A Blockchain-Based Housing Lease Transaction Mechanism

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Abstract—In traditional house leasing transactions, real estate intermediaries are used as information transfer and trust guarantee, which virtually increases the cost and risk of both parties to the transaction. At the same time, the transaction process often requires cumbersome communication, negotiation and signing processes. Therefore, this chapter designs a blockchain-based housing lease transaction mechanism, and in order to improve the time for both parties to reach agreement on a transaction, an optimization model for housing lease transaction matching is proposed to improve the efficiency and transaction rate of lease transactions.

Keywords-component; blockchain; smart contracts; house rental transactions;

1. TRADITIONAL HOUSE LEASING TRANSACTIONS

Since entering the period of reform and opening up in 1979, my country's housing supply has shifted from unified distribution by work units to privatization and marketization [1]. Along with the process of urbanization, the transaction volume of the real estate industry has grown explosively, and the soaring housing prices have made more people choose to live in rented houses. At present, there are mainly two ways of offline transactions and online transactions in house leasing transactions [2]:

Offline transactions mainly include direct rental by landlords and rental by real estate agents. The former has no agency fees and is relatively inexpensive, but has a smaller number of properties to choose from and requires more time and effort. In the latter case, the real estate agency provides the tenant with a large amount of housing information and coordinates the views of both parties to the lease, but the tenant has to find different shops one by one, which is time-consuming and expensive, and is prone to the agent renting more than one room.

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Online transactions mainly include website/software rental and public rental supported by government policies. In the website/software rental, tenants can find satisfactory housing sources through the Internet platform or software, and combine with offline viewing or online VR to determine the final transaction. For landlords and tenants, this method is convenient and quick, and the process is short, which greatly saves time and energy. However, security is difficult to guarantee. The platform may have security loopholes or be attacked by hackers, which may easily cause personal information leakage and property loss. In addition, housing information is easy to falsify, and it is very likely that the housing does not exist and the pictures of the housing are not true, which leads to a lack of trust, and the public rental housing supported by government policies is a public rental housing system built by the government to solve the housing difficulties of low- and middle-income groups. The rental housing security system with public rental housing as the main body eliminates false housing sources and "black intermediaries" from the source. Eligible tenants can submit an application to the local government, and the registration is successful if there is no objection after the materials are successfully reviewed. However, housing projects can only cover a part of the low- and middle-income groups, and there are many restrictions, and there is a phenomenon of "difficulty exiting", which makes the demand for private rental housing grow day by day.

2. HOUSING LEASE TRANSACTION MECHANISM UNDER THE BLOCK CHAIN

The shareable, trustworthy, and traceable features of blockchain technology [3-4] can construct a decentralized, credible and reliable housing rental transaction environment [5], which has significant transaction advantages in the housing rental industry [6-9].

2.1 Adaptability Analysis of Blockchain and Housing Leasing Transactions

This part starts from the business and leasing process characteristics involved in house leasing transactions, combines the current problems faced by house leasing, and comprehensively considers the cross-action and influence between blockchain and house leasing transactions, and uses this to analyze the relationship between the two adaptability [10-12]:

2.1.1 High transaction efficiency

In the process of house leasing transactions, human participation is often required to participate in the review and the process is complicated. However, smart contracts running on the blockchain can replace the cumbersome manual operations in the past, code the transaction requirements, transaction rules and business logic in the leasing process, and access The world state and recorded historical data in the blockchain ledger can automatically judge whether the current state of the leaser meets the triggering conditions according to the conditions stipulated in the contract, and can automatically execute the transaction operation in the contract, and the execution process of the smart contract will be complete. Every time the smart contract is executed, the state of the world will be updated accordingly, effectively reducing the cost of manpower and material execution in the transaction process, and ensuring the fairness and effectiveness of the transaction.

2.1.2 information transparency

Different from the situation where information asymmetry existed in the transaction subject in the past, the chain structure of the blockchain guarantees the detailed information of each transaction that can be traced back. Therefore, in the environment of the blockchain, both parties of the house lease can view or verify transaction information on the chain, including the performance and breach of contract of the transaction object, the transaction process is more transparent, and to a certain extent avoids the uncertainties and risks that exist when both parties sign a contract or perform a contract. In addition, the application of asymmetric encryption algorithm makes the authenticity and reliability of the data in the network more guaranteed, and once the transaction data is uploaded to the chain, it cannot was deleted or changed, so as to ensure that the information obtained by both parties to the transaction is original data, which can solve the problems of falsification of contract data and information forgery in house leasing transactions, and can protect the privacy and security of users, and can also be used as effective evidence to reduce the occurrence of friction in house leasing .

2.1.3 High security

The decentralized feature of the blockchain makes it different from traditional centralized management. When writing data into the blockchain, each node needs to agree on the data. When-the node consensus is completed, the ledgers of each node in the blockchain network will be updated synchronously to maintain the consistency of the ledgers. Therefore, even if a node fails or is attacked maliciously, the entire blockchain network can still work normally. Currently the most extensive blockchain platform Ethereal middle The Ethash workload proof algorithm is used for consensus, and Through rigorous mathematical operations promise Consistency among multiple nodes, and no third party required of support At the same time, the anti-mining machine mechanism is also adopted to prevent a small number of nodes from deploying large-scale mining machines with strong computing power to improve mining efficiency and monopolize block rewards, which can encourage more nodes to join Ethereum network The new block is verified in the middle, which not only maintains the decentralization property of the blockchain network, but also reduces unnecessary resource consumption.

2.2 Housing lease transaction framework under blockchain technology

Under the framework of the house lease transaction, the house lessor and the house lessor no longer make trust endorsements through real estate intermediaries or other third-party institutions, but combine the house lease transaction with the Ethereum open source blockchain[9], through the use of peer-to-peer transactions The method is that both parties to the house lease directly realize the transaction and settlement of the house lease in a safe, transparent and reliable transaction environment. The whole process of the transaction will be automatically executed based on the smart contract to realize the transfer of funds between the leasing entities, while using anonymous identity authentication and encryption algorithms to protect the privacy and security of both leasing parties[13-14]. It is worth noting that every transaction executed during the house leasing process will be completely recorded in the block chain. The leasing information is open, transparent and cannot be tampered with, which can effectively prevent users from fraudulent behavior and can benefit both parties Supervise each

other and reduce transaction disputes. In addition, in order to improve the credibility among transaction subjects and the security of the house rental transaction network, access criteria have been added to the rental transaction network. Only transaction users can be eligible to participate in house rental transactions after successful account registration. The constructed housing rental security transaction framework is shown in Fig. 1, which is divided into five layers from top to bottom: user layer, application layer, interface layer, smart contract layer, and core support layer.

User layer, this layer aims to provide identity mapping between the blockchain-based house leasing transaction platform and different types of leasing entities. Different identities have certain differences in the use of platform functions and authority ownership. In addition, house lessors. Application layer, which provides different application services for leasing entities with different identities. Through various corresponding functions provided by the blockchain-based house leasing trading platform, leasing entities can realize their different transaction needs. Specifically, it includes transaction identity registration, transaction type selection, transaction request release, transaction matching, lease contract creation and signing, order query, etc. The transaction request will be passed to the smart contract layer for processing through the interface layer, and the execution result will be returned to the user's visualization page after the processing is completed.

The interface layer, which is the bridge connecting the application layer and the smart contract layer, simplifies the difficulty of development through the API interface and provides convenient access and calling methods for the application layer. The API interface is provided by Ethereum, mainly including Web3.js, JSON-RPC, IPC and so on.

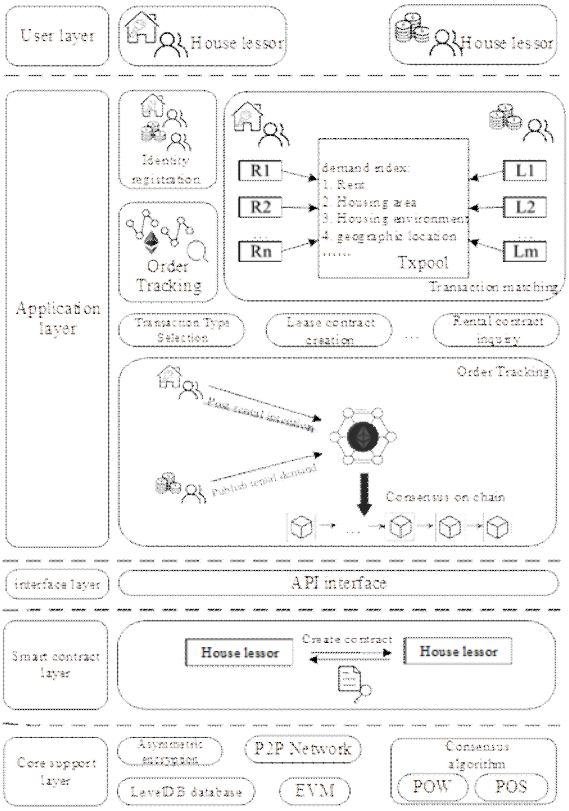

Figure 1. Housing lease transaction framework under blockchain technology

The smart contract layer, which implements the key business logic of house rental transactions, processes and implements different requests from users at the application layer by using smart contracts. By comprehensively considering the housing transaction amount, transaction time, geographical location and other aspects, a rental matching smart contract is designed for both parties. When users submit their own rental needs or house rental intentions through the user page provided by the platform and initiate a transaction request, The contract will be triggered when the preset conditions are met and run automatically according to the pre-established rental housing transaction rules, so that the entire transaction is matched without the intervention of three parties and the whole process is safe and credible.

The core support layer, which is the core technology provided by the Ethereum blockchain for normal transactions of house rentals. Encryption algorithm, P2P network, consensus algorithm, LevelDB database and Ethereum Virtual Machine (Ethereum Virtual Machine, EVM), etc. Asymmetric encryption and Hash algorithm prevent users without access rights from viewing the content of smart contracts from the level of cryptography, thereby ensuring the confidentiality and security of smart contracts, and can be used to verify the validity of house rental transactions and user identities. The transmission and synchronization of transaction data between nodes on the platform is realized by the P2P network, and the status of the entire network is maintained through message sharing. The consensus algorithm can determine

which rental transactions are packaged into the next block so that the transaction data in the house rental internal network is consistent, preventing malicious tampering or falsification of transaction data to ensure the security of the entire network. The LevelDB database stores the data on the chain in the form of key-value pairs. In order to avoid synchronizing a large amount of original data on the block at the same time and save the gas cost when the data is uploaded to the chain, the method of fragmentation is used to reduce the network burden and improve the speed of data access. EVM module is provides a reliable and isolated execution environment for operations such as deployment, invocation, interaction, and gas billing of smart contracts.

2.3 Trading Rules

In order to standardize distributed house leasing transactions, the following rules are formulated:

Rule 1: All users participating in the distributed housing leasing transaction must first obtain the access qualification of the blockchain distributed housing leasing trading platform, and the platform will review the information provided by both parties;

Rule 2: All users can only choose one of the two identities of the house renter and the house lessor to participate in a rental transaction;

Rule 3: There are multiple house lessors and house lessors on the platform performing rental transactions at the same time.

Rule 4: The number of house lessors and house lessors is limited and the two are disjoint.

2.4 Transaction Process

As shown in the Figure 2, the blockchain-based housing rental transactions can be chronologically main divided into five stages:

Registration stage, post transaction stage, transaction matching stage, the deal is reached stage and Consensus on chain stage. Use the block chain to store the transaction data of house leasing, realize the information interaction between the house lessor and the house lessor, and broadcast the rent, lease period and surrounding environment of the leased house in the house lease transaction network, and at the same time through specific The matching process and smart contract complete a series of non-tamper able processes such as automatic transaction settlement with the optimal lease object, and perform corresponding supervision on the behavior of the transaction subject after the transaction is completed. Specific transaction step like Figure 2:

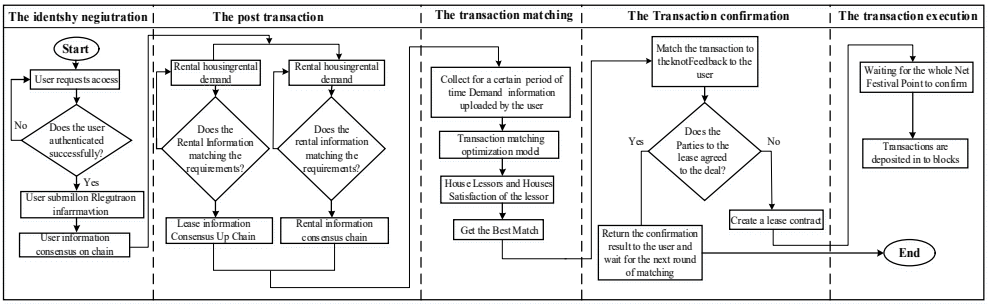

Figure 2. Blockchain-based housing rental transaction process

Identity registration stage: The house lessor and the house lessor need to register their identities on the chain first, and obtain their own unique public key and private key, which is the prerequisite for participating in house leasing transactions. Everyone will use their own private key to generate a wallet to participate in the house rental transaction.

Post transaction Stage: Both parties to the lease submit their own transaction requests in the blockchain network. Among them, the house lessor releases its own demand information, including specific indicators such as the house area and geographical environment, and the house publisher publishes the renting intention of the house, including rental demand and the status of the house. The platform will check the demand indicators uploaded by both parties to the lease, and judge whether their attribute fields meet the specifications. The demand indicators that successfully pass the inspection will be added to the next block.

Transaction matching Stage: After collecting the rental needs provided by the house lessor and the house lessor for a period of time, match the two parties according to the house lease transaction matching optimization model and use the improved TLBO algorithm to solve the model to determine the optimal transaction object.

Trade Confirmation stage: According to the matching results, when both parties to the transaction agree to the transaction, a corresponding smart contract will be created and a transaction list will be generated, including the initiator of the lease transaction, the time of the transaction, the target account of the transaction, the price of the transaction, and other information. If one party to the transaction is not satisfied with the matching result, the transaction process will stop immediately, and users can choose whether to wait for the next round of matching according to their actual situation. In order to prevent the information from being maliciously tampered with, the user needs to perform a Hash operation on the transaction information before actually sending the transaction, and sign the result with a private key.

Transaction execution stage: After submitting the transaction, wait for the nodes of the whole network to verify. After the node receives the broadcast information, it will verify whether the transaction is valid. If the verification is successful, the transaction is added to its own transaction pool and propagated to adjacent nodes. If the verification fails, it is an invalid transaction. Then select the transactions in the transaction pool according to a certain priority to construct a preparatory block, compete to solve a mathematical problem based on the hash

algorithm, and constantly adjust the random number Nonce in the preparatory block so that the generated hash value is smaller than the target hash value. The first successful node broadcasts the new block to the adjacent nodes for further verification. When the adjacent nodes receive and pass the verification, they will add the new block locally and abandon the calculation of the current block until the nodes in the whole network confirm complete.

At this time, the corresponding transaction ends, and both parties to the lease can check the details of the historical house lease transaction on the chain at any time.

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