

# Blockchain Based Land Registration System with Hierarchy Maintenance

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**Abstract**— Land registry system denotes to the system that records the particulars of land ownership rights by government bodies. The deposited record can be used as the proof on right and avoid any sort of scam. The aim of this work is to use decentralized system to increase the consistency of land registration and storage of property records based on ownership hierarchy. The system architecture is proposed and implemented here supported with dashboard for land contact owner, land inspector and users. Land inspectors dash board contains various operations like verification of user, land and transfer of property from one user to another user. Similarly, user dashboard contains entry of user details for registration, add land details, land gallery, send request to buy and received request for sale. Here, a consensus algorithm is employed to make nodes in a network like users, land registrar to reach a common agreement about the present state of the distributed ledger. Proof of Stake (PoS) consensus algorithm is utilized to authorize the blocks. The validators will confirm blocks by keeping a bet on them if they notice a block that can be added to the chain. SHA256 is a cryptographic hashing algorithm used which converts an input of arbitrary length into a fixed-size output and is utilized to generate addresses of blocks created when transaction happens. The system is working well as intended with respect to various operations.

**Keywords**—Blockchain, Ethereum, Land registration, Smart contracts, Consensus.

## I. INTRODUCTION

In order to fix the faults of central systems, blockchain-based decentralized systems are currently in development. Blockchain is an associate electronic ledger of digital records, transactions, or events, that are hashed cryptographically, and controlled over a shared network of participants. This work aims at building a model for secure and stable land administration, title registration and upkeep of ownership hierarchy supported with blockchain technology, which can enable in eliminating the weaknesses which are there in present land registration and administration method.

The existing land registry system has the following drawbacks:

- The outdated land records make it hard to verify ownership of the land leads scam. As a result, several parties assert differing degrees of control over a particular parcel of property.
- The land registry is unable to confirm any outstanding debts on the property.

- The primary motivation behind blockchain technology is the necessity for decentralization, which is met by dividing computation tasks among all the blockchain system's nodes.
- By tampering with records and selling a portion of land to one person, this technology has the capacity to close the aforementioned loopholes and address the issues with the land written record system.

Objectives of the proposed work are:

- To digitize land registration through Ethereum smart contracts.
- To make hierarchy of ownership transparent and accessible to the users.
- To ensure security through Blockchain's immutability property

Here, it is proposed to address all the above objectives.

## II. LITERATURE REVIEW

Access to land records and data organization have long been main issues in developing nations. In some locations, land data is still traditionally stored and controlled by a central who maintains this important data on sizable paper-based registries. Land record information has been digitized and deposited into computer systems in several nations. Although digitizing papers and other relevant data has speed up the process, security, resilience, and traceability continue to be major issues.

Blockchain-based decentralized solutions are currently expanding to address the flaws of centralized systems. Blockchain is a cutting-edge technology and database that has the capacity to completely eliminate the issues that plague the current systems for managing land titles and storing facts in a particular computer system.

According to [1], in order for the public to adopt blockchain-based solutions, they must be knowledgeable to manage cutting-edge technologies like blockchain. It is an outline on land registration and may be utilized in the upcoming days to create a software structure. Finally, it can surely offer insights of the actual system.

This paper [2] envisioned an outline that applies the idea of a feasible contract at various points in the documented land record. Offers a pre-agreement associate rule, i.e., a suggested an algorithm for initial business logic between a buyer and a

seller. This also envisioned an outline that applies the idea of a feasible agreement at numerous points in the documented land record. Discussed various features of blockchain technology in land registry system and offered a pre-agreement associate rule algorithm for a pre-agreement contract between a buyer and a seller. Also, discussed a quantity of blockchain's features for the property register system. Applying this on a large scale would also be one of the future scopes.

In [3], debated on potential identity models and their comparative analyses to decide which identity model would be most effective in resolving the individuality problems with land register systems. Examined the shortcomings of the current land registration system. It makes the different blockchain types and their features apparent. It also assesses how well blockchain technology integrates with different land registration operations. The Self- Sovereign Identity (SSI) model is proposed and the primary goal is to issue identity identifications based on a trustworthy network between two parties. The outcomes of the investigation demonstrated that the SSI model conforms to all identifying standards. This concept is better suitable for giving people a digital identity and overcoming the challenges with the blockchain- based land register system.

This article [4] proposed a blockchain- based system with the capability to significantly decrease the time it takes to sell or buy land-related assets, stop fraud, and delivers an improved level of ownership security. The government will benefit from the presentation of this system in land organization in points of tax gathering, service delivery, and other aspects of governance. A blockchain-based system that can prevent fraud, drastically cut down on the time needed to sell or buy land-related assets is proposed. It can also give owners a secure level of ownership protection. This kind of land organization will be advantageous to the government in points of taxation, service supply, and other facets of governance.

In [5], developed a cutting-edge plan that makes use of the blockchain to carry out the property registration procedure and give people in Bangladesh real and unquestionable ownership rights [12]. Blockchain integration will increase ownership assessment transparency and stop illegal transactions in Bangladesh's current land registration system. The suggested system's distributed near- deed information will significantly lessen disagreements.

In [6], developed a plan to fix the problems with the current property registration system in a centralized manner. There have been discussions over a various of aspects including private key, public key, encryption and decryption process. The issue of property registration on the blockchain is discussed and also how the decentralization and immutability of the facts on the blockchain can assist in finding a solution. Noticed the shortcomings of conventional systems. An outline that addresses scam avoidance by combining the standard Blockchain technologies with either asymmetric or public/private cryptography.

It was hoped [7] that a novel mechanism would be created to growth the Delegated Proof of Stake (DPoS) consensus in directive to deliver a private record-based system for managing land assets. The time it takes to acquire land is reduced from months to a few days. Possession is immediately and correctly confirmed. Because the entire system is digital and everything is logged into the blockchain upon a transaction or registration, there is a less paperwork. Strict security and anti-fraud measures are employed.

An identification [8] response must be given in direction to have a trustworthy blockchain based land register system is discussed. Researched the available SSI options, evaluated them in accordance with the SSI principles, and developed the optimal SSI option for a blockchain-based land register system. A reliable land register system built on a blockchain needs an identifying response. After carefully examining the various SSI solutions and evaluating them in light of SSI principles, the ideal SSI solution for a blockchain based property registration system has been designed.

III. PROPOSED WORK

Fig. 1. shows the architecture of the proposed work. This includes various modules like user interface, privacy engine, user details, trusted execution environment, blockchain network and validated transactions.

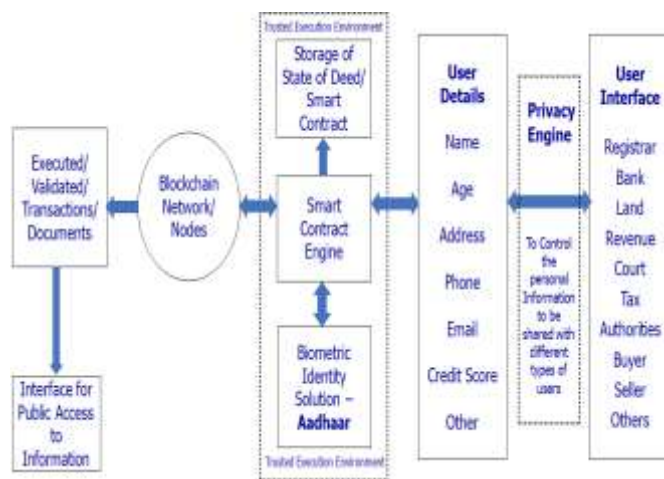


Fig. 1. Proposed system architecture

The following components are used for implementation such as Flutter, Smart Contract, Truffle, MetaMask and web3.js.

➤ Frontend - Flutter

- We have developed frontend using Flutter implemented with Dart (Distributed art Language). Flutter is open source and created by Google. It is a cross platform SDK.
- On the front screen, one can login as a user, land inspector, or contract owner. The contract owner can add a land inspector and see all the added land inspectors. The land inspector's dashboard consists of

the functionality to verify user, verify land and transfer ownership.

- If we login as the user, we have the options of adding lands, land details, seeing all lands, sending and receiving land requests. Here, used truffle IDE (Integrated Development Environment) to set up the DAPP (Decentralized App).

#### ➤ Backend – Smart Contract

- Ethereum blockchain extended the scripting feature into a complete code execution framework called smart contract implemented with Solidity Programming Language.
- A smart contract provided a very powerful capability of code execution for embedding business logic on the blockchain.
- In this work, it is implemented a smart contract as the backend which consists of all the terms and conditions for a smooth and secure transfer of property registration.

#### ➤ Truffle

Truffle is an environment for development and testing by means of Ethereum Virtual Machine (EVM). Truffle is widely considered the most popular tool for blockchain application development.

#### ➤ MetaMask

MetaMask is a cryptocurrency software wallet that is utilized to interact with Ethereum. It permits users to contact their wallet through a browser extension for interaction with distributed applications.

#### ➤ web3.js

Web3.js interact with Ethereum with JSON RPC expanded as Remote Procedure Call protocol. It is a peer-to-peer network of nodes which stores a replica of code and data on the blockchain. It utilizes jQuery and a JSON API with a web server to read/ write data.

#### ➤ Consensus Algorithm

A consensus algorithm is a technique used to make certain that each node in a network is in agreement with the ledger's current state. To put it another way, it denotes to the procedure through which the network decides which transactions are legitimate and should be involved in the chain.

Without a consensus algorithm, it would be possible for malicious actors to manipulate the blockchain by adding invalid transactions to the chain. The consensus procedure confirms that all network nodes have a copy of the same ledger and agree on its current state, making it virtually impossible to alter or corrupt the blockchain.

#### ➤ Proof of Stake (PoS)

It is a newer consensus algorithm that aims to address the issues with Proof of Work (PoW), namely high energy consumption required to solve the mathematical problems. This is also a common consensus algorithm that evolved as a low-cost, low-energy-consuming, alternative for the PoW algorithm. For providing the responsibilities the public ledger delivers the virtual currency token like Ethereum.

- SHA-256, or Secure Hash Algorithm 256, is a hashing algorithm used to convert text of any length into a fixed-size string of 256 bits (32 bytes). This is used to generate addresses of blocks when transactions happen.

## IV. RESULTS

This section presented sample results obtained after demonstration of the work. Fig. 2 shows the unlocking of MetaMask to enter into the system.

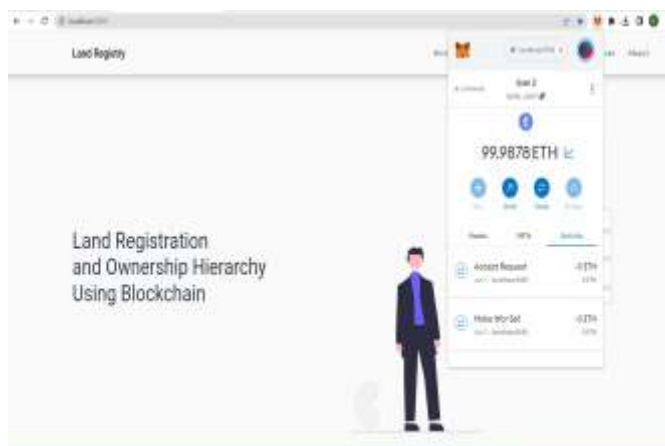


Fig. 2. Open MetaMask to unlock system

The Fig. 3. shows the land inspector dashboard where various operations are performed like verification of user, land and transfer of property from seller to buyer.

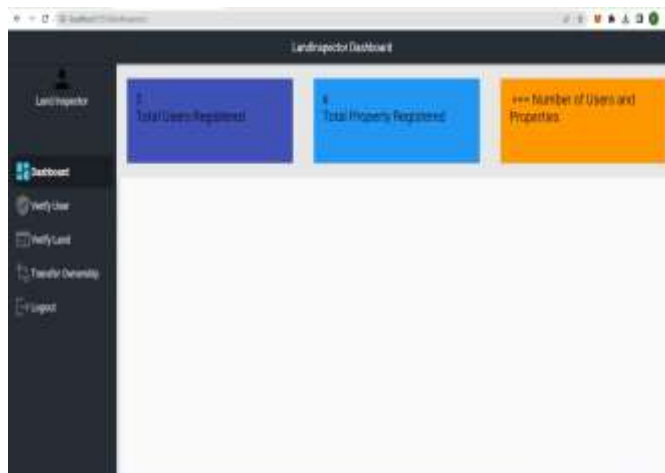


Fig. 3. Land inspector Dashboard

Fig. 4. shows verification of user by land inspector to check the details entered during registration. Before any transaction, user should be verified the by the land inspector. Fig. 5. shows verification of land, by land inspector whenever land details are entered. Here, some are verified and some yet to be verified. Fig. 6 shows the transfer of land from seller to buyer after acceptance by the seller and payment towards the same. This process is approved by land inspector after verification of seller, buyer, their photos and witness. Later, a sale deed is generated and stored in a file in the server. Copies of the same can be downloaded for reference by both the parties.

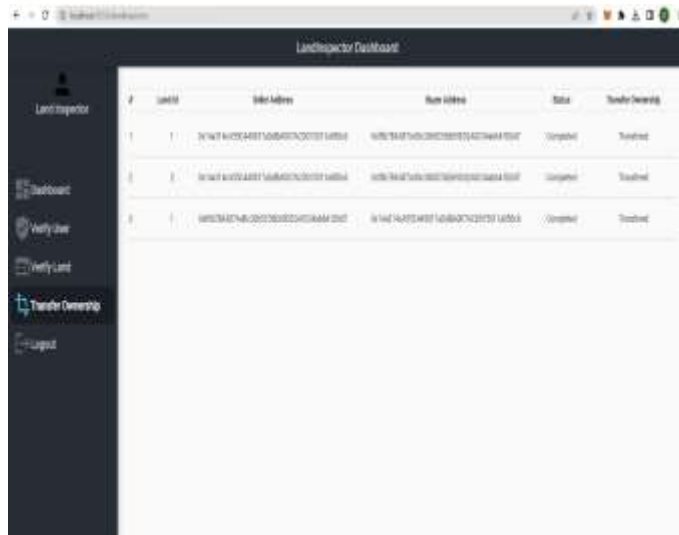


Fig. 6. Land inspector – Transfer Ownership

Fig. 7. shows the sale deed generated after a transaction happened between a seller and buyer.

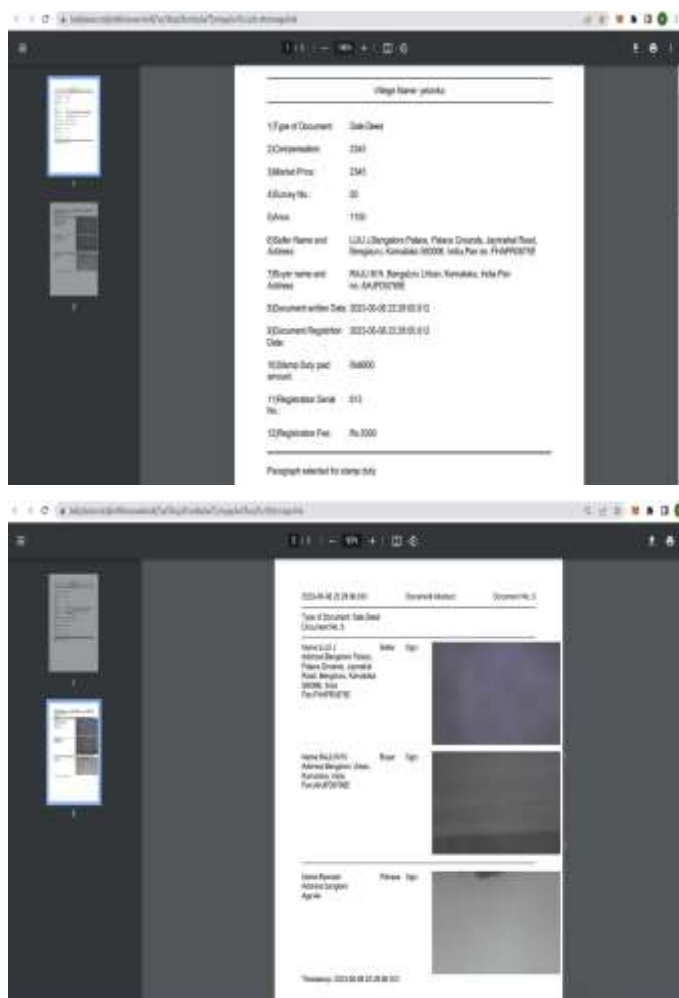


Fig. 7. Sale deed of a land

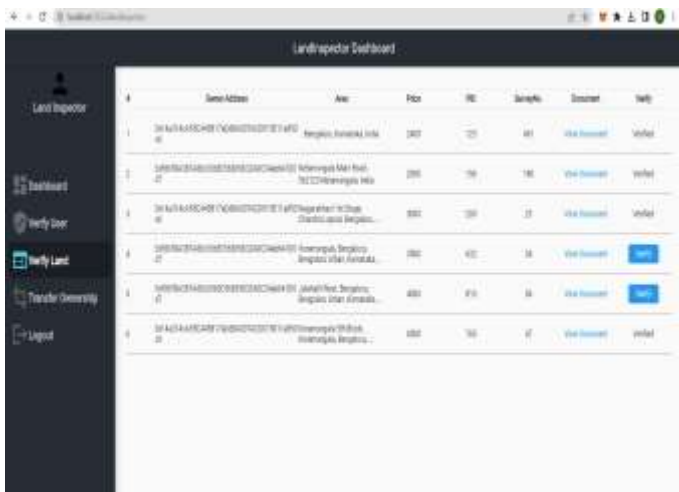


Fig. 4. Land inspector – verify land

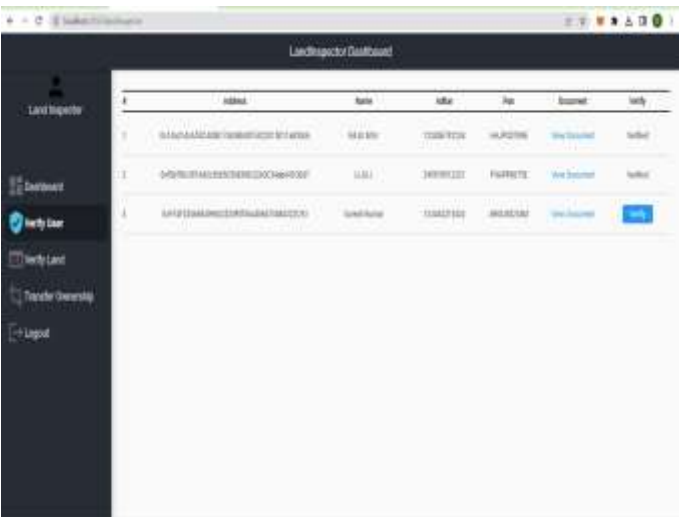


Fig. 5. Land inspector – verify user

## V. CONCLUSIONS AND FUTURE SCOPE

Numerous flaws in the traditional land registration system necessitated the attention of investigators in direction to resolve problems. There are numerous difficulties, such as record tampering, property misuse, and unethical behavior involving bad financial management, which make the traditional property system a topic for study. This paper offers a method for limiting transparency and a reliable blockchain based property registration system. The infrastructure provided numerous advantages to the parties included in the purchase and sale of real estate. A tamper-proof ledger ensures the record's integrity, transparency, and trustworthiness.

Blockchain is a social revolution and is making its means through all important areas especially where security is a concern. We have to take our best efforts to harness this technology to the best of our ability. There is good scope for improving the current solution for cloud storage. The application serves basic functionalities but can be protracted to provide some advanced features.

- **Deployment on mainnet or a private Ethereum Network** – Currently, it is deployed on the ropsten testnet which uses ETH from faucets that has no real value and therefore no market for tesnet ETH. So going further we would deploy it on a Mainnet or a private Ethereum network depending upon our requirements so that it gets connected with real world.
- **Hosting the DAPP on a cloud platform** - When deployed in real-time the number of users on the application would increase so to scale this application, we can host it on a cloud platform such as AWS.
- **Collaboration with government agencies** - The final stage of this work is to reach out to government and test DAPP with their collaboration to collect real world inputs and see how this work stands in the real time.

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