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Land Registration & Transfer of Entitlement using Blockchain

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Abstract: ***This project report aims to explore the potential of using blockchain technology for land registration. Land registration is a critical process that involves the transfer of ownership of land and property rights, which is often time consuming and prone to errors. Blockchain technology offers a secure and transparent method of recording land registration transactions that can significantly reduce the time and cost associated with traditional land registration systems. The report first provides an overview of blockchain technology, its characteristics, and how it works. It then discusses the current land registration systems and the challenges associated with them, such as fraud, corruption, and inefficiency.***
The report identifies the potential benefits of using blockchain technology for land registration, including increased transparency, security, and efficiency. The report also analyses existing blockchain-based land registration systems and case studies from various countries, highlighting their strengths and weaknesses. It then proposes a conceptual model for a blockchain-based land registration system, outlining its architecture, functionality, and potential features. The proposed system aims to provide a decentralized, transparent, and tamper-proof land registration process that can be accessed by all stakeholders. The report concludes by discussing the challenges and limitations of implementing a blockchain-based land registration system, such as regulatory issues, technical challenges, and adoption barriers. It suggests that a collaborative effort from all stakeholders, including government agencies, landowners, and technology providers, is necessary for the successful implementation of a blockchain-based land registration system. In summary, this project report provides an in-depth analysis of the potential of blockchain technology for land registration, identifies its benefits and challenges, and proposes a conceptual model for a blockchain-based land registration system. The report provides valuable insights for policymakers, landowners, and technology providers who are interested in exploring blockchain-based land registration systems.
Keywords: Blockchain technology, Ethereum based smart contracts, Web 3.0, MetaMask.

I. INTRODUCTION

Land registry system refers to the system that records the details of ownership entitlement by several government bodies. The stored record can be used as the proof on entitlement and avoid any short of fraud and smooth transition whenever required. The old land record leads to hindrances in the verification of land title and may result or cause frauds.
According to the survey conducted by the world bank around 70 % of the population do not own any land title. Land entitlement is an essential prospect for social and economic resilience of citizen. The secure and up-to-date land record will also help governments in tax collection, service delivery and other aspects of governance. The world bank is actively working in this direction and providing support for improving land registration system in several countries and funding conferences as well as land registration modernisation projects. Various government agencies are exploring and working in the direction of a secure, reliable and tamperproof digital system for the land record. There are many stakeholders involved in the process that makes the system complex and needs various checks and balances to counter different type of threats and create an environment of mutual trust. The blockchain-based solution is appropriate in the applications where multiple entities are collaborating and transacting but having little confidence among each other. The blockchain is helpful where some information is shared on multiple system or platforms.

II. LITERATURE SURVEY

A. Existing System

1) The Land Registration Act of 2002 has also introduced the system of online registration of land. This has numerous benefits for the people as well as the government and municipal authorities. This has helped all to get rid of all the boring paper works and all the edition and addition can be done easily with the help of technology. Moreover, all lands can be tracked properly just by one click on the button of the online land registration system. This has also eliminated errors and has encouraged transparency in valuation of the land.

2) Many attempts have been made to map the land records to this emerging technology (blockchain) with the goal of securing and maintaining land data.
3) U. M. Ramya (2018) proposed a blockchain system for land registration. It uses a private permissioned Blockchain - Multichain, where the authority lies with the registrar making the process faster because proof-of-work is not required.
4) Archana Sahai and Rajiv Pandey proposed applying of smart contracts for land registry in blockchain. It describes the current process of land records maintenance and land registration in the country and emphasizes on the importance of smart contract for land registry applying the Blockchain.

B. Limitations Of Existing System

1) In India, the Land Registry System is a very time-consuming procedure that requires many intermediaries. The first thing that one visualizes when one thinks about the land records in India, are those huge heaps and piles of papers stacked one above the other in a dark room which has barely any place left to walk.
2) All our registration departments and offices are required to maintain a physical record of each and every original registered document since the date the Registration Act, 1908 came into force.
3) Maintaining a record of documents as old as a century old is a laborious task requiring a lot of manpower, gigantic store rooms, huge offices and an extensive capital. Thus, in this time where land costs are reaching all time high and real estate is considered as the most valued asset, dedicating such huge spaces to store documents, would not be considered as an optimum utilization of space.
4) The presumption of land ownership is drawn from multiple documents and records which are maintained by multiple departments, making it a very long and cumbersome process of title investigation. Quite often it is also found that the documents maintained with these departments are either not updated or have missing documents or the documents are in such condition that it barely can be read, leading to discrepancy.
5) Thus, if one undertakes a title investigation for a particular property one must go through all the documents pertaining to the property right from its inception or at least resort to a 30 years title search, visit various departments, collect all data, assimilate all information, draw a title flow, point out any title flaws and finally draw a conclusion, which together is a tedious process. The only way to eliminate the above hardships is to establish a single window title verification and investigation system which is easily accessible to the professionals as well to the general public.
6) Maintaining physical copies of all original land documents always comes with a fear of them getting lost, stolen, damaged, torn, misplaced or destroyed due to any Force Majeure event like fire, tempest, flood, and earthquake.

III. PROBLEM STATEMENT

The process of buying, selling, and transferring property ownership is often lengthy, complex, and involves numerous intermediaries such as lawyers, real estate agents, and government officials. This can lead to inefficiencies, errors, and fraud, which can result in disputes and legal battles. Traditional land registry systems are centralized and often rely on paper-based records, making them vulnerable to loss, theft, and tampering. This can result in significant delays and costs when it comes to verifying ownership and transferring property. The proposed solution is an online land registry system that leverages the benefits of blockchain technology. Blockchain is a decentralized, immutable, and transparent ledger that can securely record and store ownership information, transfer history, and other relevant data.

IV. PROPOSED SYSTEM

1) Based on the limitations of the central server-based data storage systems for land record data of India, we emanated up with blockchain-based solution that will be able to handle those problems from which the existing centralized land record data storage system is suffering.
2) Digitizing real-world land records require systems to be built which are robust and can withstand hacking attempts. Such systems need to be built upon frameworks that can ensure integrity and longevity.
3) The systematic contribution is to offer a significant and authenticated conceptual framework for blockchain-based land registration systems where transparency, security, and rights can be made sure without the need of the trusted third party.
4) A centralized server for land record data is facing numerous issues, i.e., loss of data due to any natural hazards and loss of data due to some strong adversary that can forge all the available data.

5) Our motivation and goal are to give a solution to the centralized land management system shortcomings using distributed and decentralized blockchain technology. For this, first we proposed a blockchain-based framework and then validated that framework with the blockchain-based proof-of-concept system (PoC).

The system that we are trying to implement is based on Ethereum Blockchain that will store all the transactions made during the process of land ownership transfer. Using the concept of smart contracts of blockchain technology we can triggers various events like access of land documents to a land inspector and fund transfer event from buyer to seller after successful verification of the land ownership transfer. This system will solve the problems faced by all the three parties during the land registration and will also remove the intermediaries like property dealers. This system makes the process of land registration resilient and decrease the cases of fraud in the process. Using the system, validation of the lands is also possible as immutable transactions are being stored in the public ledger.

Our proposed system includes Super Admin, Admin, Owners, and Buyers.

Roles:

Super Admin: Only the super admin has the capability to assign an admin

Admin: Only Admins can register a property/land after verification.

Owners & Buyers can access their properties / land with their respective accounts.

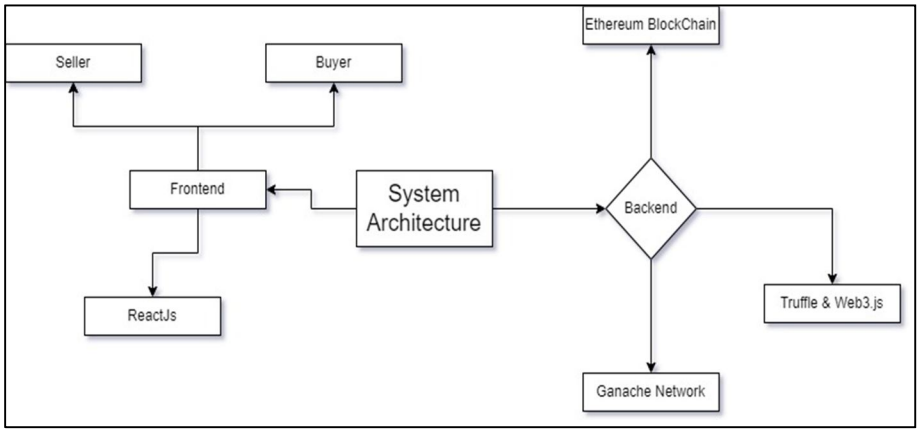

Fig. 1: Proposed system architecture

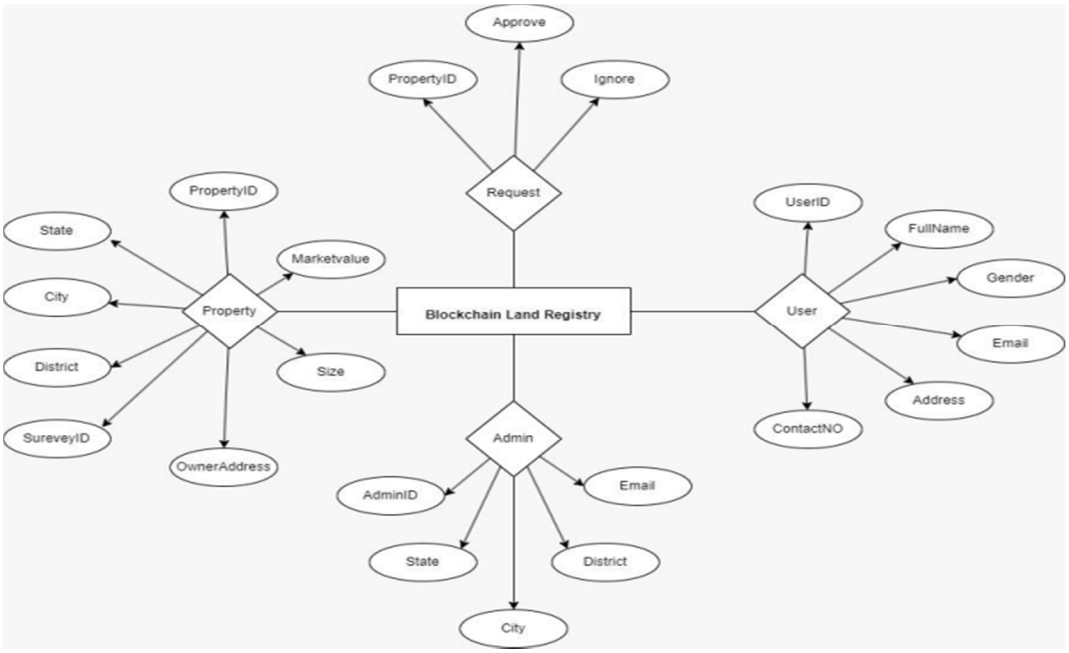

Fig. 2: Entity-Relationship Diagram

V. TECHNOLOGIES USED

1) *Blockchain:* Blockchain is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets on corporate networks. Assets can be tangible (in our case land/property) or intangible. Almost anything of value can be tracked and traded on a blockchain network, reducing risk and cost for everyone involved.
2) *Ganache (Local Blockchain):* A personal Ethereum blockchain platform that establishes a peer-to peer network that securely executes and verifies application code, called smart contracts. Smart contracts allow participants to transact with each other without a trusted central authority. Transaction records are immutable, verifiable, and securely distributed across the network, giving participants full ownership and visibility into transaction data. Transactions are sent from and received by user-created Ethereum accounts.
3) *React.js (Front-end):* A declarative, efficient and flexible JavaScript library for building user interfaces which enables the user to build single page applications with dynamic UI elements. The entire front end of the project is built in react.js. It uses Bootstrap framework. Bootstrap: Bootstrap is a free and open-source tool collection for creating responsive websites and web applications. It is the most popular HTML, CSS, and JavaScript framework for developing responsive, mobile-first websites**.**
4) *Solidity (Back-end development):* Solidity is an object-oriented programming language created specifically by the Ethereum Network team for constructing and designing smart contracts on Blockchain platforms. It's used to create smart contracts that implement business logic and generate a chain of transaction records in the blockchain system.
5) *Truffle:* Truffle is a world-class development environment, testing framework and asset pipeline for blockchains using the Ethereum Virtual Machine (EVM). One of the primary goals of Truffle Suite focuses on ensuring better accessibility in the development process. The three components of Truffle Suite are Truffle, Ganache and Drizzle. Each component serves a distinct functionality, which empowers the overall ecosystem for developing blockchain applications. Here is an overview of the basic roles of each component of Truffle Suite.
6) *web3.js:* web3.js is a collection of libraries that allow you to interact with a local or remote Ethereum node using HTTP, IPC or WebSocket.
7) *MetaMask Wallet:* MetaMask provides the simplest yet most secure way to connect to blockchain-based applications. MetaMask generates passwords and keys on your device, so only you have access to your accounts and data. You always choose what to share and what to keep private. MetaMask is an extension for accessing Ethereum enabled distributed applications. The extension injects the Ethereum web3 API into every website's JavaScript context. MetaMask also lets the user create and manage their own identities, the user gets a secure interface to review the transaction, before approving or rejecting it. MetaMask also helps warn you when you navigate to sites that are known to have engaged in phishing, or that have names that are suspiciously like popular phishing targets.

VI. RESULTS & SYSTEM CONFIGURATION

A. *System Configuration*

System	Minimum requirements
Operating System	Windows: 8, 8.1, 10 or higher.MacOS: Linux: Supports Redhat, Arch, Linux Mint, Ubuntu distros only.
CPU	Compatible with any Desktop CPU architecture.
RAM Capacity	2GB or greater
GPU	(optional) CUDA supported Nvidia GPU for training and inferencing a model.
Extra Hardware	
Digital/Surveillance Camera with flash light.	Pixel Count: 2MP or greater. Aperture: anywhere between f/1.2 to f/5.Frame rate: 24fps or greater.

Table 1: Minimum System Requirements

B. Results

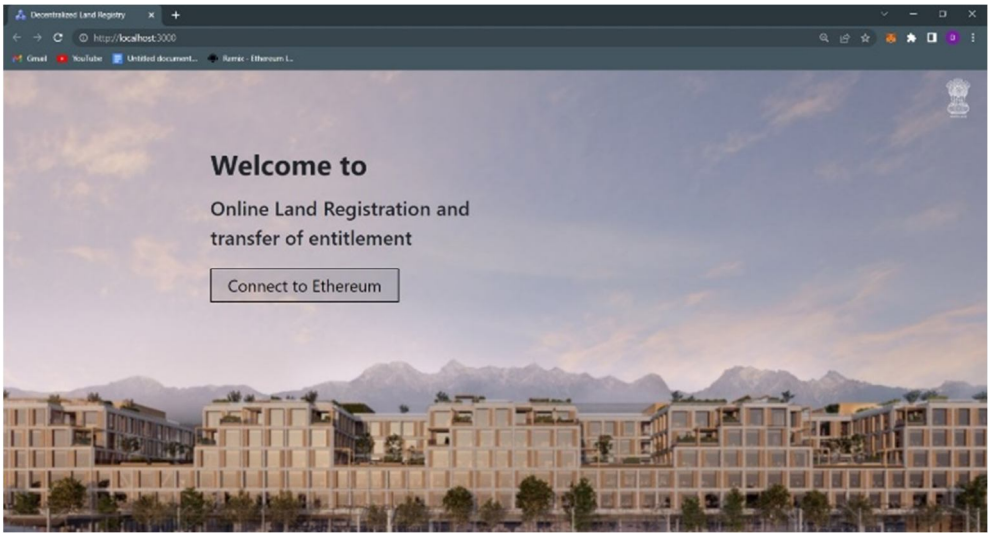

Fig 3: Home Page

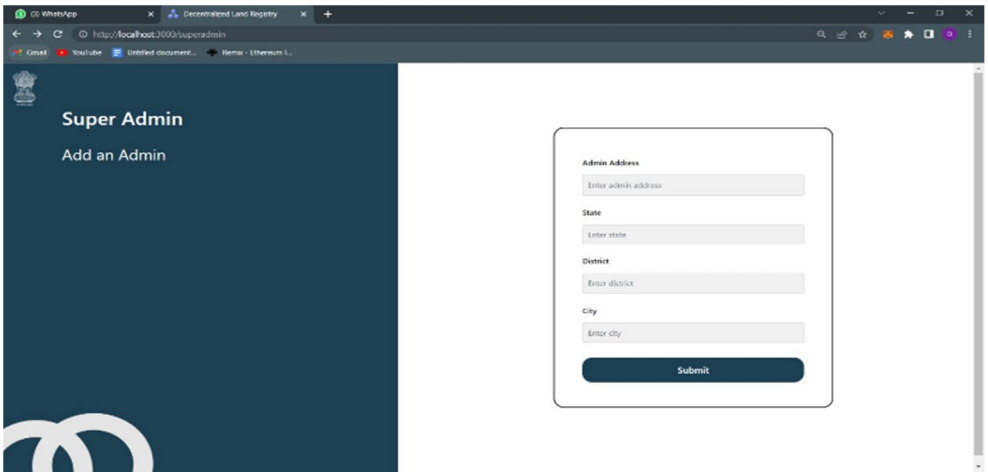

Fig 4: Super Admin Page

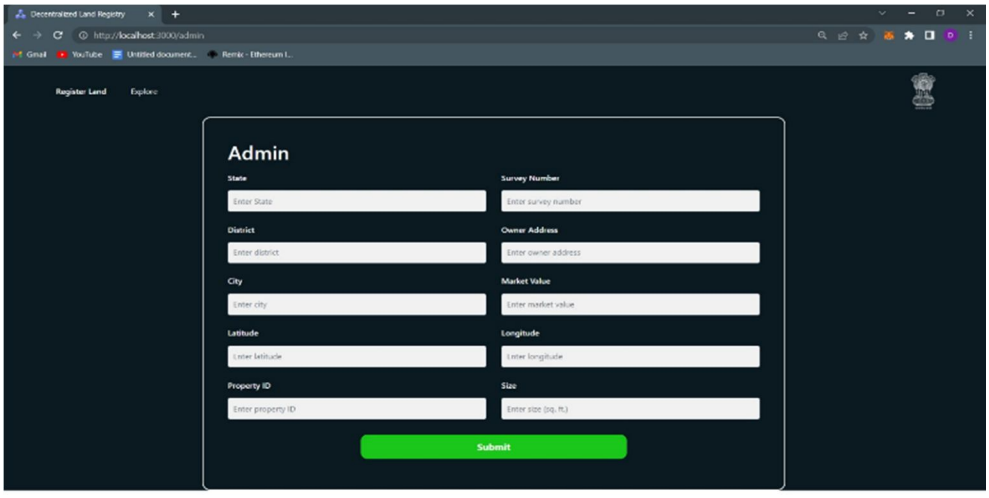

Fig 4: Admin Registration

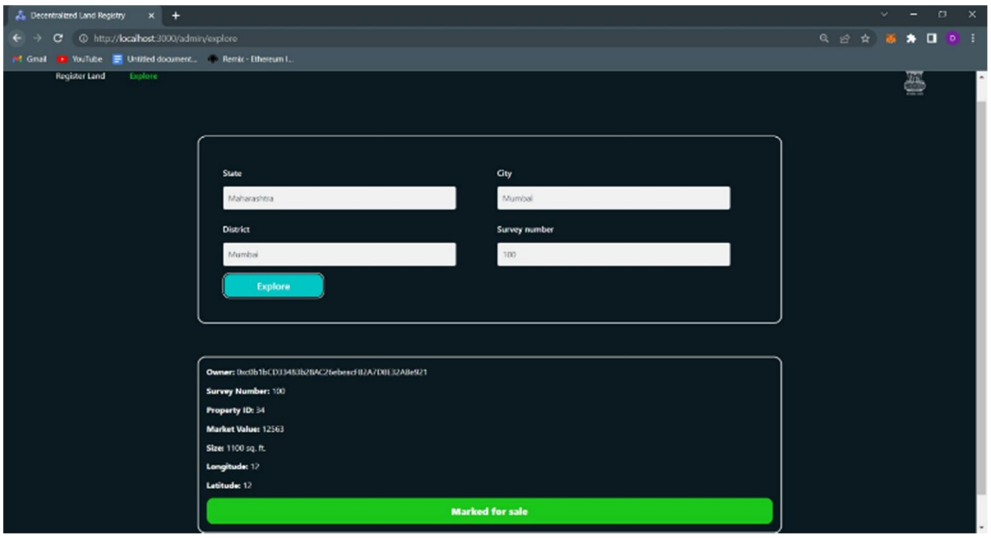

Fig 5: Property/Land exploring page.

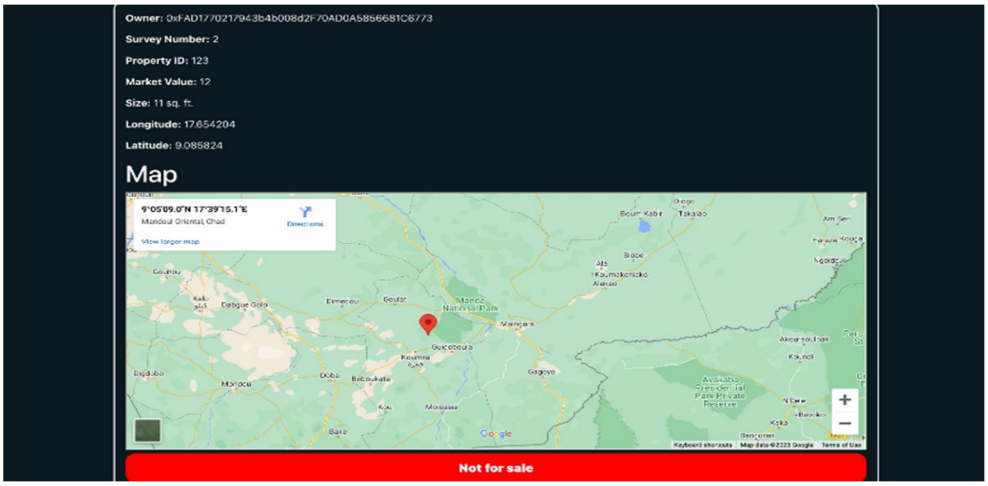

Fig 6: Property/land details with map

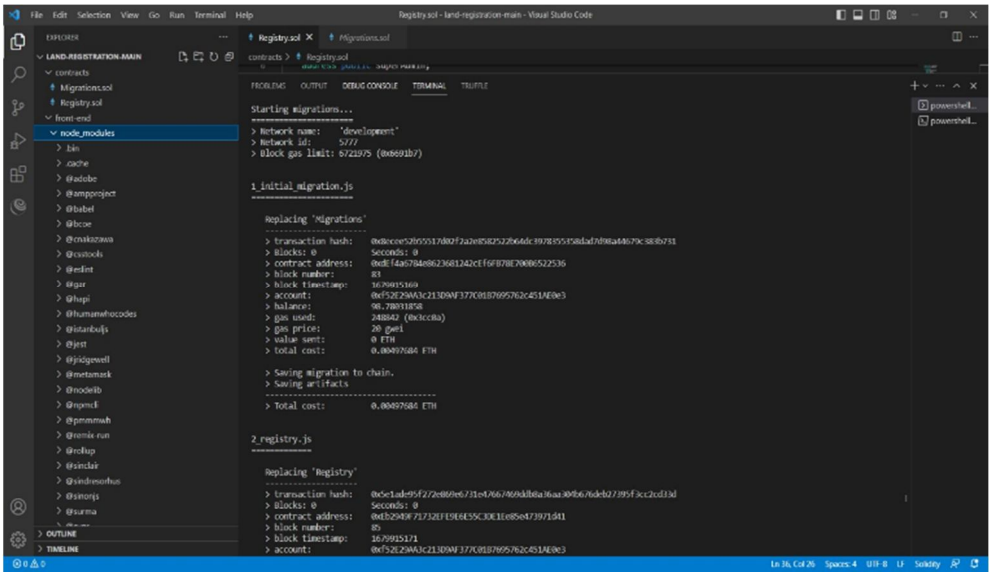

Fig 7: Back-end

VII. CONCLUSIONS & FUTURE SCCOPE

A land registry system is an essential tool for managing property ownership records. It provides a centralized source of information that can be accessed by anyone who wants to buy, sell, or lease a property. The system ensures that the rights of the owner are protected and maintained, reduces the risk of fraud and theft, and provides proof of ownership through title certificates. It also helps to resolve disputes relating to property ownership and provides a secure way of storing and maintaining property ownership records. However, land registry systems also have limitations that need to be addressed to ensure their effectiveness and efficiency. These limitations include incomplete information, limited access, high cost, legal challenges, political interference, and technology limitations. In the development of land registry systems includes the adoption of modern technology such as blockchain and artificial intelligence, which can improve the accuracy and efficiency of the system. There is also a need to address the issue of incomplete information by improving data collection and management, and to reduce the cost of registering land or property, particularly in developing countries. Additionally, efforts should be made to address political interference and ensure the independence and integrity of the system.

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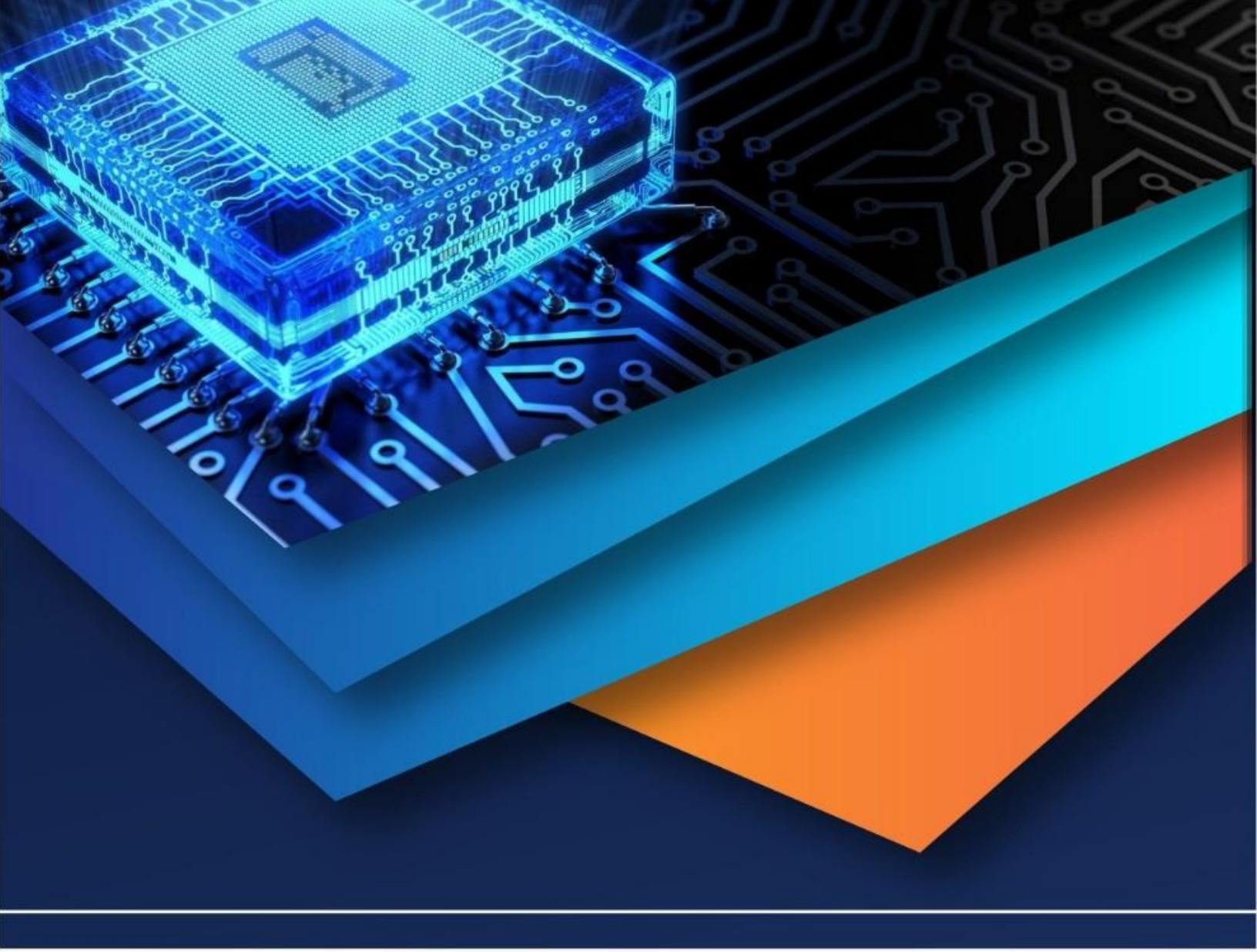

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