tailored for real estate document processing. Permissioned blockchains restrict access to transaction verification and data management functions to authorized participants, ensuring privacy and regulatory compliance. By leveraging permissioned blockchain technology, this solution enables secure and transparent document processing in the real estate industry.
- Development of algorithms for property registration, mortgage registration, and mortgage release: To automate and streamline real estate document processing, particular algorithms which developed to property registration, mortgage registration, and mortgage release. These algorithms define the rules and procedures for validating and recording transactions related to property ownership, mortgage agreements, and lien releases. By standardizing and automating these processes, the solution enhances efficiency, reduces errors, and minimizes a need to manual intervention.
- Utilization of IPFS for document storage: The Interplanetary File System (IPFS) is used for decentralized and distribute file storage. In this methodology, IPFS is leveraged to store real estate documents securely and immutably on several network of nodes. By storing documents on IPFS, the solution ensures data integrity, availability, and resilience to censorship or data loss. Additionally, IPFS enables efficient retrieval and sharing of documents among stakeholders involved in the real estate transactions.

3.3. Exploration of Blockchain-Based Property Transaction Platforms

- Including the Proof of Elapsed Time (PoET) Mechanism: A consensus algorithm called the Proof of Elapsed Time (PoET) mechanism was created to accomplish distributed consensus in blockchain networks. PoET uses a trusted execution environment (TEE) to guarantee equitable and effective block validation. to select block validators randomly based on a predetermined waiting period. By incorporating the PoET mechanism, the real estate transaction platform ensures that transactions are validated securely and fairly, without the need for expensive computational resources.
- The algorithm known as Practical Byzantine Fault Tolerance (PBFT): A consensus method for achieving Byzantine fault tolerance in distributed systems is the Practical Byzantine Fault Tolerance (PBFT) algorithm.. PBFT enables the real estate transaction platform to tolerate Byzantine faults, such as malicious nodes or network partitions, while maintaining consensus among honest nodes. By implementing PBFT, the platform ensures the reliability and uniformity of transaction records, even with the presence of adversarial behaviour.
- P2P Protocol: Peer-to-peer (P2P) protocol is used to establish Information sharing among network node in a decentralized network. In the background of the real estate transaction platform, P2P protocol facilitates direct interaction between buyers and sellers without the need for middlemen. By enabling peer-to-peer transactions, the platform reduces transaction costs, eliminates delays, and enhances transparency in real estate transactions.
- Hyperledger Fabric: Hyperledger Fabric is a permissioned blockchain framework that provides a modular and scalable infrastructure for building enterprise-grade applications. In the context of the real estate transaction platform, Hyperledger Fabric serves as the underlying blockchain technology, offering features such as permissioned access, smart contracts, and privacy-enhancing techniques. By leveraging Hyperledger Fabric, the platform ensures the security, scalability, and efficiency of real estate transactions while adhering to legal mandatesand industry standards.

The decentralized method was selected over alternative methodologies for following reasons.

- The decentralized approach makes use of blockchain technology, which inherently aligns with the fundamental ideas of security and transparency, and decentralization. By utilizing blockchain, this approach aims to address the inefficiencies, lack of transparency, and susceptibility to fraud common in conventional real estate transactions.
- The decentralized approach has a number of benefits over other methodologies, such as permissioned blockchain solutions or centralized systems. By doing away with the necessity for middlemen and central authorities, the decentralized approach promotes transparency and accountability, lowers the possibility of fraud, and streamlines the transaction process. Additionally, blockchain's cryptographic security mechanisms ensure the reliability and confidentiality of transaction data, safeguarding it against illegal access and tampering

4. Challenges in implementing blockchain in real estate transactions

- Regulatory Compliance: Adhering to existing regulations and navigating legal frameworks presents a significant challenge in implementing Blockchain technology in real estate transactions. Real estate regulations vary across jurisdictions and may change over time, necessitating careful consideration and adaptation of blockchain ways to guarantee compliance with local laws and regulatory requirements.
- Interoperability: Getting various blockchain platforms to work together and legacy systems used in real estate transactions is essential for a smooth integration and data exchange. However, Combining blockchain technology with current systems and ensuring compatibility can be complex and requires standardized protocols, robust communication channels, and collaborative efforts among stakeholders.
- Scalability: Real estate markets involve a large volume of transactions, ranging from property sales and purchases to lease agreements and property management tasks. Scaling blockchain networks to handle the transactional volume of real estate markets while maintaining decentralization, security, and performance is a significant technical challenge. Solutions such as sharding, layer 2 scaling solutions, and Research is being done on optimized consensus algorithms to addressscalability issues.
- Privacy Concerns: While blockchain offers transparency and immutability, there are worries about the privacy of sensitive real estate data. Balancing the transparency benefits of blockchain with the need to protect personal and confidential information poses a challenge. Implementing privacy-enhancing technologies such as zero-knowledge proofs, data encryption, or private transactions is essential to gather these concerns and Ensure adherence with privacy regulations.
- Adoption Hurdles: Encouraging adoption a blockchain technology among stakeholders in the field of real estate requires overcoming various hurdles. These include educating purchasers, vendors, and real estate brokers, and regulatory bodies about blockchain's benefits, addressing concerns about security and reliability, and incentivizing adoption through tangible benefits such as cost savings, efficiency gains, and improved transparency. Building trust and confidence in blockchain solutions through pilot projects, industry partnerships, and regulatory endorsements can help overcome adoption barriers.

5. Case studies

Propy: Propy stands as a pioneering platform within the real estate industry, harnessing the blockchain technology's power to revolutionize property transactions. With the utilization of a smart contract, Propy facilitates seamless transactions by automating and executing contractual agreements in a transparent and safe manner. By keeping track of these transactions on the Ethereum blockchain, Propy ensures that all property dealings are securely documented, immutable, and transparent, mitigating the risks of fraud and enhancing trust between parties involved. The platform's adoption of Blockchain technology is not just streamlines cross-border property transactions, but additionally presents a new level of transparency and efficiency to the real estate market. Through Propy, users gain access to a global marketplace where they can confidently buy, sell, or invest in properties, regardless of geographical boundaries. Moreover, by leveraging blockchain's inherent security features, such as decentralized storage and cryptographic hashing, Propy offers users unparalleled security and assurance, thereby revolutionizing the way real estate transactions are conducted on a global scale.

Harbor: Harbor becomes a force for change in the real estate industry by introducing a blockchain platform that facilitates the Real estate tokenization assets. Through this innovative approach, Harbor enables investors to purchase and trade fractional ownership of properties, breaking down traditional barriers to entry and democratizing access to real estate investment opportunities. By tokenizing real estate assets, Harbor aims to increase liquidity in the market,

as investors can now easily buy and sell fractions of properties, thereby unlocking a new level of flexibility and agility in real estate investment. The platform's core functionality resides in its capacity to offer a safe and transparent environment for digitizing and trading real estate assets on the blockchain. By leveraging blockchain technology, Harbor ensures that property ownership is accurately represented through digital tokens, with ownership records securely stored and transactions transparently recorded through blockchain. This improves security in addition of integrity of real estate transactions but also fosters trust and confidence among investors. Additionally, by reducing the dependency on intermediaries and streamlining the investment process, Harbor significantly enhances liquidity and availability in the real estate market, clearing the path for a more inclusive and efficient investment landscape.

Ubitquity: Ubitquity emerges as a pioneering solution within the real estate industry by leveraging blockchain technology to revolutionize record-keeping and title management. Through its platform, Ubitquity facilitates the recording of property ownership and transfer information on the blockchain, effectively streamlining title searches and enhancing the efficiency of real estate transactions. By securely storing this data in the blockchain, Ubitquity reduce the risk in fraud and manipulation, providing a auditable and impenetrable record of property ownership that instills trust and confidence among stakeholders. The platform's implementation of blockchain-based title management provides a transparent and safe way to manage real estate records, thereby enhancing transparency and decreases the likelihood of disputes in real estate transactions. Ubitquity's approach not only simplifies the progress of verifying property ownership but also guarantees the immutability of transaction records.and easily accessible, facilitating smoother and more efficient real estate transactions. By providing a reliable and trustworthy system for recording and managing property titles, Ubitquity contributes to the overall integrity and stability of the real estate industry, fostering a more transparent and safe environment for property transactions.

6. Conclusion

The methodologies explored through this paper represent significant strides in utilizing blockchain technology to address longstanding challenges in the real estate transactions. By adopting decentralized approaches, permissioned blockchain solutions, and blockchain-based transaction platforms, the real estate industry stands to benefit from increased transparency, efficiency, and security in its operations. The decentralized approach harnesses the core principles of the blockchain, as transparency, cryptographic security, and decentralization, to expedite real estate transactions. By eliminating intermediaries, enhancing transparency, and automating settlement processes through smart contracts, this approach offers a promising solution to inefficiencies and fraud in the real estate market. Similarly, the permissioned blockchain-based solution focuses on document processing in real estate transactions, aiming to ensure transparency, record integrity, and trust. By leveraging blockchain technology for property registration, mortgage management, and document storage, this approach reduces this need

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be dislcsoed.

References

[1]   Langaliya, V., Gohil, J.A. Innovative and secure decentralized approach

[2]   to process real estate transactions by utilizing private blockchain. Discov Internet Things 3, 14 (2023). https://doi.org/10.1007/s43926-023-00041-6 2. Langaliya, V., Gohil, J.A. (2022). Permissioned Blockchain-Based Solution to Document Processing in the Real Estate Industry. In: Rajagopal, S., Faruki, P., Popat, K. (eds) Advancements in Smart Computing and Information Security. ASCIS 2022. Communications in Computer and Information Science, vol 1760. Springer, Cham. https://doi.org/10.1007/978-3-031-23095-0_16

[3]   Yang, Liwen & Wang, Jiehua. (2020). Research on Real Estate Transaction Platform Based on Blockchain Technology. Journal of Physics: Conference Series. 1486. 072074. 10.1088/1742- 6596/1486/7/072074.

[4]   Karamitsos, I., Papadaki, M., Al Barghuthi, N.B.: Design of the blockchain smart contract: a use case for real estate. J. Inf. Secur. 09(03), 177–190 (2018). https://doi.org/10.4236/jis.2018.93013

[5]   Ullah, F., Al-Turjman, F.: A conceptual framework for blockchain smart contract adoption to manage real estate deals in smart cities. Neural Comput. Appl. 1–22 (2021). https://doi.org/10.1007/s00521-021-05800-6

[6] Thakur, V., Doja, M.N., Dwivedi, Y.K., Ahmad, T., Khadanga, G.: Land records on blockchain for implementation of Land Titling in India. Int. J. Inf. Manage. 52, 1 (2020). https://doi.org/10.1016/j.ijinfomgt.2019.04.013

[7] Ali, T., Nadeem, A., Alzahrani, A., Jan, S.: A transparent and trusted property registration system on permissioned blockchain. In: 2019 International Conference on Advances in the Emerging Computing Technologies (AECT), pp. 1-6 (2020). IEEE.https://doi.org/10.1109/AECT47998.2020.9194222

[8] Xu, J., et al.: Healthchain: a blockchain-based privacy preserving scheme for large-scale health data. IEEE Internet Things J. 6(5), 8770–8781 (2019). https://doi.org/10.1109/JIOT.2019.2923525

[9] Sun, J., Yao, X., Wang, S., Wu, Y.: Blockchain-based secure storage and access scheme for electronic medical records in IPFS. IEEE Access 8, 59389–59401 (2020). https://doi.org/10.1109/ACCESS.2020.2982964

[10] Bennett, R., Miller, T., Pickering, M., Kara, A.K.: Hybrid approaches for smart contracts in land administration: lessons from three blockchain proofs- of-concept. Land 10(2), 1–23 (2021). https://doi.org/10.3390/land10020220 vol. 24, no. 2, pp. 379–393, Jun. 2015, doi: 10.1080/10618600.2014.901225.