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Housing rental system based on blockchain Technology

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Abstract. As for the housing rental market, there are many landlords, arbitrary charges, false rental information and so on, and it is difficult for the government to record and supervise the housing rental situation. Based on the block chain technology of encryption algorithm, this paper constructs a housing leasing Alliance chain. The landlord and tenant sign lease agreements through smart contracts, determine the lease relationship, pay and collect rent automatically on a regular basis, and return the rental right when due. In the design of the Alliance chain network, the certification department node and the record managerment node are introduced to authenticate the authenticity of the house source and personal identity information, and backup the lease contract information, register the housing rental situation, and achieve the effect of safe leasing. This method eliminates the mediation, less cost, clear housing rental information, and is conducive to government market supervision.

1. Introduction

With the increase of floating population, the problem of Housing leasing is becoming increasingly prominent. There are a lot of housing rental systems. In Li rui's "design and implementation of a block chain based housing rental allocation system"[1], intelligent intermediary nodes are introduced to realize the housing matching between the landlord and the tenant, and the leasing information is put on the chain, but the intermediary problem is not solved. In Li Jiawen's "design and implementation of housing rental platform based on blockchain technology"[2], the article combines stellar star network to build a house rental system, which manages transactions through smart contracts and multi-signatures, and uses the storage security of blockchain to complete house leasing. However, there is a lack of specific design in identity verification design. In Rosie's "design and implementation of housing rental service system based on micro-services"[3], the paper adopts the self-employed housing rental mode. The housing rental service agencies have the right to rent houses, using the micro service architecture to provide rental services. Compared with the block chain storage mode, the security of information storage is insufficient.

The data storage based on blockchain has the advantages of tamper proof and traceability, which is conducive to the preservation of lease contracts[4]. Moreover, it is decentralized, which can avoid intermediary services and realize the one-to-one handover between the landlord and the tenant. Based on the Alliance chain architecture, through P2P peer-to-peer network, private landlord nodes, tenant nodes, rental company nodes, public rental housing nodes, certification department nodes, the record managerment nodes, join the network and participate in the leasing process[5]. At the same time, based on the programmable smart contract, online agreement is reached and implemented automatically, which saves time and effort and facilitates market management[6].

2. Technical Background

2.1. Blockchain structure

As shown in Figure 1, the structural form of a blockchain[7][8] is a chain structure in which one block is connected with another. Blocks are connected by hash operation. Hash operation is unidirectional and irreversible. After a certain number of blocks are generated, the transactions packed by blocks will be determined. If you want to void the original block record, you need to generate forks to change the generation direction of blocks. The participants of the blockchain network package the transaction records recognized by the participating nodes into the chain through consensus algorithm[9]. The proof of work algorithm represented by bitcoin[10] chain as an example, the node that completes the difficult hash calculation first obtains the bookkeeping right, packs all transactions, and thus gets the reward of virtual currency bitcoin.
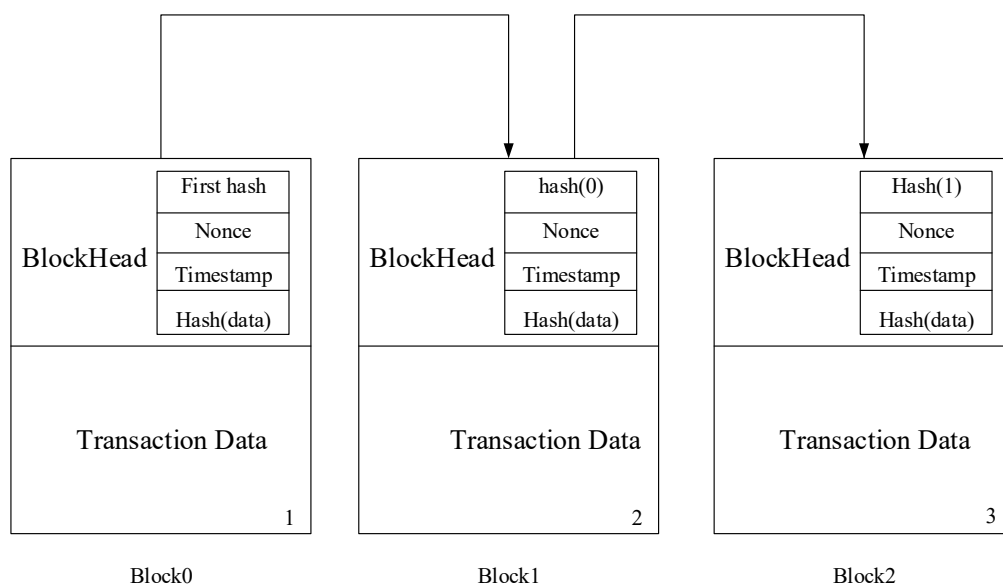

Figure 1 Blockchain structure

2.2. Smart contract.

Smart contract is similar to the form of real contract. It can be automatically executed by writing script language code. Taking Ethereum smart contract as an example, it has Turing completeness. In principle, it can write any contract and has state machine mechanism. When a certain condition is triggered, the state of state machine will change and the contract content will be executed. This method improves the application intelligence[11][12][13].

According to the trigger conditions contained in the event description information, the smart contract system automatically sends the preset data resources and events including the trigger conditions from the smart contract when the trigger conditions are met. The core of the whole smart contract system is that the smart contract is processed by the smart contract module in the way of transaction and event. The smart contract is just a system composed of transaction processing module and state machine. It does not generate smart contract or modify smart contract. It exists only to make a group of complex and trigger conditions Digital commitment can be implemented correctly according to the will of participants.

2.3. Alliance chain

Alliance chain is a weakly centralized organization structure. which allows multiple organizations to participate. Only for the members of a specific group and limited third parties, it specifies multiple pre-selected nodes as bookkeepers, and the generation of each block is determined by all the pre-selected

nodes. It is characterized by partial decentralization, strong controllability and fast transaction speed. Data is not exposed by default.

Frabric project belongs to the application of Alliance chain, which is supported by Linux foundation[14]. It is bound by chain code and smart contract, and connects multiple organizations through channels. Using Kafka[15] consensus algorithm, each organization has its own ledger, and through authorization, it can have the authority to manage another organization's ledger. Each organization has an anchor node and a master node. The anchor node is responsible for communicating with other organizations, and the master node is responsible for communicating with the ordering service node. Through the blockchain network, each node reaches a consensus. Ordering nodes package transactions, broadcast other nodes to update ledgers. This system is based on the architecture of Fabric project.

3. System Design

3.1. System entity

The participating entities of Alliance chain can be divided into six categories: Certification Department, record management department, private landlord, leasing company, public rental housing management agency and tenant.

Certification Department: the main responsibility of Certification Department is to verify personal information and real estate information. The authentication of personal information is to verify the authenticity of the identity, and the real estate information is to verify the owner of the real estate and the service life of the house.

Record management department: the main responsibility of the record management department is to record the housing rental situation and the lease contract reached by both parties. It not only records the housing rental situation, but also supervises the validity of the lease.

Private landlords: private landlords can register and rent the idle houses in their own names.

Leasing company: the leasing company can register and rent the houses under the name of the company.

Public rental housing management organization: the public rental housing management organization can register and rent the houses under its management.

Tenant: the tenant can conclude a lease contract with the private landlord, leasing company and public rental housing, and sign relevant terms and conditions.

3.2. Overall structure of leasing system

As shown in Figure 2, the system is mainly composed of three parts: client application system, Alliance chain network and blockchain repository.

The client application system is oriented to the rental public. The landlords can register and log in to release the idle rental information. The tenant can find the matching housing resources according to their own needs, and send a request to the Alliance chain network after reaching the intention. The Alliance chain network is responsible for recording transaction information, authenticating housing source and personal identity information, and putting on chain record of leasing situation. The blockchain repository has the characteristics of tamper proof and traceability, which is conducive to the settlement of disputes related to housing lease, such as accommodation, priority of lease, etc.
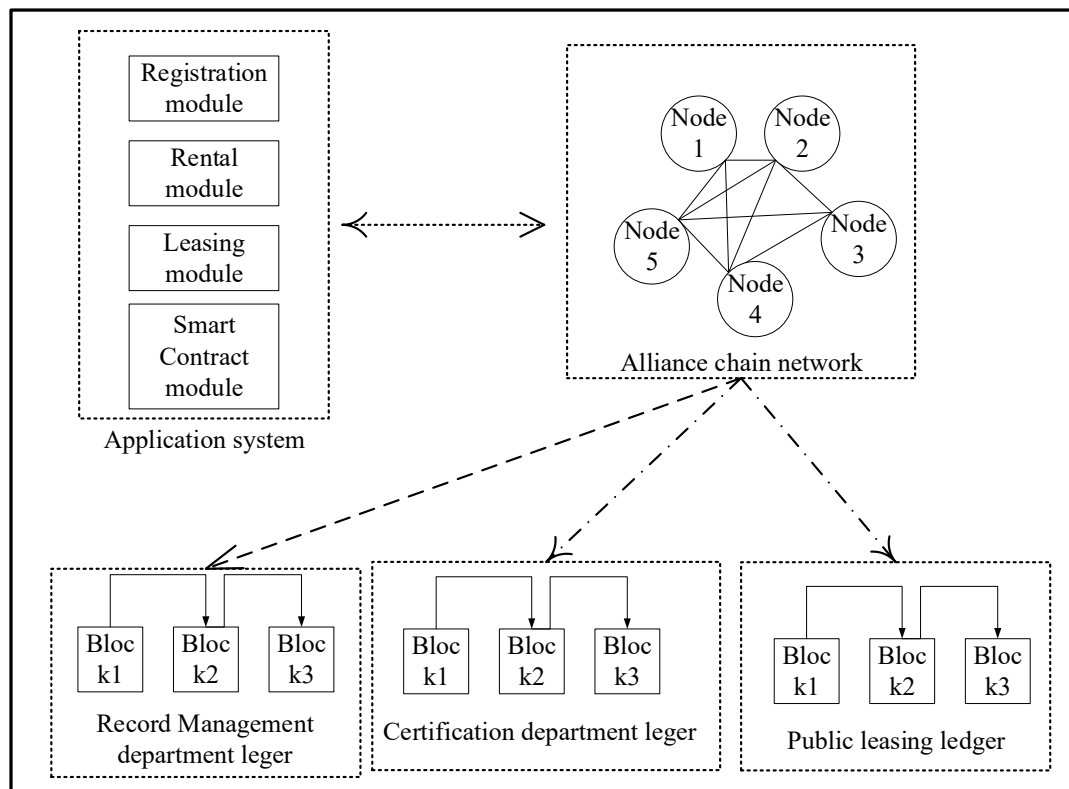
Figure 2 Overall structure of Housing rental System

3.3. *Functions of client application system*

The client system is mainly composed of registration module, rental module, leasing module and smart contract module.

Registration module: the house lessor or the house renter logs into the system for information entry. The tenant needs to input personal information. The landlord needs to input personal information and housing source information for private landlords. It needs to input the company information and its house source information if it is a leasing company and it needs to input the house source information and relevant government or public institution information for public rental housing.

Rental module: the house lessor logs in the system to input the rental information, including the area of the house, the decoration, the geographical location, the description of the adaptability, the monthly rent and the deposit.

Leasing module: the tenants log in the system to screen the houses, and can conduct classified inquiry according to the housing area, geographical location and decoration conditions. After reaching a two-way intention, a lease contract is formed.

Smart contract module: the contract terms between the tenant and the landlord are stored in the smart contract, which includes three types of contracts: rent contract, identification contract and recordmanage contract. In the case of completing the information certification, the leasing contract is concluded and the contract information is backed up in the account book of the record management department.

3.4. *Alliance chain network node*

Alliance chain refers to a blockchain that is jointly participated and managed by several institutions, each of which runs n nodes. The data of the alliance chain can only be read, written and traded by different organizations in the system. Based on the alliance chain, the network nodes are divided into three organizations. The design structure of Alliance chain based on fabric architecture is shown in Figure 3. Fabric supports the function of creating channels. The transaction ledger of members in the channel are different from those of members outside the channel. A group of private landlords, rental

companies, public rental housing, and tenants manage the lease transaction, which is ledger 1. The certification department manages its own ledger 2 and also manages ledger 1. The ledger 2 mainly stores the personal identity information and house source information records certified by the Certification Department. The record management department manages its own ledger 3 and also manages ledger 1. The ledger 3 mainly stores the contents of the contract terms and the housing rental situation.

In the leasing process, through the audit and certification of the identity information and housing source information, the leasing public carries out safe and orderly leasing transactions, and the filing management department records the leasing situation to complete the safe leasing.
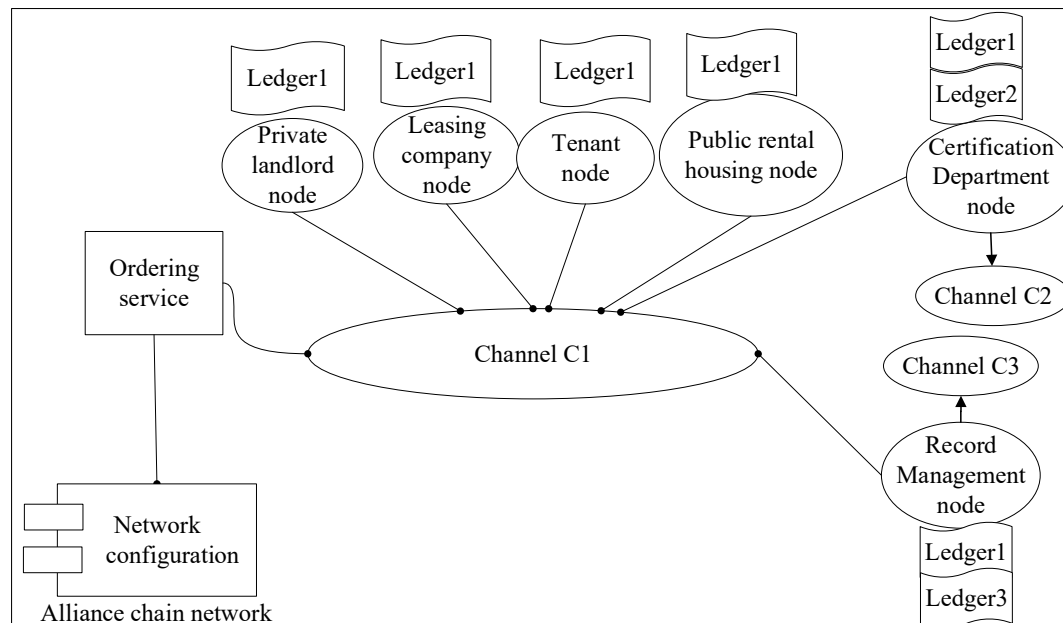

Figure 3 Network structure of Alliance chain

4. Conclusion

The system introduces Certification Department and record management department into the Alliance chain network of Housing leasing to realize leasing service. It has the following characteristics: (1) based on the alliance chain structure, it cooperates with the government certification and management departments to participate in the audit and recording of rental related information, so as to facilitate the government management. (2) The lease smart contract based on Alliance chain realizes the automatic execution of lease terms and eliminates the intermediary. (3) Based on the anti-tampering and traceable advantages of blockchain technology, it is easy to deal with contract disputes.

To sum up, the system has a wide range of application prospects in housing rental market supervision, population mobility survey, purification of intermediary market and other aspects.

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