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# Block Chain Based Property Registration

Prof. Nitin Thakre[1], Prasad vaibhav pande[2], Aman Bodkhe[3], Paras Patil[4], Khushi Kanade[5], Sahil Dongre[6]
[1]*Assistant Prof., Department of Computer Science Engineering,*
[2]*Student, Department of Computer Science Engineering,*
*Govindrao Wanjari College of Engineering & Technology*

*Abstract—* **The traditional real estate industry is hampered by inefficiencies, lack of transparency, and high transaction costs due to its reliance on intermediaries. This paper presents a decentralized application (dApp) for a property marketplace built on the Ethereum blockchain to address these challenges. We have designed and implemented a Solidity-based smart contract that governs the registration, sale, and transfer of property ownership in a secure and automated manner. The system features a React-based frontend that allows users to interact with the marketplace seamlessly using their MetaMask wallets. Our results demonstrate a functional prototype that enhances transparency through a public transaction ledger, increases security by eliminating single points of failure, and improves efficiency by reducing the need for intermediaries. This work serves as a proof-of-concept for a more trustworthy and efficient real estate ecosystem powered by blockchain technology.**

## I INTRODUCTION

The process of buying and selling real estate has long been a complex and cumbersome undertaking, involving numerous intermediaries such as agents, brokers, and lawyers. This traditional model, while established, introduces significant friction, including high costs, lengthy delays, and a lack of transparency that can erode trust between parties. The advent of blockchain technology offers a promising opportunity to fundamentally reshape the real estate landscape by enabling secure, transparent, and peer-to-peer transactions.

This paper proposes and implements a decentralized property marketplace built on the Ethereumblockchain. Our primary contribution is a system that leverages a smart contract to automate and secure the entire lifecycle of a property transaction—from registration and listing to the final sale and transfer of ownership. By encoding the rules of the marketplace into a self-executing contract, our solution minimizes the reliance on costly intermediaries and provides a single, immutable source of truth for all participants.

The system consists of a PropertyRegistry smart contract written in Solidity and a user- facing dApp developed with React and ethers.js. Users can connect to the platform using their MetaMask wallets, browse a marketplace of listed properties, purchase properties directly from sellers, and manage their own property assets. All transactions are recorded on the blockchain, creating a transparent and auditable ledger of ownership history. This project demonstrates the practical application of blockchain technology to solve real-world problems in the real estate sector, paving the way for a more efficient and equitable market.

The remainder of this paper is structured as follows: Section 2 discusses related work in the field. Section 3 outlines the system architecture. Section 4 details the implementation of the smart contract and frontend. Section 5 presents the results, and Section 6 concludes the paper with a discussion on future work.

## II RELATED WORK

The application of blockchain technology to the real estate sector has been a topic of growing interest among researchers and practitioners. The literature reveals a consensus that traditional real estate systems are fraught with inefficiencies, and that blockchain offers a viable path toward a more transparent and secure future.

Early research in this area focused on identifying the primary pain points in conventional real estate transactions. Studies consistently highlight the dependence on a multitude of intermediaries, the lack of transparency, high costs, and the risk of fraud as significant challenges. These foundational issues set the stage for exploring alternative, technology-driven solutions.

With the rise of blockchain, numerous researchers have proposed its application to the real estate industry. A significant portion of the literature focuses on the use of blockchain for land registry and title management. The argument is that a decentralized and immutable ledger is an ideal solution for creating a tamper-proof record of property ownership, thereby reducing title fraud and disputes. Our project builds on this concept by not only recording ownership but also enabling the active trading of these properties within a decentralized marketplace.

Another major area of research is the tokenization of real estate assets, where a property's ownership is represented by digital tokens on a blockchain. This allows for fractional ownership, increasing liquidity and making real estate investment more accessible to a broader range of investors. While our project does not implement fractional ownership, the principle of representing property ownership as a unique, transferable digital asset on the blockchain is a core component of our system.

Several conceptual frameworks for blockchain-based real estate platforms have been proposed. For instance, some studies describe multi-layered architectures that include a user interface layer, a control layer, a service layer, and a data layer. Our project implements a similar, practical architecture consisting of a React frontend (user interface), the ethers.js library (control layer), and the Solidity smart contract (service and data layer). Many proposed systems also emphasize the role of smart contracts in automating transaction processes, such as executing sales and transferring ownership, which is a central feature of our implemented Property Registry contract.

While much of the existing literature discusses the potential benefits and conceptual models of blockchain in real estate, there are fewer examples of fully implemented, end-to-end decentralized marketplaces that a non-technical user can interact with. Our work contributes to the field by presenting a functional proof-of- concept of such a system, complete with a user-friendly interface and a clear demonstration of the core transaction lifecycle, from listing to sale. We bridge the gap between theoretical proposals and practical application, providing a tangible example of how these concepts can be realized.

## III THE PROPOSED SYSTEM ARCHITECTURE

The architecture of our decentralized property marketplace is designed to be robust, secure, and user-centric. It is built upon a three-layer model, which is common for decentralized applications (dApps), ensuring a clear separation of concerns between the user interface, blockchain interaction, and the core business logic.

- Presentation Layer (Frontend): This is the client-side interface that users interact with. It is developed as a

  single-page application (SPA) using React, a declarative JavaScript library for building user interfaces. The frontend is responsible for rendering data fetched from the blockchain and for capturing user inputs to trigger transactions. Styling is handled by Tailwind CSS, a utility- first framework that allows for rapid UI development.

- Blockchain Interaction Layer: This layer serves as the bridge between the frontend and the Ethereum blockchain. We utilize the ethers.js library, a powerful and complete toolset for interacting with Ethereum. Its primary responsibilities include connecting to the user's MetaMask wallet, fetching data from the smart contract, and prompting the user to sign and send transactions to the network.

- Smart Contract Layer (Backend): The core logic of the entire system resides in the Property Registry.sol smart contract, which is deployed on the Ethereum blockchain. Written in Solidity, this contract is immutable and acts as the ultimate source of truth for all data and transactions within the marketplace. It governs all property registrations, listings, and sales, ensuring that all operations are executed securely and transparently according to its predefined rules.

Figure 1 provides a high-level overview of the system's arc hitecture.

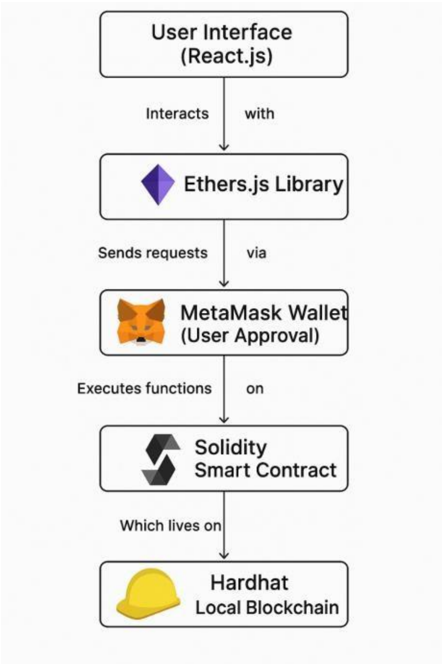


**Figure 1: System Architecture**

This layered architecture ensures that the application is decentralized, with no central server controlling the data or transaction logic. The user remains in full control of their assets and data, interacting directly with the immutable smart contract through a secure and user-friendly interface.

## IV IMPLEMANTATION DETAIL

The implementation of the decentralized property marketplace is divided into two core components: the on-chain smart contract that enforces the rules of the marketplace, and the off-chain frontend application that provides a user-friendly interface to interact with the contract.

### 4.1 The Property Registry Smart Contract

The smart contract, Property Registry.sol, is the heart of the system. It is written in Solidity and deployed on an Ethereum- compatible blockchain. The contract is designed to be a self-contained and autonomous registry for managing property assets.

**Core Functions**

- registerProperty(string memory _ownerName, string memory _location, string memory _documentHash): This function allows a user to create a new property record on the blockchain. When called, it creates a new Property struct and assigns the caller (msg.sender) as the owner. A unique propertyId is generated, and the property's details are stored in the properties mapping. Finally, it emits a Property Registered event to log the action on the blockchain.
- List Property(uint256 _property Id, uint256 _price): This function enables a property owner to list their asset on the marketplace. It includes crucial security checks, using a require statement to ensure that only the current owner of the property can call this function. It then updates the isForSale status to true and sets the price of the property.
- buyProperty(uint256 _propertyId): This payable function facilitates the purchase of a property. It verifies that the property is for sale and that the amount of Ether sent with the transaction (msg.value) is equal to the asking price. If these conditions are met, it transfers the funds to the seller, updates the owner to the buyer's address, and sets the isForSale flag to false. The entire operation is atomic, ensuring that the payment and ownership transfer either both succeed or both fail together.

### 4.2 Frontend Application and Blockchain Interaction

The frontend is a single-page application built with React, providing a dynamic and responsive user experience. It interacts with the Ethereum blockchain via the ethers.js library.

**Connecting to the Blockchain**

Upon loading, the application prompts the user to connect their MetaMask wallet. The connectWallet function in App.jsx handles this process. It initializes a connection to the Ethereum provider injected by MetaMask, requests access to the user's account, and creates a contract instance that the application can use to interact with the deployed PropertyRegistry smart contract. A network check is also performed to ensure the user is on the correct network

(Hardhat Localnet, chainId: 31337).

**Reading Data and Sending Transactions**

The frontend application reads data from the blockchain to display property listings and transaction history. The fetchData function calls the public properties mapping and propertyCounter variable in the smart contract to retrieve the data for all registered properties. It also uses contract.queryFilter('PropertySold') to get a log of all past sale events, which is used to populate the transaction ledger.

When a user initiates an action, such as buying or listing a property, the frontend constructs and sends a transaction to the smart contract. For example, the handleBuy function first converts the price to the appropriate format (Wei) and then calls the buyProperty function on the contract instance, passing the property ID and the transaction value. The await tx.wait() command ensures that the application waits for the transaction to be mined and confirmed before updating the UI, providing a seamless user experience.

## V RESULT AND ANALYSIS

The implementation of the decentralized property marketplace resulted in a functional proof-of-concept that successfully meets the project's objectives. The application provides a seamless and secure interface for users to interact with a real estate marketplace on the Ethereum blockchain. This section presents the visual and functional outcomes of the system and analyzes the advantages of this blockchain-based approach.

### 5.1 System Functionality and User Interface

The final application provides a clean, intuitive user interface, divided into three main sections: a public marketplace, a personal property portfolio, and a transparent transaction ledger.

- Marketplace View: This view serves as the main entry point for users, displaying all properties currently available for sale. Each property is presented with essential details such as its location, owner, and price, allowing for easy Browse. A user can initiate a purchase directly from this screen, as shown in Figure 2.

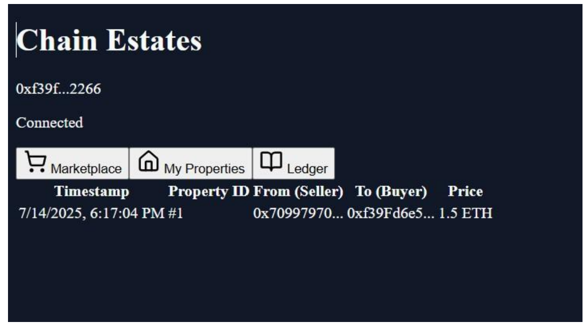


Figure 2: The Marketplace View

- User Portfolio View: The "My Properties" view provides a personalized dashboard for users to manage their assets. For each owned property, the interface indicates whether it is listed for sale. If not, it provides a simple form for the owner to set a price and list it on the marketplace with a single transaction, as depicted in Figure 3.

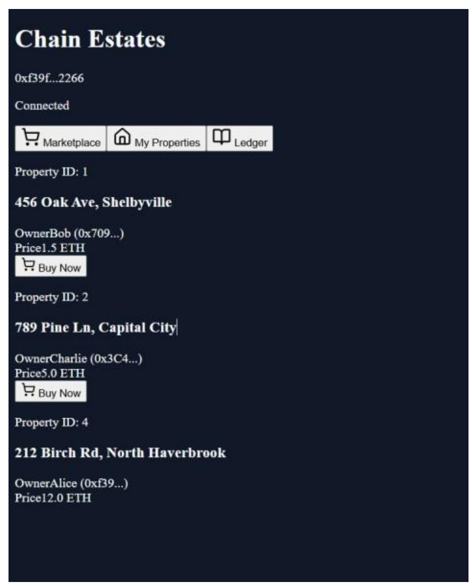


Figure 3: Personal Property Portfolio and Listing Functionality.

- Transaction Ledger: To ensure transparency, the application includes a ledger that displays a complete history of all property sales. This log, populated by querying the PropertySold events from the smart contract, provides an immutable and publicly verifiable record of all transactions, including the property ID, seller, buyer, price, and timestamp (Figure 4).

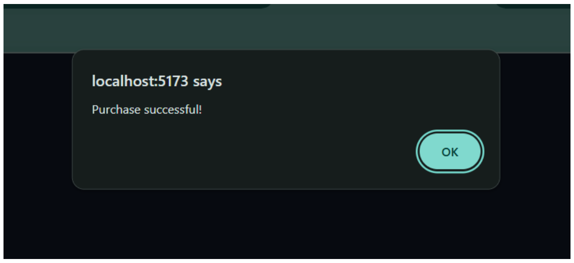


Figure 4: The Transparent Transaction Ledger

5.2 Analysis of Outcomes

The implemented system demonstrates several key advantages over traditional real estate platforms:

- Enhanced Security and Trust: By using a smart contract to govern all transactions, the system eliminates the need for trust between the buyer and seller. The atomic nature of the buyProperty function ensures that the transfer of funds and the change of ownership occur simultaneously, mitigating the risk of fraud. The immutability of the blockchain ensures that property records cannot be tampered with once they are recorded.
- Increased Efficiency and Reduced Costs: The automation provided by the smart contract streamlines the entire transaction process. It removes the need for many intermediaries, such as escrow agents, which in turn has the potential to significantly reduce transaction fees and the time required to complete a sale.
- Full User Control and Ownership: In this decentralized model, users are in complete control of their assets. They hold their properties in their own digital wallets and interact with the marketplace on a peer-to-peer basis. There is no central entity that can censor transactions or take control of a user's assets.
- Transparency: The public nature of the blockchain provides an unprecedented level of transparency. All listings and sales are recorded on an immutable ledger that is accessible to all participants, fostering a more open and fair market environment.

The successful development of this dApp serves as a practical demonstration of how blockchain technology can be applied to create a more modern, secure, and efficient real estate marketplace.

## VI CONCLUSION AND FUTURE WORK

This paper has presented the design, implementation, and analysis of a decentralized property marketplace on the Ethereum blockchain. Our work successfully demonstrates that blockchain technology, coupled with smart contracts, can provide a viable solution to many of the long-standing inefficiencies and security concerns in the traditional real estate industry. By creating a transparent, peer-to-peer platform, our system reduces the reliance on costly intermediaries, streamlines the transaction process, and enhances trust among participants.

The implemented dApp, with its intuitive React-based frontend and robust Solidity smart contract, serves as a functional proof- of-concept. It validates the core premise that complex transactions, such as the sale and transfer of property, can be automated and secured on a decentralized ledger. The key outcomes—enhanced security through cryptographic principles, greater transparency via a public ledger, and increased efficiency through automation— collectively point toward a more modern and equitable future for real estate.

### *6.2 Future Work*

While this project establishes a solid foundation, there are numerous avenues for future development that could further enhance its capabilities and bring it closer to a production-ready system. Future work could focus on the following areas:

- Integration with Decentralized Identity (DID): To increase the security and legitimacy of the platform, a decentralized identity solution could be integrated. This would allow users to verify their real- world identities without relying on a central authority, adding a layer of trust and helping to prevent fraudulent activity.
- Property Tokenization with Non- Fungible Tokens (NFTs): The current system represents properties as structs within the smart contract. A more advanced implementation would be to represent each property as a unique Non-Fungible Token (NFT) conforming to standards like ERC-721 or ERC-1155. This would make each property a distinct, tradable digital asset, opening up possibilities for easier integration

with other DeFi protocols and marketplaces.

- Off-Chain Data Storage and Management: To reduce the cost and storage burden on the blockchain, off-chain storage solutions like the InterPlanetary File System (IPFS) could be used to store property documents and images. The smart contract would then only need to store the hash of these files, ensuring their integrity while keeping the blockchain lean. The documentHash field in our Property struct already provides a hook for this functionality.
- Advanced Smart Contract Features: The smart contract could be extended to include more complex features, such as auctions, rental agreements, and mortgage-like financing mechanisms. This would expand the scope of the marketplace beyond simple buy/sell transactions.
- Deployment to a Public Testnet or Mainnet: To move beyond a local development environment, the dApp could be deployed to a public testnet like Sepolia for wider testing, and eventually to the Ethereum mainnet for real-world use. This would involve addressing gas optimization and scalability challenges.

By pursuing these future enhancements, the foundation laid by this project could evolve into a comprehensive and disruptive platform for the global real estate market.

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