

E-Governance of Properties using Blockchain Technology

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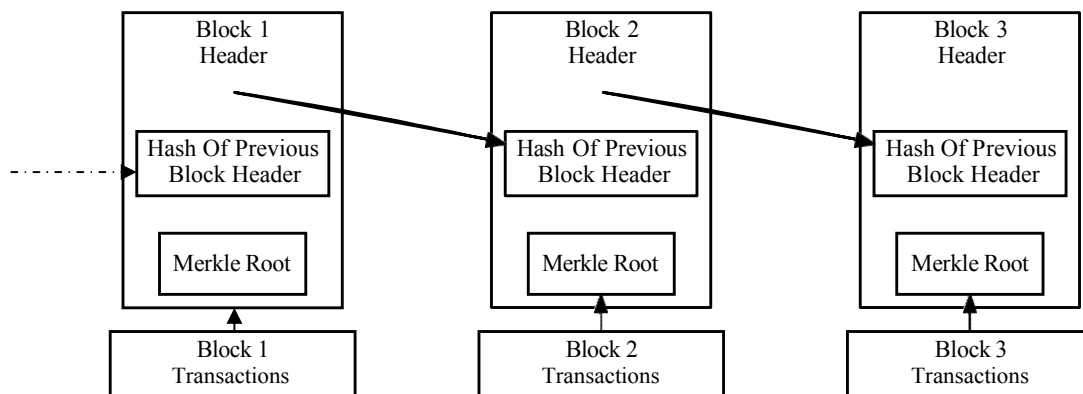
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Abstract: Blockchain technology can be utilized in various ways, and one of its potential uses is in the field of Real Estate. Real Estate transactions require high levels of security and transparency, which are characteristics provided by Blockchain technology. In the traditional process of buying a house, ownership is proven through a physical deed or agreement signed by the government, which is recorded in a ledger maintained by the government. However, if the ledger or deed is lost or damaged, there may not be any other concrete proof of ownership. To address this issue, we propose a system that allows for the creation of a digital deed through a smart contract, which is then recorded as a new block in the Blockchain. The distributed nature of Blockchain technology ensures the integrity of the records even in the case of a system failure or attack, as each node is present on multiple servers.

Keywords: Blockchain technology, Real estate, Transparency, Ownership, Ledger, Smart Contract

I. INTRODUCTION

A blockchain is a distributed ledger or database that stores a secure, decentralized, and transparent record of digital transactions. Each transaction is recorded as a block in the blockchain and is verified by the consensus of the network participants. Once a block is added to the blockchain, it cannot be altered or deleted, making the blockchain an immutable and tamper-proof record of every single transaction ever made on the network.

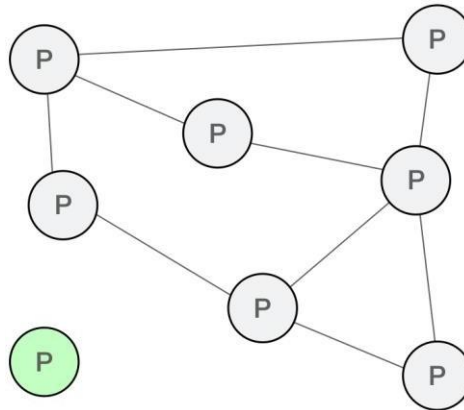


Simplified Dash Block Chain

The blockchain is essentially a data structure that contains various transactions along with some other fields that are hashed using an algorithm called SHA-256. The first block in the blockchain is known as the genesis block, and it does not contain a previous hash as there is no block before it. Every subsequent block in the chain is linked to the previous block using its hash, creating a chain of blocks that is secure, transparent, and tamper-proof.

SHA-256 is a hash function that fulfills all the requirements for an ideal hash, such as being one-way, deterministic, and computationally efficient. The Avalanche Effect is also a crucial property of the SHA-256 algorithm, which ensures that even a tiny change in the data will cause the hash of the block to change randomly, making it impossible to predict or manipulate.

The immutability of the blockchain is attributed to the SHA-256 algorithm, which ensures that any change made to the data will cause the hash of the block to change, breaking the chain. The blockchain is also distributed across a network of nodes, and each node contains a copy of the blockchain. This makes the blockchain resistant to censorship, as there is no central authority controlling it. The consensus protocol is used to ensure that all nodes agree on the validity of the transactions recorded in the blockchain.



Peer to peer network

Hardhat is a popular development environment for building decentralized applications (DApps) on the Ethereum blockchain. Built on top of the Ethereum Virtual Machine (EVM), it offers a powerful CLI that streamlines the development process by providing an integrated suite of tools for compiling, testing, deploying, and debugging smart contracts. One of its key features is the ability to create local blockchain networks for testing, allowing developers to simulate real-world scenarios before deploying to the mainnet. Hardhat also supports multiple programming languages, including Solidity and Vyper, and offers extensive documentation and a robust testing framework. With a large and active community, Hardhat is an excellent choice for developers looking to build DApps on Ethereum or other blockchain networks.

II. LITERATURE SURVEY

Blockchain is a fast-innovative technology that is becoming a major component in various industries. In recent years, blockchain technology is growing at a considerable rate and has gained considerable attention from numerous researchers and institutions.

One such researcher, Ioannis Karamitsos et al., proposed a design methodology for smart contracts that enables the development of different use cases using blockchain technology. He explained detailed working functions and processes that are described for a specific use case providing beneficial contributions to the real estate domain. He also explained how the blockchain helps us for the development of a paperless layer for all city transactions, in a secure way for the optimum management of the smart city's assets. Using this, the smart contract helps to provide a secure, distributed and shared decentralized ledger of all assets and transactions between landlord and tenants.

Konstantinos Christidis et al. provided a detailed description of the working of blockchains and smart contracts and helps us to understand the pros and cons that this will bring to the system. They also laid emphasis on various ways that how the blockchains and IoT can be used together. We gained knowledge of various use cases for the IoT work and also various that can be helpful when implementing blockchain in our project.

Zibin Zheng et al. provided an overview of blockchain architecture firstly and compared some typical consensus algorithms used in different blockchains. Furthermore, technical challenges and recent advances are briefly listed. They also layout possible future trends for blockchain. According to them, blockchain technology has the potential to revolutionize a wide range of industries, including finance, healthcare, and supply chain management.

Avi Spielman in his work explained one aspect of recording property titles - by comparing the advantages and disadvantages of a blockchain with those of the current record-keeping system. According to him, the blockchain title recording system is the future of title record-keeping and would provide faster benefits over the current title recording

system, with additional benefits helpful in the future as blockchain technology grows rapidly.

III. MOTIVATION

Blockchain technology has gained significant attention in various industries due to its innovative nature and fast-paced development. Real estate is one of the industries that has shown an increasing interest in leveraging blockchain technology to improve its traditional processes. The traditional real estate industry has several issues, including lack of transparency, time-consuming processes, and multiple intermediaries involved in transactions. However, the use of blockchain technology can provide fast and transparent transactions and eliminate the need for intermediaries.

One of the primary benefits of using blockchain technology in real estate is its ability to provide a high level of transparency in transactions. The introduction of cryptocurrency enables fast and more transparent transactions, ensuring that there are no hidden fees or costs. The Panama Papers controversy exposed the issues in the traditional real estate industry and revealed the amount of corruption and scams that are taking place. The transparency provided by blockchain technology can help overcome these problems, including corruption, tax evasion, and illegal money transfers.

The security of deeds and agreements in the traditional real estate industry is a major concern. In most cases, the information regarding these records is kept manually in a register. In case this information is lost or misplaced, there is no proof of the actual owner of the property. This becomes a significant concern when there are disputes over a property, as there will be no official proof of ownership. The blockchain technology can provide a secure and immutable digital record of all property deeds and agreements, ensuring that they cannot be tampered with or lost.

IV. EXISTING SYSTEM

Real estate is a complex industry that involves the buying, selling, renting, or leasing, and managing of properties. It is a process that includes various stakeholders such as buyers, sellers, real estate agents, brokers, property managers, and financiers. The traditional real estate industry follows a process where a buyer works with a real estate agent or broker to identify properties that fit their requirements. Once the buyer finds a suitable property, they submit an offer, and if the seller accepts, both parties enter into a contract. The contract specifies the terms and conditions of the transaction, which may include contingencies such as a home inspection and mortgage financing. At the closing, the buyer pays the seller the agreed-upon price, and the seller transfers ownership of the property to the buyer. The transaction is typically facilitated by a title company or attorney who ensures that all legal requirements are met.

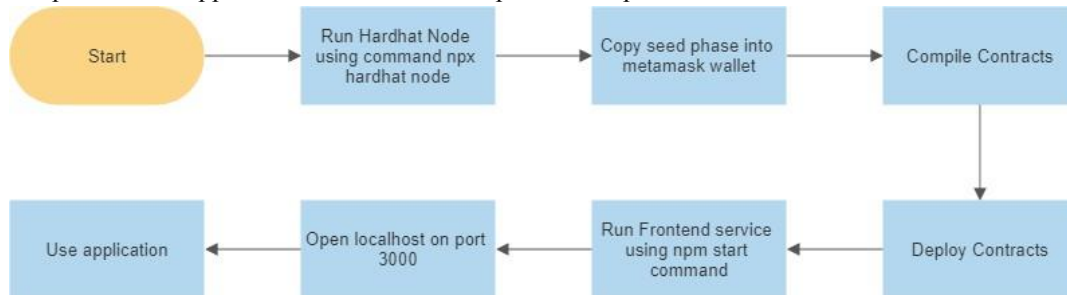
After the transaction, the new owner takes over the responsibility of managing the property, which includes making repairs, paying property taxes, and renting it out if desired. However, the traditional real estate industry has its drawbacks, including being time-consuming and involving multiple intermediaries, which can result in higher transaction costs. Additionally, there is a lack of transparency in the industry, which can lead to fraud, corruption, and scams. The industry is also heavily reliant on manual paperwork, which can be prone to errors and loss of information. These limitations have led to the exploration of web3 solutions that leverage blockchain technology and smart contracts to create more efficient and transparent real estate transactions.

V. PROPOSED SYSTEM

The proposed system for real estate transactions is a decentralized web application that harnesses the power of blockchain technology to offer secure, transparent, and efficient transactions. The application will enable users to buy, sell, and transfer non-fungible tokens (NFTs) representing public properties in a secure and transparent manner. One of the most critical components of the application is the inclusion of an escrow smart contract. The smart contract will handle the transfer of NFTs and funds between the buyer and seller in a secure and transparent manner, ensuring that all parties have equal access to the same information.

The escrow smart contract will utilize the ERC721 interface for NFT transfers and will contain multiple functions that can only be called by specific parties. These functions are designed to guarantee the proper flow of the transaction, ensuring that it progresses smoothly. Furthermore, the contract will include multiple mappings that monitor the status of the transaction, such as whether the NFT is listed for sale, the purchase price, and the amount of funds held in escrow. The contract will serve as a mediator between the buyer and seller, ensuring that the transaction is completed.

only when all parties have approved the sale and the inspection has passed.



The proposed system has several advantages over traditional real estate transactions. Firstly, it is a decentralized system that eliminates the need for intermediaries such as brokers, reducing transaction costs and increasing efficiency. Secondly, it provides a secure and transparent transaction process through the use of blockchain technology, eliminating the risk of fraud and ensuring that all parties have access to the same information. Thirdly, it allows for fractional ownership, making it easier for people to invest in public properties and increasing liquidity in the market.

The proposed architecture of the E-Governance of public properties decentralized web app consists of three layers. The presentation layer, which is the user interface of the application, will be developed using React. The user interface will be designed to provide an intuitive and user-friendly experience for the users. The business layer will include the smart contract code, which will be developed using Solidity. The smart contract code will be responsible for handling the business logic of the application, including the escrow service, NFT transfer, and payment processing. Finally, the data layer will be the blockchain, which will be implemented using the Ethereum network. The blockchain will store all the data related to the application, including the NFTs, transactions, and escrow service. This three-layer architecture will work in tandem to ensure that the E-Governance of public properties decentralized web app runs smoothly and effectively, providing secure and transparent real estate transactions to users.

- **Frontend:** We have used React to implement the front end. There are two main pages accessed by the user and admin- React is used to create single page applications and its key feature is to make applications in a modular way thus making it easier to reuse the code and debug. HTML elements can be modified dynamically.
- **Backend:** The back end is supported by the Solidity contract. Solidity contract can be deployed using the Hardhat Framework- The Hardhat-CLI which is an efficient Blockchain emulator runs on Port 8545 and provides IO free addresses with 100 Ethers each to spare. A Firefox extension called Meta-Mask has been used to display the chain. Phase I: In this phase, a Blockchain Simulation is run on HARDHAT and shown on Metamask. The Contract is deployed by one of the account/addresses on hardhat.

When we run Hardhat CLI, it starts listening on port 8545. There are IO addresses and private keys associated with them. A seed phrase i.e., a randomly generated key is shown. MetaMask is a browser extension and acts as a wallet interface in which the users can check their account details. This account is linked to the IO addresses on HARDHAT, giving IO different accounts on separate addresses. HARDHAT provides 100 ETHERS per account for the transactions to be done. When the seed phrase is entered into the respective field in MetaMask, it gets linked to HARDHAT.

This is followed by compiling and deploying smart contracts. The smart contracts get compiled with the help of a command `hardhat compile`. The Hardhat compiler checks if the syntax is correct and makes the contract ready for deployment. The deployment is charged a minimum amount of ETHERS. The account selected on the MetaMask extension will be the primary account on port 8545 and the amount will be deducted from there.

Finally, the Front End is run on the port 3000 on localhost with the help of a command `npm start`. This command runs the React code and sets it up on port 3000 on the localhost.

VI. RESULTS AND DISCUSSION

The Hardhat Node is started and thus starts running on its default port 8545. There are 10 addresses with 10 private keys each and 100 ETH each.

```

→ millow git:(master) x npx hardhat node
Started HTTP and WebSocket JSON-RPC server at http://127.0.0.1:8545/

Accounts
=====

WARNING: These accounts, and their private keys, are publicly known.
Any funds sent to them on Mainnet or any other live network WILL BE LOST.

Account #0: 0xf39Fd6e51aad88F6F4ce6aB8827279cFfFb92266 (10000 ETH)
Private Key: 0xac0974bec39a17e36ba4a6b4d238ff944bacb478cbed5efcae784d7bf4f2ff80

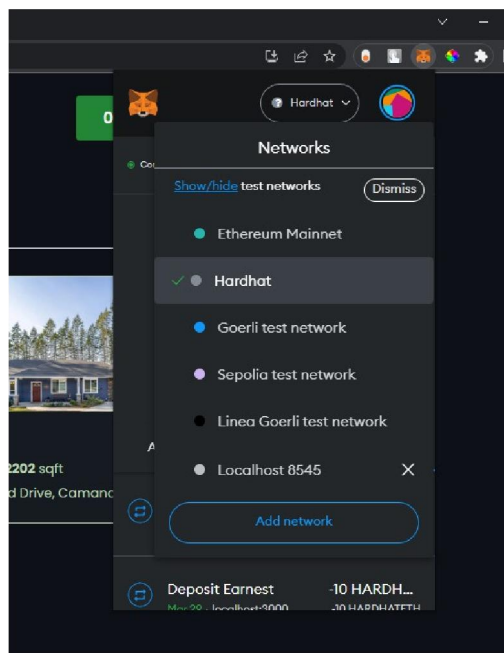
Account #1: 0x70997970C51812dc3A010C7d01b50e0d17dc79C8 (10000 ETH)
Private Key: 0x59c6995e998f97a5a0044966f0945389dc9e86dae88c7a8412f4603b6b78690d

Account #2: 0x3C44CdDdB6a900fa2b585dd299e03d12FA4293BC (10000 ETH)
Private Key: 0x5de4111afa1a4b94908f83103eb1f1706367c2e68ca870fc3fb9a804cdab365a

Account #3: 0x90F79bf6EB2c4f870365E785982E1f101E93b906 (10000 ETH)
Private Key: 0x7c852118294e51e653712a81e05800f419141751be58f605c371e15141b007a6

```

The seed phrase which is a dynamic key is pasted from Hardhat to the MetaMask extension to login into the wallet.



Hardhat compiles the contracts and deploys it by using the command `hardhat run --network localhost scripts/deploy.js`. Here, the account open on port 8545, on MetaMask will be the default account and will be used to deploy the contract.

```

→ millow git:(master) x npx hardhat run scripts/deploy.js --network localhost
Deployed Real Estate Contract at: 0x5FbDB2315678afecb367f032d93F642f64180aa3
Minting 3 properties ...

Deployed Escrow Contract at: 0xe7f1725E7734CE288F8367e1Bb143E90bb3F0512
Listing 3 properties ...

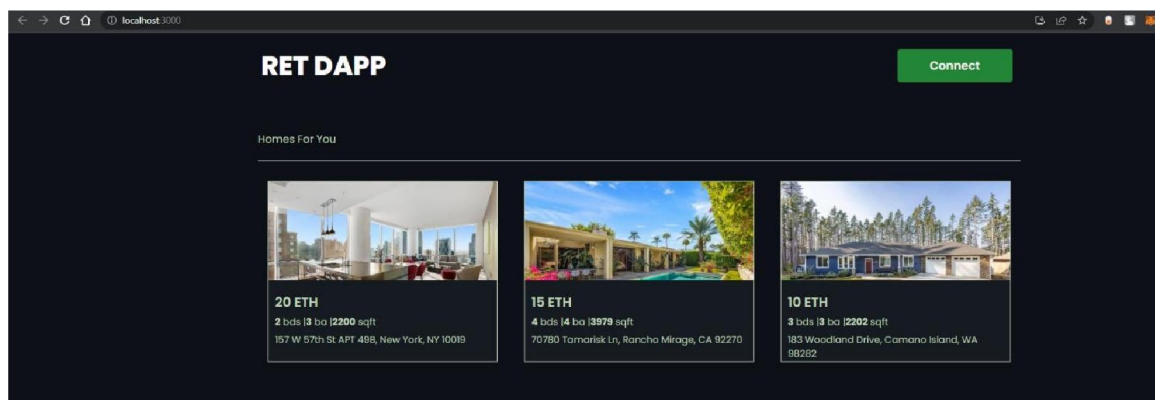
Finished.

```

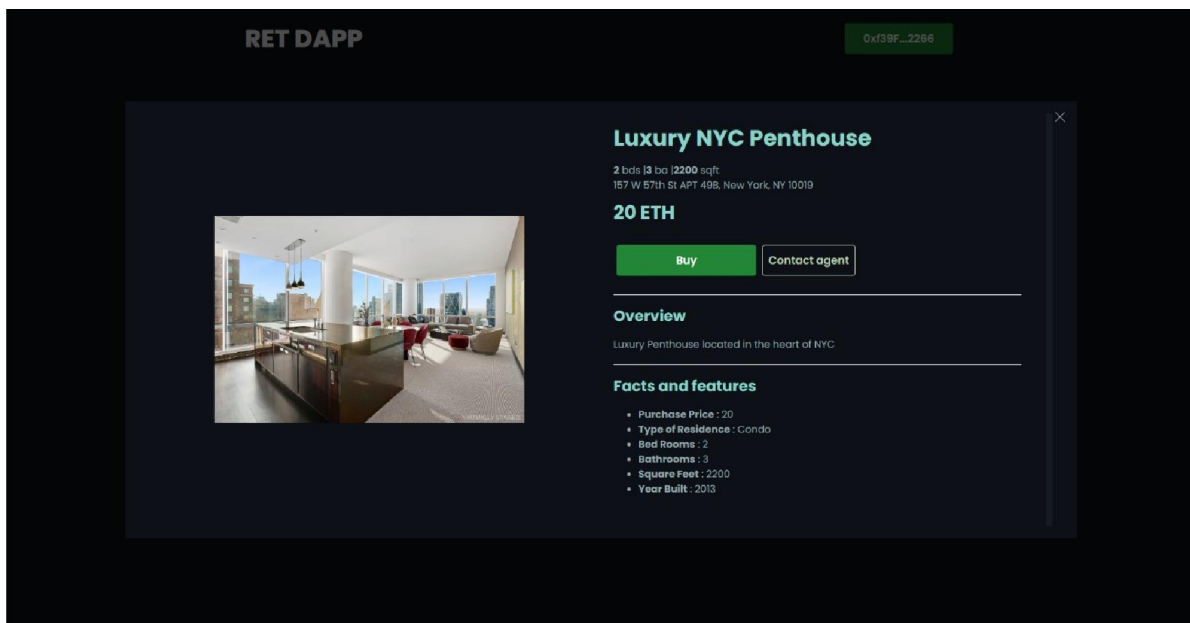
React page is started

```
→ mallow git:(master) x npm start  
  
> mallow@0.1.0 start  
> react-scripts start
```

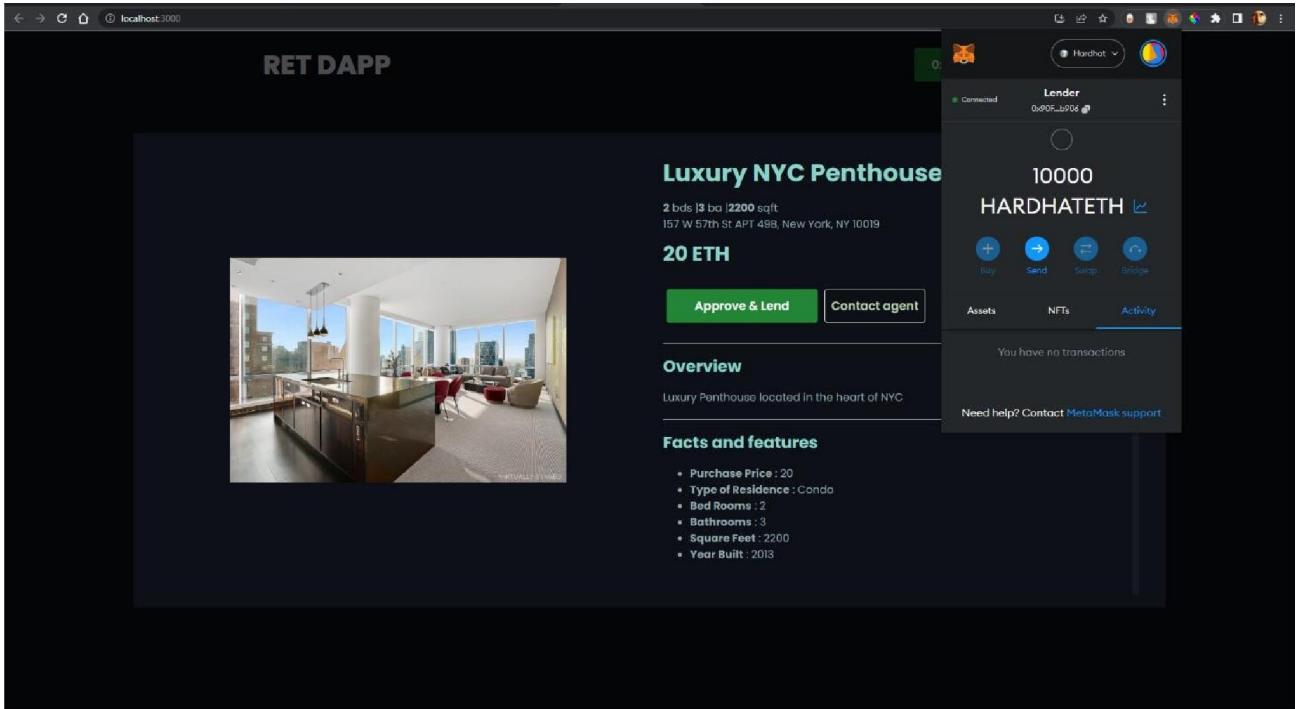
Home page displays the listed properties



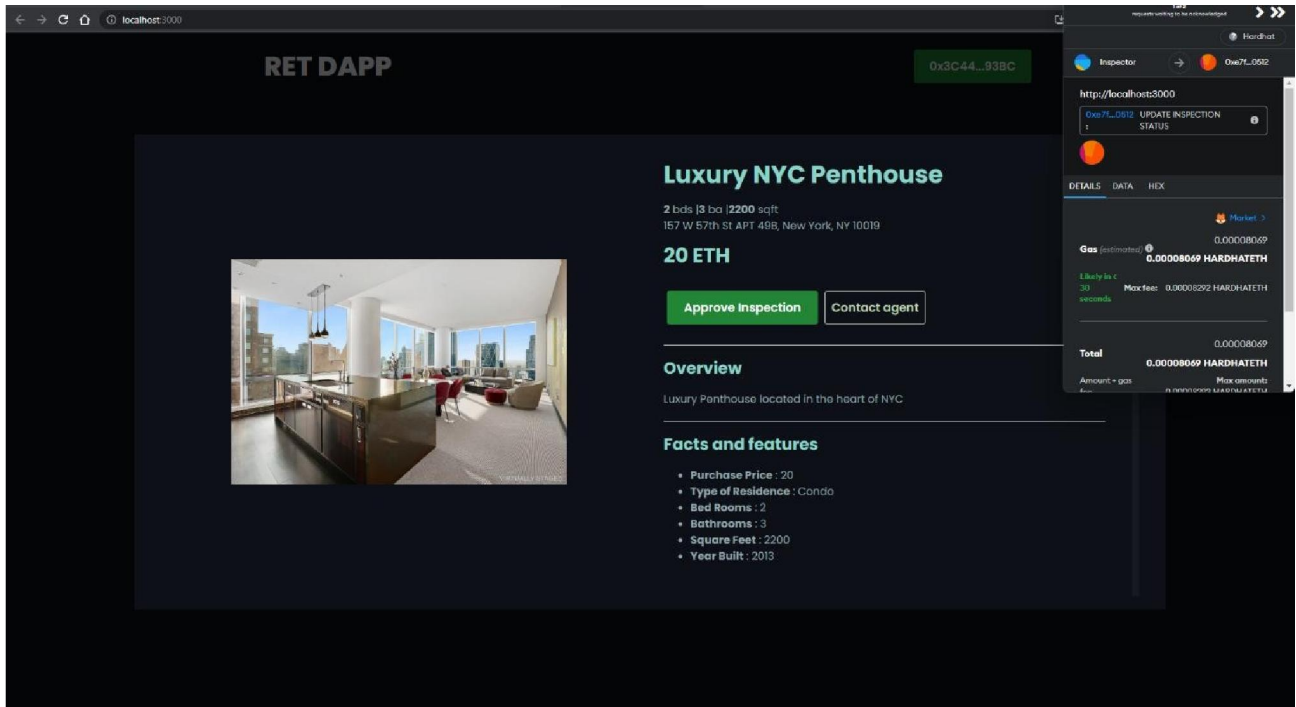
Switch the network to local chain (Hardhat node). Property Component looks as follows



Buyer approves and Initiates buy with half of the amount to be paid sent to escrow.

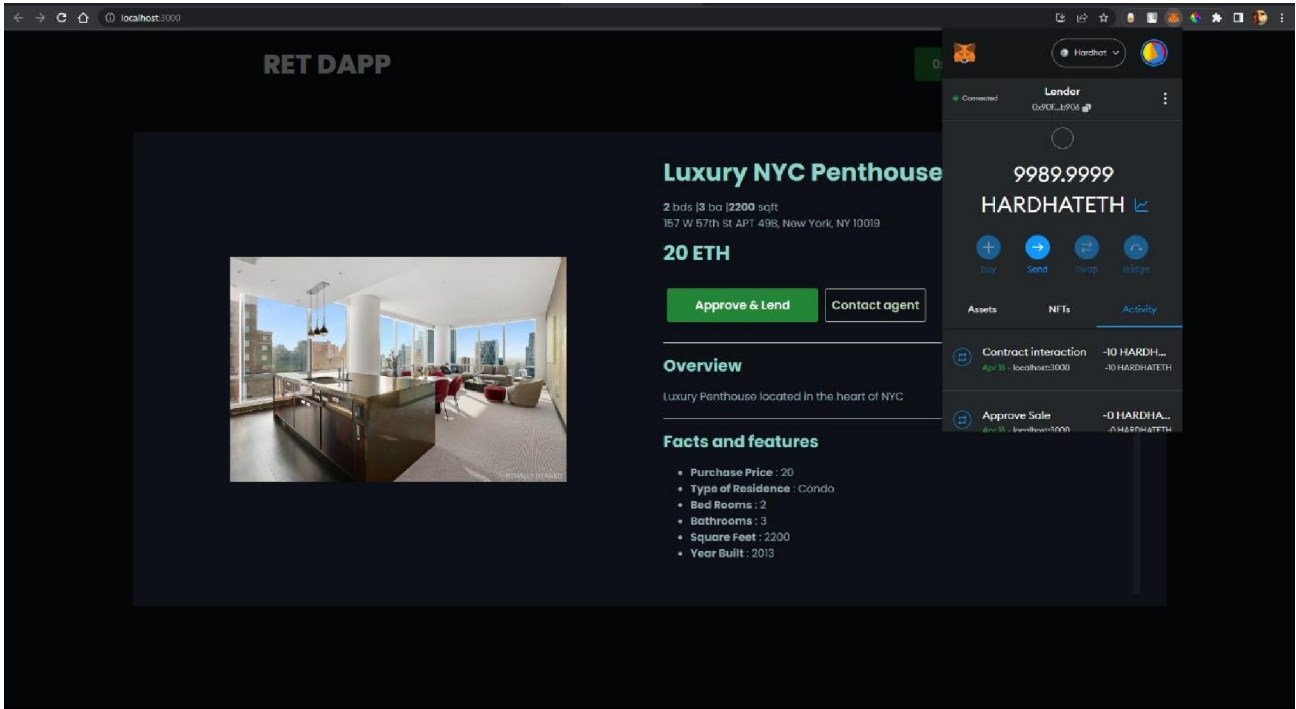


Inspector approves inspection

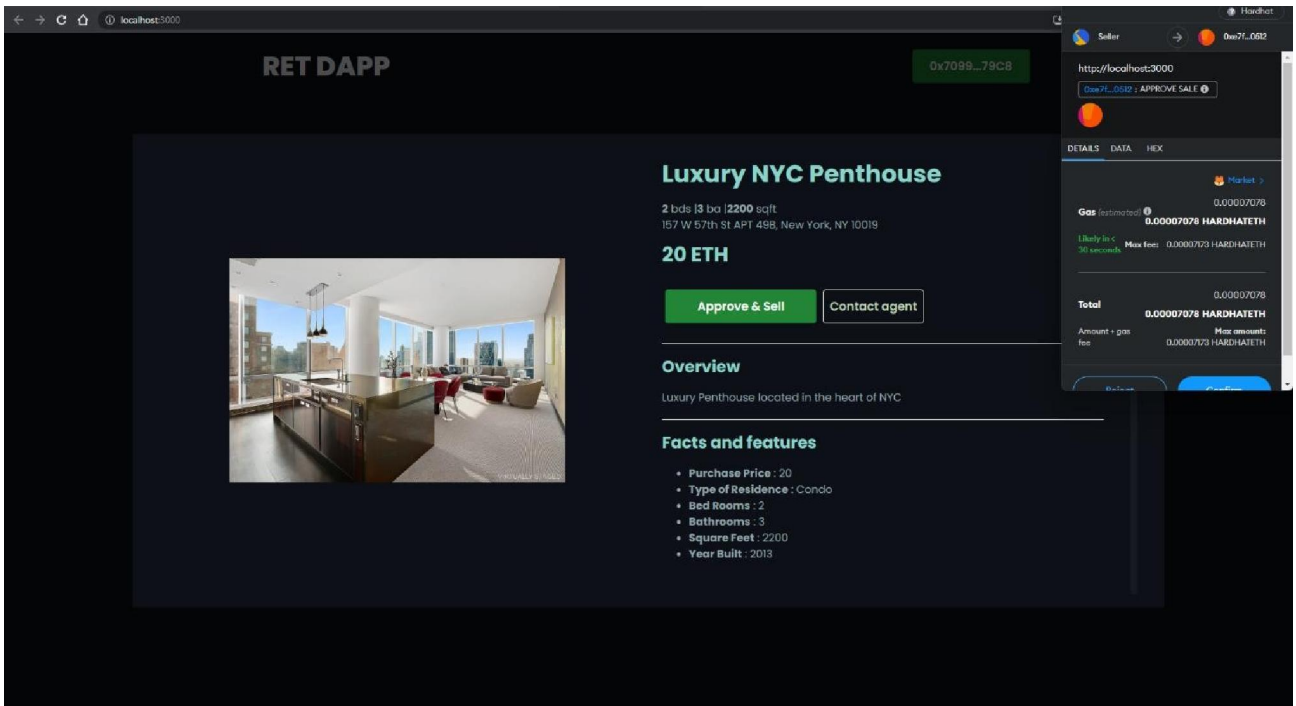


Lender lends remaining amount to escrow.

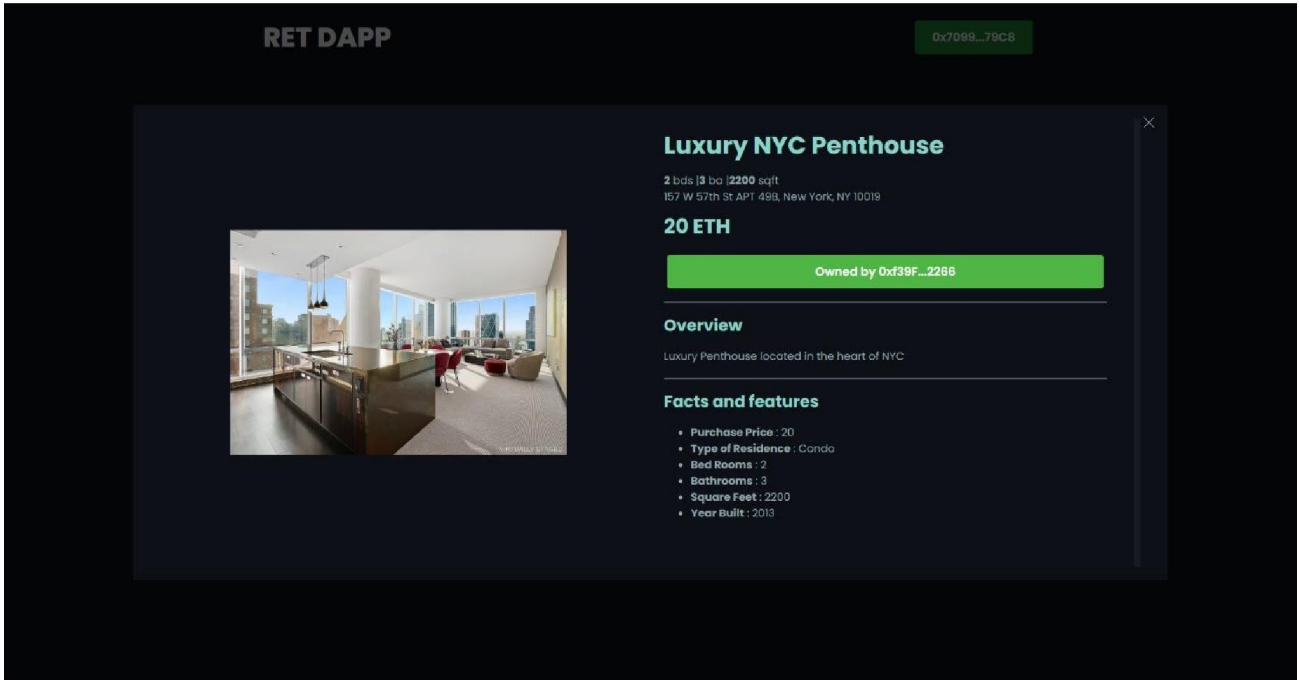
Lending decreases ether in Lender's account confirms transfer of ether to escrow.



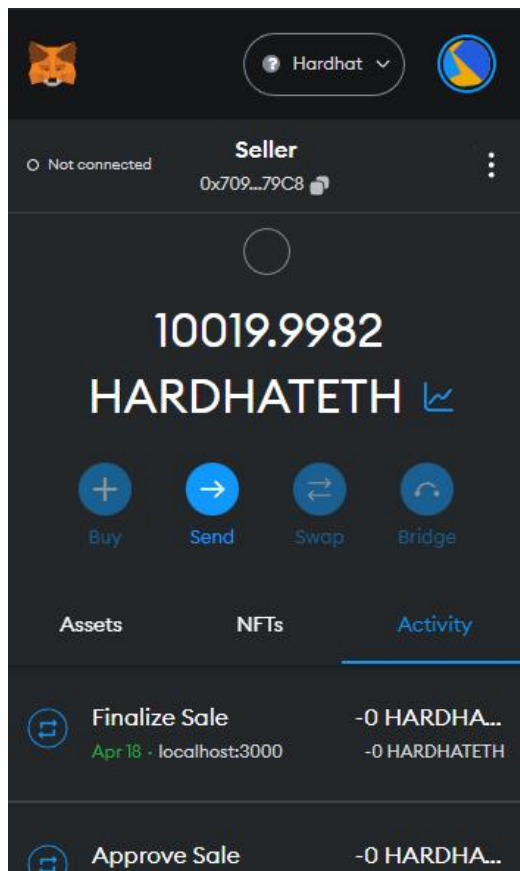
Finally, Seller approves the sale transfers property to buyer



Now, buyer own the property



Seller gets the amount for the property.



VII. FUTURE SCOPE

While our project is functional and meets the requirements, there are several areas where it can be improved and expanded upon. One area for future enhancement is the user interface of the application. While the current interface is functional, it could be made more user-friendly and intuitive with additional features such as search filters, sorting options, and a user dashboard. This would improve the user experience and make it easier for users to navigate the platform.

Another area for improvement is the integration of additional functionalities to the application. For example, the ability to add digital signatures to contracts and documents would increase the level of security and transparency in transactions. This could be accomplished through the integration of third-party signature verification services or through the development of a proprietary solution.

Additionally, the application could be expanded to include more types of real estate properties beyond just houses and apartments. This would require modifications to the smart contracts and the addition of new functionalities to the platform, such as the ability to handle commercial property transactions.

Also, the scalability of the application could be improved to handle larger volumes of transactions. This could be accomplished through the optimization of the smart contracts and the use of sharding or layer-2 solutions.

VIII. CONCLUSION

Blockchain provides an innovative solution to the challenges facing the real estate industry, including the lack of transparency and security in transactions. Our application leverages the benefits of blockchain technology to provide a secure, transparent, and efficient platform for the buying and selling of real estate properties.

Through the development of smart contracts and the integration of the escrow service, our application provides a secure and transparent way for buyers and sellers to conduct transactions. The use of NFTs ensures the authenticity of properties and reduces the risk of fraud in the buying and selling process.

IX. ACKNOWLEDGMENT

On this great occasion of accomplishment of our project on E-Governance of properties using blockchain technology. We would like to take this opportunity to extend our heartfelt appreciation to P. Ravi sir, Assistant Professor in the Department of Computer Science and Engineering at Raghu Institute of Technology-Visakhapatnam, for all the support he has provided throughout the completion of this project. At several points along the process of finishing this job, your insightful direction and recommendations were a great assistance to us. In this sense, we will be grateful to you for the rest of my life. To conclude, as a member of the team, we would like to express my gratitude to the other members of the group for their assistance and coordination, and I express the hope that we will be successful in our ongoing endeavours.

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