

# Secure Land Registration Management via Ethereum Blockchain

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**ABSTRACT:** Land is a critical asset, and transferring its ownership traditionally requires voluminous paperwork, numerous intermediaries, and multiple verification stages that slow the process and increase the potential for fraud. Researching historical land transfers is likewise cumbersome due to fragmented records. A blockchain-powered land registry can solve these issues by creating a decentralized, immutable ledger that logs every transaction openly. This project presents a secure and efficient land registration system built on the Ethereum blockchain, utilizing Solidity-based smart contracts to automate verification and property transfers. By cutting out middlemen, the platform minimizes corruption, speeds up the process, and increases public trust. Especially in high-volume areas like India, where thousands of property exchanges occur daily, this system reduces the environmental burden caused by excessive paperwork. Beyond efficiency, it also brings the general public closer to digital technology and ensures long-term security for property records. This project aims to design and deploy a user-friendly blockchain-based land registration system that streamlines ownership changes, bolsters security, and reduces environmental impact by cutting down on paper records—particularly beneficial in high-transaction regions like India.

**Keywords:** Blockchain, Ethereum, Smart Contracts, Solidity, Land Registration, Decentralized System, Transparency, Digital Governance, Property Records.

**INTRODUCTION:** The integrity and clarity of land records are paramount for government agencies responsible for property registration. However, existing systems often suffer from fraud, ambiguous sale documentation, and difficulties reconciling outdated, siloed records. These challenges create inefficiencies, disputes, and mistrust among stakeholders, emphasizing the need for a more reliable framework. This project introduces an Ethereum blockchain-based solution for land registration. Smart contracts automate essential processes such as

validating documentation, executing transfers, and maintaining a transparent history removing reliance on central authorities and reducing human error. By harnessing blockchain's decentralized, tamper-resistant design, the system promises faster, more secure land transactions and paves the way for a modernized, trust-based approach to real-estate Administration.

## Problem Statement

Traditional land registration systems face numerous persistent issues, including data fragmentation, lack of transparency, and susceptibility to manipulation or fraud. These limitations result in ownership disputes, lengthy verification processes. Government struggles to maintain consistent and trustworthy property records. Therefore, there is a critical need for a secure, efficient, and transparent solution that eliminates these systemic weaknesses while ensuring reliability. By implementing this decentralized solution, the project not only seeks to modernize the land registry process but also to build public trust, reduce administrative burdens, and foster a more inclusive and accessible land management infrastructure ..

The primary objective is to develop a user friendly blockchain based land registration system, with the aim of simplifying the complex process of transferring land ownership. This entails minimizing paperwork to enhance overall efficiency. The project aims to implement a decentralized and immutable ledger using blockchain technology. By employing cryptographic techniques, consensus mechanisms, and hashing algorithms, the goal is to establish a secure and transparent system for land transactions, fostering trust and preventing tampering.

## LITERATURE SURVEY:

### Title: Blockchain Enabled Digitization of Land Registration

**Authors:** Suganthe R. C., Shanthi N., Latha R. S., Gowtham K., Deepakkumar S., Elango R.

**Year:**2021

**Summary:** This work analyzes the complexities of India's traditional land registry system and proposes a blockchain-based framework to eliminate middlemen

and ensure a secure, digitized registry. It highlights the role of hashing algorithms, cryptography, and consensus mechanisms to validate each transaction block securely.

**Title: Securing Land Registration using Blockchain**

**Authors:** K.S., G. Sarath

**Year:** 2020

**Summary:**

This study emphasizes the use of SHA-256 hashing and Proof of Work (PoW) mechanisms to secure land transaction data. The proposed blockchain-based registry improves record immutability and authenticity using elliptic curve cryptographic algorithms and Merkle Trees. It reduces the manual effort by up to 99%, thereby ensuring transparency and efficiency in land ownership validation.

**Title: Secured Land Registration Framework on Blockchain**

**Authors:** Nandi M., Bhattacharjee R. K., Jha A., Barbhuiya F. A.

**Year:** 2020

**Summary:**

This paper presents a framework for converting land titles into blockchain-based tokens. The system uses Ethereum smart contracts to ensure tamper-proof ownership, traceable transactions, and data permanence. It specifically addresses legacy issues with land data and reduces litigation risk through transparent record keeping.

**Title: Land Registry Management using Blockchain**

**Authors:** Thosar A., Hame M., Sarode A., Kaur P.

**Year:** 2020

**Summary:**

The study focuses on developing a decentralized land registration DApp using the Ethereum blockchain. A government super admin oversees transactions between landowners and buyers. It aims to eliminate corruption and reduce registration delays by implementing smart contracts and reducing manual dependencies.

**Title: Smart Contract Definition for Land Registry in Blockchain**

**Authors:** Sahai A., Pandey R.

**Year:** 2020

**Summary:**

This paper defines the architecture of smart contracts tailored for land registry systems. It introduces structured validation and legal documentation checks using Ethereum's Solidity contracts. The focus is on automating the end-to-end process of land registration, from verification to transaction finalization.

**Title: Blockchain Based Land Registry with Delegated Proof of Stake (DPoS)**

**Authors:** Majumdar M. A., Monim M., Shahriyer M. M.

Published in: *IEEE Region 10 Symposium (TENSYP)*

**Year:** 2020

**Summary:**

Utilizing Delegated Proof of Stake (DPoS), this system optimizes scalability for large-volume land transactions. Nodes are selected to verify and add blocks, reducing energy consumption and improving consensus efficiency compared to traditional PoW systems.

**Title: Digitalization of Land Records using Blockchain Technology**

**Authors:** Mishra I., Supriya, Sahoo A., Vivek Anand M.

Published in: *IEEE International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE)*

**Year:** 2021

**Summary:**

Focuses on converting legacy paper-based records to a blockchain-backed database. It addresses issues like forgery and centralized data manipulation, enhancing data security and regulatory compliance in land transactions.

**Title: Land Records on Blockchain for Implementation of Land Titling in India**

**Authors:** Vinay Thakur, M.N. Doja, Yogesh K. Dwivedi, Tanvir Ahmad, Ganesh Khadanga

Published in: *International Journal of Information Management*

**Year:** 2020

**Summary:**

This paper proposes a complete land titling solution on blockchain that eliminates duplicate titles and fraudulent claims. The authors detail a model that integrates blockchain with India's existing land databases, ensuring title assurance, tamper-proof records, and access transparency. The paper discusses scalability and policy-level implications for full-scale adoption in India.

**Title: Land Registry using Blockchain – A Survey of Existing Systems and Proposing a Feasible Solution**

**Authors:** Shinde D., Padekar S., Raut S., Wasay A., Sambhare S. S.

Published in: *5th International Conference on Computing, Communication, Control and Automation (ICCUBEA)*

**Year:** 2019

### Summary:

This work presents a comparative survey of existing blockchain-based land registry systems and proposes a hybrid framework using Ethereum smart contracts and centralized verification agents. The proposed solution enhances trust and scalability while ensuring compliance with regulatory frameworks.

### DEVELOPING METHODOLOGIES:

#### Overview

The proposed system uses Ethereum blockchain, smart contracts, and a web-based interface to streamline the process of land registration. It removes the need for intermediaries, ensures transparency, and prevents tampering of land records. The system has four main components:

1. User Interface (UI)
2. Smart Contracts on Ethereum
3. Blockchain Network (Ethereum)
4. Admin/Central Authority Panel

#### Methodology Steps

##### Step1: User Registration and Authentication

Users (Sellers/Buyers) register on the platform via a web interface.

They are authenticated through the system before proceeding with transactions.

##### Step 2: Land Data Submission by Seller

Seller uploads land details such as location, ownership proof, and valuation documents.

The data is temporarily stored and linked with the user's wallet address.

##### Step 3: Admin Verification

The central authority/admin verifies the uploaded land documents.

On approval, the data is permanently recorded using smart contracts on Ethereum.

##### Step 4: Smart Contract Deployment

A Solidity-based smart contract is deployed to record ownership and enable automated ownership transfer.

Land records become immutable and timestamped on the blockchain.

##### Step 5: Purchase Request by Buyer

A buyer submits a purchase request.

If approved, the ownership is transferred through the smart contract, and a new transaction is added to the chain.

##### Step 6: Blockchain Logging & Status Update

Every transaction (land addition, approval,

purchase) is recorded on Ethereum.

Both buyer and seller can verify the transaction status via blockchain.

### SYSTEM ARCHITECTURE:

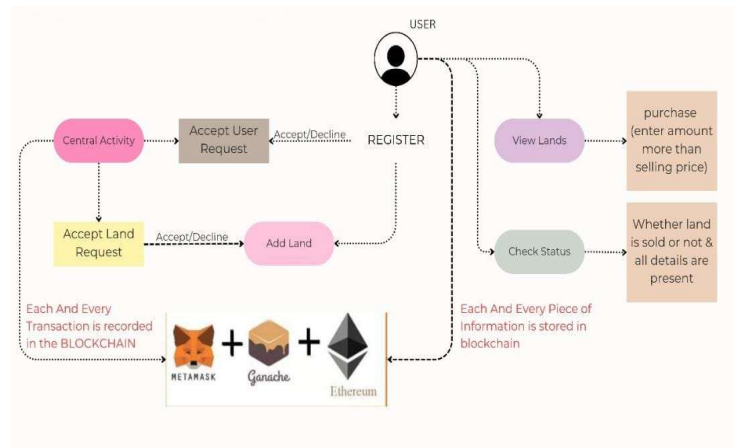


Fig: System Architecture

### IMPLEMENTATION

#### EXISTING SYSTEM:

In literature they highlights issues, such as minimal transparency, accountability, incoherent data sets with different Government Departments relating to the same portion of land and delays in the current Land registry management process. They 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.

#### Disadvantages of Existing System:

The existing work acknowledges minimal transparency and trust in the system. The existing work points out delays in the current land registry management process. The existing work does not explicitly address security concerns.

#### PROPOSED SYSTEM:

We propose a secure land registration system using Ethereum blockchain. This will decrease corruption in the process by removing middlemen from the process. Also, it will increase the speed, and create trust in the system without even the involvement of any central agency. This system will use smart contracts, cryptographic algorithms, and consensus mechanisms to develop a user-friendly land registration system. Smart contracts are self executing contracts that have the contents of the agreement between sellers and

purchasers directly put into lines of code. The code and the agreements found in it exist across a dispersed, open blockchain network. Without the requirement for a centralized authentication system, a formal legal framework, or an external compliance mechanism, smart contracts enable the execution of reliable transactions and agreements between dispersed, anonymous parties. They make transactions clear, irreversible, and traceable. The aim of this work is to develop, blockchain-based land registration system to ease the process while maintaining security and trust.

**Advantages of proposed system:** Our work emphasizes security through cryptographic algorithms, consensus mechanisms, and the tamper-resistant nature of blockchain technology. Our work promises to increase the speed of transactions and streamline the registration process through automation and smart contracts. Our work addresses this by creating a decentralized, trustless system through blockchain technology, ensuring transparency and trust without relying on central agencies.

## SYSTEM TESTING TESTING STRATEGIES

**UNIT TESTING :** Unit testing, a testing technique using which individual modules are tested to determine if there are issues by the developer himself.. it is concerned with functional correctness of the standalone modules. The main aim is to isolate each unit of the system to identify, analyze and fix the defects.

Unit Testing Techniques:

**Black Box Testing** - Using which the user interface, input and output are tested.

**White Box Testing** –Used to test each one of those functions behavior is tested.

**DATA FLOW TESTING :** Data flow testing is a family of testing strategies based on selecting paths through the program's control flow in order to explore sequence of events related to the status of Variables or data object. Dataflow Testing focuses on the points at which variables receive and the points at which these values are used.

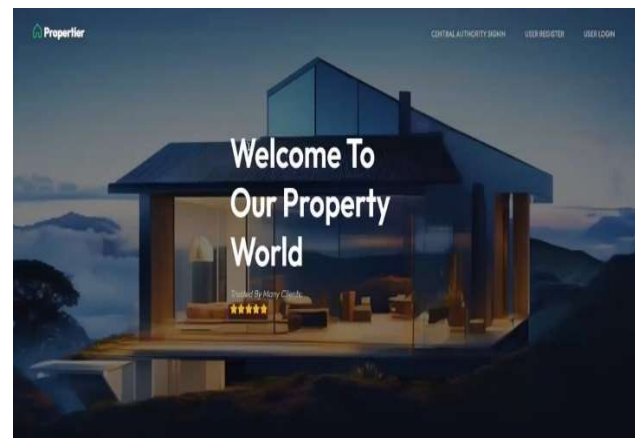
**INTEGRATION TESTING :** Integration Testing done upon completion of unit testing, the units or modules are to be integrated which gives raise too integration testing. The purpose of integration testing is to verify the functional, performance, and reliability between the modules that are integrated.

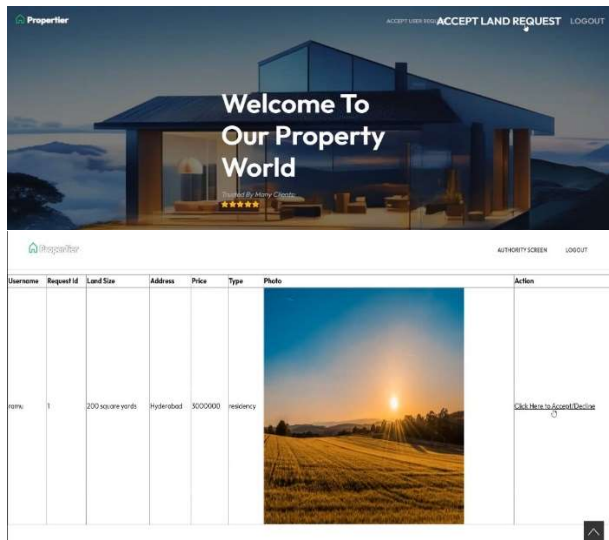
**BIG BANG INTEGRATION TESTING :** Big Bang

Integration Testing is an integration testing Strategy wherein all units are linked at once, resulting in a complete system. When this testing strategy is adopted, it is difficult to isolate any errors found, because attention is not paid to verifying the interfaces across individual units.

**USER INTERFACE TESTING :** User interface testing, a testing technique used to identify presence of defects is a product/software under test by Graphical User interface [GUI].

**SNAPSHOTS:**





**CONCLUSION :** Successfully user-friendly blockchain-based land registration system is developed, streamlining the complex process of transferring land ownership and minimizing paperwork, thereby enhancing overall efficiency. The project's decentralized approach addresses corruption issues in land registration by removing intermediaries, leading to increased reliability and a reduced likelihood of forgery, ultimately contributing to a more trustworthy land registration process. Leveraging blockchain technology, the project successfully expedites land registration processes. By eliminating the need for multiple verifications at various stages, the system becomes more responsive to user needs, enhancing overall speed and efficiency. The project's broader impact extends to environmental sustainability, reducing paper use in land record maintenance. By encouraging technology adoption and eliminating manual paperwork, especially in regions with frequent land transfers like India, the project makes a positive contribution to the environment.

### FUTURE ENHANCEMENTS

As blockchain technology continues to evolve, several improvements can be integrated into the existing land registration system to enhance its performance, scalability, and user experience. Below are some potential future enhancements: **Integration with Government Databases**

To improve trust and legal compliance, the system can be directly integrated with official land revenue departments and municipal records. This would enable automatic cross-verification of property details and ensure that only legitimate land assets are tokenized and transferred.

### Mobile Application Development

A mobile version of the system could be developed to

allow users—especially those in remote or rural areas—to register land, track status, and initiate ownership transfers using smartphones. This would increase accessibility and promote digital inclusion.

### Biometric-Based User Verification

In the future, biometric authentication (like fingerprint or facial recognition) can be incorporated to strengthen identity verification during registration and transactions. This will reduce impersonation and enhance system security.

### Support for Multi-Signature Transactions

Adding multi-signature support for land transactions can improve security by requiring approvals from multiple parties (e.g., seller, buyer, and admin) before a transfer is finalized. This can help prevent unauthorized or fraudulent.

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