Registration Of Land Using Blockchain Technology

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Abstract:

Land records comprise a vast array of data that is kept up to date by many agencies at the village or district level. The land acreage, plot number, khatian number, and owner's name are all included in this data. There are several obstacles facing the current land registration system, which is plagued by fragmented operations and irregular data updates, especially in metropolitan areas. These obstacles include distribution networks that are inefficient, inadequately maintained data, and challenges evaluating land throughout the acquisition process. Large-scale scams that cause errors and disagreements in property records include title fraud, false promises, unapproved transactions, and numerous sales of the same unit. These frauds further complicate the system.

This study suggests a blockchain-based approach to these problems, making use of the decentralized and irreversible characteristics of the technology to establish a safe and open land registration system. The suggested solution guarantees greater visibility across all departments, quicker data updates, and tamper-proof records by turning actual land holdings into token assets based on blockchain technology. The system's practical use has been demonstrated by its reasonable transaction processing speeds, as demonstrated by its implementation on the Ethereum blockchain. This strategy seeks to reduce fraud, enhance the accuracy of property records, and provide a more reliable and effective land registration procedure.

Keywords- Blockchain, Land, IPFS

1. Introduction:

Land records contain various types of information for land and are maintained in different departments at the district or village level. The land record of any property is an assortment of information related to the property, including the owner's name, area of land, plot number, and khatian number of the property. Deeds and ownership are the real part of land registration. Land registration is work in silos(Scott, I., & Gong, T. ,2021) and the data across the sections are not updated properly. The main problems with the current land registration system are poorly updated land records, especially in urban areas, in many cases, difficulty in the evaluation of land at the time of purchase, and an inefficient distribution system. Major frauds(Deininger, K., & Feder, G., 2009) include title fraud, guaranteed returns, fake promises, selling without authorization, and selling the same unit to multiple buyers. Therefore, inconsistencies are often found in land documents. The system of land records has involved many people, ranging from inheritance problems and weak governance to serious complexities such as loopholes in the legal framework.

Transparency:

All transactions are recorded on a public blockchain, making the data accessible and verifiable by all parties involved. This transparency reduces the risk of fraud and builds trust in the system.

Trust:

By leveraging blockchain's immutable ledger, all recorded data is secure and tamper-proof. This immutability ensures that once a transaction is recorded, it cannot be altered, thereby protecting the integrity of the land registry.

Secure Data:

Blockchain technology ensures the security of data through cryptographic methods. Each transaction is encrypted, and access to the data requires appropriate cryptographic keys, ensuring that only authorized parties can interact with the land records.

Blockchain is used in Land Registry for the secure transfer of land assets. The transparent and immutable nature of blockchain enables tracking of changes made to land records. The trendsetter form of blockchain technology in land registry plays a very beneficial role in this developing era. Blockchain advantages secure data sharing and provide premium due persistence across portfolios. Increases functional efficiencies and

allows for time and cost savings by this. Through blockchain technology, NFTs bring a new level of transparency, security, and ownership rights to the real estate industry. NFT(Dowling, M., 2022) real estate refers to the use of non-fungible tokens to depict ownership or rights to virtual or physical real estate property. NFT real estate is digital ownership of virtual or physical property, represented by non-fungible tokens, while traditional real estate is physical ownership of the property through lawful contracts. NFT real estate can be easily transferable and alienable while transferring traditional real estate ownership can involve legal and physical processes. ERC721(Hasan et. Al., 2022) is a standard for representing ownership of non-fungible tokens, i.e. where each token is unique. It is a non-fungible token standard that implements an API for tokens within smart contracts.

Blockchain replaces old paperwork with true digital assets and tracks changes in an immutable ledger that serves as a distributed shared source of honesty for documents between multiple parties and organizations. The Interplanetary File System, or IPFS(Zheng, 2018), is a peer-to-peer hypermedia protocol designed to make the Web faster, safer, and more open. IPFS is a protocol for storing and sharing content. As in the blockchain world, each user is running his node (server). Nodes can communicate with each other and exchange files. The polygon testnet is called Mumbai, which is a layer-two (L2) scaling platform for Ethereum. Like other testnets, Mumbai allows developers to deploy and test their applications on a polygon network without spending real money. PolygonScan allows you to explore the Polygon blockchain and search for transactions, addresses, tokens, prices, and other activities taking place on Polygon.

The remaining part of this paper has been organized as follows: Section 2 background and overview. Section 3 related work. Section 4 current process of land registration. Section 5 challenges in land record management. Section 6 process of land registration. Section 7 Proposed land registration framework Finally, section 8 states the conclusion.

2. Background and Overview:
2.1 Mutation:

The word "property mutation," which is commonly used in real estate transactions, describes the transfer or sale of a property that results in a change of title ownership from one person to another. This procedure is essential to ensure that property taxes are paid to the legitimate owner by amending the official land records to reflect the new ownership. This paper will explore the nuances of property mutation(Toaha, M., & Khan, S., 2008), including its significance, the steps involved, the paperwork required, and the consequences of not following this protocol.

In the context of property ownership and administration, property mutation fulfills a number of vital purposes.

- **Legal Recognition**: It provides legal recognition to the new owner, formally documenting the change of ownership in government records.
- **Tax Liability**: It ensures that the property tax is levied on the current owner, thereby preventing any disputes related to tax payment and responsibility.
- **Clear Ownership Records**: This helps maintain updated and accurate land records, which is essential for various administrative and legal purposes.
- **Property Transactions**: Facilitating smoother property transactions, as clear and updated records are crucial for any future sales, mortgages, or disputes.

The following steps are usually included in the property mutation process:

- **Application Submission**: The new owner must submit an application for mutation to the relevant land or municipal authority. This application should include all necessary documents and details of the property and transaction(Khan et. al., 2009).
- **Document Verification**: The authorities verify the submitted documents to ensure their authenticity and completeness. This may involve cross-checking with other government records and databases.
- **Fee Payment**: A nominal fee is usually required for processing the mutation application. The amount varies based on the jurisdiction and the value of the property.

- **Field Inspection**: In some cases, a field inspection may be conducted by the authorities to confirm the details provided in the application.
- **Approval and Record Update**: Once the application and documents are verified, the authorities approve the mutation and update the land records to reflect the new ownership.

A crucial component of transferring property ownership is property mutation, which guarantees correct tax responsibility, legal recognition, and unambiguous ownership records. Anyone purchasing, selling, or inheriting real estate must comprehend the significance of this procedure, the stages involved, and the required paperwork. When implemented correctly, mutation protects the interests of the government as well as the people by offering security and clarity in property transfers.

2.2 Blockchain Technology:

Blockchain technology is most simply defined as a decentralized, distributed ledger that records the emergence of a digital asset. A block collects information together or stores recent transactions in a group. When completed the transaction then the current block is stored in a permanent database or attached with a pre-filled block in a chain and a new block is generated. Forming a chain of data known as a blockchain(Yli-Huumo et. al., 2016). The transactions contained in the block are immutable.

An unchangeable ledger of data that is shared among a network of computers is the foundation of blockchain technology, which functions on a straightforward yet effective idea. These are the major elements:

- **Decentralization**: Unlike traditional databases maintained by a central authority, blockchain is decentralized(Zheng et. al., 2017). The ledger is distributed across multiple nodes (computers), ensuring that no single entity has control over the entire network.

- **Distributed Ledger**: Every participant (node) in the network has access to the entire ledger and its history. This distribution enhances transparency(Andoni et. al., 2019) and security since all transactions are publicly verifiable.

- **Blocks**: A block in a blockchain collects a set of transactions. Each block contains a timestamp, a list of transactions, and a reference to the previous block(Ahram et. al., 2017) through a cryptographic hash, forming a continuous chain.

- **Immutability**: Once a transaction is recorded in a block and the block is added to the chain, it cannot be altered or deleted. This immutability ensures the integrity and trustworthiness of the data.

The blockchain operates through a series of steps that ensure data integrity and security:

- **Transaction Initiation**: A transaction is requested, such as transferring a digital asset or recording data.
- **Block Formation**: The transaction is grouped with other transactions into a block. Each block contains a unique code called a cryptographic hash of the previous block.
- **Validation**: Nodes in the network (often through consensus mechanisms like Proof of Work or Proof of Stake) validate the block. This ensures that the transactions are legitimate and comply with the network's rules.
- **Chain Addition**: Once validated, the block is added to the existing blockchain, making the transaction permanent and immutable.

- **New Block Creation**: A new block is generated to continue the process, ensuring the ledger is always growing and updated.

The maintenance of property ownership and land records is one of the most exciting uses cases for blockchain technology. Conventional land record systems frequently suffer from inefficiency, fraud, and manipulation. Blockchain provides a strong remedy for these issues:

- **Transparency**: Blockchain ensures that all transactions(Pilkington, M., 2016) related to land records are transparent and publicly verifiable. Every change in ownership or transaction is recorded on the blockchain, visible to all participants.
- **Security**: The decentralized nature of blockchain and its cryptographic foundations provide high security(Guo, H., & Yu, X., 2022). Once recorded, land ownership data cannot be altered or tampered with, significantly reducing the risk of fraud.
- **Trust**: Blockchain removes the need for intermediaries by providing a trusted and verified system for recording transactions. This reduces the reliance on third-party entities, which are often sources of inefficiency and corruption.
- **Immutable History**: Blockchain preserves a complete and immutable history of land records. This historical record is crucial for verifying ownership, resolving disputes, and ensuring legal compliance.

Blockchain plays a vital role in ensuring transparency, digital signatures, trusted, secured land records without an intermediary, and securely preserves the history of ownership of land records in the blockchain. Blockchain(Zheng et. al., 2018) solution tackles several issues related to conventional systems by offering an immutable, transparent, and decentralized ledger. Land records use of this technology is expected to lead to more reliable, safe, and effective property management systems globally as it develops and becomes more widely used. An era of smooth, transparent, and fraud-proof real estate transactions may therefore be achieved by embracing blockchain technology.

2.3 Smart Contract:

Smart contracts represent a transformative innovation in the field of digital transactions and legal agreements. A smart contract(Mohanta et. al., 2018) is a self-executing agreement that has its terms encoded directly into computer code. With the use of blockchain technology, this technology makes it possible for agreements between parties to be automated, transparent, and unchangeable. Without the need for middlemen, the contract automatically comes into effect as soon as the predetermined requirements are satisfied. This overview looks at the basic ideas, advantages, features, uses, and prospects of smart contracts in the future.

A smart contract functions as a digital protocol that makes contract negotiation and performance easier, more reliable, or more enforced. These are the fundamental components that make up smart contracts:

- **Self-Executing**: Once the conditions encoded in the contract are met, the contract automatically enforces the terms. This eliminates the need for human intervention.
- **Blockchain-Based**: Smart contracts are deployed(Macrinici et. al., 2018) on blockchain platforms, such as Ethereum, ensuring they are decentralized and tamper-proof.
- **Immutable**: Once a smart contract is written and deployed on the blockchain, it cannot be altered. This immutability ensures that the contract terms are fixed and secure.
- **Transparency**: All parties involved can view the contract terms and conditions, promoting transparency and trust.

When it comes to online transactions and contracts, smart contracts are a big step forward. Numerous advantages are provided by their capacity to automate(Balcerzak et. al., 2022), secure, and transparently enforce contract conditions across a range of businesses. Though there are still issues with scalability and legal acceptance, smart contracts have a promising future. Smart contracts have

the potential to significantly influence how decentralised apps and digital transactions develop in the future as technology advances.

2.4 Inter Planetary File System:

The Inter Planetary File System (IPFS) is a peer-to-peer distributed file system that seeks to connect all computing devices with the same system of files. Its decentralized nature, coupled with its ability to ensure the integrity and availability of data, makes it a powerful tool for various applications, including land registry systems. Traditional land registry systems are often plagued by issues such as fraud, inefficiency, and lack of transparency. Integrating IPFS into these systems can address these challenges, offering a more secure, transparent, and efficient method of managing land records.

IPFS differs from conventional file storage systems in a fundamental way. IPFS(Zheng et. al., 2018) uses a network of nodes to distribute files rather than depending on a single server or a cluster of servers. Every file is uniquely recognized by a cryptographic hash, making it simple to identify any modifications. Users may request files based on their content rather than location thanks to hash-based addressing, which also makes content delivery more effective.

- **Content Addressing:** Files are addressed by their content, not by their location. This ensures that data is immutable and tamper-evident.
- **Decentralization:** Files are stored across a distributed network of nodes, eliminating the single point of failure.
- **Versioning:** IPFS supports versioning, allowing for the tracking of changes over time.
- **Efficient Data Retrieval:** The network can quickly retrieve data from the nearest node that has the requested content, improving efficiency.

Integrating IPFS into land registry systems can transform the way land records are managed and maintained. Here are some ways IPFS can address the challenges faced by traditional land registry systems:

Enhanced Security and Integrity:
Immutable Records: Since each file in IPFS(Steichen et. al., 2018) is identified by a unique cryptographic hash, any alteration to the file results in a new hash. This immutability ensures that land records cannot be tampered with without detection.
Tamper-Evident Storage: Any attempt to alter the data is easily detectable, providing a secure and trustworthy environment for storing land records.

Increased Transparency:
Public Accessibility: Land records stored on IPFS can be made publicly accessible, ensuring transparency and enabling stakeholders to verify the authenticity of records.
Audit Trails: IPFS supports versioning, allowing for the creation of audit trails that can track changes to land records over time. This feature is particularly useful for resolving disputes and verifying historical data.

Improved Efficiency:
Decentralized Access: With IPFS, land records are distributed across a network of nodes. This decentralized approach ensures that data is always available, even if some nodes go offline, thus improving the reliability and accessibility of land records.
Fast Data Retrieval: IPFS can quickly retrieve data from the nearest node, reducing the time required to access land records and speeding up the transaction process.

Cost-Effective and Scalable:
Reduced Infrastructure Costs: By leveraging a distributed network, IPFS reduces the need for extensive centralized infrastructure, lowering costs associated with maintaining and securing centralized databases.
Scalability: IPFS can easily scale as the number of land records grows, accommodating increasing amounts of data without significant additional costs.

Land registry systems are crucial for maintaining records of land ownership and transactions. However, traditional systems often face significant challenges:

- **Fraud and Corruption:** Centralized databases can be manipulated, leading to fraudulent transactions and disputes over land ownership.
- **Inefficiency:** Paper-based records and bureaucratic processes can cause delays and errors in updating and retrieving land records.
- **Lack of Transparency:** Limited access to land records can hinder transparency, making it difficult for stakeholders to verify the authenticity of transactions.
- **Data Security:** Centralized databases are vulnerable to hacking and data breaches, putting sensitive information at risk.

3   Related Work:

This paper(Shinde et. al., 2019) present land system in India does not fix the "Double spending" problem due to the numerous cases of property paper fraud. Blockchain can be a long-term, efficient, and optimal solution since it can provide a decentralized platform for authentication. Suffering in the current system in terms of security, all documents are stored centrally Official database which can be risky.

This work the Land Records Department, the Blockchain Registration Department, Banks, and other associated departments can all benefit from using blockchain technology to track records and identify ownership. In Blockchain Technology, ownership can be easily determined, transfer of ownership can be done in a short time and records can be maintained reliably. Any specific property has certain elements such as owner account number, owner's name, owner's father's name, address, total area, consumer's name, consumer's father's name, and how much area he/ she purchased. When a property is registered for the first time, push its record block with a hash. The same data is stored with the previous hash. If someone changes the hash it returns a false which means this record is not Valid(Thakur et. al., 2020).

This paper talks about registration that is implemented to secure land transactions from the attacker and easily maintain the record. The proposed solution keeps track of double spending on the same land deals with multiple sales to other clients. Users with more than one land in multiple states are also kept track in the chain. It forms a chain of users with basic transaction details like previous and current owners of the property, the actual value of the property, and the sale price(Krishnapriya, S., & Sarath, G., 2020).

This article suggested(Khan et. al., 2020), there are many problems like the involvement of brokers or intermediaries, time delay, etc. This paper will address issues related to land registration in India as well as in many parts of the world. Land preparation undocumented registration will not only simplify the process but also secure land ownership documents from Various man-made and natural disasters.

The study (Sharma et. al., 2021) discussed the system will verify the digital file with the stored record in blockchain, and when matched with digital files records, owner details, and land details will be sent via third-party email. Third parties can be a financial institution where the owner can apply for a loan, The Institution will ask for proof of property, and the owner will be able to give it. They create a digital file through the system and send a notification through email. If digital files are found, The system provided digital files with system blockchain records, and details of the land owner will be sent through the bank email.

This Paper(Nandi et. al., 2020) proposed, the frequent change of land ownership, coupled with fraudulent or incomplete registries, exacerbates the challenge, often leading to prolonged legal disputes. Traditional systems, reliant on legacy paper documents or non-transparent centralized databases, are susceptible to fraud and manipulation. This paper proposes a blockchain-based system to address these issues by converting physical land assets into immutable blockchain token assets. This digital approach ensures secure, tamper-proof, and selectively visible records of ownership. The implementation on Ethereum demonstrates that transaction processing times are reasonably low, making this solution viable for practical use. This system aims to enhance security, transparency, and efficiency in land registration, effectively mitigating ownership disputes and fraudulent activities.

4   Current process of land registration:

Land record management in India has undergone significant reforms since independence, aiming to rectify historical injustices and streamline the system of land ownership and transactions. The land is a state topic, which means that every Indian state maintains its own land records on its own, leading to a variety of practices and systems throughout the nation. This variety has resulted in a number of problems, such as fraudulent(Hanstad, T., 1997) transactions and protracted legal conflicts, when combined with outmoded procedures and a lack of coordination across several departments. An overview of significant changes, the condition of land record administration now, and the difficulties in maintaining accurate and updated land records are given in this article.

Key Reforms in Land Record Management

- **Zamindari Abolition Act**
  The Zamindari Abolition Act was one of the first post-independence measures that attempted to eliminate the feudal zamindari system. Large landowners, known as zamindars, controlled a great deal of the agricultural land and received rent from tenant farmers under this arrangement. In order to empower the real farmers and advance agricultural fairness, the Act aimed to seize the lands from these landlords and give them to the tillers.
- **Land Ceiling Act**
  The Land Ceiling Act, which set a maximum limit on landholdings, was another significant change. To alleviate discrepancies in land ownership, surplus land above this limit was to be transferred to the landless. Nevertheless, there were a number of obstacles to this act's execution, such as legal loopholes and landowners abusing the system by owning land in the names of others, or benami transactions.
- **Tribal Ownership Rights**
  In order to safeguard tribal groups' land rights, acknowledge their customary land ownership patterns, and stop non-tribal entities from exploiting them, the government has also passed a number of legislation. Through guaranteeing tribal communities' rights to land and forest resources, these laws seek to protect their way of life and cultural legacy.

Land Record Management:

The administration of land records involves maintaining thorough records of property transactions, ownership, and use. Three main state departments oversee this process:

- **Land Records Department**: In charge of keeping up Records-of-Rights (RoR), which list land parcels' owners and tenancy information. Typically, these documents are maintained at the sub-district administrative level, or Tehsil or Mandal.

- **Survey Department**: Handles the preparation and updating of land maps and plans, ensuring that the spatial dimensions of land parcels are accurately recorded.

- **Registration Department**: Manages the registration of land transactions, including sale, purchase, mortgage, and inheritance. This department ensures that all land transactions are legally recorded.

5   Challenges in Land Record Management:

Effective land record management is essential for maintaining clear land ownership, preventing disputes, and facilitating smooth land transactions(Dewangan, O., & Sarkar, P., 2022). However, there are a number of issues that make land record administration in India less accurate and efficient. These difficulties include out-of-date documentation, a lack of departmental coordination, disputed legal titles, presumed ownership, and difficulties with land transfer procedures. Comprehending these obstacles is essential to formulating remedies to enhance the system.

Outdated Records and Lack of Synchronization

One of the primary challenges in land record management is the infrequent updating of Records-of-Rights (RoR). RoRs are critical documents that detail ownership and tenancy information for land parcels. However, these records are often not updated regularly(Dewangan, O., & Sarkar, P., 2022), leading to significant discrepancies between the actual land status and the recorded information. This issue is compounded by the lack of synchronization between various state departments responsible for land records.

- **Infrequent Updates**: In many cases, updates to land records occur sporadically, leading to outdated and inaccurate information. This delay in updating can result from bureaucratic inefficiencies, lack of resources, or insufficient technological infrastructure.

- **Lack of Synchronization**: Land records are maintained by multiple departments, including the Land Records Department, Survey Department, and Registration Department. Each department operates independently, and updates in one department are not automatically reflected in the others. This lack of coordination can cause confusion over the actual ownership and status of land parcels, making it difficult for stakeholders to access accurate and up-to-date information.

Presumptive Ownership Titles

Ownership titles in India are largely presumptive, meaning they are not guaranteed by the state. This system creates uncertainty and can lead to disputes over land ownership. The lack of a clear and definitive ownership title opens the door for various fraudulent activities:

- **Double Sales**: The same parcel of land may be sold to multiple buyers due to unclear ownership records, leading to disputes and legal battles.

- **Sales by Non-Owners**: Fraudulent individuals can sell land they do not own, exploiting the lack of accurate and updated land records.

- **Backdated Transactions**: Manipulation of transaction dates can occur, creating further confusion and disputes regarding land ownership.

Legal Disputes

Land-related disputes constitute a significant burden on the Indian legal system. Approximately 40 percent of cases in various courts are related to land encroachments and title disputes. These disputes often arise from unclear or outdated land records and can take years to resolve, causing significant hardship for the parties involved.

- **Encroachments**: Unclear boundaries and outdated land records can lead to encroachments, where individuals or entities unlawfully occupy land.

- **Title Disputes**: Unclear ownership titles and records result in frequent title disputes, which are often lengthy and complex, involving multiple parties and extensive legal proceedings.

Land Transfer Mechanisms

The transfer of land and property can occur through various mechanisms, including sale/purchase, land acquisition, inheritance, court orders, and bank mortgages. Each of these mechanisms requires accurate and up-to-date land records to prevent disputes and ensure smooth transactions. However, the current state of land records often hampers this process.

- **Sale/Purchase**: Accurate land records are essential for verifying ownership and ensuring the legality of the transaction. Outdated or unclear records can lead to disputes and fraudulent transactions.

- **Land Acquisition**: Government and private entities acquiring land for development projects need clear and accurate records to identify rightful owners and ensure fair compensation. Discrepancies in records can lead to delays and disputes.

- **Inheritance**: Transfer of land through inheritance requires accurate records to establish rightful heirs. Outdated records can result in conflicts among potential heirs.

- **Court Orders**: Legal proceedings related to land disputes depend on accurate records for resolution. Inaccurate or outdated records can prolong legal battles.

- **Bank Mortgages**: Financial institutions require accurate land records to verify ownership and assess the value of the property for mortgage purposes. Inaccurate records can lead to issues in securing loans and financial transactions.

These challenges with land record administration must be resolved in order to ensure unambiguous property title, prevent disputes, and facilitate smooth land transactions. Initiatives aimed at modernising and digitising land records, such as the Digital India Land Records Modernization Programme (DILRMP), may enhance land record accessibility(Sarkar et. al., 2023), accuracy, and transparency. The successful completion of these projects is contingent upon the effective management and collaboration of many governmental entities. By removing these barriers, India can develop a more trustworthy and effective land record management system that would advance social justice and the country's economy.

6 Process of Land Registration:

Land registration is an important procedure that entails registering deeds in order to update ownership records. The Digital India Land Records Modernization Programme (DILRMP) has brought modernity to this procedure. Deed registration and title registration are the two main types of land registration processes in India. Every system has unique protocols and legal ramifications.

Deed Registration

Under the Deed Registration procedure, a written transfer deed is completed by both parties and filed at the registrar's workplace. This procedure, which permits the transfer or sale of immovable property through a registered document, is governed by the Transfer of Property Act, 1882. This recorded deed is evidence of the transaction, but it does not imply possession of the land title. The registered sale deed and other supporting documentation, such as property tax receipts, survey records, and Records-of-Rights (RoR), demonstrate ownership.

Title Registration

Title Registration, on the other hand, involves a more secure process where the legal validity of the transaction is verified by the registrar. In this system, the registrar checks and confirms that the grantor (seller) has a clear and undisputed title to the property before the transfer is approved. This process aims to provide a higher level of security and certainty in property transactions, ensuring that the buyer receives a guaranteed and legally sound title. As a result, Title Registration helps to prevent disputes over property ownership and provides greater confidence in the property market.

Current Land Registration Process

The process of land registration in India, post-DILRMP implementation, involves several steps designed to ensure transparency, security, and accuracy in land transactions. Here's an overview of the current process:

- **Agreement to Sale**: The buyer and seller finalize the 'Agreement to Sale' and get it notarized. The buyer usually pays a token amount to the seller at this stage.

- **No Encumbrance Certificate**: The seller has to get a "No Encumbrance Certificate" from the Land Registration Office before the buyer may apply for a loan. This certificate demonstrates the property's lack of liabilities or legal issues. Afterward, the bank approves the loan depending on the buyer's qualifications.

- **Payment of Stamp Duty**: The buyer pays the stamp duty to the Treasuries & Accounts Department. This can be done online or through bank deposits after raising a challan through the Government Receipt Accounting System (eGRAS), which is used in states like Maharashtra, Rajasthan, Haryana, and Jharkhand.

- **Drafting the Sale Deed**: The final sale deed is drafted on the obtained stamp papers. The buyer or their bank pays the full and final amount to the seller. The sale deed is signed by both parties and two witnesses.

- **Registration of the Deed**: The deed is registered at the Sub-Divisional Registrar Office (SRO). The SRO verifies the identity of the parties and the map of the property before registering it. The original registered deed is then collected by the buyer or their bank.

- **Application for Mutation**: The buyer applies for mutation at the Patwari's land revenue office at the Taluka (Tehsil/Block) level, submitting required documents such as an affidavit and property tax receipt.

- **Verification by Patwari**: The Patwari records the statements of both parties and matches them with the submitted documents. A proclamation inviting objections is issued.

- **Granting Mutation**: If no objections are received, the mutation is granted. If objections arise, the case is transferred to the Revenue Assistant Officer for resolution.

  Process

  Agreement to Sale -> No Encumbrance Certificate (if loan) -> Payment of Stamp Duty -> Drafting of Sale Deed -> Registration at SRO -> Application for Mutation -> Verification by Patwari -> Granting Mutation

The process of land registration in India involves several steps and requires interaction with various government offices to ensure the transaction's legality and transparency. This procedure has been improved by the Digital India Land Records Modernization Programme(Sarkar, P., 2023), increasing its efficiency and lowering its mistake rate. Proper documentation and adherence to the recommended procedures can help prevent conflicts and provide safe and unambiguous land ownership.

7 Proposed Land Registration Framework:

This section mainly deals with the proposed land registration framework using Blockchain technology and smart contract(Sarkar, P., 2023). The main features that a land registration system should have been transparency and immutability and Blockchain technology provides these key features.

7.1 Entity Registration: The proposed system focuses on a hassle-free transfer of land ownership from the seller to the buyer. In this system, all the entities are connected through peer–to–peer (P2P) network. The entities involved in the system are Land Registry Official, Seller, Marketplace, and Buyer. The main role of each entity is given below:

7.1.1 Land Registry Official: A land owner can register the land by providing the land details to the land registry official. This process of registering the land will be done once per land. Upon successful verification of the land details by the official, a signature is generated by the officials. This signature can be verified on-chain. All the details related to land like a land number, location of the land with coordinates, type of land like agricultural, etc are stored in IPFS.

7.1.2 Land Owner/Seller: Upon successful verification of the signature on-chain, the land owner can register their land as a Non-Fungible Token (NFT) in the Blockchain network.

7.1.3 Marketplace: The landowner needs to provide approval to the marketplace to sell their land. After successful approval, Landowners can list their land in the marketplace to sell. Selling of land can be done in two ways. One is a fixed-price sale and another is an auction sale for a limited period.

7.1.4 Buyer: Buyers can buy any of the listed lands in the marketplace. For the land which is in fixed price sale, the ownership will be transferred immediately upon receiving the required money. For the auction sale, ownership will be transferred to the highest bidder only after the completion of the auction time. This new ownership can be verified on the Blockchain.

A land only once needs to be registered with the Land Registry official.
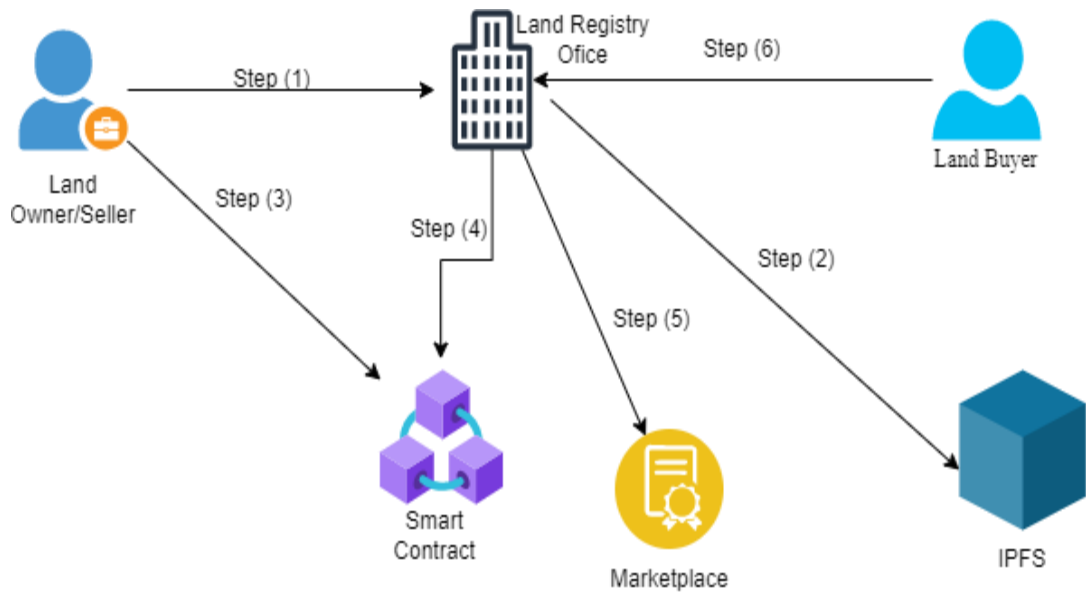

Fig:1: Land Registration

7.2 Process Of Land Registration Framework

LRO = Land Registration Office
LO_i **(i = 0,1,2...) = Land Owner**
P_n **(n = 1,2,3...) = Plot Number**
MSG_x **= Signed Message of Land Owner**
WA_x **= Wallet Address of Land Owner**
S_t **= Service Tax**
P_l **= Price Of Land**
VK_x **= Private Key of Seller**
PK_x **= Public Key of Seller**

Step (1)
Land Owner(LOi) requests the Land Registry Office(LRO) for land registration with the plot number(Pn).
Step (2)
LRO will verify the details of the land and ownership of the land and store the details (like a plot number, land location, land type, etc.) in the IPFS.
Step (3)
A message(M SGx) is signed by the LRO which can be verified on-chain. The message will be created using the wallet address of the LOi, IPFS, and land number.
Step (4)
LOi will register their land in the Blockchain network by provid-ing the wallet address, IPFS, plot number, and signature. Upon successful
verification of the signature, the land is registered in the Blockchain network corresponding to the wallet address(W Ax). Anyone can verify the owner of the land.
Step (5)

LOi needs to approve the marketplace to sell the land on the LOi's behavior. The LOi will list their land in the marketplace to sell at a fixed price or an auction price. Service tax(St) will be set by the LRO. St will be set by the (LRO). The final price of the land is = PL + St.

Step (6)

Buyer will pay the required amount. In the case of fixed-price sell-ing, the ownership will be transferred as soon as the required price of the land is received, and in the case of the auction sale, ownership will be transferred to the highest bidder only after the completion of the auction period.

Conclusion:

The purchase of real estate assets, particularly land, is a complex and often opaque process. Transparency issues plague many land registry systems, leading to fraudulent activities where sellers deceive buyers. To address these challenges, blockchain technology, with its immutable ledger and decentralized nature, offers a robust solution. By leveraging blockchain, the data once recorded remains permanently accessible, ensuring transparency and security.

Blockchain technology's core principles decentralization, immutability, and transparency make it an ideal candidate for overhauling traditional land registry systems. Unlike traditional databases, blockchain operates on a decentralized network where each transaction is recorded in a public ledger, ensuring that data cannot be altered without detection.

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