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Tokenization of Real Estate Assets for Crowdfunding Investment with Ethereum Smart Contracts

Dr.M. Kannan[1], Sankara Kannan.S[2], Sivasankaran.T[3], Mugilvannan.R[4]

[1] *Head of Department, M.E., Ph.D., Department of Computer Science and Engineering, Mahendra Engineering College, Tamilnadu, India*

[2,3,4] *UG Students, Department of Computer Science and Engineering, Mahendra Engineering College, Tamilnadu, India*

Abstract: **Global real estate (RE) investments is one the reliable investment in terms of the returns received. Yet the number of investors in RE are much lower, because of the liquidity and global access. Blockchain and Real Estate go hand in hand. The kind of security and transparency needed in Real Estate is exceptionally provided by Blockchain. Tenants, owners, and investors are barely satisfied in the current system. Consider a scenario where you buy a house as an investment. The property you want to buy is very expensive and you are unable to buy. We propose a system which will help us to solve this problem. The investor is given platform where we will conduct an Initial Coin Offering (ICO) which is a type of crowdfunding, where we sell ERC20 Tokens to the investor and raise funds. We the platform then use the raised funds to buy real estate properties and we put those properties up for rent. Then the rent we get from the tenants is split between the investors based on the amount of token they own which is verified by the smart contracts in the Ethereum blockchain. Hence we can eliminate and overcome the major drawbacks we face in the commercial real estate market.**

Index Terms **- Blockchain technology, Commercial Real Estate, Crowdfunding, Investing, Initial Coin Offering.**

INTRODUCTION

RE investment is considered one of the safest options for investing. For that we have: it provides security to investors and is a hedge against inflation (money inflation). It is also a physical asset that is excellent for portfolio diversification, and can be non-volatile and essentially risk-free over a long period of time. RE investment is available to everyone as opposed to for experts only.

RE market is the single largest asset class globally. However, the way business with this asset class is carried out is not just complicated, but also costly, non-transparent and highly inefficient. Most importantly, RE investments are even more out of bounds for ordinary people. RE investments are dominated by either institutional investors or by ultra-high-net-worth individuals. This restrictive access prevents ordinary people to profit from growing returns on RE investments. For owners of RE, the value of their RE often serves as a security for unforeseen eventualities. However, it is no liquid wealth. To access the wealth 'trapped' in their RE, owners either have to sell off their equity in it or take recourse to some financial vehicle which secures their equity release. In addition to these drawbacks, Commercial RE (CRE) industry has been slow and problematic to innovate its core business processes. Today, commercial brokers and other middlemen are struggling hard with old-fashioned technology, data sharing mechanism, inefficient cash flow management, real-time performance data, and so forth. These drawbacks lead to collusion and side effects for tenants, owners and investors.

Blockchain is a shared database technology whose well- known application has been to support Bitcoin digital crypto currency. It works with linked databases that update digital record books continuously. Smart contracts are also another concept that means: a work be done and be audited automatically without the existence of middlemen. In smart contracts, codes are laws and two parties in a transaction agreed on its content. Blockchain and smart contracts introduce a new set of tools and framework to create a new generation of markets where supply and demand is equipped with a secure commercial transactions, and also with such various commercial rules and without the need for a central mediator sector. Blockchain broadly can be used for asset management (trade processing and settlement) even when there is no trust between seller and buyer or any other members in the network.

LITERATURE SURVEY

In recent years, Blockchain technology is growing at a considerable rate and has gained considerable attention from numerous researchers and institutions. Blockchains and smart contracts and helps us to understand the pros and cons that this will bring to the system. The digitized world enhance mobility, efficiency and transparency for one of the largest global asset categories, namely RE. Due to the drawbacks that centralized databases are facing, the emerge of blockchain technology is able to be present and solve some of these radical issues [1] in RE. Blockchain as a decentralized one offers the following benefits:

• Tokenization: Blockchains make tokenisation business models and economies possible–This is fundamental to tokenizing RE [2]. The liquidity problem has always been the biggest problem of RE. Tokenization democratizes ownership of assets to split assets into tokens that are stored on the blockchain. People in different geographies and tax brackets now have access to attractive investment opportunities that they previously would not [3], [4].

• Transparency and Trust: Blockchain-based applications and businesses are by design transparent in their transactions and building trust. The possibility of frauds and ownership dispute can be almost eliminated with the high degree of transparency. Data and transaction records cannot be manipulated or tampered with. This makes blockchains ideal for trust-free transactions.

• P2P transactions: Blockchains provide P2P transactions a big thrust because by design they eliminate intermediaries.

• Cost reduction: The current process of ownership transfer can take months due to the various parties involved and the need to verify the documentation during various stages, usually with the assistance of a lawyer. The blockchain technology will be able to address this issue by deleting the middle parties [2], [3].

• Smart contracts: A transaction using a smart contract is completed entirely between the buyer and the seller (or renter and landlord) and has no human interaction. Transactions can be done in far less time with far less chance of fraud. Computer protocols check the legitimacy of the transaction and no agreement can be completed until all of the terms are met[13].

• Integrity and Security: The decentralized nature of the Blockchain technology ensures that records stored on it can't be changed or controlled by a single source, thus it provides security against malicious attacks such as hacking.

Applying blockchain in the realm of RE transactions and land/title registries has drawn a considerable attention and support from governments such as North America [5], [7], Europe [6], Dubai [8],and Japan [9]– all of which are economic giants. This simply means that the CRE world is potential to embrace a faster, better and more affordable way of taking its action. Forbes noted three areas that blockchain has the ability to improve regarding the RE market: multiple listing service (MLS) property data, title records, and transactions.

As such effective projects, aassio [3] is a blockchain- based platform where people will get easy access to easily invest, hold, buy or sell RE with other cryptocurrencies or crypto assets. Moreover, AgentMile [10] which received Finances Online award aims to become the world's first decentralized commercial RE leasing platform powered by artificial intelligence (AI). Properbuz [11] also aims to decentralize a $217 trillion global RE market by developing a blockchain-based decentralized protocol. Besides SMART Realty [12] intends to employ smart contracts to broaden the traditional contracts. As discussed, using blockchain and smart contract can help having a secure and easier investment in RE market.

METHODOLOGY

We will build our blockchain application project for real estate investment and renting platform and the Initial Coin Offering based crowdfunding is done using the following technologies:

1) Front End

We have used Vue to implement the front end. There are two main pages accessed by the Investor, Tenant and admin. Vue 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.

2) Back End

The back end is supported by the Solidity contract. Solidity contract can be deployed using the Truffle Framework. The Ganache-CLI which is an efficient Blockchain emulator runs on Port 8545 and provides 10 free addressed with 100 ETHERS each to spare.

3) Database

We have used Firebase Database to host the front end. And to store the data of the real estate properties which is used in the investor, tenants page and the admin which is not needed to be stored in the blockchain.

4) Metamask

The MetaMask is a wallet to store and transfer cryptocurrencies. We use this MetaMask wallet to send profit share to the investor and receive payments from the user. The Chrome extension MetaMask has been used.

5) Stripe

The Stripe is an payment processor to accept online payments from anywhere in the world and we are using this to charge the tenants rent.

Phase I: In this phase, a Blockchain Simulation is run on GANACHE and shown on Metamask. The Contract is deployed by one of the account/ address on GANACHE.

1) When we run GANACHE CLI, it starts listening on port 8545. There are 10 addresses and private keys associated with them. A seed phrase i.e. a randomly generated key is shown. GANACHE 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 GANACHE.

2)This is followed by compiling, testing and deploying smart contracts. The smart contracts get complied with the help of a command truffle compile. The truffle 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.

3)Finally, the Front End is run on the port 3000 on localhost with the help of a command npm run serve. This command runs the Vue code and sets it up on port 3000 on the localhost.

Phase II: This phase is used to buy ERC20 tokens and invest in the platform where the Initial Coin Offering takes place.

As shown in the flowchart, the investor goes to the investor page and creates an account to be able to invest in the ICO. After that the investor enters their Metamask wallet address and the amount of tokens that they would like to buy. Then the investor will pay the equal price in relation to 1 token in fiat currency. Then the investor is verified and the tokens are sent to his wallet in the Metamask. The investor will get the equal amount of profit sent to his metamask wallet.

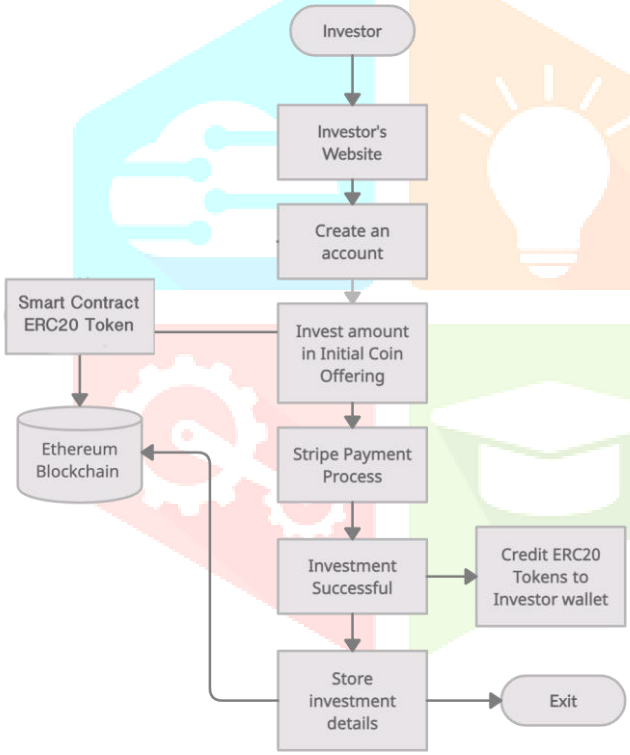

Fig 1: Investor flow

With the funds that the project receive from the ICO [15], REs assets are bought. Then the RE that are bought are tokenized to tokens SSM (proportional to its value) and given to investors– 1 SSM = 1 rupee. The details of the Investor on how much they have invested in stored in the blockchain and later when there is a profit share, the investor is verified based on the data on how much they have invested is stored in the blockchain. The platform also takes a small cut in every transaction of the investment, also takes a small cut for maintaining the platform and the real estate assets.

Phase III: This phase is used to rent the properties by the tenants.

As shown in the flowchart, the Tenant goes to the tenants page and creates an account to be able to rent a property in the platform. After that the tenant enters their credit card details in the payment page which is handled by stripe . The tenant will pay the rent the

required amount of rent amount to get the access to the property that they wanted to rent.

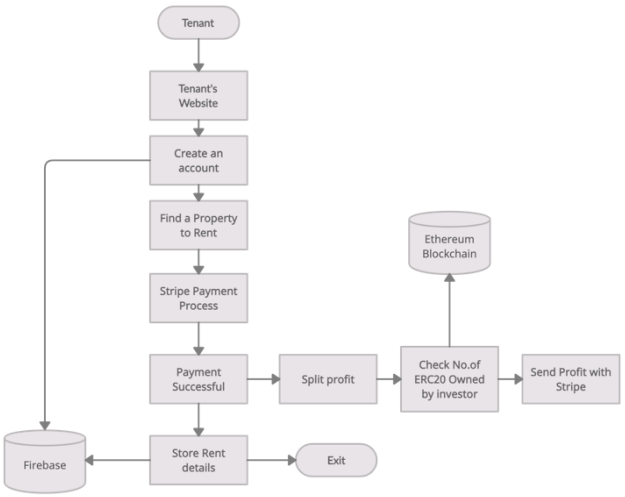

Fig 2: Tenant flow

The rent got from the tenants is sent to the platform with the help of the stripe payment processing. Then the total profit amount of the rent is collected and then split between the investors based on how much tokens they hold in their meta mask wallet, the equal amount of the profit share is deposited to them in the form of eth crypto currency to their meta mask wallet. This makes sure to eliminate all the drawbacks faced by the commercial real estate industry.

Phase IV: This phase is used to deploy the smart contracts to the Ethereum blockchain (test network)

The smart contract we developed is used to test locally within our system, so if anyone from other network wants to use our platform we have to deploy our smart contracts in the Ethereum blockchain. After that anyone can access our platform. We are using the truffle deploy command to deploy our smart contract to the Ethereum blockchain. We can also use the remix IDE to test and deploy our smart contracts.

RESULT AND DISCUSSIONS

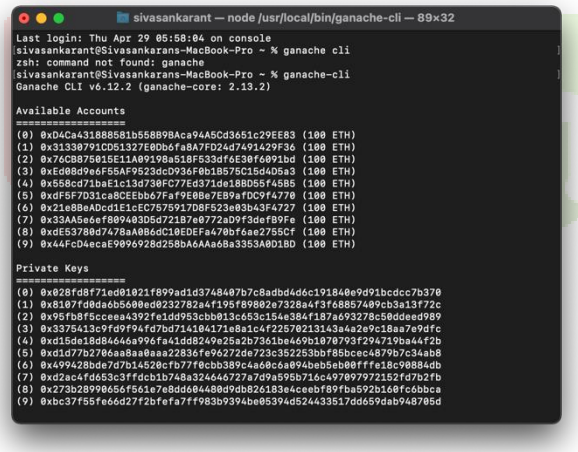

Fig 3: Ganache Cli

The Ganache Cli is started in the terminal using the command ganache-cli. This starts a local Ethereum blockchain which we can use for testing our smart contracts. Its also gives us some accounts with 100 eth to test and import into our metamask with those private keys.

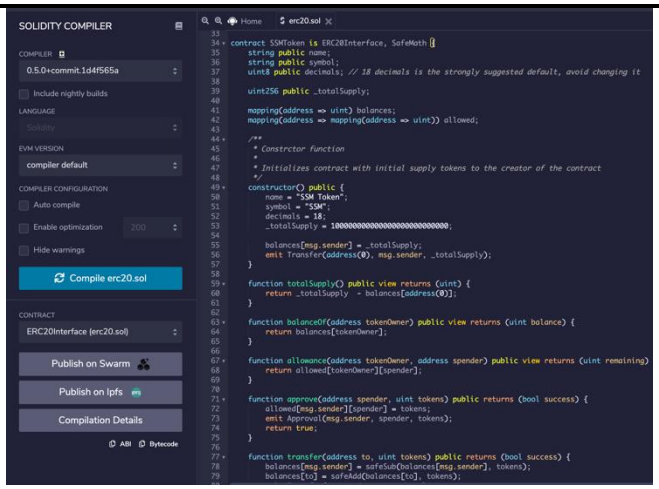

Fig 4: remix IDE

The remix IDE is used to develop our smart contracts and to deploy them to the Ethereum blockchain. We write our smart contract and compile it in the remix IDE and then we deploy it to the Ethereum blockchain. To deploy our smart contract we will have to pay some ethers to the Ethereum network. After paying the ether the smart contract for the Initial Coin Offering will be deployed.

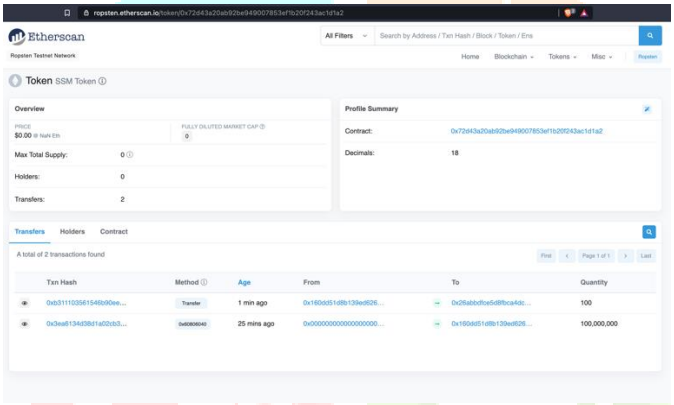

Fig 5: ERC20 Token

Then we have deployed our ERC20 token smart contract in the Ethereum blockchain and it has generated its own address by which we can access it. Only the admin has access to transfer the tokens. Once the investor has invested in the Initial Coin Offering they will get the equal tokens in their meta mask wallet. The token is used to verify how much the investor is invested so the investor has to keep the token safe in their metamask wallet.

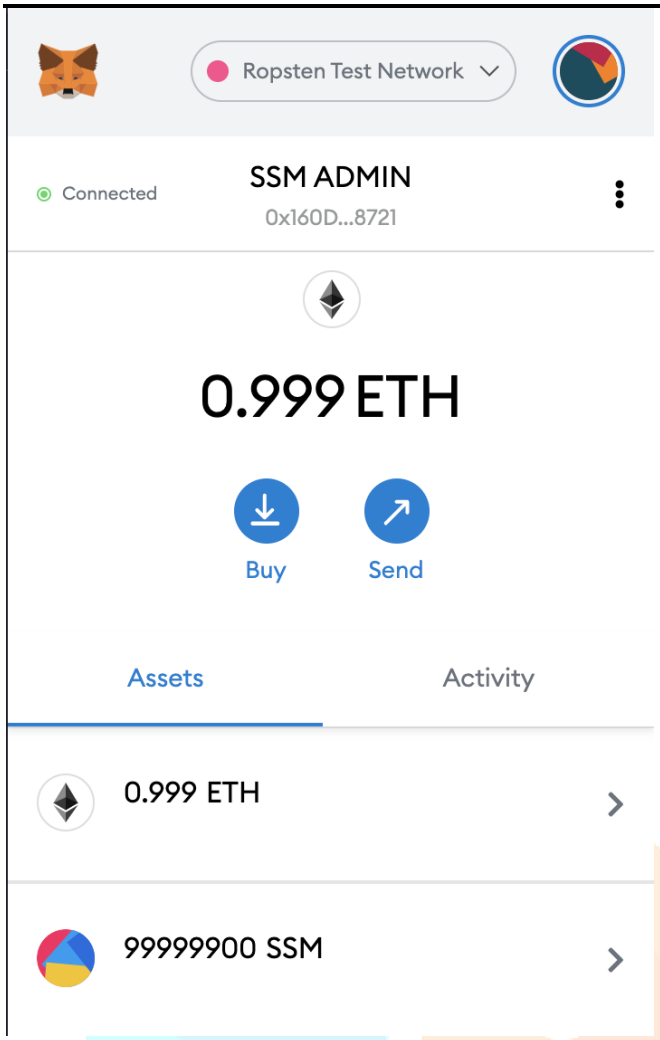

Fig 6: Metamask wallet

In the metamask wallet we can see from the above image that we have access to our newly deployed SSM token.

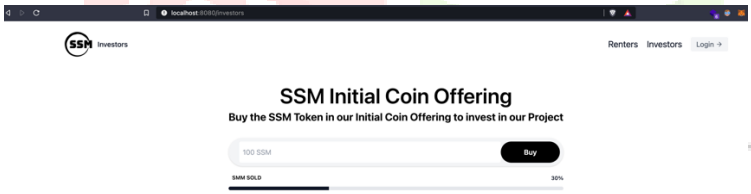

Fig 6: Investor ICO page

In the investor ICO page the investor will enter the amount of token they want to invest and buy with the help of the metamask wallet. And the tokens will be sent to their wallet by the admin

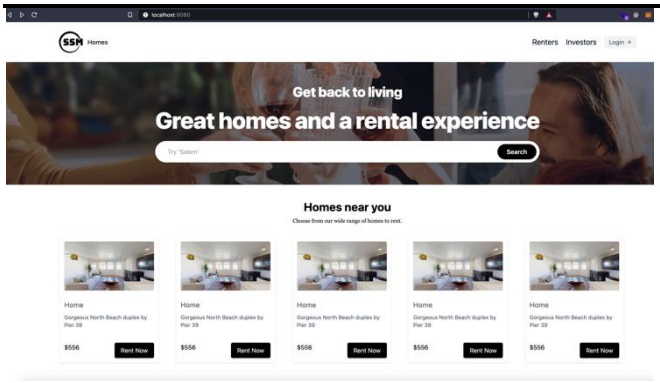

Fig 6: Tenant page

In the tenant page the users who want to rent a property will come and create and account and login into the platform. Then they will select a property and pay the rent with stripe to get access to their property.

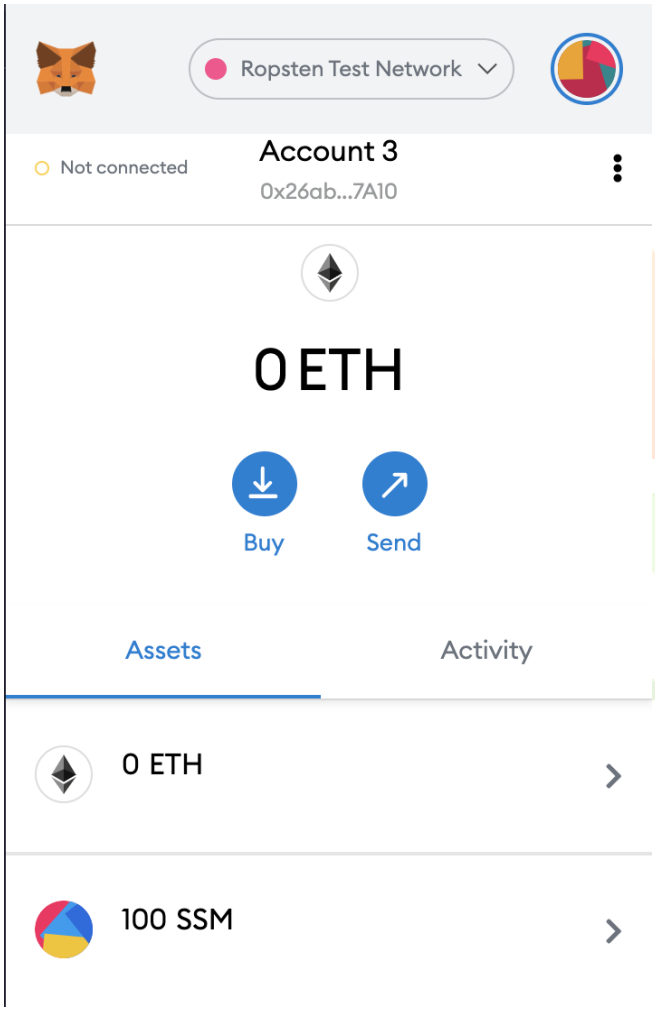

Fig 6: Metamask Investor wallet

As we can see from the above shot the investor has got the tokens in his wallet. The profits are split and the investor has got the token.

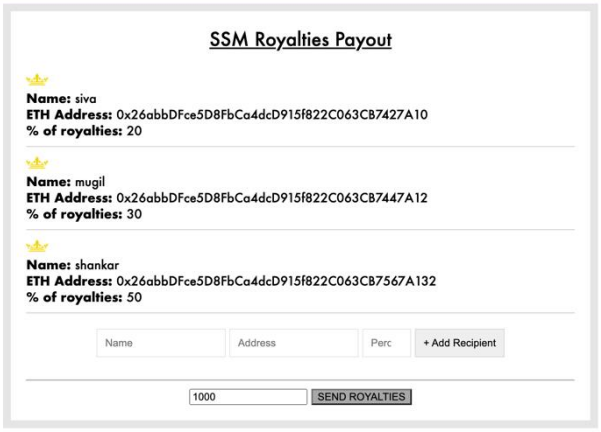

Fig 6: Admin pay out

In this page the admin can enter the investor details like name, metamask wallet address and percentage then the admin sends the shares to the investors.

FUTURE WORK

We discussed that this is possible to provide liquidity by tokenizing RE assets in the RE market and remove middlemen classical issues in real estate. For this, blockchain technology helps fulfil this plan by harnessing smart contracts and crowdfunding. So in the future we are planning to automate to investor payments and rent payments in the smart contract and to improve the usability of the platform.

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