

Survey Paper

Blockchain Technology in Real Estate: Applications, Challenges, and Future Prospects

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Abstract: Blockchain technology has emerged as a transformative force across various industries, including agriculture, education, healthcare, information technology (IT), and notably, real estate. Within the real estate sector, there is a discernible shift away from traditional paper-based processes towards digitalization. Blockchain technology has ushered in a new era by ensuring secure record-keeping and facilitating safe transactions. However, real estate investment has faced persistent challenges related to liquidity and global accessibility, factors that have constrained the expansion of its investor base. Nonetheless, stakeholders such as real estate investors and property owners have expressed satisfaction with the current state of affairs. This paper focuses on the specific impact of blockchain technology on the real estate sector and provide insights into the integration of cryptocurrencies within this industry. It also explores the global implications of blockchain technology in real estate, shedding light on the intricate relationship and interaction between blockchain and the real estate domain. In contemporary society, technology has seamlessly woven itself into the fabric of our daily lives, with blockchain standing out as a technological revolution. This innovation brings heightened security, precision, and efficiency to various frameworks. Functioning as a distributed network database, blockchain securely stores transaction data, primarily involving cryptocurrencies, with data maintenance distributed across interconnected computers to prevent manipulation. Transactions are organized into immutable blocks that are securely linked together, giving rise to the term "blockchain." Notably, these blocks house data that extends beyond financial transactions, encompassing an array of valuable information. This paper aims to delve into the applications of blockchain in real estate, travel, and education systems while offering a balanced analysis of its advantages and disadvantages. Additionally, it identifies both major and minor challenges facing blockchain technology, paving the way for a comprehensive understanding of its potential impact on the real estate industry's future.

Keywords: Blockchain technology, real estate, cryptocurrencies, digitalization, secure transactions

1. Introduction

Blockchain technology, often hailed as one of the most secure options available for various industries, has made profound inroads into the world of real estate. This innovative technology represents a distributed database, serving as the repository for records and histories of all transactions and digital events executed within its purview, and these records are shared among all involved parties. At its core, blockchain ensures the verification of every transaction within the public domain through consensus among a majority of participants in the system, introducing an unparalleled level of trust and transparency into the real estate sector. The foundation of this technology lies in its organization of data into blocks, with each block

functioning as an independent node. This decentralized structure fosters an unparalleled degree of data transparency, efficiency, and accuracy, making it particularly well-suited for real estate applications, where data integrity and security are paramount.

The term "blockchain" itself underscores its role in managing data as a linked sequence of blocks, with the precise manner of data handling varying depending on the specific application. These blocks are secured through cryptographic techniques, a necessity in an era where safeguarding computer network information is of paramount importance. The use of asymmetric-key cryptography, while highly flexible, poses a drawback in terms of the time required for encryption and decryption.



Addressing this limitation, a novel mechanism known as the "Algorithm of Parallel-key Cryptographic Algorithm (PCA)" has been proposed. PCA accelerates cryptographic processes, fortifying the system against brute force attacks and optimizing the encryption and decryption timelines .

Blockchain's distributed ledger approach ensures the secure and decentralized management of information without the reliance on a centralized authority. The method by which blocks rely on one another is pivotal, as it determines the moderation of information and its susceptibility to modification. Blockchain technology has proven its utility across diverse applications, spanning the banking sector, insurance domains, and supply chain systems. While there are numerous primary applications built upon blockchain, a fundamental characteristic is the distributed nature of data storage. This characteristic, however, can pose a challenge in terms of ensuring that all servers possess essential data. Furthermore, these servers lack specific IP addresses and domains, enhancing their security.

One of the fundamental features of blockchain technology is its resistance to the modification or adaptation of individual data once it has been dispersed across nodes, some of which may be located in different countries . This attribute is particularly advantageous in safeguarding the integrity of data records. If a hacker attempts to make unauthorized changes, the original data remains preserved in all nodes, thwarting any potential manipulation. Beyond real estate, blockchain technology finds application in various industries, including medicine, education, and information technology. However, it assumes particular significance in the realm of real estate due to the high volume of daily transactions and the vulnerability of the sector to fraudulent activities and tampering by malicious actors.

At its essence, blockchain serves as a distributed ledger, leveraging individual computers, or nodes, to manage files and records. These nodes collaborate to share and synchronize the proceedings documented in their respective digital ledgers, effectively eliminating the need for centralized data storage. The core architectural concept of blockchain involves organizing data into blocks, which are then securely chained together in an interconnected manner. Within the blockchain network, nodes are continually connected, and new transactions trigger requests for synchronization or modifications. In this dynamic environment, the ledger receives uploads of modifications and records each new transaction, creating an ongoing chain of interconnected data. In the realm of real estate, this technology not only ensures interconnectivity but also guards against misuse by allowing the detection and correction of any unauthorized modifications while preserving the sanctity of the original data.

2. Survey on block chain technology in Real Estate:

The inception of blockchain technology can be traced back to Bitcoin, which pioneered the implementation of a decentralized digital currency, capable of achieving irreversible transactions without reliance on a trusted third

party. This revolutionary concept combines elements such as hash-based work, public key cryptography, peer-to-peer networks, and public key cryptography. Initially designed to address the issue of double-spending in electronic money without the need for a trusted intermediary, blockchain technology has found applications in diverse fields. This paper aims to present an overview of blockchain concepts, applications, challenges, and potential improvements, referencing relevant literature in the blockchain domain.

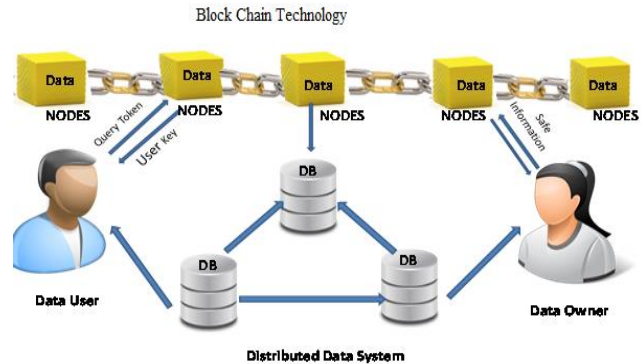


Figure 1 : Using Black Chains Technology

Blockchain, at its core, is a distributed database maintained by a network of interconnected computers or nodes. It functions as a transparent ledger where data is securely shared and synchronized among participants. Some blockchain networks, like open blockchains, operate on decentralized frameworks where server members collectively oversee and validate data updates. This survey highlights a prevailing issue with traditional land registration processes, which are often antiquated and complex, requiring significant time and effort for data changes or property transfers. To address these challenges, the survey explores the concept of online land registration using blockchain technology.

Of particular interest in this survey is the examination of people's perception of blockchain and its relevance to online land registration. Data was collected from 64 respondents, including students and experts from diverse backgrounds. The findings reveal a growing comfort with online technologies for transactions, as online platforms have gained popularity in recent years. Many individuals prefer to store their data online due to the added security and convenience it offers, reducing the risk of losing critical information. This survey also sheds light on how other countries are adopting technology for various purposes, including land registration, emphasizing the potential benefits of blockchain technology in this domain. Moreover, it highlights the increasing adoption of blockchain technology by various companies across different sectors. The survey includes a table listing some of these companies and their tools.

Table 1: Enterprises employing blockchain technology along with the tools they utilize.

S.No	Companies	Tools
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1	Ripple Labs Inc.	Solidity
2	Science Soft	Mist
3	Leeway Hertz	Geth
4	Tec racers	Solc
5	ChromaWay	Remix
6	Open Ledger	Metamask
7	Ezotech	Truffle
8	Lime chain	Ganache
9	Chain	Block chain Tesnet

3. Implementation

Tokenization is a process whereby real estate assets are transformed into digital tokens, allowing them to be traded on virtual platforms. Ownership of a particular token entitles the holder to a share of the underlying asset.

In the real estate industry, each token represents direct ownership of a property. These properties are typically part of a larger portfolio held by a company. With tokenization, all asset transactions can occur digitally, eliminating the need for traditional face-to-face and paper-based processes. Developers can create blockchain applications using dedicated platforms designed for this purpose. These platforms serve as the foundation for building blockchain-based applications.

The primary objective of this process is to secure tangible wealth, which is why it is referred to as "security relics." Similar to safeguarding wealth through its division into multiple shares, tokenization entails breaking down an asset into various segments, each representing a specific portion of the underlying asset.

Tokenization is the process of issuing blockchain tokens, often referred to as security tokens, which digitally and legally represent assets. The emergence of digital transformation has brought significant improvements across various sectors, particularly in the realm of digital payments. However, advancements in payment technology have also introduced notable security risks concerning sensitive customer information. When digital payments are made, data is transmitted through various points, rendering it vulnerable. Consequently, the combination of tokenization with blockchain technology has been widely recognized as a responsible approach to data isolation within ecosystems.

Historically, tokenization has found applications in the payment industry for securely storing credit card information without exposing the original data. Furthermore, the utilization of tokenization within

blockchain technology has garnered attention for its potential to convert both tangible and intangible assets into digital tokens. In the ever-evolving landscape of financial services and the extensive applications thereof, it is challenging to identify an industry that has remained untouched by this technology. The influence of cryptocurrencies on payments and foreign exchange markets has been substantial, with Initial Coin Offerings (ICOs) affecting stock investments, startup funding, and venture capital. Likewise, blockchain technology has made its mark in supply chain management, revolutionizing processes within the food industry.

Utilizing blockchain technology and cryptocurrencies like Bitcoin has facilitated registration processes across international borders. One significant advantage of using cryptocurrencies is the simplified tax situation, making processes more straightforward. However, it is crucial for parties involved in cryptocurrency transactions to have a mutual understanding of the transaction amount to ensure smooth operations.

In recent years, blockchain technology has gained significant momentum owing to its exceptional attributes, notably its stability and neutrality. Industries such as healthcare, development, and information technology have wholeheartedly embraced blockchain for its potential in digital transformation and security enhancement. Likewise, the real estate sector has been steadily progressing toward digitization, leaving behind traditional pen-and-paper processes. In this transformative journey, blockchain technology has emerged as a valuable tool for securely recording and transparently managing real estate records and transactions.

The innovation in data storage facilitated by blockchain holds the promise of simplifying property acquisition, streamlining entrepreneurial ventures, and facilitating publicly funded projects, among other applications. Its primary objective is to instill confidence in the legitimacy of transactions and offer comprehensive solutions for both commercial and residential real estate. This technology empowers individuals to seamlessly purchase their dream homes, rent vacation properties, or acquire land, all within the secure framework of blockchain. The inherent nature of blockchain ensures a tamper-resistant data-keeping system, with its decentralized architecture enabling swift responses to any breaches and bolstering fraud prevention measures.

Blockchain can serve as a shared database for property ownership and acquisition records, catering to the daily needs of consumers and providing up-to-date real estate transaction information. Integrating blockchain technology with existing Multiple Listing Service (MLS) databases can create a highly distributable ledger structure. This empowers real estate agents and arbitrators by offering access to the complete history of a property's commercial transactions, fostering transparency, and enhancing transaction assurance. This chapter underscores how blockchain can be an invaluable tool for real estate business owners and clients, improving the buying and selling process, instilling confidence in transactions, and expanding service availability to consumers without unnecessary delays.

4. Characteristics of block chain technology

Blockchain technology has ushered in a new era of flexibility, particularly within the real estate sector. Traditional registration processes in government offices have long suffered from sluggish servers and the sheer volume of data held across multiple municipalities. This inefficiency has led to significant delays, especially with the daily influx of thousands of registrations. To address this issue, blockchain technology emerges as a transformative solution. In blockchain, the ledger plays a pivotal role; it consists of a network of computers called nodes. In this system, all the data that was once scattered across servers is consolidated within the ledger. Each node retains original data, facilitating rapid and efficient processing.

Blockchain technology functions as an integrated and systematic chain of blocks, housing transaction history and various user data. It operates on the principle of a segregated, distributed digital ledger, enabling secure transactions that gain unanimous approval from network users in a transparent environment. This technology has gained popularity through the use of digital cryptocurrencies. However, while blockchain presents promising prospects for the internet banking system, it remains susceptible to various security and privacy issues. This paper delves into blockchain technology, its applications, and the associated security concerns, shedding light on the interests of blockchain enthusiasts and researchers.

Investments, including those in the real estate (RE) sector, come with their own set of advantages and disadvantages. Real estate investors, in particular, leverage various strategies to maximize profits. Initiating investments can be challenging, as they often involve abstract concepts and complex analyses that can be hard to grasp. Municipalities have distinct data management methods, each with its comprehensive assessment criteria. Blockchain introduces transparency, offering a clear view of public data updates made by municipalities, eliminating corruption and data tampering concerns.

When the public seeks authentic information, blockchain provides a convenient and secure avenue. In the RE market, blockchain serves as a transparent means to access original data. While using national currencies for RE transactions is commonplace, the adoption of cryptocurrencies like Bitcoin poses security risks, making it susceptible to misuse and fraud by hackers. Cryptocurrency exchange values, such as Bitcoin, fluctuate daily based on market dynamics, posing a challenge for buyers who may experience either gains or losses. To mitigate this issue, buyers can opt to pay a token amount as a percentage of the purchase price when using cryptocurrency for transactions.

The chart above illustrates the global adoption of blockchain technology across various sectors, including agriculture, real estate, education, and healthcare. The paper employs a range of methodologies to implement blockchain technology effectively.

4.1 Enhanced Liquidity

In contrast to traditional real estate transactions, which can be notoriously slow, cryptocurrencies and tokens offer a remarkable level of liquidity. These digital assets can be readily exchanged for fiat currency through cryptocurrency

exchanges, making real estate more marketable. Sellers can derive value from their property without waiting for a buyer interested in acquiring the entire asset.

4.2 Fractional Ownership Simplified

Blockchain technology has dismantled barriers to fractional ownership in real estate. Traditionally, substantial upfront cash was necessary to purchase real estate, making investment challenging. With blockchain, investors can pool their resources to acquire higher-value properties. Utilizing a blockchain platform, investors can easily buy and sell tokens in any quantity, including fractional shares. Fractional ownership also alleviates the responsibilities associated with property management, such as leasing and maintenance, reducing the costs and complexities involved.

4.3 Decentralization for Trust

Blockchain is renowned for its robust and secure decentralized architecture. All data is stored in a blockchain database, ensuring transparency and immutability accessible to all network participants. The fallout of the 2008 housing bubble crash underscores the consequences of institutional greed and a lack of transparency. Blockchain, with its decentralized trust and transparent ledger, enhances confidence among buyers and sellers. Transactions can be verified by peers, reducing the likelihood of fraud. The acceptance of smart contracts as legal documents in various states further bolsters the system's trustworthiness.

4.4 Cost Efficiency

Blockchain's transparency paves the way for reduced transaction costs in real estate. Expenses like security fees, registration fees, mortgage fees, and property-related taxes often outweigh savings achieved by bypassing intermediary fees and commissions. These costs can vary based on jurisdictional regulations. As platforms automate these processes and integrate them into their operations, they can become more cost-effective or even eliminated from the equation. Despite the real estate market's vast value, it has long been dominated by wealthy individuals and large organizations. Blockchain technology holds the potential to open up the market, making transactions more transparent, secure, and equitable, ultimately fostering peer-to-peer interactions through blockchain-backed platforms.

4.5 Unyielding Stability

Blockchain's inherent stability stems from its immutability. Each block in the blockchain contains data, a hash, and the previous block's hash. Tampering with one block would alter its hash, rendering it incompatible with the rest of the chain. Consequently, any interference is readily detectable without necessitating a comprehensive audit.

4.6 Trust through Consensus

Blockchain engenders trust among participants through consensus mechanisms. Various consensus algorithms like PoS, PoA, and PoW ensure that any new block added to the chain adheres to predefined specifications. This verification process maintains the network's integrity.

4.7 Enhanced Privacy

Blockchain provides enhanced privacy by concealing contributors' identities. Only a digital address and its associated units are visible to the public eye.

4.8 Robust Cryptographic Security

Blockchain employs multiple layers of security, incorporating various encryption methods at different levels. Participants use asymmetric key cryptography to access the blockchain, bolstering the system's cryptographic seal.

5. Impact of block chain

Blockchain technology has brought about significant transformations in the real estate sector, offering novel avenues for buyers and sellers to interact and revolutionizing the concept of fractional ownership. While previous attempts at real estate crowdfunding encountered challenges related to ownership liquidity, blockchain technology has emerged as a solution that fosters transparency in transactions.

For instance, consider the scenario of an owner residing in a foreign country who wishes to buy or sell their property. Thanks to blockchain, this process becomes remarkably streamlined, eliminating the need for extensive paperwork and document verification. Instead, the entire registration process can be accomplished with a mere digital signature, a stark departure from the complexities of conventional methods. This level of simplicity and efficiency underscores the transformative potential of blockchain technology in the real estate sector.

6. Result

Leveraging blockchain technology has yielded precise outcomes that promise to optimize real estate transactions by mitigating the potential for human error. The adoption of this technology is poised to usher in a new era characterized by faster, safer, and more cost-effective real estate transactions, revolutionizing everyday processes such as registration and amendments. A key allure of blockchain and cryptocurrencies lies in their unparalleled security measures. Utilizing cryptocurrencies for land or property transactions streamlines the payment process, circumventing the need for traditional banking intermediaries. Furthermore, the concept of tokenization, which involves converting physical assets like bonds, artwork, and real estate into secure digital assets, is gaining traction. Tokens, similar to cryptocurrencies and title registrations, possess ownership rights, predefined rules, and a comprehensive transaction history. Through tokenization, assets can be divided into multiple pieces, enabling them to be distributed among various owners, offering a level of flexibility and security that traditional methods struggle to match.

7. Conclusion

In essence, a blockchain serves as a globally distributed transaction database that offers accessibility to all participants. At its core, this technology relies on a confluence of multiple forces. Transactions within the

blockchain network undergo validation by a web of interconnected computers. The resulting ledger meticulously records these validated transactions in a sequential manner. The robust security of the blockchain system derives from the collaborative efforts of these interconnected computers, rendering hacking extremely challenging. Contrasting with traditional systems where hackers target a single database, the blockchain environment requires them to breach thousands of systems simultaneously. Supplementing the blockchain is a layer of smart contracts, distinguished by their open-source nature, visible to all participants, and immutable in their code. This transparency enhances auditability, leading to the belief that blockchain implementation can substantially diminish overall database management costs [14]. The potential of blockchain technology to revolutionize the real estate (RE) market lies in its capacity to address longstanding issues such as vulnerability, processing delays, server-related problems, and security concerns. The deployment of smart contracts within blockchain technology offers a promising solution to these challenges. In conclusion, blockchain technology holds the promise of transforming the RE sector by eliminating fraud and tampering risks, streamlining registration processes, reducing document and brokerage fees, and ultimately delivering more authentic and secure results.

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