

# Digital Land Registry System using Blockchain

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**Abstract**— In today's world, the security of data plays a very important role, many industrial sectors are trying to secure the data from hackers. Blockchain is an advanced technology through which peers can digitally transfer currency, financial documents, land properties, etc. It is an open-source public network where no central authority is needed, it is a peer-to-peer network where all transactions, value transfer, data shared through a single node would be verified by all other connected nodes in the network. The traditional land registration process is a slow and laborious process, involves many intermediaries, and has maximum chances of fraudulent and fake land transfer. Blockchain is a perfect domain for the land transfer process, in this paper proposed solution is given on securely transferring land ownership using blockchain technology, without involving any intermediaries, buyers and sellers are making a land ownership deal using ethereum network.

**Keywords**— *Blockchain, Ethereum, Smart contracts, Cryptography, Land Registry.*

## I. INTRODUCTION

Land registration describes systems by which matters concerning ownership or other rights in land can be recorded to provide proof of title, facilitate transactions and to prevent illegal activities. After the land registration, the property owner is provided with the Land Title by the government and the title plan that indicates property boundaries[2]. Land registration systems record property rights and provide evidence in relation to property title holders[3]. The primary aim of the system is to ensure the title certainty. There are many challenges involved in the existing centralized land registration system, If a fraudster effectively pretends to be a landowner, after completion, they will collect the amount and escape with the funds. In many cases, until detected by the land registry as part of a spot check exercise, both sellers and buyers were uninformed of the fraud. Land registries have traditionally been focused on paper records that could be misplaced, burned, altered, or otherwise manipulated[8]. However, if someone wants to sell an past property that has

not been registered before and the paper title documents have been lost or destroyed, it may become incredibly difficult to register the property. Time taken to register the land is considerably long in the centralized system. Between completion and registration, there may be a period of several months. During this long pause, several legal issues can also arise.

In order to remove these threats, blockchain technology will help, with its ability to immutably record and share information, ultimately providing us with reliable and precise records of recorded land titles. The digital land registry platform would allow you to sync the land title records to the blockchain network where sellers can sign the document and validate it when required by other users[6]. Blockchain will prove that you are the owner of the land title by maintaining an immutable record of transactions and preventing falsification of documents. A smart contract is a set of rules that can be embedded in blockchain to enable, validate or negotiate a contract. Smart contracts work under a set of terms which users agree to. When those conditions are fulfilled, the terms of the agreement will be automatically executed. Ethereum, It's a decentralized, open source, and distributed computing platform which helps to create smart contracts and decentralized applications which are also known as dapps. using blockchain technology, In the presence of hostile third-parties, known as adversaries, cryptography allows for safe communication. A set of rules, encoded in a smart contract-the token contract, reflect cryptographic tokens. Every token belongs to a blockchain address. For every untrusted party to check, the immutable, decentralized existence of the blockchain network makes data transparent[2]. Doing so will make the transfer of ownership smooth and faster than the conventional process. After the notary approves the land title, smart contracts activate a new buyer's ownership update and the resulting transaction is stored on blockchain. In this way, Using blockchain technology for land registration will result in a friendly system.

The rest of the paper can be referenced as follows. Section II focuses on the various related works with respect to the land registry system in both traditional and technical ways. Section III gives an idea about the flow of the system mentioning all the features of the system. Section IV concludes the paper after dealing with the trade offs of the blockchain technology on the system.

## II. RELATED WORK

### 1. Smart Contract Definition for Land Registry in Blockchain[1] -

This paper highlights the challenges faced in the current process of land registration in India such as Centralisation, involvement of Middlemen/Brokers, Time Delays, Fraud Cases and Human-error/interventions. To overcome these issues they have proposed the idea of usage of blockchain technology and emphasises the importance of Smart-Contracts. The solution proposed in this paper overcomes all the above mentioned issues but it doesn't perform the verification of buyer and seller.

### 2. A secured land registration framework on Blockchain[4] -

The system proposed in this paper follows a decentralized approach of hybrid blockchain with various consensus algorithms for validating each transaction of land between new owner and old owner without involvement of third parties. The system also handles various cases of land ownership transfer like partition of land, hereditary cases, wills, mortgage cases using decentralised Blockchain technology. This system implements using ethereum which results into very low transaction processing time thereby making it efficient for real-time application.

### 3. Bitcoin: A Peer-to-Peer Electronic Cash System[9]-

The paper outlines the problem of double-spending in online transactions and proposes a solution of a peer-to-peer network using proof-of-work for electronic transactions without relying on trusted parties. The system is very much secured as network timestamps each transaction by hashing them into an ongoing chain, but the paper lacks the implementation details of the system.

### 4. Blockchain challenges and opportunities: a survey[11]-

This paper briefly describes the Blockchain technology and its key-elements such as decentralisation, persistency, immutability, anonymity and auditability. This paper introduces the blockchain architecture and its taxonomy, also describes the various consensus algorithms and compares them, and discusses the technical challenges such as scalability, privacy leakage, and selfish mining and mention recent advances to eliminate these challenges. This paper also

gets the attention of the future possibilities in blockchain technology.

### 5. An Overview of Smart Contract and Use cases in Blockchain Technology[16] -

This paper explains how the Smart Contracts on blockchain streamlines the complex process with high security and low cost. Unification of blockchain technology with Smart-contract can be robust. In this paper, various components and working principle of smart contracts is mentioned. The paper basically overview the smart-contracts in blockchain technology with no detailed study.

TABLE I. DIFFERENCE BETWEEN THE TRADITIONAL WAY OF LAND REGISTRY SYSTEM AND USING BLOCKCHAIN TECHNOLOGY

<b>Parameters</b>	<b><i>Difference between System using Traditional way and using Blockchain Technology</i></b>	
	<b><i>Traditional</i></b>	<b><i>Blockchain as a Potential Solution</i></b>
<b>Type of System</b>	It is a Centralized System	It is a Decentralized System
<b>Fraud Cases</b>	Huge cases of claimers posing as the seller of a land or property. Thus increases the chances of fraud cases.	The digital land registration platform could serve as proof of land ownership, record existence, exchange and transaction by keeping the immutable records of the transactions. Hence reduces the fraud cases.
<b>Middlemen/ Brokers Need</b>	Middlemen/ Brokers are involved.	No need for Middlemen Brokers.
<b>Time</b>	It is a time expensive process	This system accelerates the process.
<b>Human Error</b>	The Land Registry system is paper based. Hence, the chances of bugs increase in the land registry system.	As the user confirms the transfer of land title, smart contracts activate to update the land ownership for a new buyer and respective

		transactions get stored on the blockchain. Thus, the history of the ownership records is traced making the system paperless. Thus, decreases the chances of errors in the system.
<b>Need of Witness</b>	Need at least 2 witnesses	No need of witnesses

### III. PROPOSED SOLUTION

In this proposed system, there are two modules: land registry and verification.

#### A. Land Registry Module -

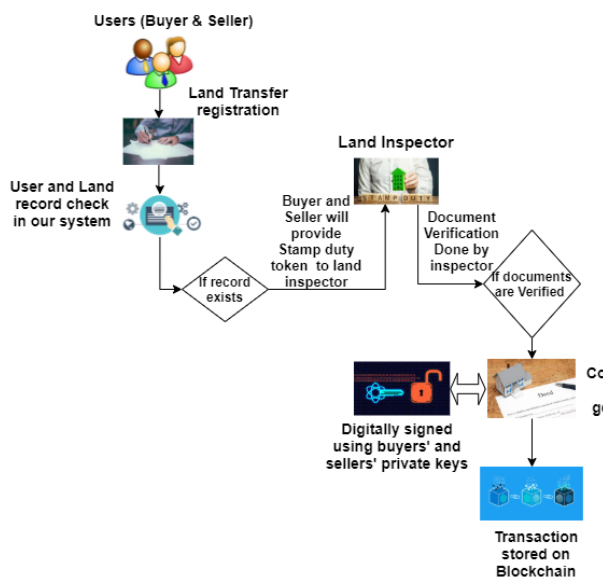


Figure 1 - Land Registry Architecture

In land registry module, three steps process is followed -

- User Login** - Users will register on the system by providing their contact details, email address, name, aadhar number and the details would be verified from digilocker which inturn would be integrated in the system, If the user details are verified successfully, then through the system private and public keys would be generated for users, keys are generated using aws key management store.

- Seller/Buyer** - Once the registration is done, option would be given to sellers for the transfer of land ownership, prior to conveyance deed, buyers and sellers has to submit some amount of token to land inspector for document verification, once the documents are verified by land inspector, seller would provide the contact details, aadhar number, email address of a buyer and a buyer would receive a notification on an email regarding land transfer process to accept or reject the request. Once the request is accepted, the buyer will enter their details and the details would be matched with the details given by the seller, if the details are matched, notification would be sent to both buyer and seller regarding signing the conveyance deed.

- Conveyance deed** - once the notification accepted by both buyer and seller, corresponding private keys would be fetched from aws key management store and a digital signature would be generated which would be stored on blockchain and the digital file would be sent to the buyer via email. Once the land transfer process is completed, events would be triggered and the land ownership function would be called from a smart contract for updating the land owner and a transaction would be generated on blockchain.

#### B. Verification Module -

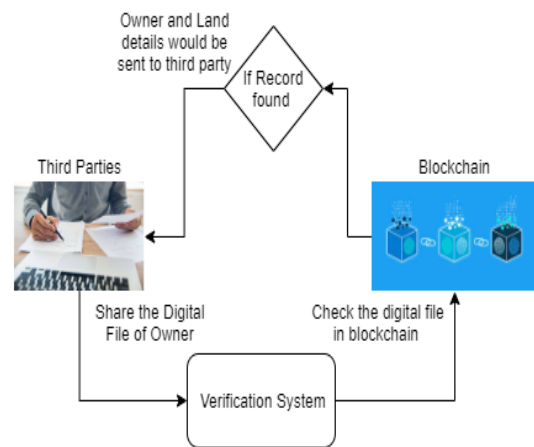


Figure 2 - Verification Architecture

In the verification process, different third parties will verify the owner and land details by uploading the digital file on the system, digital file would be matched with the records stored on the blockchain, once the digital file is matched with the record, the details of the owner and land details will be sent to the third party via email. Third party can be a financial institution wherein owner can apply for a loan, institution would ask for a proof of land property, owner can provide them a digital file generated through the system and institute would make a request for details and send notification via

email to the system, provided digital file would be matched with the system blockchain records, if digital file found out, then the owner and land details would be send to the bank via email.

Throughout the process, blockchain plays a very important role in maintaining transparency, digitally signing and verifying the land records without involving any intermediaries, and securely storing the land record ownership transfer history on blockchain.

Following is the list of tools used throughout the process -

- a. *Smart Contracts* - Different smart contracts are made for buyer, seller, land inspector and events are generated in smart contracts for web application, different functionalities and data structures are used while writing smart contracts, those are structures, arrays, contracts, modifiers, functions, constructor.
- b. *Solidity* - solidity programming language is used while writing smart contracts, solidity compiler is used for generating bin and abi files. Bin file is used while communicating with blockchain and abi file is used for accessing the smart contract functions.
- c. *Web3js* - web3js is a javascript library which is used for connecting the web application to blockchain via rpc port, web3 object is generated and different functions of web3 are used while communicating with ganache, truffle console.
- d. *Ganache* - ganache is a testing environment which is used for testing the functionality of smart contracts, ganache provides 10 pre funded accounts for testing the transactions, and smart contracts.
- e. *Truffle* - truffle is a framework used for deploying the contracts, truffle automatically provides the structure for storing the contracts and migrations folders for connecting it with mainnet and testnet.
- f. *Geth* - geth is an ethereum client used for connecting it with an ethereum network on users' local machine and truffle inturn used with geth for deploying the contracts and testing the transactions on testnet.

#### System Use Cases -

1. Digitizing property ownership records.
2. Offering ownership verification as a service for various use cases like applying for a loan.
3. Tracing the land ownership history.

#### Comparison between existing systems and proposed solution-

Existing Systems	Proposed Solution
Land Ownership Hierarchy is not maintained.	Land Ownership Hierarchy is maintained.
IPFS is not used in the existing systems.	Land Documents are stored in IPFS
No land documents verification has been done.	Notary Functionality has been added for cross verifying whether the land document exists or not in blockchain.
Direct land transfer process is created.	e-kyc for authenticating the user.

#### IV. CONCLUSION

Blockchain has shown its potential for almost all the industries namely cryptocurrency, asset transfer, certificate/document verification, etc. All this is attainable due to its key characteristics: decentralization, anonymity, persistence, audability. Traditional land registration system is a cumbersome process, involving many intermediaries and verifications. Blockchain technology can play a vital role in the land registry procedure because of its immutability, security features. The transparency and invulnerable characteristics of blockchain are attracting the organisations around the world to switch and adapt to blockchain-based solutions. With use of blockchain the proposed solution tries to minimize intermediaries involved, minimize time consumption, reduce the complexity. Enforcing the use of smart contracts would speed-up the procedure by changing the ledger details automatically which in turn storing the land owner hierarchy securely. Additionally it would help to resolve disputes, suppress fraudulent acts.

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