

Blockchain based Land Transaction System

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Abstract—Existing land registration systems have several issues like dual ownership, fraudulent or incomplete registries. The existing system also includes a lot of middle men which makes it prone to malicious acts and results in a vulnerable system. Keeping track of who owns which part of land is a big challenge. To overcome this problem blockchain technology is used. Use of blockchain will remove middle men, increase trust, efficiency of the system and reduce corruption. This paper highlights the issues related to the current system such as authenticity, centralization , reliability , transparency , etc and proposes a better method using ethereum blockchain and smart contracts to overcome this problem. Blockchain method provides identification of true ownership of land, authenticity and transparency in the system.

Index Terms—Introduction , Motivation , Objective , Literature survey , Methodology , Algorithm , Future Work , Applications , Conclusion , References

I. INTRODUCTION

In recent years blockchain has become an emerging technology for developing decentralized and secured applications. Blockchain is considered to be the next booming technology because of its properties like security and privacy. Blockchain concept was first introduced as bitcoin in 2009 by an unknown person named Satoshi Nakamoto. It was introduced to avoid the problem of Double-spending , Security, privacy, etc. Blockchain is a distributed digital ledger which is open, shared, transparent and highly secured. Because of which all the transaction data is immutable and verifiable . Blockchain can be categorized in two parts: public blockchain and private blockchain. In public blockchain, a number of computer nodes are connected through the public internet and in private blockchain, only permitted members are allowed to join the network and all decisions remain in that private network. The paper contains the survey of different papers related to land registration and real estate registration systems using blockchain as well as some other use cases of blockchain. In the survey, it is given that buyer and seller can interact with each other in a completely secured manner. The land or property is verified before putting it to sell and also seller and buyer are verified before completing the transaction. In this system, users will register on portal and can take up the role of seller and buyer according their needs. Both of them need to upload their basic details to get verified and to make sure that they are not malicious users Sellers need to put all documents related to property on a portal where buyers can see basic property details and decide whether to buy it or not. In this way the proposed system will not involve any middleman and all transactions will be between buyer and seller.

II. MOTIVATION

- India being a huge country, the economic status of the country is completely dependent on the land possessed.
- Many frauds have been seen in the real estate sector due to poor security techniques and various loopholes .
- Also with the changes in the world, the prices of the properties change accordingly so there is a need of a system which can ensure fair price and high security for any transaction.
- Building such a system would revolutionize the real estate sector and would help the common people understand the process and could be helpful to them.

III. OBJECTIVE

- To create a DAPP that could Digitize all the records and create a tamper proof system which is immutable in nature thus being trustworthy in nature.
- To build a transparent system in which the ownership of land can be viewed by everyone who is a member of blockchain and creating completely transparent and reliable system
- To eliminate third party dependency which generally leads to malicious activity performed by member of system , thus system would remove any such activity from the system
- To eliminate double spending and dual ownership of land by using tokenization methods.

IV. LITERATURE SURVEY

A. Novel Framework for Implementation of Land Registration and Ownership Management via Blockchain in Bangladesh [1]

This paper explores Bangladesh's land registration system and their developed blockchain framework for secure ownership. It highlights the global issue of limited "legal" land ownership, even in developed countries with paper-based records. The paper argues that a decentralized and immutable blockchain system is crucial to prevent land forgery, as opposed to centralized databases. The key components emphasized are smart contracts, public blockchain, and Ethereum. Smart contracts enable conflict resolution through code, while Ethereum, a public open-source blockchain, is well-suited for implementing large-scale land registration systems.

B. Design of the Blockchain Smart Contract: A Use Case for Real Estate [2]

This work introduces a paperless and highly secure approach, advancing towards smart cities. Key parameters include the consensus mechanism for user authentication, solidity programming language for smart contracts, and the use of Ethereum cryptocurrency for mining. A Decentralized Application (DApp) was developed, featuring front-end and back-end interfaces interacting with Ethereum virtual machine via JSON RPC. The DApp involved designing smart contracts in Solidity, compiling them into binary files, and deploying them on the EVM. A user-friendly web application facilitated interactions with the smart contracts. The DApp utilized three phases: agreement points, signature validation, rental payment debits, efficient record-keeping, automatic deposit refund, and damage repair payments upon contract termination. This system effectively addressed loopholes, fraud, and maintained an efficient transaction ledger.

C. Land Registration System Using Blockchain [3]

This study proposes a private and permissioned blockchain system to address issues of openness, trust, and efficiency. Hyper ledger Fabric, an open-source platform, is suggested for implementing the land registration system. The process is divided into two modules: one focuses on registering land and triggering smart contracts, while the other covers ownership change and land purchase. The steps involve the super admin peer managing transactions, adding users, verifying land ownership, activating smart contracts, and changing ownership based on verification and payment. Module 2 ensures confidentiality by hiding price information from buyers, allowing personalized treatment. Hyper ledger acts as a ledger for user and land transactions, updated through smart contract calls.

D. Blockchain based land registry system using Ethereum Blockchain [4]

The authors propose a new, stable land registry system on the blockchain to overcome issues with third-party influence, tampering, and slow processes in traditional methods. The proposed system involves sellers registering and posting property details, buyers requesting access, and sellers approving or denying access. Upon approval, the registrar verifies details, digitally signs documents, and validates the sale, resulting in a faster and more efficient process.

E. A secured land registration framework on Blockchain [5]

The paper highlights loopholes in the current land ownership transfer system, which makes it vulnerable to attacks. Sales documents lack information on ownership, and the process of transferring ownership is cumbersome. Blockchain's decentralized storage system is proposed as a solution, providing a safe and decentralized environment for executing logic and sharing data across multiple nodes. The system addresses issues related to wills, mortgage, and hereditary land ownership transfers through a decentralized application. The proposed system eliminates the need for physical presence of both buyer and seller. With blockchain, secure, decentralized, and tamper-proof systems can be established.

F. A Blockchain Solution for Securing Real Property Transactions: A Case Study for Serbia [6]

The real estate system in Serbia consists of property records and a map with geometric attributes. The proposed work deals with alphanumeric transaction data stored in the blockchain, as well as geographical content like coordinates. To handle this, a special layer was implemented to collect and update land coordinate data. Two types of accounts were created in the DApp: one for property owners and another for smart contract holders, both requiring electronic signatures for identity verification. Transactions and adjustments are stored in a single block, while another DApp stores notaries and document hashes for rights transfer operations. Cadastral referents primarily use the DApp to modify information blocks.

G. Blockchain to Prevent Fraudulent Activities : Buying and Selling Property Using Blockchain [7]

Blockchain technology simplifies real estate transactions, offering transparency. The front end is built using Angular, allowing user and admin access. Solidity contracts are used for the backend, deployed with the Truffle framework and Ganache-CLI emulator. Meta-Mask is utilized for displaying the chain. The method involves two steps: contract deployment and property purchase/sale. The initial step includes launching Ganache-CLI, logging in with a seed phrase, and creating/implementing smart contracts using truffle compile. In the second phase, superAdmins can add properties after verification, sellers can list properties for sale, and buyers can request purchases. Future scope includes adding rental property features with blockchain-based rent details.

H. Blockchain-based framework for secure and reliable land registry system [8]

The paper discusses the progress of countries in establishing online and user-friendly land registry systems. Countries like the Republic of Georgia and Ghana have successfully implemented such systems, while others are still in the development or testing phase. The paper also presents a method involving a pre-agreement smart contract, where buyers and sellers sign a contract and the registrar verifies their identities and property details. Ownership transfer occurs after financial transactions and receipt of taxes and transfer fees. The buyer receives a certificate, and record updates are shared across relevant departments by adding a new node to the ledger.

I. Land Registry Management using Blockchain [9]

The paper discusses the drawbacks of the current land registration system and proposes a solution using blockchain technology. Maintaining records of numerous lands is challenging and prone to fraud due to the involvement of middlemen. Implementing a decentralized application on the Ethereum blockchain can address these issues by removing intermediaries, reducing corruption, and enhancing system efficiency. Smart contracts written in Solidity ensure transparent and complete transfers between buyers and sellers. Ethereum's blockchain records and manages all transactions, while test networks enable error detection during smart contract deployment. The proposed system verifies data, updates registries, and improves transparency.

J. Digitization of land records using blockchain technology [10]

NodeJS is used for making blocks and recording transactions. NodeJS is JavaScript runtime environment. The postman tool is used to write prerequisite scripts to validate the mapping of schema. The workflow described in this paper is as follows: writing Backend code to store data related to land records and setting up nodes is done as the first step of implementation. Registering and broadcasting each node in the network by sending API requests using postman. And also transactions are done with the help of a postman. setting up nodes to solve the proof of work to mine blocks. Data is recorded after each transaction and a block-explorer is used to view each transaction. To display all transactions performed using blockchain some frontend code is written. The main aim in this paper was to assess whether the introduction of blockchain in the land registration system is a really feasible solution or not. They discovered the problems associated with the current process during this study, then they made an application to mimic the current land record mechanism and also they focused on the blockchain network's design aspect and performance assessment.

K. Securing Land Registration using Blockchain [11]

The proposed system ensures security and addresses double spending issues by utilizing a blockchain with 12 nodes and 200 transactions. Proof of Work validates transactions and adds blocks to the blockchain. Public and private keys are used for user identification and document uploads. The system allows owners to specify the amount of land for sale and handles multiple owners through a consensus layer. Five algorithms are employed to facilitate land splitting, accurate sales, and successful transactions. Data transfer to other nodes notifies the owner of the transaction.

V. METHODOLOGY

The construction of a real-estate blockchain web application is described in detail by this technique . A safe and decentralized platform for the administration of property records is what the aim of the application

Step 1: Requirement Gathering

- The first step is to gather the requirements for the application from stakeholders , land records , process flow
- These requirements will be used to inform the design and development of the application .

Step 2: Technology Selection

- This step is to select the appropriate blockchain technology and framework for the application
- The points that need to be considered while technology selection include security , scalability and ease of use and development .

Step 3: Design and Development

- The application design and development process should be guided by the data from the previous two steps.
- Also design should take user experience and data privacy into consideration . The development should follow secure coding practices and adhere to any kind of regulations .

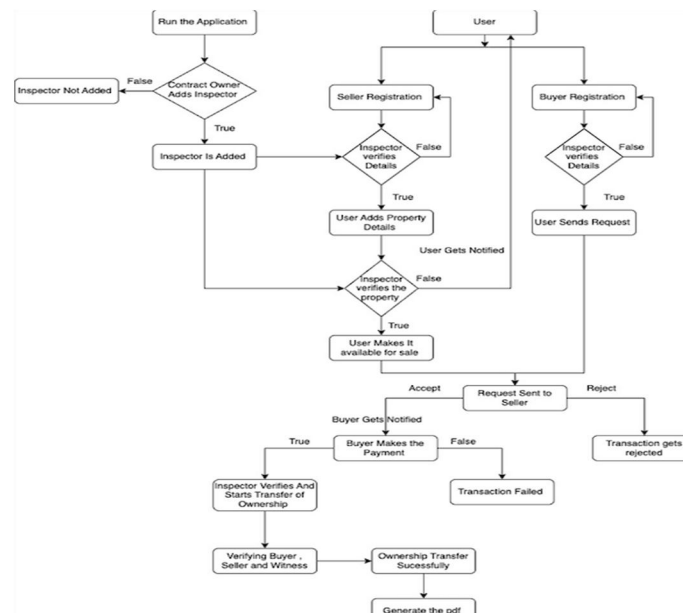
Step 4: Test and Deployment

- The application will undergo testing to ensure that it meets the requirements and functions as intended . Once the testing is complete , the application will be deployed on a secure and scalable infrastructure

Step 5: Maintenance and Upgrades

- The application will require ongoing maintenance to ensure that it continues to function properly and to make any necessary upgrades along with regular security and performance reports to ensure efficiency of the application.

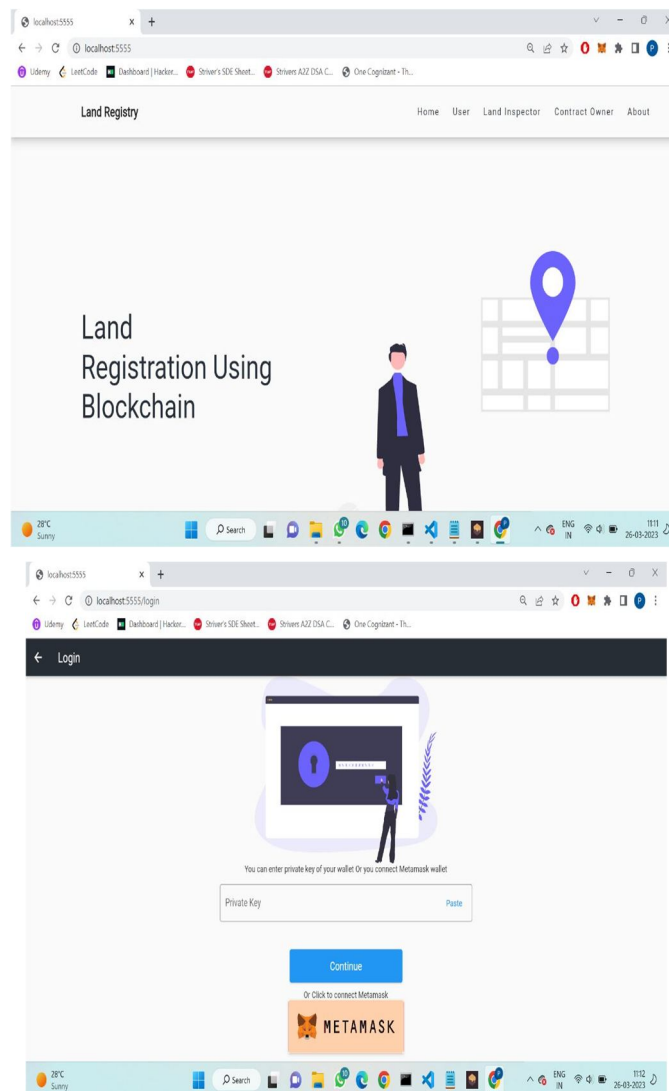
A. Block Diagram :

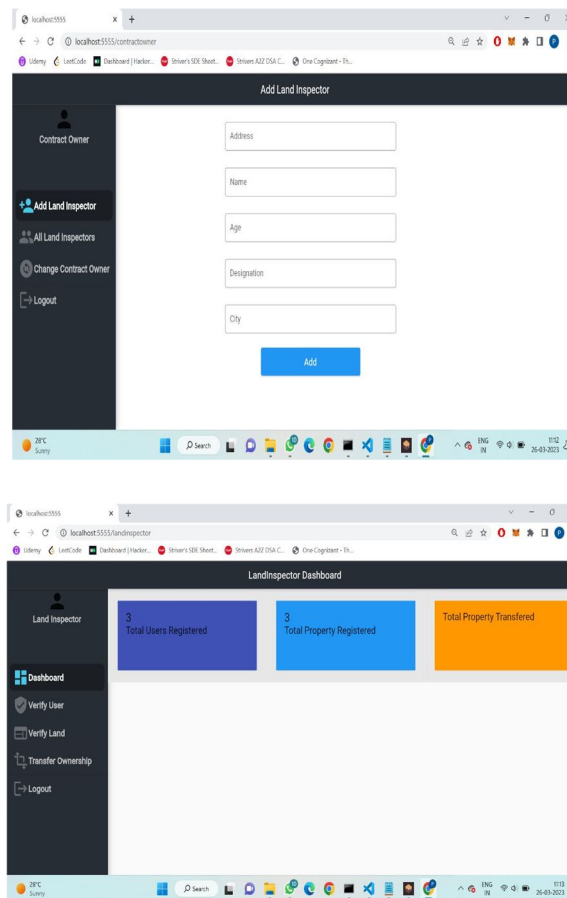


1. Land Owners register their land on the blockchain by calling the `add Land` function and providing details like area, address, land price, property identification number (PID), survey number, and document. The land owner needs to be a registered user and verified by a land inspector before registering the land.

2. The land inspector can verify the user by calling the `verify User` function and providing the user's address. Once the user is verified, the landowner can register their land on the blockchain.
3. Once registered, the land information is stored in a `Landreg` struct that is associated with a unique ID. This ID is used to access the land information.
4. The landowner can also set the land to be up for sale by setting the `is for Sell` flag to `true`.
5. Buyers can request to buy a particular land by calling the `request To Buy Land` function and providing the land ID, seller ID, and the amount they are willing to pay. The request is stored in a `Land Request` struct.
6. The seller can accept or reject the request by calling the `accept Land Request` or `reject and Request` function, respectively. If accepted, the buyer needs to make the payment by calling the `make Payment` function.
7. Once the payment is made, the `is Payment Done` flag in the `Land Request` struct is set to `true`, and the land ownership is transferred to the buyer by calling the `transfer Land Ownership` function.
8. The land inspector can add or remove themselves from the system by calling the `addL and Inspector` or `removel and Inspector` function, respectively. Only the contract owner can change the contract owner address by calling the `change Contract Owner` function.

B. Output Screenshots:





C. Requirements:

The requirement for developing the decentralized application are as follows:

- **Flutter** : To build cross platform applications quickly and deploy our smart contracts for better UI .
- **Solidity**: Knowledge of Solidity programming language is necessary to write smart contracts for the Ethereum network.
- **Web3**: Understanding of Web3 and how to use Web3.js to make API calls to the Ethereum network is crucial for developers.
- **Secure Key Management**: Key management is an important aspect of a blockchain web application, and it should be secure enough to allow users to store their private keys and manage their Ethereum-based assets safely.
- **MetaMask**: Integration with MetaMask is necessary to provide a secure and convenient way for users to access and interact with the Ethereum network.
- **UI**: A user-friendly interface is crucial for a blockchain web application as it should be easy to use and intuitive for users to interact with.
- **Scalability**: The application should be compatible and scalable with the ethereum network and work efficiently.
- **Security**: Protection against typical security risks, such as theft, data leaks, and illegal access, should be provided by the web application's security.

D. Technologies And Hardware:

- OS: Windows ,Linux
- Browser: Any
- Programming Language used: Solidity
- Scripting language used: HTML, CSS,
- Bootstrap, JavaScript & Flutter

- Storage Technology used: Blockchain
- Other Technology used: GIT, Meta-mask , Ethereum Environment Remix ide , VS code , Netlify.

VI. ALGORITHM

A. General Flow :-

1. Land Owners register their land on the blockchain by calling the `add Land` function and providing details like area, address, land price, property identification number (PID), survey number, and document. The land owner needs to be a registered user and verified by a land inspector before registering the land.
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VII. FUTURE WORK

Here are some potential areas of future work for a *Real - Estate registration* system using blockchain:

Enhancing transparency and trust: Blockchain provides high security. Users can view their data and code execution flow. This could be integrated with smart contracts which would be triggered when specific conditions are met.

Improving efficiency and reducing costs: With the use of blockchain, we can remove intermediaries thus reducing costs and increasing efficiency. Future work could include working with AI and the Internet of Things(IoT).

Addressing legal and regulatory challenges: Blockchain brings great security to data, however, there are a lot of concerns when it comes to legal rules and regulations, they need to comply with existing property laws, thus future work includes working on legal and regulatory challenges.

VIII. APPLICATIONS

1. Property owner can automatically check whether he is eligible to sell the property.
2. Both buyer and seller can get easy access to each other as blockchain connects users over a single platform.
3. Verification of property and land records is very easy.
4. The purchase of land is done through smart contracts, so its transparent and immutable process.

IX. CONCLUSION

The current property registry and selling systems have several shortcomings that can be overcome by implementing a decentralized land registry system that utilizes blockchain technology. This revolutionary technology has the potential to bring about significant changes in the real estate sector by offering enhanced security, data privacy, accuracy, transparency, and data interoperability. However, there are several obstacles that must be addressed, such as scalability, regulation, acceptance, and technical understanding. Future research should focus on topics like adoption growth, security, interoperability, and integration with AI and machine intelligence. To offer buyers and sellers a secure and transparent platform for storing and managing their personal and property data, the smart land registry blockchain web application has the potential to revolutionize the way property data is handled in the real estate sector. Ongoing research and development will be required to keep advancing the technology and addressing any potential issues that may arise.

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