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Land Registration System Using Blockchain

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ABSTRACT: Land registration is a critical process that enables individuals to legally own property and use it as a financial asset. However, traditional land registration systems are often inefficient and prone to fraud and corruption, leading to disputes and uncertainty over land ownership. This research paper proposes a blockchain-based land registration system for securing land ownership in developing countries. The proposed system utilizes a permissioned blockchain network to securely record land ownership and transaction history, providing a transparent and tamper-proof system for managing land ownership. The proposed land registration system comprises several key components, including a permissioned blockchain network like Ethereum, smart contracts, digital identities, and a user interface.. Smart contracts are used to automate land transactions, ensuring that all parties involved in a transaction can securely and efficiently exchange information, manage contracts, and complete transactions using blockchain technology. The system also includes a user interface that allows users to interact with the system and manage their land ownership rights. Thus, the proposed land registration system provides a secure, transparent, and efficient way to manage land ownership in developing countries. By utilizing blockchain technology, the system can provide greater certainty over land ownership, reducing disputes and promoting economic development.

KEYWORDS: Blockchain, Smart Contracts, Ethereum

I. INTRODUCTION

Land registration involves the recording of details pertaining to ownership or other rights in land to establish title proof, facilitate transactions, and prevent illegal activities. Following registration, the government issues the property owner a Land Title and a title plan outlining property boundaries[21]. These systems aim to ensure title certainty. However, the existing centralized land registration system faces challenges such as fraud and delays. Fraudsters can pose as landowners, collecting funds and escaping undetected until a subsequent registry check. Traditional paper-based land registries are susceptible to loss, damage, or manipulation of records[22]. Additionally, registering an unregistered property with lost or destroyed paper documents can be highly challenging. The process's time consumption and potential legal issues during the registration pause further compound the challenges[8].

Blockchain technology emerges as a solution to these issues by offering immutable recording and sharing of information, ensuring reliable and precise land title records[7]. A digital land registry platform synchronized with the blockchain network allows secure signing and validation of land title records[6]. Blockchain establishes ownership through an immutable transaction record, preventing document falsification [16]. Smart contracts, encoded rules in the blockchain, enable, validate, or negotiate contracts automatically when predefined conditions are met. Ethereum, a decentralized computing platform, facilitates the creation of smart contracts and decentralized applications. Cryptography ensures secure communication against hostile third-parties[14]. The transparency of blockchain allows any untrusted party to verify data. Leveraging blockchain for land registration enhances the process's efficiency, making ownership transfers smoother and faster [16]. Smart contracts, upon notary approval, activate ownership updates for new buyers, storing transactions securely on the blockchain. Adopting blockchain technology in land registration promises a more user-friendly system.

The aim and objectives of implementing blockchain in the digitization of land records in India can be:

1. To improve the efficiency and accuracy of land records management by eliminating manual processes and reducing the chances of errors and fraud.[16]
2. To increase transparency and accessibility of land records, enabling citizens to verify land ownership and transaction details without relying on intermediaries.[18]
3. To establish a secure and tamper-proof system that ensures the integrity of land records, preventing unauthorized changes and preserving the historical data.[20]
4. To streamline the land acquisition process, reducing the time and cost involved in land transactions and promoting ease of doing business.[21]

5. To enable faster resolution of land disputes and provide a mechanism for swift and fair settlement through a decentralized and transparent system.[16]

II. RELATED WORK

“Potentials of Blockchain Technology in Streamlining Land Registries” analyzes issues in traditional land registries and explores how blockchain can streamline them. It discusses potential advantages of implementing blockchain in land registry systems and proposes using private blockchains for enhanced security.[1] “Privacy-Preserving Solutions for Blockchain: Review and Challenges” reviews privacy-preserving solutions for blockchain, focusing on scalability, security, and privacy issues. It covers various privacy techniques and challenges in implementing privacy-preserving mechanisms on public and permissionless blockchains.[2]

“Research on Data Transaction Security Based on Blockchain” discusses security challenges in traditional database systems and proposes a blockchain-based solution for data transaction security. [3] It presents a blockchain-based data transaction model and analyzes its security mechanisms.

“The Use of Blockchain Technology in e-Government Services. Computers”

explores the potential use of blockchain technology in e-government services to enhance efficiency, transparency, and accountability.[4] It presents a conceptual model for blockchain-based e-government services and discusses practical implications and limitations.

“Record Storage and Management System Using Blockchain” paper examines a record storage system built on blockchain technology, focusing on medical records[5]. It highlights the advantages of using blockchain for secure record storage and management.

“Web-Based Land Registration Management System: Iraq/Duhok Case Study” paper proposes an electronic land registration system to modernize land registration in Duhok, Iraq.[6] It aims to reduce time and paper waste and improve communication between government sectors.

“A Survey on Blockchain and Online Land Registration” paper presents a survey on blockchain's potential utilization in online land registration. It explores people's awareness and interest in blockchain and its potential for online land registration.[7]

“Blockchain for Real Estate” paper discusses the potential of blockchain technology in the real estate sector, emphasizing transparency, security, and reliability.[8] It presents a conceptual model for blockchain-based real estate systems.

“A Detailed Study of Blockchain: Changing the World” paper provides an overview of blockchain technology, its features, applications, and challenges. It discusses how blockchain technology can revolutionize various industries and contribute to digitalization.[9]

“A distributed ledger management mechanism for storing and selling private data” paper proposes a mechanism for storing and selling private data using secret exchanges. [10] It discusses the use of blockchain technology for secure storage and exchange of personal data.

A Survey on Privacy Protection of Blockchain: The Technology and Application paper surveys privacy protection of blockchain technology and its applications. It discusses privacy protection key technologies and their applications in blockchain.[11]

“An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends” paper provides an overview of blockchain technology, including its architecture, consensus mechanisms, and future trends. It discusses challenges and solutions in blockchain development and deployment.[12]

“Blockchain-Based Land Registration System: A Conceptual Framework” paper proposes a conceptual framework for blockchain-based land registration systems. It discusses data collection techniques, framework design, and technologies used in the proposed framework[13].

“Crypto Wallet: A Perfect Combination with Blockchain and Security Solution for Banking” paper focuses on crypto wallets as a secure combination of banking and blockchain technology. It discusses the use of blockchain in ensuring security and privacy in banking transactions[14].

“Digital Land Registry System Using Blockchain” explores how blockchain technology can streamline land registry systems with high security and low cost. It discusses the integration of blockchain and smart contracts in land registry procedures[15].

“Securing Land Registration using Blockchain” presents a conceptual framework for blockchain-based land registry systems. It discusses the components and working principles of smart contracts in land registry procedures[16].

“Real Estate Land Transaction System Using Blockchain” paper proposes a blockchain-powered real estate management system to address inefficiencies and insecurity in real estate management. It discusses the use of blockchain for decentralized data storage and smart contracts in real estate transactions[17].

“Reference of Land Registration System from Countries in Asia-Pacific Region: Comparison of the United States, Canada, Russia, South Korea, Japan and Australia” paper compares land registration systems from countries in the Asia-Pacific region. It discusses the potential benefits of blockchain technology in land registration and its applications in various industries[18].

“A Review of Blockchain Technology and Its Applications in the Business Environment”

provides an in-depth analysis of blockchain technology and its applications in various industries, including cryptocurrency, smart contracts, and supply chain management. It discusses the benefits, limitations, and challenges of blockchain technology in the business environment[19].

“The Use of Blockchain in Real Estate” explores the potential use of blockchain technology in the real estate sector to address issues like intermediaries, lack of transparency, and high transaction costs. It discusses how blockchain can improve transparency, reduce costs, and increase efficiency in real estate transactions[20].

III. METHODOLOGY

To address the challenges previously mentioned in the land registration process, the implementation of blockchain technology through the use of Ethereum Blockchain is proposed to replace the existing system. The project involves the development of a smart contract that is based on the Ethereum Blockchain, which requires the use of Solidity Language. The project caters to two types of users, namely citizen users who can only access the data and government officials who can add, update, and access the records. Smart contracts are developed for these two types of users. A website is created for users to access records, and government officers can add or update records to the blockchain. The tool Flutter for Web3.0 development is utilized to develop this website.

Additionally, to view the land records on a map, mapbox API is utilized to create a polygon that highlights the land using geocoordinates.

Ethereum blockchain was chosen due to its robust support for Smart Contracts through Solidity, a proven security track record, interoperability, and its status as a public blockchain ensuring transparency. The development environment is set up next, which includes installing necessary tools like Ethereum Node (such as Geth), Solidity Compiler, Truffle Framework, and Ganache for local testing. Smart contracts are then designed and developed using Solidity to govern the land registration processes, defining functions for user registration, property creation, and ownership transfer.

Local testing of smart contracts is conducted using Ganache, providing a simulated Ethereum network environment for controlled testing. Frontend development is crucial, accomplished using Flutter Web to design a user-friendly interface for the land registration system. This UI integration ensures a seamless experience for users interacting with the blockchain-based system. The development includes creating a home page introducing users to the system, login page with Metamask integration for Ethereum wallet access, and user pages enabling property-related actions like creation, ownership transfer, and document uploads.

Additionally, a dedicated page for land inspectors is created to review and approve transactions, verify users and properties, and facilitate ownership transfers. Documents related to land registration are stored securely using IPFS (InterPlanetary File System) for decentralized and tamper-resistant storage, with NFTStorage API used for integration. Functions for adding land for sale, payment through Metamask wallet, and transfer of ownership are implemented, ensuring a seamless and secure process for users.

Customer support features are incorporated, including chat, call, and email support, to assist users throughout their interactions with the platform. Clear feedback mechanisms are also provided to ensure users are informed about their actions and transactions. Overall, the project aims to leverage blockchain technology to create a transparent, secure, and efficient land registration system, enhancing trust and reliability in property transactions.

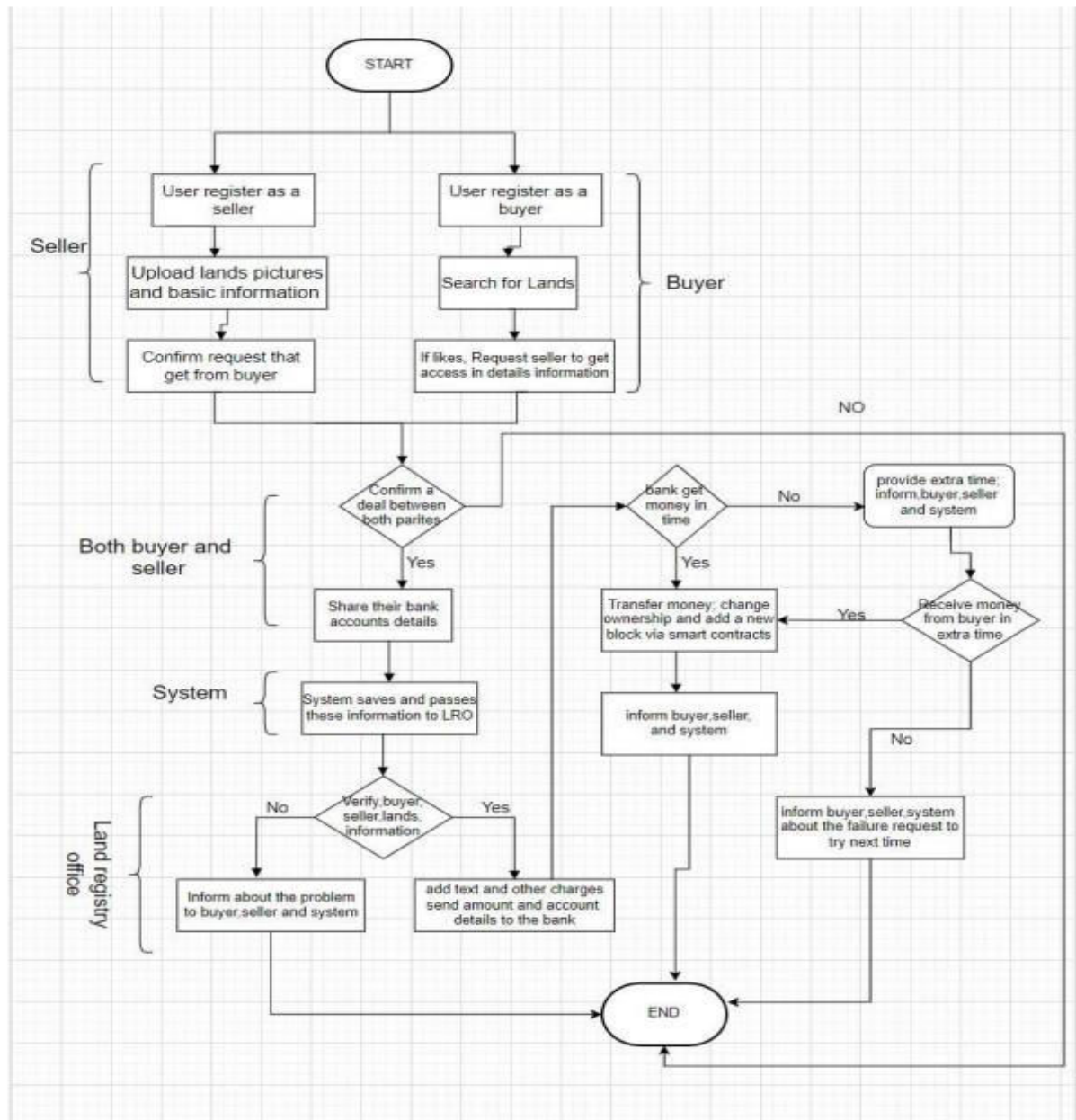


Figure 3.1: Flow Chart of the proposed system

IV. CONCLUSION AND FUTURE SCOPE

Conclusion:

In conclusion, the proposed land registration system using blockchain technology has the potential to address the challenges faced by the traditional land registration process in India. The conventional property registration system has several flaws that demanded focus of researchers to address the same issues. Among many issues, tampering of record, misuse of property and unethical practices concerning poor finance management, that lead traditional property system an area for research. This study provides a solution for controlling transparency and provides a trusted property registration system over the Blockchain. The infrastructure offers many features to the stakeholders related to the buying and selling of property. The transparency, integrity of the record, and trust factor is ensured via a tamper proof ledger.

Future Scope:

Blockchain is a social revolution and is making its way through all important areas especially where security is a concern. It is a social revolution and 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 extended to provide some advanced features.

- Deployment on mainnet or a private ethereum network: Currently the blockchain network is deployed on the Ganache testnet which uses ETH from faucets which has no real value and therefore no market for testnet 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 realtime the number of users on the application would increase so to scale our application we will host it on a cloud platform such as AWS.

- Collaboration with government agencies: The final stage of our project is to reach out to government and test our DAPP with their collaboration to collect real world inputs and see how our project stands in the realtime.

- Integration with other systems- The blockchain-based land registration system can be integrated with other government systems, such as tax or revenue departments, to streamline the overall process of property transactions

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