Apartment Rental Application Using Block Chain

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***Abstract*— In this project, we would like to implement Blockchain technology in apartment rental transaction workflow. For people who have experience in renting apartment, leasing offices make the thing look easy. However, it can be quite complicated in reality. A significant challenge nowadays faced by apartment rental networks is that the supporting information systems are often disintegrated. Blockchain technology provides a possibility where every member in this network could monitor access and share and analyze consistent and up-to-date information.**

I. Introduction

A. How does the application work

1. Blockchain is used to store all the important documents to ensure they remain secure.
2. Customer specifies the requirements and the application scans the entire lease document using Spark. This provides the exact, accurate summary of the lease document and allows customer to have a clear understanding of the long lease document.
3. It will provide the customer the penalty associated with early lease termination, violation of any terms specified in the lease document.
4. The dispute resolution at the time of lease termination is handled effectively.
5. If some state law has proposed a new law stating that there is increase in rent or any specific change, then we will compare with the current information and then tenant will get the updated information.
6. The payment of rent is associated with a time-stamp to keep track of the exact time of the rent payment. This avoids any confusion relating to delay in rent payment.
7. The transaction history for every tenant and the request raised is maintained and cannot be deleted.

B. Problem

A significant challenge nowadays faced by apartment rental networks is that the supporting information systems are often disintegrated. This increases the complexity of the leasing process. The tenant does not get a clear view of all the terms specified in the lease document. There is also no rigid process that performs dispute resolution at the time of lease termination.

C. Proposed Solution

To deal with the current problem in apartment leasing we have proposed a new solution which is implemented by using blockchain as its underlying technology. All the important documents of each tenant are stored in block. The blockchain has an immutable ledger which is distributed, the processes to which update the ledger require a quorum. Furthermore, different access rules are granted to manipulate data based on the role of the application's user. This project, Apartment Rental, is a prototype of a web-based application which stores the details of the tenants with the transaction history and summary of every tenant very securely.

D. *Use Cases/ Personas*

1.Jake, a customer looking to buy an apartment will surely experience an easy and flexible leasing procedure which governed by the implementing blockchain and spark. It will be very easy to get a summary of lease document and raise any maintenance related issues.

2.Rick, a leasing officer can keep track of all tenants, their lease contracts and any other issues relating to lease violation. It will be easy for him to record various requirements specified in the lease document by different tenants. Also track any fraud detection.

3.Kelly, a member of management office can serve the customers in an efficient and better way for the maintenance requests they raised. Also perform big data analysis on all the properties Timestamping: each block is timestamped, with each new block referring to the previous block. Combined with cryptographic hashes, this timestamped chain of blocks

provides an immutable record of all transactions in the network, from the very first block.

II. WHY BLOCKCHAIN

The blockchain technology is emerging at a great pace. It has an immutable distributed ledger. Each participant who is part of the blockchain network has his own copy of his ledger. It acts like a decentralized database with all the transactions being performed by consensus of the participants. In our case we have initially used rent as an asset to be transferred between the owner and the tenant. The smart contract specifies the rules under which the asset transfer(transaction) is allowed. Each contract maintains the status of any request raised by the tenant. The owner keeps track of all the requests. Blockchain helps to keep track of the transaction history. This does not allow any false blames on the tenant as each transaction is logged and cannot be deleted. Furthermore, all the important documents are secure and can be accessed only by authorized users.

III. WHY HYPERLEDGER FABRIC

For the apartment leasing application, lease document should be kept secure. Furthermore, all the important user date along with the transaction details should be easily accessible. Hyperledger Composer provides a permissioned environment with help of access rights for each participant in the network. For example, the tenant can view only his records while the owner should have a view of all the tenant's registered under him. Access rights to modify the contract can also be set easily using the 'acl' file provided by the hyperledger composer. The '.cto' acts like a database schema which defines the participants, assets, contract and the transactions for the blockchain application. This makes hyperledger composer very easy to use. It also provides a flexible and secure environment to make the transaction visible to intended users.

IV.APARTMENT RENTAL

The project is developed using a 3-tier architecture. The front-end of the web application is created in HTML, CSS, JavaScript with React library. The back-end is implemented in JavaScript and Node.js, and the server is built using express modules. MongoDB is used as the database and it stores the useful information for the users. Hyperledger Composer is used to implement the blockchain. All the transactions are stored by Hyperledger. Sockets are used to communicate Hyperledger Composer's REST server communicates with Hyperledger Fabric Network.

A. Application Scenarios of Apartment Rental

Steps:

- An administrator creates the account and logs in.
- Once the tenant logs in a new contract is created with a unique id for each customer.
- Each tenant has his own account and can perform multiple operations like signing the lease, raise a maintenance request, pay the rent, terminate the lease and checkout.
- A status field is associated with each request raised by the tenant. The unique id assigned to each tenant and the value of the status id (0 or 1) helps the owner identify the tenant and type of request.
- Leasing office handles the requests which are received from tenants.
- Tenant would be informed even if there is any change in the state laws or any new law stated regarding the lease or rent based on the lease rules.
- There is also timestamp associated with each transaction performed which acts as a proof for when the transaction occurred.

B. Activity Diagram

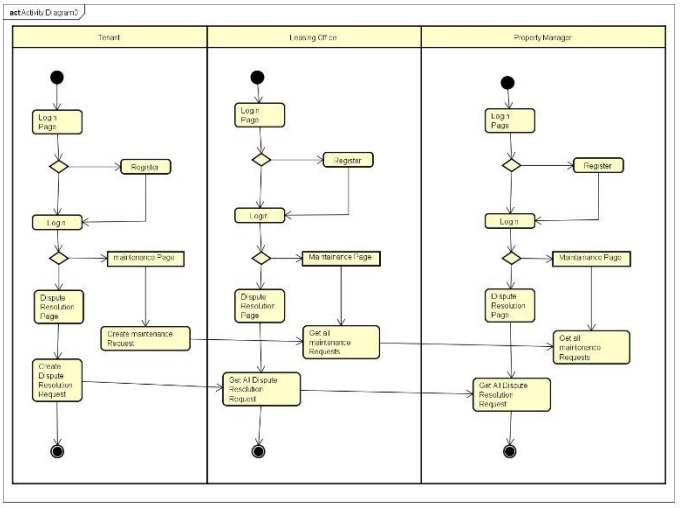

Fig 2.1 Activity Diagram for the application

V.TECHNOLOGY STACK

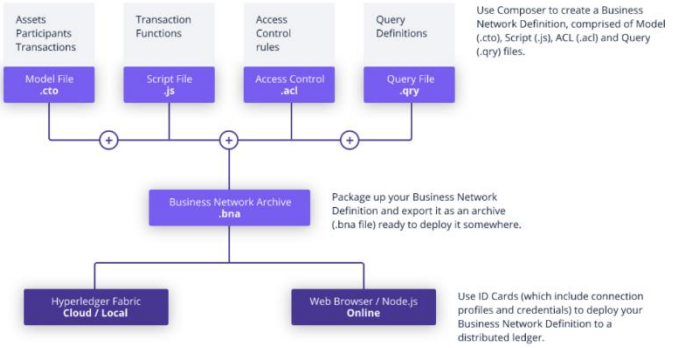

Fig. 3.1 Hyperledger composer architecture

The front-end for the application is developed using React library. The back-end for the application is implemented using Node.js which is used to create a server. MongoDB database is used for login and session data storage, to perform authentication and store user details. Additionally, this NoSQL database helps to manage the applications more efficiently for higher number of users, which meets our needs in terms of our data storage. Hyperledger Fabric is the platform used to implement blockchain. For our project, the deployment is done on google cloud. We were looking for a solution which is easily scalable and can be migrated with minimal data-loss.

VI. FUTURE ENHANCEMENTS

- Ensure ML algorithm detects any fraudulent activity and takes suitable actions.
- Keep the application database up-to-date with new state laws.
- Make the web application more secure by using protocols like TLS, HTTPS.
- Use of Machine learning to scan the information from the leasing document.

VII. SUMMARY

Using a Hyperledger Fabric blockchain to store the lease document with consistent information for every tenant, handling the requests raised by the tenant efficiently is the goal of the project. The entire transaction history helps to keep track of all the transactions performed. The application provides a simple user interface to which makes it very easy for the users. The dispute resolution at the time of lease termination is effectively handled.

References

[1] https://github.com/hyperledger/composer

[2] https://hyperledger.github.io/composer/latest/tutorials/tutorials

[3] https://www.ibm.com/developerworks/cloud/library/cl-deploy-interact-extend-local-blockchain-network-with-hyperledger-composer/index.html

[4] https://en.wikipedia.org/wiki/Blockchain

[5] https://www.youtube.com/watch?v=t5wZvmZGuAY&t=1412s