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## FRAUD PREVENTION IN REAL ESTATE USING BLOCKCHAIN

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### ABSTRACT

The real estate industry is crucial sector of the world economy Buying and selling properties usually takes a long time, is complicated, and can be expensive. There's also a risk of mistakes and fraud, which might cause big financial losses and legal problems. This research paper delves into the innovative use of blockchain technology to address the pervasive issue of fraud within the real estate industry. By introducing a comprehensive system where user authentication is conducted through Aadhaar numbers, properties are represented as Non-Fungible Tokens (NFTs), and transactions involve the crucial oversight of designated inspectors, this paper aims to provide a robust framework for fraud prevention. Additionally, it explores how blockchain's inherent properties prevent instances of double selling, thus bolstering the integrity of real estate transactions. The research demonstrates the effective utilization of blockchain technology and Ethereum's smart contracts. The immutability nature of the blockchain ledger and transactions can provide a safe environment for the real estate sector. The project also identified some challenges and opportunities for blockchain adoption in the real estate industry. One of the challenges is the lack of awareness and understanding of blockchain technology. Another challenge is the regulatory environment, which is currently unclear. However, there are many opportunities for blockchain adoption in the real estate industry, such as streamlining the real estate transaction process, reducing fraud, and improving transparency.

**Keywords:** Blockchain, Fraud Prevention, NFT, Real Estate.

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### I. INTRODUCTION

Real estate assets, including land, buildings, and infrastructure, frequently make up the majority of individual and institutional portfolios [1]. The real estate industry encompasses the buying, selling, and development of properties, including land, residential and commercial buildings. It plays a crucial role in the economy, influencing sectors like construction, finance, and various related services. Real estate is characterized by its tangible nature, long-term investment potential, and its impact on both urban and rural landscapes.

Real estate transactions are susceptible to various types of fraud like title fraud, identity theft, and double-selling of properties. These fraudulent activities not only result in financial losses but also undermine trust in the real estate market. Traditional methods of preventing fraud often fall short due to their reliance on centralized authorities and paper-based documentation, which are susceptible to manipulation and falsification. A blockchain is a distributed ledger which stores all transactions in a transparent and immutable manner [6].

Blockchain is an emerging technology that has changed many aspects of modern finance; however, its use cases are not limited to financial systems [2]. Blockchain technology offers a decentralized and tamper-proof solution to address these challenges by providing a secure and transparent platform for recording and verifying property transactions. Blockchain is a distributed ledger technology that is characterized by its decentralized and immutable nature. It has several key features that make it appealing for various applications, such as the ability to ensure data integrity, security, transparency and privacy [3], [4].

Blockchain technology is used extensively throughout smart cities around the world to address various data related challenges. These include blockchains in the smart economy [7], transparency in the global supply chain [8], equity crowdfunding and smart elections [9,10].

## II. METHODOLOGY

Our system for fraud prevention in real estate uses blockchain technology to maintain transparency, security, and trust in real estate transactions. The architecture comprises the following components:

- **User Registration and Authentication:** Users register and log into the system using Aadhaar numbers, providing a secure and verifiable identity authentication mechanism.
- **Property Representation with NFTs:** Each property is represented as a Non-Fungible Token (NFT) on the blockchain. When a new property is added, a new NFT is minted, ensuring uniqueness and authenticity.
- **Ownership and Marketplace Integration:** The added property is recorded in the user's owned property section. Users can list their properties on the marketplace, where other users can discover and potentially purchase them.
- **Transaction Verification by Inspectors:** Before a transaction is finalized, it undergoes verification by designated inspectors. Transactions cannot proceed without the inspector's approval, adding an additional layer of security and trust.
- **Smart Contracts for Transaction Execution:** Transactions are facilitated through smart contracts, which automate and enforce the terms of the transaction. Once verified by the inspector, the transaction is executed, completing the trade securely and efficiently.

### Common Frauds in Real Estate Business and Solutions Provided by Our System:

#### Title Fraud:

**Problem:** Title fraud occurs when a fraudster illegally transfers ownership of a property by falsifying documents or forging signatures.

**Solution:** Our system leverages blockchain technology to maintain a transparent and immutable record of property ownership. Each property is represented by a unique Non-Fungible Token (NFT), with ownership recorded on the blockchain. This ensures that only legitimate owners can transfer property ownership, mitigating the risk of title fraud.

#### Phantom Listings:

**Problem:** Phantom listings involve fake properties being advertised for sale or rent by scammers to deceive unsuspecting buyers or tenants.

**Solution:** Our system verifies property listings by cross-referencing them with authenticated data stored on the blockchain. This ensures that only genuine properties are listed on the platform, reducing the likelihood of users falling victim to phantom listings.

#### Wire Fraud:

**Problem:** Wire fraud occurs when fraudsters intercept communication between buyers, sellers, and real estate agents to deceive them into wiring funds to fraudulent accounts.

**Solution:** Our system employs secure communication channels and smart contracts to facilitate property transactions. Smart contracts automatically execute transactions only when predefined conditions are met, reducing the risk of wire fraud by eliminating the need for manual fund transfers.

#### Forgery and Identity Theft:

**Problem:** Forgery and identity theft involve fraudsters impersonating property owners or legitimate buyers to illegally transfer property ownership or obtain loans.

**Solution:** Our system utilizes advanced identity verification mechanisms, such as Aadhaar login validation and decentralized identity solutions. Users' identities are securely verified through Aadhaar authentication before they can participate in property transactions, reducing the risk of forgery and identity theft.

#### Double Selling of Properties:

**Problem:** Double selling occurs when a fraudster sells the same property to multiple buyers, leading to disputes over ownership and financial losses.

**Solution:** Our system prevents double selling by recording property ownership on the blockchain and enforcing rules that prohibit multiple sales of the same property. Once a property is sold, its ownership status is updated on the blockchain, preventing further transactions involving the same property.

**Preventing Double-Selling with Blockchain:**

One of the key challenges in real estate transactions is the risk of double-selling, where a property is sold to multiple buyers simultaneously. Our system addresses this challenge by utilizing blockchain technology to maintain an immutable record of property ownership. When a property is listed on the marketplace, ownership of the property is temporarily transferred to the marketplace itself. This prevents the original owner from selling the property to multiple buyers simultaneously, as the property remains under the control of the marketplace until a legitimate transaction is completed.

**Technology Stack:**

Our project uses a carefully chosen technology stack to ensure the effectiveness and security of our fraud prevention system. This stack comprises of blockchain platforms, smart contract languages, and frontend frameworks, each selected to address specific project requirements. and challenges

- **Blockchain Platform:** For the foundation of our system, we opted for the Ethereum blockchain platform, renowned for its widespread adoption, robust infrastructure, and support for smart contracts. Ethereum provides a decentralized and immutable ledger that serves as the backbone for recording property transactions securely and transparently. Leveraging Ethereum's network, we ensure trust and integrity in every transaction executed within our system. Blockchain technology, according to the authors of study [5], makes real estate transactions faster, safer, and more low-cost.
- **Smart Contract Language:** To implement the logic governing property transactions and user interactions, we used Solidity as the primary language. Solidity is designed to write smart contracts on the Ethereum platform. With Solidity, we developed smart contracts that enforces the rules and conditions of property transactions, ensuring prevention of fraudulent activities.
- **Frontend Framework:** For crafting intuitive and responsive user interfaces, we chose Next.js as the frontend framework for our web and mobile applications. Next.js is a popular React framework that adds server-side rendering, static site generation, and other performance optimizations out of the box. By leveraging Next.js, we designed user-friendly interfaces that empower users to effortlessly interact with the system, from property listing and discovery to transaction management and authentication.

**Additional Components:**

In addition to the core components mentioned above, our technology stack incorporates several complementary tools and frameworks to enhance system functionality and performance. These include:

- **Truffle Suite:** For development, testing, and deployment of smart contracts, providing a comprehensive suite of tools and utilities.
- **Web3.js:** A JavaScript library for interacting with Ethereum nodes and smart contracts, enabling seamless integration of blockchain functionality into our frontend applications.
- **IPFS (InterPlanetary File System):** For decentralized storage of property-related data and metadata, ensuring resilience and accessibility while minimizing reliance on centralized servers.

By leveraging this comprehensive technology stack, we have built a robust and efficient fraud prevention system in real estate that leverages the capabilities of blockchain technology while providing a seamless and user-friendly experience for all stakeholders involved.

```
function mint(string memory tokenURI) public returns (uint256) {
    _tokenIds.increment();
    uint256 newTokenId = _tokenIds.current();
    _safeMint(msg.sender, newTokenId);
    _setTokenURI(newTokenId, tokenURI);

    return newTokenId;
}
```

- This function mint is responsible for creating and minting a new Non-Fungible Token (NFT) with the given tokenURI, which represents the metadata of the token.
- It takes the tokenURI as input parameter and returns the ID of the newly minted token.
- Inside the function, the `_tokenId` counter is incremented to generate a new unique token ID for the newly minted token.
- The `_safeMint` function is called to mint the new token and assign ownership to the address of the message sender (i.e., the caller of the function).
- Then, the `_setTokenURI` function is used to set the token URI for the newly minted token, associating it with its metadata.
- Finally, the ID of the newly minted token is returned as the output of the function.

```
function nftTransferToContract(uint _propId, uint _newPrice) external nonReentrant {
    require(_newPrice > 0, "Price must be greater than zero");
    require(_propId > 0 && _propId <= _propIds.current(), "Item does not exist");
    Property storage prop = props[_propId];
    require(prop.nft.ownerOf(prop.tokenId) == address(msg.sender), "You does not own the NFT");
    IERC721 nft = prop.nft;
    prop.price = _newPrice;
    // transfer nft
    nft.transferFrom(msg.sender, address(this), prop.tokenId);
    resetDetails(_propId, false, false);
    //call listProperty() after this function in frontend
}
```

- This function `nftTransferToContract` allows a user to transfer an NFT representing a property to the contract and update its price.
- It takes two parameters: `_propId`, which is the ID of the property, and `_newPrice`, which is the new price set for the property.
- The function first ensures that the new price is greater than zero and that the property ID exists.
- It then retrieves the property details based on the provided ID and verifies that the caller owns the NFT representing the property.
- After updating the price of the property, the function transfers the NFT from the caller to the contract address.
- Finally, it resets the details of the property and suggests calling `listProperty()` after this function in the frontend to update the property listing.

```
function makeItem(IERC721 _nft, uint _tokenId, uint _price) external nonReentrant {
    require(_price > 0, "Price must be greater than zero");
    // increment itemCount
    _propIds.increment();
    uint256 currPropId = _propIds.current();
    // transfer nft
    _nft.transferFrom(msg.sender, address(this), _tokenId);
    // add new property to Property mapping
    props[currPropId] = Property (
        currPropId, //propertyId
        _nft, //nft address
        _tokenId, //nft Id
        _price,
        payable(msg.sender), //seller
        payable(address(0)), //buyer
        false, //sold
        // Price(_purchasePrice, _depositPrice, _purchasePrice+_depositPrice), // purchasePrice, depositPrice, totalPrice
        Property_info(false, false, false) // isListed, isInspected, isApproved
    );
    //emit event
    emit Offered(
        currPropId,
        address(_nft),
        _tokenId,
        _price,
        msg.sender
    );
}
```

- This function makeltem creates a new property item and lists it for sale.
- It takes three parameters: `_nft`, which is the address of the NFT contract, `_tokenId`, which is the ID of the NFT token, and `_price`, which is the price set for the property.
- The function first ensures that the price is greater than zero.
- It then increments the property ID counter and retrieves the current property ID.
- The NFT token is transferred from the caller to the contract.
- The details of the new property, including its ID, NFT address, NFT ID, price, seller, buyer (initialized as `address(0)`), and sale status, are stored in the Property mapping.
- An event Offered is emitted to indicate that the property has been offered for sale, including details such as the property ID, NFT address, NFT ID, price, and seller address.

### III. MODELING AND ANALYSIS

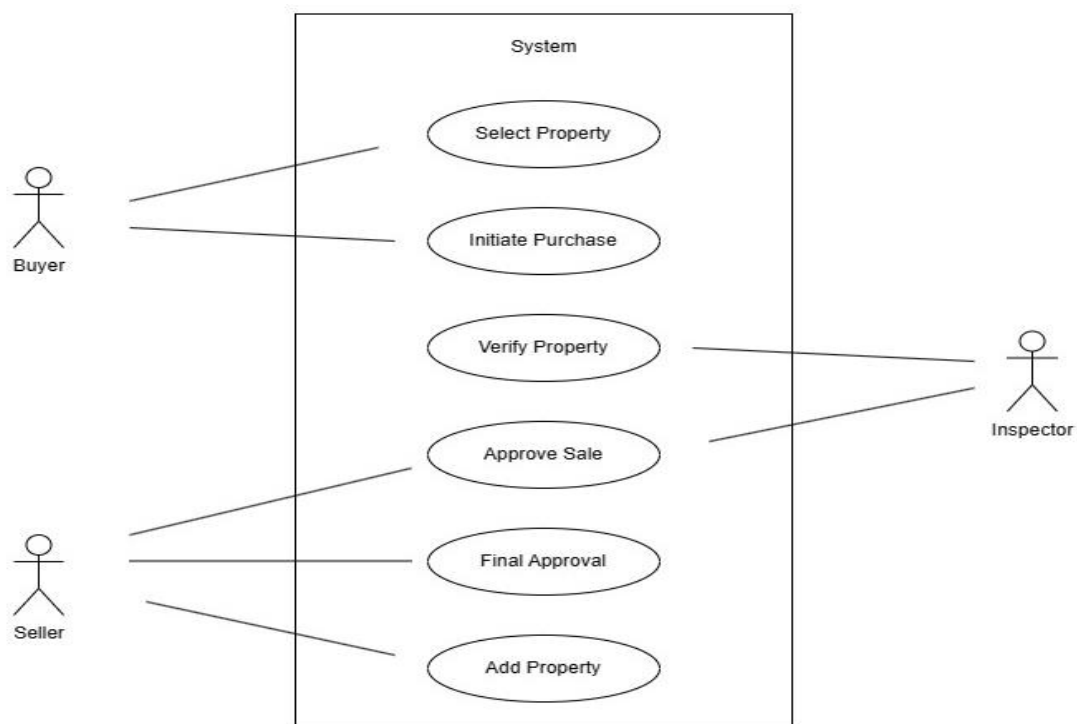


Figure 1: Use Case Diagram.

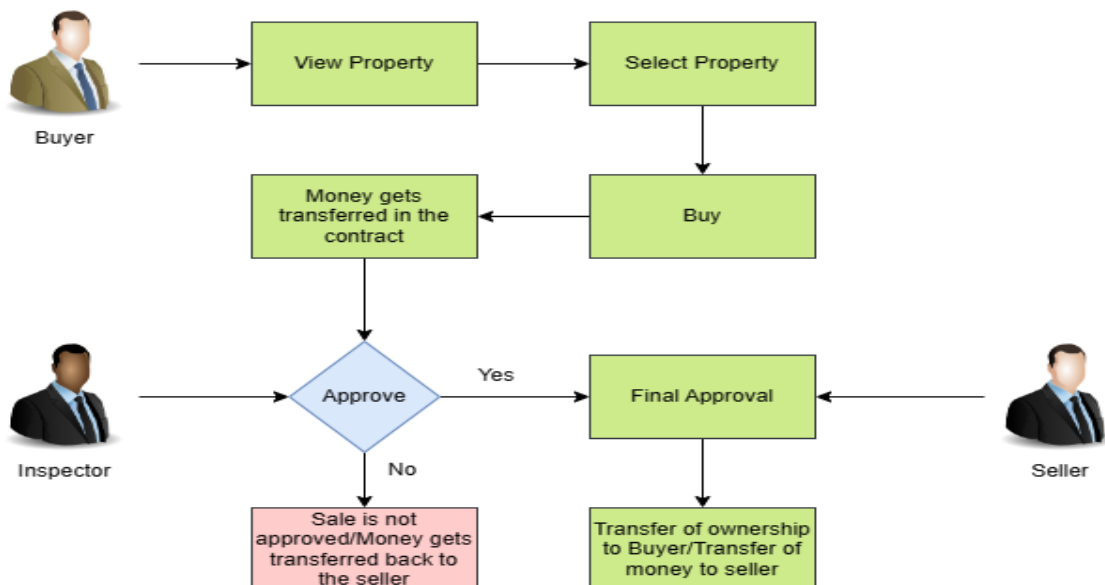


Figure 2: Buyer process flow

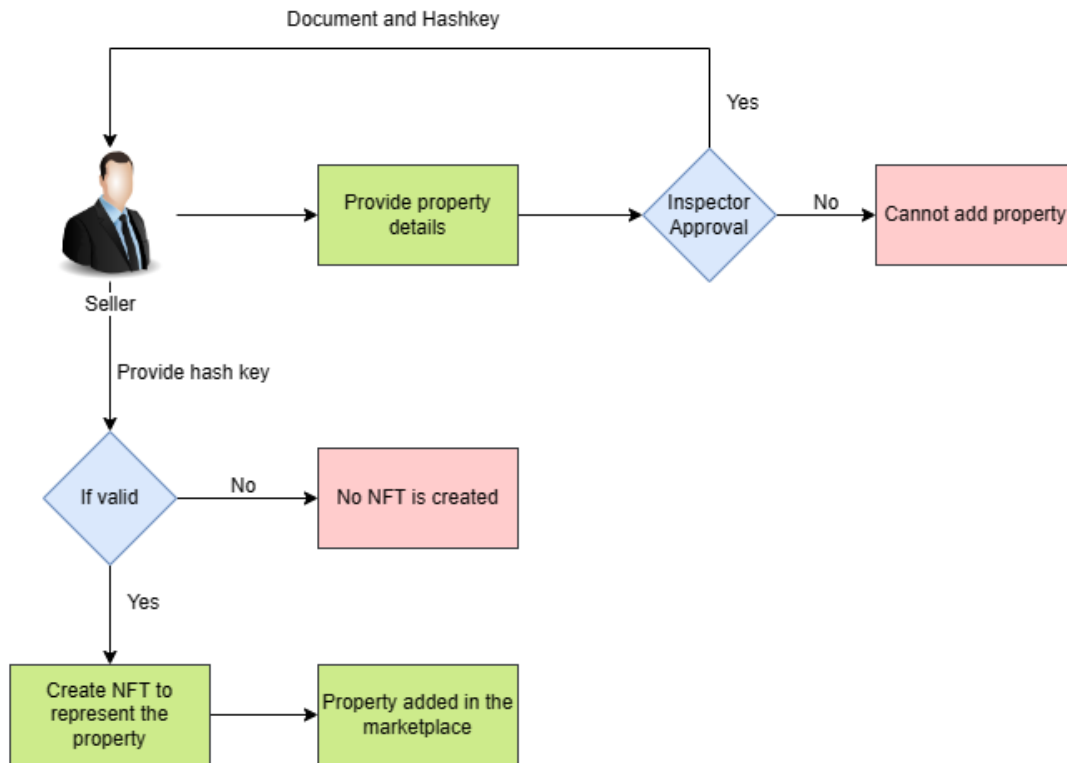


Figure 3: Seller process flow

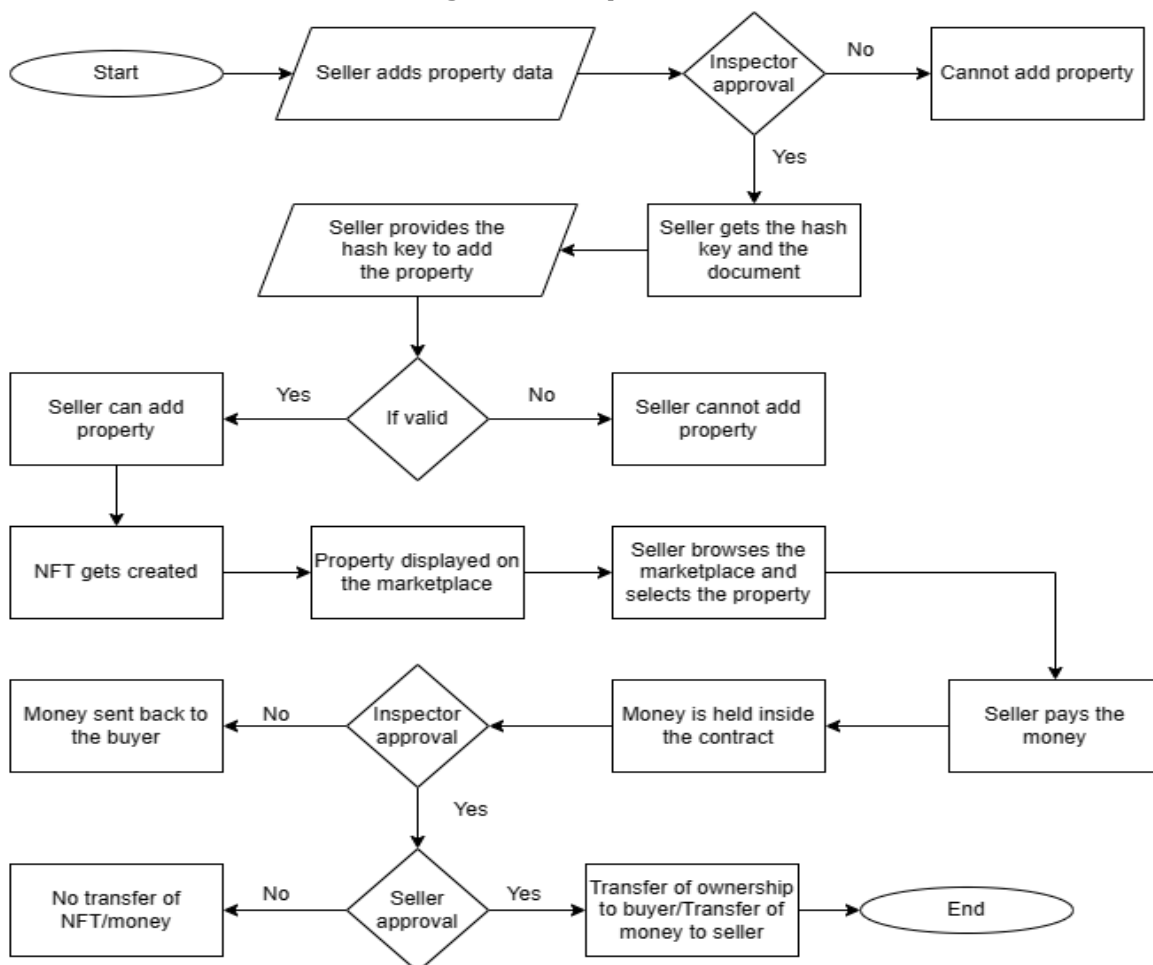


Figure 4: Flow Chart

#### IV. CONCLUSION

Fraud prevention in real estate is a critical issue that demands innovative solutions. By harnessing the power of blockchain technology, our system provides a robust framework for ensuring transparency, security, and trust in property transactions. Through features such as Aadhaar-based authentication, NFT representation of properties, inspector verification, and smart contracts, we offer a comprehensive approach to mitigating fraud in the real estate market. Overall, our solution has the potential to significantly reduce the incidence of fraud in real estate transactions, fostering a more trustworthy and efficient marketplace for buyers and sellers alike.

#### V. FUTURE SCOPE

- **Enhanced Authentication Mechanisms:** Implement advanced authentication mechanisms, such as biometric authentication or multi-factor authentication (MFA), to further strengthen user identity verification and prevent unauthorized access to the system.
- **Expansion of Property Verification Features:** Extend the capabilities of the system to include comprehensive property verification features, such as automated property title verification and verification of property ownership history. This would provide users with greater confidence in the legitimacy of properties listed on the platform.
- **Development of Mobile Applications:** Develop dedicated mobile applications for iOS and Android platforms to offer users the convenience of accessing the fraud prevention system on their smartphones and tablets. Mobile applications would enable users to perform property transactions on the go, further enhancing user engagement and accessibility.
- **Expansion into Global Markets:** Explore opportunities to expand the reach of the fraud prevention system into global markets, collaborating with local real estate agencies and regulatory bodies to tailor the system to the unique requirements and regulations of different regions. This would facilitate cross-border property transactions and broaden the user base of the platform.

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