Blockchain enabled Digitization of Land Registration

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Abstract - **In India, the Land Registry System is a very time-consuming procedure that requires many intermediaries, thus increasing the number of fraudulent cases. The use of Blockchain Technology for Land Registry Management can eliminate these problems. Blockchain is simply a data structure where each block is connected to another block. It is a distributed data ledger with an immutable public record of digital transactions. The key features of this technology are, the data in the block are immutable which is achieved by using hashing algorithms, cryptography techniques and consensus mechanisms which are done before adding a block into the blockchain. Even though there are limitations in Blockchain technology like, it is complex to implement and not as much fast as the centralized system. Also, there is a need of miners to validate the transactions but these can be overcome by using appropriate consensus mechanisms. In India, the Land registration process is one of the tedious process and most often people are not aware of the entire rules to be followed during registration process. Also, more documents need to be verified and thus it takes delay in completing registration. In addition to this, the middlemen collect bribes to complete this process. Mistakes also may occur while processing land records. The aim of this work is to develop a land registry system using Blockchain with a detailed and user-friendly feature with high reliability and good interface. It mainly focuses to cover the rules and procedures stated by the Indian Government regarding land registration. It ensures the enhanced security and accuracy of records.**

I.INTRODUCTION

The land registration refers to a system whereby ownership and land-related rights are recorded by a government entity. Maintenance of land documents are more important because land is a valuable asset. These records provide evidence of title, facilitate transactions, and prevent fraud. In our current land registration system in India, the Tamilnadu government and other state governments have started digitizing the land registration processes. But still the entire processes are not yet completely digitized. Now a days the number of security attacks on online are increasing. Also, new methods of attacks are evolving with competing to the developing security measures and standards. Even though there are higher risks, the digitization is unstoppable. Ensuring security plays the major role in the government processes like land registrations. This problem can be solved by applying Blockchain technology.

A. Blockchain technology

Blockchain network is transparent and data once entered in the block cannot be changed at all. When the whole process and person involved in land registry are present in the blockchain network that will nearly impossible for anyone to show miscalculated and alerted value, because all the transactions made are transparent and in case any fault happens it is easier to identify.

B. Working of blockchain technology

Blockchain technology, which is a type of distributed database that stores, organizes and manages a permanent and tamper-proof ledger of transaction data across multiple computers, promises to transfer value, build trust and reduce third-party participants. A blockchain is a growing list of records, called blocks, which are linked using cryptography. Each block contains a cryptographic hash of the previous block, timestamp, and transaction data (generally represented as a Merkle tree root hash).
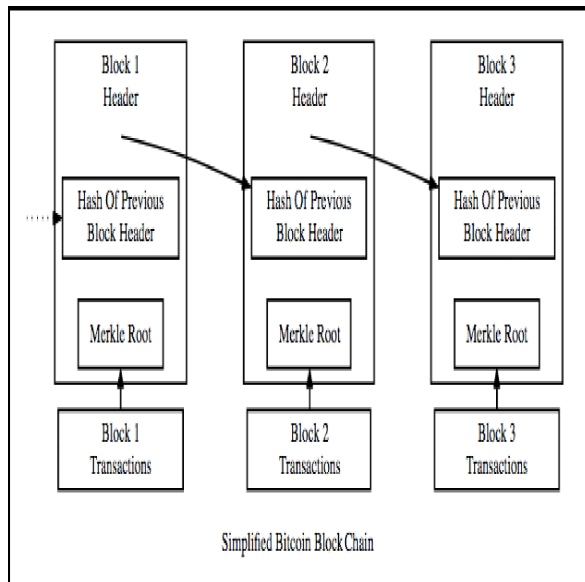
Fig. 1. Nakamoto"s Blockchain Proposal

Figure 1 depicts every blockchain has to start somewhere, so there"s what"s called a genesis block at the beginning. Each and every block contain block header, previous block header, Merkle root and block transaction. Every block on the blockchain is linked together using previous block hash.

Using Cryptographic hash function all the blocks will be interconnected in blockchain. The data present inside block will also be hashed and stored in the form of Merkle tree. When someone tries to alter the data stored in the block, the value of hash changes and the link between the block breaks. Hence, loss of data happens from which it can be inferred data has been tampered. This is how storing values in blockchain differs from normal storage.

II.LITERATURE REVIEW

U. M. Ramya (2018) proposed a blockchain system for land registration. It uses a private-permissioned Blockchain - Multichain, where the authority lies with the registrar making the process faster because proof-of-work is not required. The implementation of land registration use-case involves recording the documents into blockchain and verifying it with the one stored in digital locker thereby reducing forgery of documents.

Archana Sahai and Rajiv Pandey (20202) proposed applying of smart contracts for land registry in blockchain. It describes the current process of land records maintenance and land registration in the country. It emphasizes on the importance of smart contract for land registry applying the Blockchain.

Various blockchain application development platforms like Ethereum, Hyperledger, R3Corda are came into practice. Many organizations like IBM, Facebook are contributing for developing tools to create blockchain applications. IBM and Linux foundations have developed many frameworks for different type of applications like Hyperledger Burrow for permissionable smart contract machine, Hyperledger Fabric for permissioned with channel support, Hyperledger Grid for web assembly-based project, Hyperledger Iroha for mobile applications. Also, there are many tools like Hyperledger Aries, Hyperledger Cello, Hyperledger Explorer for different applications.

For creating different type of blockchains like public, private and consortium with permissioned and permission-less, there are many blockchain networks and IDEs like Ganache, Remix help for testing those applications.

These are some of the methods that are currently available for creating blockchain based applications. But there is a need for a faster and reliable method that could be used for creating blockchain applications. In this project, an approach for implementing land registrations with blockchain enabled is developed by creating smart contracts and applied in a Ethereum blockchain network. This ensures that the land records are secured, tamper proof.

III. PROPOSED SYSTEM

Smart contracts are self-executing contracts that are directly written into lines of code with the terms of the agreement between sellers and buyers. Across a distributed, open blockchain network, the code and the agreements found in it exist. Smart contracts allow the execution of trustworthy transactions and agreements between disparate, anonymous parties without the need for centralized authentication, legal framework or external compliance mechanism. They render transactions traceable, transparent, and irreversible.

The smart contracts are developed for the Ethereum blockchain. Ethereum is a decentralized platform that runs smart contracts. Contracts can be deployed on the Ethereum Virtual Machine (EVM). Once deployed it can be accessed globally. These contracts are enforced and certified by parties that we call miners. Miners are multiple computers who add a transaction (Addition or modification of the state) to a public ledger that we call a block. Multiple blocks constitute a blockchain.

We pay these miners with something called Gas, which is the cost to run a contract. When you publish a smart contract, or execute a function of a smart contract, or transfer money to another account, you pay some ether that gets converted into gas.

A. *Modules Description*

The modules identified and implemented in the proposed system are listed below:

1. Setting up ether wallet for executing smart contracts in Ethereum blockchain network
2. Collecting details from user through web app
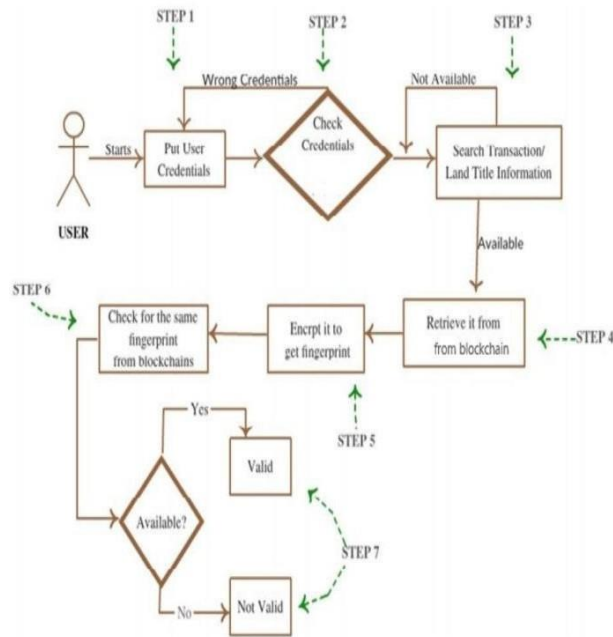3. Creating blocks using smart contracts

Fig. 1. Flowchart for proposed system

i)   Setting up ether wallet for executing smart contracts in Ethereum blockchain network

In this module, the account in metamask (i.e Ether wallet) will be created. Initially the wallet will contain 0 ethers. In order to execute ether transactions, ethers will be needed. For testing purpose, there are test networks like Rinkeby Test Network, Ropsten Test Network. Ether faucets can be used to get free ethers for testing purpose.

Smart contracts can be written using many languages. Here, Solidity language is used. These contracts are compiled and deployed using Remix IDE which is an online compiler for solidity codes. Injected Web3 Environment are selected while compiling to get the Application Binary Interface (ABI) codes which is required for connecting our web app with Ethereum network using web3.js.

ii)   Collecting details from user through webapp

The details from the user needed for land registrations are collected using forms in a web app. It is designed using HTML, CSS, JS for front end. The JavaScript code is written for sending the collected details to smart

contracts and executing those contracts through web 3 JS framework.

iii)   Creating blocks using smart contracts

The business logic like rules and regulations provided by government to follow during the land registrations and implemented in the smart contract. These contracts will carry out the ether transactions. When the transaction is successfully carried out, it means a block is created successfully

Fig 2 depicts the before and after images of the ether wallet. Here, some ethers are reduced from the user"s wallet for the transaction.
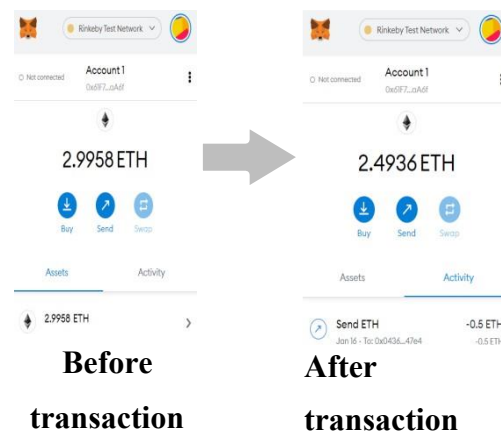

Before   After

transaction   transaction

Fig. 2. Ether in metamask wallet during transaction

B.   *Steps:*
1) Install MetaMask
2) Go to https://metamask.io/ and install the browser plugin.
3) Setup a password and open the wallet. Select the network as „Rinkeby Test Network".
4) Click on „CREATE ACCOUNT" to create a new wallet account and click „Copy Address to clipboard" to copy your public address for the wallet.
5) Go to https://faucet.rinkeby.io/ to get free test ether to the address. Check your account on metamask and verify the balance.
6) Repeat steps 3 and 4 to create more accounts.
7) Deploying contract
8) Go to http://remix.ethereum.org/ and upload your contract file (reg.sol)

9) Compile the code. Make sure you''ve selected „reg.sol'' in the dropdown next to details. Ignore warnings.

10) Go to the run tab. Make sure „Environment'' is set as „Injected Web3'' and shows „rinkeby''. Make sure „Account'' shows your wallet address in metamask. This is the account from which the contract will be deployed. „Gas limit'' and „Value'' has little importance on TestNet but make sure to pay enough gas on Livenet.

11) Make sure „User'' is shown in the dropdown above „create''

12) (If any of the above steps fail, reload the browser)

13) click „create'' and a popup will appear on metamask. Open metamask and Submit the transaction. Set a reasonable „Gas limit'' and „Gas Price'' according to network.

14) Click on the transaction to go to https://rinkeby.etherscan.io/tx/ to know the status of transaction. If it is a success, your contract is deployed. In the „To'' section "[Contract 0x000000000000000000000000000000000 0 Created]" will be shown. This is your contract address. Copy it. Click on it to know about the incoming transaction to the contract.

Now the contract is deployed on the rinkeby network. You can access it using a web app.

IV. RESULT AND DISCUSSION

A. Webpage Front-End

Figure 3 depicts the webpage for client side. This contains a form for collecting basic land details of the user to register their property.

B. Result Analysis

Each land registration processes are carried out with the help of ether transactions. Figure 4 presents the details of ether transactions carried out by a specific ether wallet (i.e., metamask wallet address) by which we can verify whether the block is created and attached to the blockchain network or not.

V. CONCLUSION AND FUTURE WORK

The proposed system aims at providing the exact details of land records and ownership. By knowing such details about a land, it can be sure about the exact details of the land and ownership. These details are already provided in normal paper-based registration system, but those data could be altered easily but with the use of blockchain and storing such details in a block will ensure no fraud takes place and data will remain unaltered.

Fig. 3. Land Registration Webpage

As mentioned earlier this project could be developed and used for other land related use case such as land registration, Transfer of properties. In this project it can get the land details from owners. These details stored within the block by using the blockchain technology, but in future it also enables to purchase the land and change the ownership of the land details. It improves the traceability, transparency and eliminate the third-party involvement.

Fig, 4. Ether scan site

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