PropCrypt – A Secure Blockchain Property Registry

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Abstract - Sensitive information such as property documents necessitates a secure and immutable database. Current centralized systems suffer from drawbacks like performance bottlenecks and susceptibility to single points of failure. To address this, we propose a blockchain-based system for secure property document storage. Our system integrates with government authorities to store property documents on the Inter Planetary File System (IPFS), generating hashes for document verification. Smart contracts on the Ethereum blockchain validate and verify documents, creating a decentralized and tamper-proof ledger.

***Key Words*:** Decentralized, Tokenization, Smart Contracts, NFT(Non-fungible-token), Delta, Polygon, Pinnata, MATIC, Ganache, DART, Flutter, Truffle, MetaMask, Local-Blockchain.

INTRODUCTION

Blockchain technology is an immutable digital transaction ledger suitable for recording various value transactions. It operates on a distributed ledger system, ensuring transparency and accountability without a central authority. Smart contracts enable automated and trustworthy transaction execution without intermediaries. While blockchain operations may be slower than centralized databases due to additional functions like signature verification and redundancy, they offer robust and secure data storage. Governments and private organizations are increasingly exploring blockchain for various applications, including financial services and smart contracts. The idea of secure property titles using blockchain dates back to Nick Szabo's proposal in 1998. The use of blockchain in property registry is gaining traction for facilitating nearly immediate asset transfers.

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LITERATURE REVIEW

Literature Review

Sr.NO	Title	Authors	Date of Publication	Proposed Work	Conclusion
1	Blockchain-Based Land Registration System: A Conceptual Framework	Muhammad Irfan Khalid	2022	A land registry combined with blockchain technology has the potential to truly revolutionize governance. Thispaper have also highlighted privacy as a fair consideration. Some of then nodes in the framework are required as part of the decentralized system's characteristics	The paper presents a link to offer a conceptual framework for blockchain-based land registry systems. Following a review of various frameworks, as well as some of the more vigorous approaches and concepts employed in these frameworks
2	Securing Land Registration using Blockchain	Krishnapriya S, Greeshma Sarath	2020	For the land transaction to be secure, an algorithm called SHA256 is used which helps to create a unique hash for each block. Once the hash value of a transaction is obtained it is not possible to obtain the original message	Land registration is implemented using blockchain which offers a more secure platform compared to its predecessors.
3	Blockchain and Smart Contract for Land Registration using Ethereum Network	Mrs. V. Nirmal Kumar	2022	The hashed input from transaction hash and the hash provided by IPFS are compared to authenticate the authenticity of a document. As a result, the validation status is generated.	Here discussed the design and execution of a Land register administration system based on Blockchain. Initially, here upload the files to the IPFS cloud and save their hashesin Ethereum smart contracts.
4	Digital Land Registry System using Blockchain	Prof. Richa Sharma$, Prof. Yugchhaya Galphat$ Ekta Kithani$$, Jaya Tanwani$$	2020	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.	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

PROPOSED METHODOLOGY

Research Methodology and Framework Design
Document Review:

In tandem with conducting interviews, we meticulously scrutinized the documentation available at the Punjab Land Record Authority, focusing on materials relevant to land registration. This method was employed to ensure a diverse array of data sources and insights, enriching our understanding of the subject matter.

Proposed Framework and Its Validation:

This section elaborates on the design of our proposed framework, outlining its core functionalities and the deployment of various record-keeping techniques. An empirical study underscored the imperative need for a blockchain-based system for safeguarding the sensitive data of land records. Additionally, the validation of our framework underwent two phases: initially employing a simple smart contract-based blockchain, followed by experiments to collect stakeholder data, as elucidated in this section.

Technology Used and the Design of the Framework:

Our framework restricts access solely to authorized entities, underscoring the paramount importance of security, integrity, and traceability of land record data. To this end, we opted for a private blockchain, leveraging the multichain blockchain for its permissioned node architecture. The framework's design is intricately woven around the protocols of the multichain, tailored to meet the specific needs and requirements of the project.

Concepts of Land Registry Systems:

Delving into the historical evolution of record-keeping techniques, we trace the transition from reliance on village officers or patwaris to digitization processes. While digitization mitigated issues of forgery and corruption, it still perpetuated centralized storage systems. In our proposed framework, we introduce two pivotal concepts: the land registry office and the land registry officer. Through blockchain validation, transactions initiated by officers are authenticated, eliminating the potential for third-party manipulation of land records.

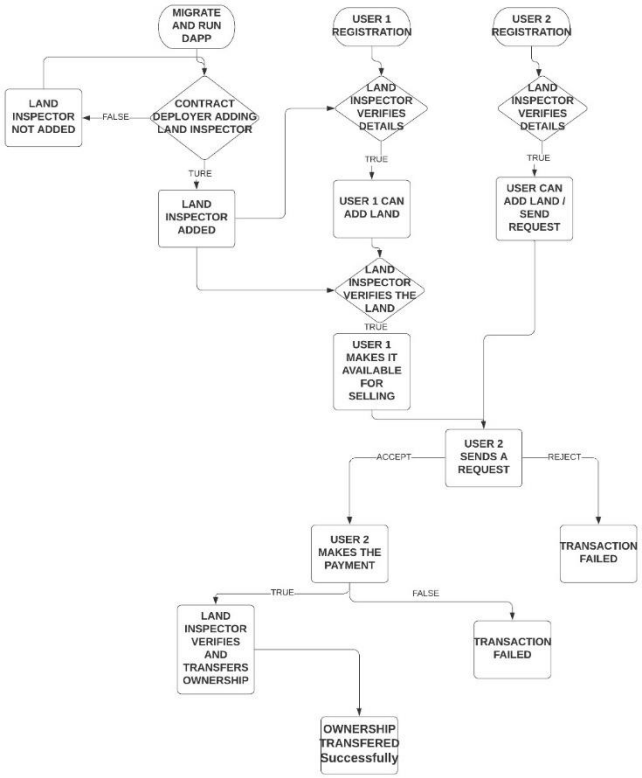
Smart Contract Compiler Processing:

Within the Ethereum Solidity integrated development environment, the smart contract undergoes a two-step compilation process. The compiler meticulously checks for bugs or errors, ensuring the integrity of the written smart contract. Upon successful compilation, the IDE seamlessly transitions to the subsequent step, as illustrated in Diagram .

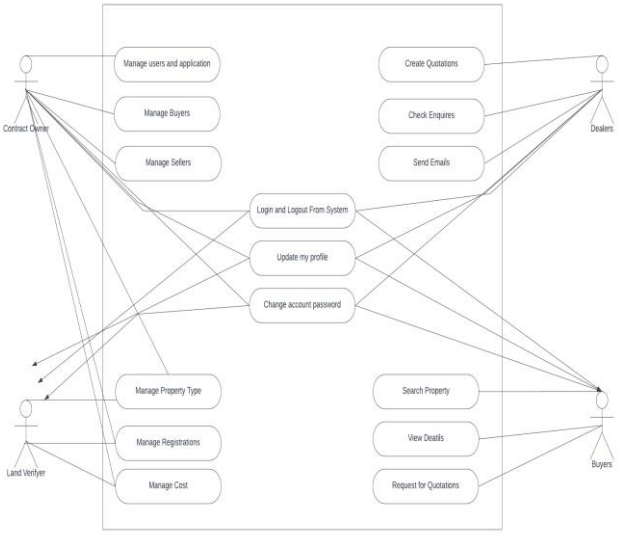
PROJECT OBJECTIVE

By deploying a decentralized blockchain network, unauthorized modifications or deletions of land ownership records are effectively prevented, thereby slashing the vulnerability to fraudulent activities and maintaining the registry's integrity. Simultaneously, the incorporation of smart contracts streamlines the cumbersome land registration process by automating tasks, slashing paperwork, reducing reliance on intermediaries, and cutting administrative expenses. This optimization significantly enhances efficiency. Moreover, facilitating universal access to land ownership data, irrespective of geographical or socioeconomic constraints, fosters inclusivity and empowers individuals to engage in property transactions with confidence, thereby bolstering overall transparency and participation in the estate field.

FLOW DIAGRAM



USE CASE DIAGRAM



PROJECT FLOW

Step 1: Upon accessing the platform, users are prompted to log in using their private key or by connecting their MetaMask wallet to their account, ensuring secure access to the system.
Step 2: For new users, the login process includes entering personal details and uploading identity documents such as Aadhar or Pan card, enhancing the system's verification process and user authentication.
Step 3: Once logged in, users can navigate to their dashboard to manage property deeds and initiate sales transactions according to their specific requirements, ensuring a seamless and user-friendly experience.
Step 4: Prior to user verification, the contract owner must add a designated land inspector to the system, establishing the necessary authority to authenticate user profiles and property transactions.
Step 5: Upon successful addition, the land inspector can log in to their account using provided credentials, gaining access to the platform's functionalities and verification tools.
Step 6: The land inspector is empowered to review registered buyers and sellers, examining submitted documents and verifying user authenticity based on the provided documentation, ensuring the integrity of the platform's user base.
Step 7: With user verification completed by the property inspector, users gain full access to the platform's features, marking a crucial milestone in ensuring secure and trustworthy property transactions.
Step 8: With all necessary setups finalized and users verified, the platform is fully operational, enabling users to engage in property sales transactions with confidence and peace of mind.
Step 9: Upon completion of a property sale transaction, the system generates a comprehensive property sales deed paper, incorporating transaction details, user images, documentation, and ownership transfer records, providing a comprehensive and legally binding record of the transaction.

IMPLEMENTATION

Flutter Frontend Development:

Our project utilizes Flutter, an open-source SDK developed by Google, to build the frontend. Flutter enables us to create applications for various platforms, including Android, iOS, and web, using a single codebase. With the latest versions of Flutter, and can develop applications for Windows, Linux, or macOS. The frontend interface offers different login options for users, land inspectors, and contract owners. Contract owners have the privilege to add land inspectors and view all the added property inspectors. On the land inspector's dashboard, functionalities such as user verification, land verification, and ownership transfer are available. Users, since, can perform actions like adding lands, viewing land details, sending and receiving property requests. To facilitate the development process, we have utilized the Truffle IDE to build the Decentralized Application (DAPP) effectively.

Smart Contract Implementation:

Similar to how the internet revolutionized email, Blockchain revolutionizes currency with its underlying technology. Ethereum, a blockchain platform, extends the concept of scripts into a full-fledged code execution framework known as smart contracts. Smart contracts enable the embedding of business logic directly onto the blockchain, offering powerful capabilities for executing code. encompassing all the rules and regulations necessary for the secure and seamless transfer of property ownership. The utilization of smart contracts ensures transparency, immutability, and security in the land registration process.

Truffle Development Environment:

Truffle serves as our primary development environment, testing framework, and guide pipeline for building blockchain applications utilizing the Ethereum Virtual Machine (EVM). Renowned for its ease of use and comprehensive features, Truffle has garnered widespread popularity among blockchain developers, with over 1.8 million downloads. It streamlines the development process by providing essential tools and utilities for writing, testing, and deploying smart contracts efficiently.

MetaMask Integration:

MetaMask functions as a software cryptocurrency wallet, allowing users to interact seamlessly with the Ethereum blockchain. It provides convenient access to Ethereum wallets through browser extensions or mobile applications, enabling users to engage with decentralized applications (DApps) effortlessly. MetaMask integration enhances the usability of our application by enabling secure transactions and interactions with the Ethereum blockchain.

Web3.js for Blockchain Interaction:

Web3.js acts as the bridge between our application and the Ethereum blockchain, facilitating communication through JSON RPC (Remote Procedure Call) protocol. The Ethereum blockchain operates as a decentralized network of nodes, storing a comprehensive record of all data and code. By leveraging Web3.js, we can make requests to individual Ethereum nodes, enabling read and write operations on the blockchain. This interaction mechanism parallels the usage of jQuery with a different API for data manipulation with web servers, providing seamless integration with the Ethereum network.

DEVELOPMENT & TESTING

Truffle

Truffle serves as an all-in-one Integrated Development Environment (IDE) tailored for the testing and development of decentralized applications, much like the one you're working on. While manually writing and compiling Solidity code might suffice for smaller projects, as your project expands, the need for automated smart contract development becomes increasingly apparent. Ensuring the reliability and

functionality of your Solidity code through rigorous testing is paramount to preempting any potential issues stemming from bugs within your smart contracts.

Thankfully, there exists a variety of frameworks designed to facilitate the development process, with Truffle standing out as a prominent option. Often hailed as the Ethereum Swiss Knife framework, Truffle offers a comprehensive suite of tools encompassing development environments, testing frameworks, and asset pipelines tailored specifically for Ethereum projects. Leveraging Truffle for tasks such as deployment and testing has proven instrumental in the advancement of your project, providing an efficient and reliable foundation as it continues to evolve and grow.

Ganache

Ganache functions as an Ethereum emulator, expediting the development of Ethereum-based applications by enhancing speed, simplicity, and security. It encompasses a comprehensive suite of commonly used RPC functions and features, including events, and offers deterministic operation to streamline development processes seamlessly. In our testing procedures, we've employed Ganache to establish a local blockchain environment. Within this environment, we deploy our smart contracts and conduct transactions. Importantly, Ganache enables us to execute an unlimited number of transactions for testing purposes, ensuring thorough validation before moving to production.

FUTURE SCOPE

Blockchain Technology as a Social Revolution:

Blockchain technology represents a transformative social revolution, permeating critical sectors, particularly those prioritizing security. As we navigate this revolutionary landscape, it's imperative to harness blockchain's potential to the fullest extent. By leveraging this technology, we can fortify systems, enhance trust, and redefine conventional paradigms across various domains.

Enhancing Cloud Storage Solutions:

Cloud storage solutions currently offer fundamental functionalities, yet there exists a significant scope for advancement. These solutions, while serving essential purposes, can be expanded to incorporate more sophisticated features. By augmenting existing capabilities, we can optimize performance, bolster security, and cater to evolving user demands effectively.

Deployment on Main-net or Private Ethereum Network:

Presently, our blockchain network operates on the Rinkeby faucet test net, utilizing ETH from faucets devoid of real-world value and market presence. Moving forward, our strategic focus entails deploying the network on either the Main-net or a private Ethereum network, contingent upon specific requirements. This transition ensures seamless integration with the real world, facilitating genuine interactions and transactions.

Hosting the Decentralize APP on a Cloud Platform:

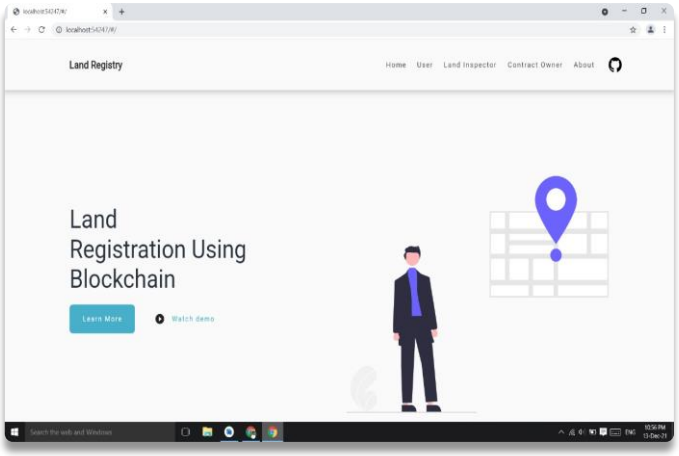
As our application gains traction and user base expands, the imperative to scale becomes paramount. To accommodate this growth, we plan to host our decentralized application (DApp) on a robust cloud platform such as web services(AWS). Leveraging cloud infrastructure enables us to seamlessly manage increasing traffic, enhance accessibility, and ensure optimal performance for our users.

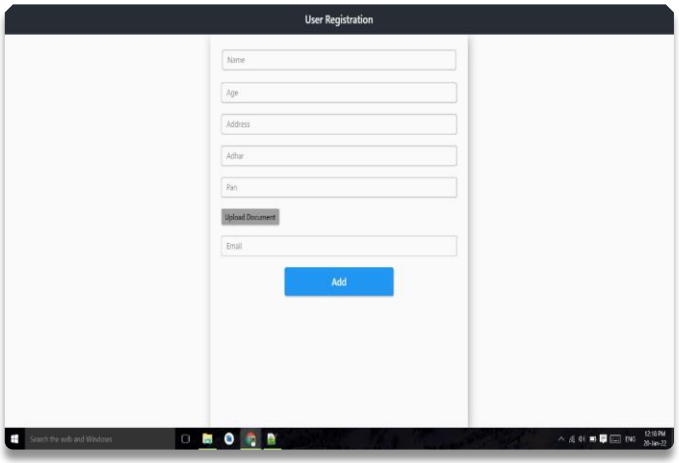
Collaboration with Government Agencies:

The culminating phase of our project entails forging collaborative partnerships with government agencies. By engaging with regulatory bodies and public institutions, we aim to subject our DApp to real-world scrutiny and validation. This collaborative endeavor enables us to glean invaluable insights, refine our solution, and ascertain its efficacy within real-time operational environments.

RESULT & DISCUSSION

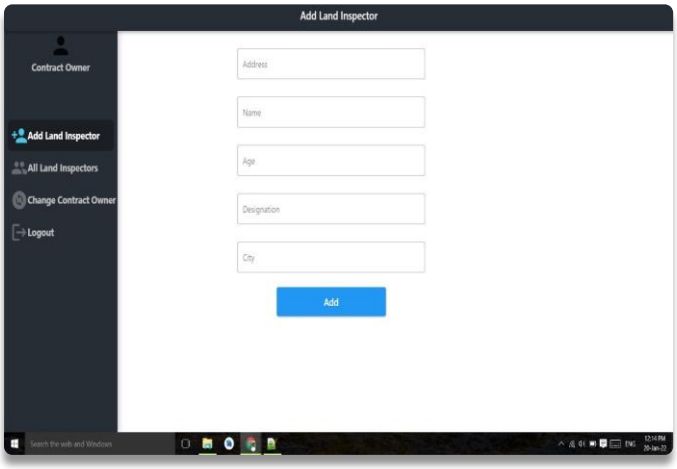
This is a landing page which consist of three entity such as contract owner, land inspector, user and also about navigation. Contract owner can login through credential during their migration time and land inspector can't directly register itself





Users can log in using their private key or by connecting their MetaMask wallet. For first-time logins, users must provide all necessary details and upload identity documents like

Aadhar/Pan card. Once logged in successfully, users can access their Dashboard to initiate property sales. Verification of users is handled by the property inspector, who must be added and verified by the contract owner beforehand. Once registered, the property inspector can log in using their credentials and view registered users. They verify users based on provided documents' authenticity. Once users are verified, the setup is complete, and property sales can proceed. The final property sales deed is generated, containing transaction proofs, user images, documentation, and ownership transfer details.



REFERENCES

- Krishnapriya S, Greeshma Sarath, Securing Land Registration using Blockchain 2020 Third International Conference on Computing and Network Communications, 2020, Vol 171, pp. 1708-1715
- R. C. Suganthe, N. Shanthi, R.S. Latha, K. Gowtham, S. Deepak Kumar, R. ElangoBlockchain enabled Digitization of Land Registration 2021 International Conference on Computer Communication and Informatics (ICCCI), 2021, pp. 1-5
- M. A. Majumdar, M. Monim and M. M. Shahriyer Blockchain based Land Registry with Delegated Proof of Stake (DPoS) Consensus in Bangladesh 2020 IEEE Region 10 Symposium (TENSYMP), 2020, pp. 1756-1759.
- I. Mishra, Supriya, A. Sahoo and M. Vivek Anand Digitization of Land Records using Blockchain Technology 2021 International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE), 2021, pp. 769-772
- D. Shinde, S. Padekar, S. Raut, A. Wasay and S. S. Sambhare Land Registry Using Blockchain - A Survey of existing systems and proposing a feasible solution 2019 5th International Conference On Computing, Communication, Control And Automation (ICCUBEA), 2019, pp. 1-6

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