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BLOCKCHAIN IN LAND REGISTRY FOR TRANSFORMING LAND ADMINISTRATION

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ABSTRACT

Land registry systems play a critical role in recording and verifying property ownership, ensuring transparency, and facilitating secure transactions. However, traditional land registry systems often face challenges related to inefficiencies, fraudulent activities, and lack of trust. The emergence of blockchain technology has the potential to address these issues and revolutionize land registries. This paper present blockchain-based land registry system that leverages the unique features of blockchain technology to provide a secure, transparent, and tamper resistant platform for recording and managing land ownership information. By utilizing distributed ledger technology, the proposed system aims to eliminate the need for intermediaries, reduce the risk of fraud, enhance data integrity, and streamline the land registration process. The blockchain-based land registry system would involve the creation of a decentralized network where each participating node stores a copy of the registry, ensuring redundancy and immutability. The use of cryptographic techniques would provide secure and verifiable transactions, allowing for a trustworthy and auditable history of land ownership transfers. A blockchain-based land registry system has the potential to transform traditional land registry practices by providing a secure, transparent, and efficient platform for recording and managing land ownership information. By leveraging the decentralized and immutable nature of blockchain technology, this system can significantly enhance trust, streamline processes, and reduce fraud in land transactions, leading to more reliable and effective property markets.

Keywords: *Blockchain, Land Registration, Smart Contracts, Solidity, Ownership-Transfer, Migration, Map, DAPP.*

1. INTRODUCTION

Indian families place a great deal of cultural, emotional, and financial value on their land. It has long been linked to status, identity, and prosperity. In Indian culture, the importance of land is enormous. It is frequently regarded as a representation of heritage and ancestor legacy. Due to the fact that property has been passed down through the years, many families feel a deep emotional connection to their land. Land is prized as a tangible symbol of the family's history and customs and is considered as a connection to one's ancestry and ancestors.

Land is seen as a significant asset in India that gives families financial stability. Agriculture is the main source of income for many people, particularly those who reside in rural areas. Owning land entails having the resources necessary to meet a family's fundamental needs for food, income, and shelter. Land ownership is regarded as a wise investment and a way to build wealth in metropolitan settings. Indian
families frequently form close emotional ties to their land. They might have happy memories of their youth, family get-togethers, and seasonal celebrations that took place there. Due to such significance and deep-rooted connection A secure land platform is of principal and paramount

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importance in Indian household. Secure land registration technologies offer legal clarity and the preservation of property rights, making land a valuable asset. Lack of a trustworthy land registry increases the possibility of land ownership disputes and competing claims, which could result in Indian households losing their investments in real estate, money and their emotional ties.

A transparent and secure land registry platform simplifies property transactions. Buying or selling land becomes smoother, faster, and more efficient when there is trust in the accuracy and authenticity of land records. It fosters a conducive environment for real estate transactions and property market growth but recently their many arising fraudulent marking and claiming of land because of archaic methods still in practise. The inefficiencies, antiquated procedures, and poor digitization that occasionally afflict India's property register systems can open doors for illegal activity, improper verification procedures and insufficient document inspection can cause fraudulent transactions to go undetected. This arises the question on how to make system secure and user friendly which not only reduces fraud but also provide user with best experience friendly and trustworthy environment. There also many issues related to unwanted involvement of third parties and broke for procurement and selling of land assets which lead to excessive cost more than budget, Brokers might not be subject to the same level of accountability as registered professionals This can make it difficult to hold them responsible for any errors or misconduct during the transaction. Third parties also use unethical practises to secure a transaction. This can include manipulating property values, misusing confidential information.

2. PROPOSED WORK

In India, the endeavour to modernize land records is evident through initiatives like the National Land Records Modernization Program (NLRMP), established in 2008 under the Ministry of Rural Development [1]. The program is designed to modernize land records, minimize disputes, and enhance transparency, thereby facilitating streamlined administrative processes and transactions related to land records. Complementing these efforts are state-specific projects such as “Bhulekh” in Uttar Pradesh [2] and other region-centric endeavours. These initiatives underscore a commitment to promoting transparency and accessibility in land-related services for the public. The integration of computerization has significantly improved accessibility and digitized land records, marking a pivotal step in the right direction.

Fig -1 Percentage of Digitalized Land Records

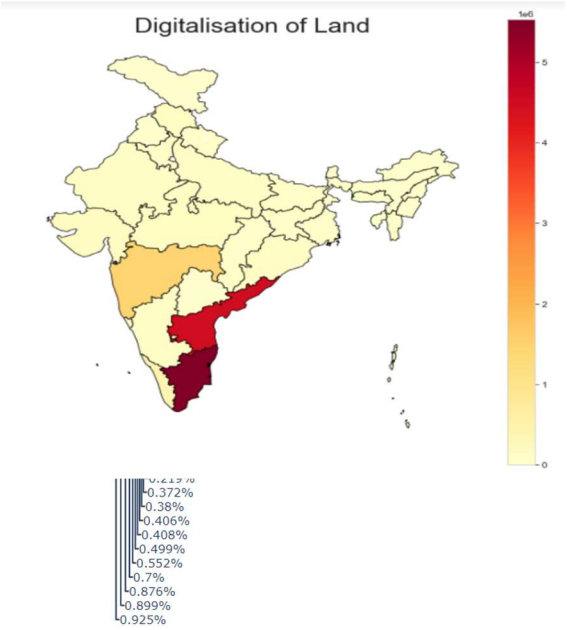

Fig -2 Leading State in Digitalization of Land Records

Fig 1 and Fig 2 delineates the disparity between the number of districts within each State/Union Territory (UT) and the count of districts that have undergone digitalization of land records [3], portraying the varying levels of technological advancement in land record management across India. The visualization starkly presents the pressing need for increased digitalization efforts, especially in states and UTs where the computerization of land records remains relatively lower.

However, computerization alone cannot entirely resolve all challenges in land governance. Despite the progress made, several persisting issues remain. One of the critical concerns revolves around data integrity. Digitized records, while more accessible, are still susceptible to discrepancies, tampering, or errors, which can lead to ongoing disputes and erode trust in the system. To effectively address these challenges, a comprehensive approach extending beyond computerization is necessary, therefore there is need to add something powerful which take care of both issues. Hence, we advocate for the fusion of two pivotal technologies computerization and blockchain in the domain of land registry systems. While computerization focuses on digitizing and refining the management of land-related information, blockchain technology introduces an immutable and decentralized ledger

system that ensures unmatched security and transparency. Integrating these technologies aims to revolutionize the management and security of land-related data.

The incorporation of blockchain fortifies the initiatives in digitizing land records. With its unalterable and distributed ledger, blockchain ensures secure and verifiable recording of land transactions. This tamper-resistant system creates an unchangeable history of land transactions and ownership, reducing the risk of fraud and unauthorized alterations. The amalgamation of computerization and blockchain technology can transform the landscape of land governance in India by addressing challenges such as fraud, discrepancies, and delayed access to land records. This approach enhances efficiency, integrity, and transparency in land management. Additionally, our proposal includes an innovative Map-based App integrated with a chatbot, facilitating direct interactions between interested parties and streamlining the land procurement process by eliminating the involvement of intermediaries or brokers.

3. RELATED WORK

Around the globe, there have been several initiatives to use blockchain technology for land registry

In 2016, Sweden's land registry authority became the pioneer of blockchain based land registry system, the Lantmäteriet, explore the use of blockchain for property transactions. The project aimed to test the feasibility of conducting real estate deals entirely on a blockchain platform [4]. It was followed by the research work in MIT in which published authors QIUYUN SHANG AND ALLISON PRICE explained their working for The Georgian government partnering with the Bit fury Group in 2016 to implement a blockchain-based land registry platform. The system was aimed at increasing transparency and reducing corruption in property registration [5]. In 2018 Ukrainian Government Partners with The Bit fury Group to Create First Full-Scale Blockchain e-governance Program for Ukraine [6]. Tarek Zein and Rohan Bennett published their work in 2018 Blockchain for Land Administrations land administration, including land registration, using blockchain technology. It gives a case study of a blockchain-based land register in Sweden and explores the advantages and drawbacks of adopting blockchain for land registration [7]. Isila Temitayo Sanusi in 2019 provided deep research on her paper A Comparative Analysis of Land Registration Using Blockchain Technology which examines how Nigeria and Ghana employ blockchain technology for land registration. It assesses the viability of deploying blockchain-based land registries in these nations and explores the advantages and difficulties of using blockchain for land registration [8].

A paper by Julius Oladele Ogunyem provided brief evaluation of blockchain-based land administration systems around the world. It indicated pros and cons of these systems and recognizes the key tests and openings for further research [9]. In 2021 Pietro Marchionni, Christian Brocchi, and Raffaele Gravina published their work “Blockchain for Land Registry and Land Transactions - A Survey” in which they examine the adoption of blockchain technology in land registry and land transactions.\ The authors present case studies and implementations from different countries, showcasing real-world applications of blockchain in land management. The paper explores how blockchain can enhance transparency, reduce fraud, and streamline the land registration process. It also discusses the challenges of interoperability, data privacy, and regulatory frameworks that need to be addressed for successful adoption [10].

In 2019 “A Survey of Blockchain Applications in Land and Property Management” by Belachew F. Alemayehu, Chathura P. Bandara, and Alan Colman was published which examines and provided deep classification for applications in land and property management, with a focus on land registry systems. The authors explore how blockchain technology can improve land title registration, enhance transparency, and reduce administrative inefficiencies. They also discuss the potential impact of blockchain on land-related transactions, such as buying, selling, and transferring property [11]. Ekta Agrawal, Ravi Kiran, and P. Prashanth discuss the advantages of blockchain in improving transparency, reducing costs, and simplifying the process of land registration. They also address the challenges of legal recognition, data privacy, and standardization of blockchain-based land registry systems [12]. According to Rishav Chatterjee's approach, the Khasra Blockchain system makes use of two key components: the Registration Document and Khasra number. The reasoning behind chain code maintains the validity of land records. The Registration Blockchain and the Khasra Blockchain are connected by the Chain code, establishing a legally binding tie between them. It is crucial to remember that every change made to the Khasra Blockchain needs to be connected to an authorized registration in the Registration Blockchain [13].

Paper by Ishita also provided a mechanism to create a market place where buyers and sellers can communicate while maintaining the legitimacy of transactions through a formal review procedure. The Proof of Work (PoW) consensus mechanism is suggested by the authors. This mechanism is a cornerstone of blockchain technology that increases security by forcing users to demonstrate their computational effort. To finish the project, the writers also incorporate the POSTMAN API. The API allows for smooth data transfer and interactions between the various parts of the blockchain-based system [14]. The study analyses the technical aspects, implementation strategies, and regulatory frameworks of existing blockchain-based land registry systems. The review provides valuable insights for future implementations, emphasizing the importance of stakeholder collaboration and addressing legal and governance issues.

4. MATERIALS AND METHODS

The Land Registry System, aimed at robustness and transparency, employs a decentralized blockchain architecture and two fundamental smart contracts, "Land Migration" and "Registry Structure," written in Solidity for the Ethereum Blockchain. These facilitate user interactions, property listings, and tailored property searches. The primary objective is an accessible website enabling data browsing and modifications, incorporating a Map and Chat Room for streamlined land migration while excluding third-party intervention.

4.1 User and Asset Registration

The system commences with user registration and validation via Digi locker integration, ensuring secure land migration. Sellers encode their land assets with unique hash values, ensuring a secure transaction. The innovative Map enables precise property demarcation and detailed information sharing. A Chat Room allows transparent communication between potential buyers and sellers, facilitating discussions and negotiations for efficient land acquisition.

4.2 Payment Gateway

Upon the potential buyer's request, the landowner verifies authenticity on the blockchain and proceeds with the formal procurement process within the dedicated chat room. This transition activates smart contracts in Solidity. During property purchase, the buyer initiates payment using digital methods or cryptocurrency. The system validates the transaction, updating the blockchain with ownership records. The successful transfer concludes with the smart contract closure, ensuring an immutable record on the blockchain.

4.3 Owner-ship Transfer

The system incorporates a technical escrow ownership transfer mechanism. This safeguards the transaction by temporarily holding the funds or property until specific conditions, agreed upon by both parties, are met. This technical escrow mechanism further fortifies the system's integrity, assuring secure and transparent land ownership transfers. the Land Registry System's implementation of a technical escrow ownership transfer mechanism plays a pivotal role in fortifying the transactional security between the involved parties. This added layer of security operates by temporarily holding the funds or property within the system until pre-established conditions are met and agreed upon by both the buyer and the seller. The conditions can vary, encompassing specific milestones in the transaction process, legal requirements, or compliance measures. Upon fulfilling these conditions, the system automates the transfer process, ensuring a seamless and secure transition of ownership.

This technical escrow mechanism serves as a neutral and unbiased intermediary, instilling confidence and trust among transacting parties. By holding the funds or property securely and releasing them only upon meeting predefined criteria, it significantly mitigates the risk of fraudulent activities, misrepresentations, or disputes that might arise during the transfer of property ownership.

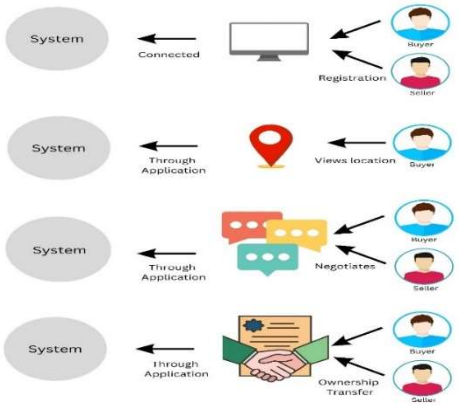

Figure 3: System Architecture

Figure 3 depicts an in-depth architecture of the Land Registry Platform, highlighting key features and interactions in land ownership transfers. This is the brief flow which we followed for setting up our system.

5. TECHNICAL SPECIFICATION

This section deals with the technical specification and technical stack used for creation of fully functional prototype of land registration system using blockchain.

5.1 Ethereum Blockchain

Ethereum is an open-source, decentralized blockchain network. It enables anyone to build and use decentralized blockchain applications. Like Bitcoin, Ethereum is an open-source project that is managed by a large global community. Nobody is in charge of or owns Ethereum. It was designed with the idea of being flexible and changeable. It is easy to create new apps on the Ethereum platform, and thanks to the Homestead release, those apps are now safer to use. The capability of Ethereum to develop and implement smart contracts is one of its core characteristics.

5.2 Solidity

The most widely used programming language for creating smart contracts on the Ethereum platform is Solidity. It is a high-level, statically-typed, contract-oriented language that was influenced by JavaScript, C++, and Python. The Ethereum Virtual Machine (EVM), the environment in which smart contracts are executed on the Ethereum network, is compatible only with Solidity.

5.3 Smart Contracts

There are two smart contracts written for managing the process of transferring land and migration of land. The contract deals with registration of asset and storage of user data whereas other optimize contract deals with ownership transfer between different parties.

5.4 Map and in-built Chat-room

To reduce the unwanted involvement of third parties and brokers in property transactions, a decentralized system can be developed that allows both involved parties (buyers and sellers) to communicate directly with each other. Such system should be made to incorporate sellers to list their properties on the platform, providing essential details such as location, size, price, and other relevant information.

5.5 Deployment and Testing

For Deployment of contact we used truffle that is framework of Ethereum Blockchain, it provides a straightforward and efficient way to deploy and manage smart contracts on the Ethereum blockchain. Truffle offers different deployment environments that allow developers to choose where and how they want to deploy their contracts.

We used Ganache for development and deployment of contracts. Ganache is a powerful development tool provided by the Truffle Suite for Ethereum blockchain development. It serves as a personal, local, and lightweight Ethereum blockchain emulator that allows developers to create a private blockchain network for testing and development purposes. Ganache is widely used by Ethereum developers to rapidly prototype, test, and debug smart contracts and decentralized applications (DApps) in a safe and controlled environment.

The main important feature for Ganache is that it acts as a local Ethereum blockchain emulator that runs entirely on your local machine. Unlike the actual Ethereum main net or test nets, which are public and decentralized networks, Ganache provides a private and isolated Ethereum network that you can use for development and testing. Ganache when launched, it automatically creates a set of pre-defined accounts, each with a balance of test Ether (ETH). These accounts were used for creating a dummy testing hash value which was used to create a dummy user. Ganache works hand-in-hand with integrated Truffle development framework. By using truffle, we compiled, deployed, and tested smart contracts easily using Ganache as the local development network. Truffle Suite provides a seamless experience for Ethereum DApp development.

6. RESULTS

To determine the level of trust in the blockchain-based land registry system, we conducted survey for our proposed prototype of system, The evaluation was conducted across a diverse range of groups. This stratified approach encompassed participants from different demographics, locations, educational backgrounds, and professional domains. By engaging with

individuals representing varied age groups, genders, and urban or rural settings, a comprehensive understanding of how different cohorts perceive the trustworthiness of the system was obtained. Participants from different professional backgrounds, including IT, finance, government, healthcare, student communities, and more, were included to ensure a holistic appraisal. Their responses were assessed through Likert scale ratings, which provided a nuanced view of trust levels. This multifaceted evaluation process sought to capture a comprehensive portrayal of the public's trust in the blockchain-based land registry system, thus offering a reliable representation of diverse opinions and perceptions.

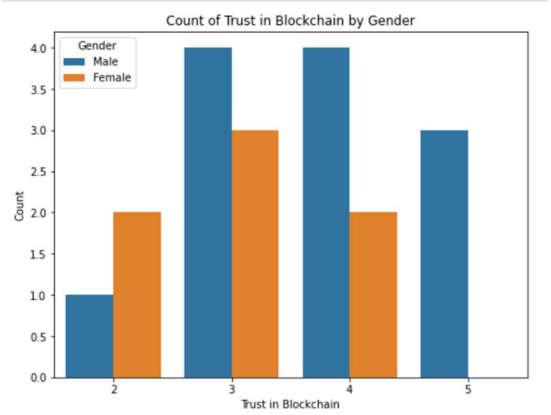

Fig 4: Count of Trust in Blockchain by Gender

Fig 4 represents the distribution of trust in the land-based registry system based on gender percentages.

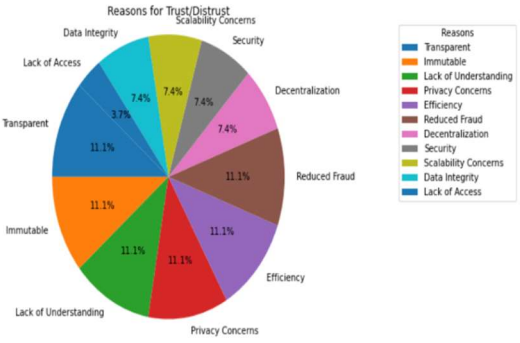

Fig 5: Reason of Trust/Distrust

Fig 5 provides a comprehensive view of the factors influencing trust or distrust in the system.

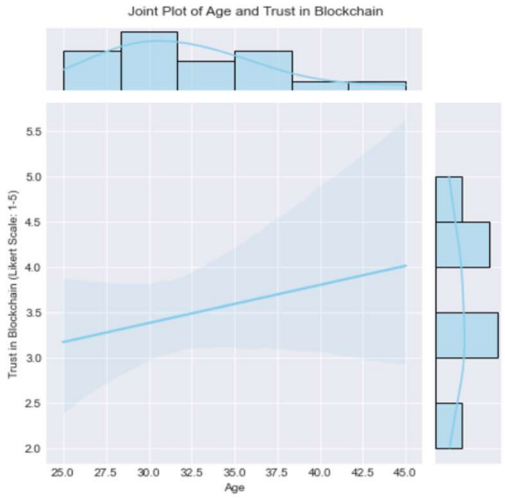

Fig:6 Trust in Blockchain Land System vs Age

Fig 6 describes the joint plot of Age and Trust and blockchain based land registry system, which provide analysis about, how the different generation see the blockchain uprising. The survey findings confirm blockchain's significance in addressing land registry challenges. Despite trust and knowledge variations among participants, blockchain's potential is clear. Educating and addressing concerns—like privacy and scalability—becomes critical. Educational campaigns can demystify blockchain, highlighting its transparency and security benefits. Targeted educational initiatives can foster broader understanding and acceptance, paving the way for successful integration into land registry systems. As awareness grows, people are likely to embrace blockchain, leading to smoother implementation and benefits for real estate stakeholders.

7. OBSERVATIONS

We observed several factor and empirical observation that the system presented is a ground-breaking deviation from conventional approaches, the adoption of blockchain technology in a land registration system offers a plethora of benefits that considerably improve the security and integrity of land and asset registration operations. This blockchain-based strategy resolves significant problems with existing systems and adds a number of elements that improve security and dependability. Every transaction, ownership transfer, or record update is cryptographically linked and time-stamped, creating an unalterable chain of custody. This permanence enhances the security factor, instilling confidence in property owners and stakeholders.

Table 1: Observation Table

Aspect	Traditional Land Registry	Blockchain-Based Land Registry
Centralization	Centralized database by authorities or government	Decentralized
Security	Vulnerable to fraud	Highly secure
Transparency	Limited access to records	High transparency
Trust	Relies on integrity of local authorities	Trust via cryptographic security
Speed and Efficiency	Paperwork, time-consuming processes	Quick and efficient with smart contracts
Dispute Resolution	Lengthy resolution processes	Faster resolution via transparent records
Accessibility	Limited public access to records	Wider access for authorized parties
Ownership Transfer Process	Manual and paperwork-intensive	Automated, transparent and quick

Table 1 provide the comparative analysis between traditional and blockchain-based approaches in land registry systems showcases several pivotal strengths and weaknesses which we observed during our research. We also observed certain drawbacks that might have influenced the thought process of people among which the most platitude remark was the threats from blockchain, though they are right because blockchain are not under the scanner and the money laundering can be the medium through it but still security protocol layer with appropriate implementation can allay all the eventualities.

8. FUTURE SCOPE AND RESULT

The successful integration of blockchain technology in land registries is poised to revolutionize the real estate industry, paving the way for a host of promising advancements. First and foremost, the incorporation of smart contracts into the blockchain framework holds the potential to automate intricate property transactions, from rentals to lease agreements and mortgages, streamlining processes and ensuring transparency and security. Furthermore, the establishment of interoperability between land registry systems, both domestically and across international borders, promises seamless data exchange and facilitates cross-border property transactions, eliminating traditional jurisdictional hurdles.

Another exciting prospect is the tokenization of property ownership, allowing real estate assets to be divided into tradeable tokens. This fractional ownership model opens up real estate investments to a broader demographic, democratizing the market and providing access to those who were previously excluded. In addition, the integration of blockchain with the Internet of Things (IoT) through smart sensors and property management systems enhances the accuracy of property data recorded on the blockchain, enabling real-time monitoring of property conditions, automated maintenance processes, and efficient energy management.

Lastly, collaboration with government agencies to test and implement decentralized applications (DApps) in practical, real-world scenarios is paramount. Such partnerships provide invaluable insights, feedback, and data, contributing to the refinement and optimization of DApps for widespread adoption. In conclusion, the adoption of blockchain in land registries not only brings immediate benefits but also sets the stage for a transformative future in the real estate sector, offering increased transparency, efficiency, accessibility, and sustainability in property transactions and management, ultimately benefitting all stakeholders in the real estate ecosystem.

9. CONCLUSION

In The project “Land Registries Using Blockchain” holds immense potential in revolutionizing land registry operations by leveraging the transparency, security, and efficiency of blockchain technology. The project aims to create a robust, trustworthy, and future-proof system for recording and managing land ownership. By addressing the challenges associated with legal frameworks, data privacy, scalability, and user adoption, the project can unlock the full potential of blockchain in the real estate sector. Successful implementation will foster trust, transparency, and efficiency in land transactions, benefiting property

owners, buyers, financial institutions, government authorities, and the overall real estate ecosystem. Blockchain, with the aid of a hybrid blockchain, offers Privacy and Transparency. We are shielded from security flaws by employing Blockchain, and the distributed ledger offers uptime-free, round-the-clock service. Records cannot be changed, which keeps land records tamper-proof. The smart contract establishes the legal ownership of the land and validates all legal checks. Blockchain makes it simple to track asset transfers from one person to another. Therefore, seeing the latest development in the field of blockchain and its huge potential its implementation in the field will be highly crucial in respect to all traditional land registries limitation. The real sector will surely benefit with robust implementation of the proposed system. Though we also feel that there is huge task for all the blockchain researcher to educate and make banal people literate about the significate of blockchain and its huge cardinality

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REFERENCES:

[1] Government of India. (n.d.). Bhoomi Samvad. Retrieved November 4, 2023, from https://dilrmp.gov.in/grading

[2] □□□□□. (n.d.). भूलेख. https://upbhulekh.gov.in/

[3] Government of India. (n.d.). Bhoomi Samvad. Retrieved November 4, 2023, from https://dilrmp.gov.in/faces/rptstatewisephysical/rptMapDigitization.xhtml

[4] How European countries are using blockchain to reform the land registration process. (2022, August Emerging Europe. https://emerging-europe.com/voices/how-european-countries-are-using-blockchain-to-reform-the-land-registration-process.

[5] Shang, Q., & Price, A. (2019, January). A Blockchain-Based Land Titling Project in the Republic of Georgia: Rebuilding Public Trust and Lessons for Future Pilot Projects. Innovations: Technology, Governance, Globalization, 12(3–4), 72–78. https://doi.org/10.1162/inov_a_00276

[6] BEZSMERTNA, N. (2022). THE FUNCTIONING OF THE UKRAINIAN LANGUAGE IN THE CONDITIONS OF FULL-SCALE AGGRESSION BY RUSSIA AGAINST UKRAINE. Almanac of Ukrainian Studies, 30, 8–16. https://doi.org/10.17721/2520-2626/2022.30.1

[7] Chigbu, U., Paradza, G., & Dachaga, W. (2019, January 22). Differentiations in Women's Land Tenure Experiences: Implications for Women's Land Access and Tenure Security in Sub-Saharan Africa. Land, 8(2), 22. https://doi.org/10.3390/land8020022

[8] Shweta Merukar, Akanksha Deshmukh, Pooja Vadje, Ketki Bhosale, & Prof. P. D. Kad. (2022, April 14). Land Registration System Using Blockchain. International Journal of Advanced Research in Science, Communication and Technology, 74–78. https://doi.org/10.48175/ijarsct-3153

[9] Land Registry Direct. (2001, March 1). Property Management, 19(1). https://doi.org/10.1108/pm.2001.11319aab.017

[10] Ameyaw, P., & de Vries, W. (2021, March 1). Toward Smart Land Management: Land Acquisition and the Associated Challenges in Ghana. A Look into a Blockchain Digital Land Registry for Prospects. Land, 10(3), 239. https://doi.org/10.3390/land10030239

[11] Guo, H., & Yu, X. (2022, June). A survey on blockchain technology and its security. Blockchain: Research and Applications, 3(2), 100067. https://doi.org/10.1016/j.bcra.2022.100067

[12] Thakur, V., Doja, M., Dwivedi, Y. K., Ahmad, T., & Khadanga, G. (2020, June). Land records on Blockchain for implementation of Land Titling in India. International Journal of Information Management, 52, 101940. https://doi.org/10.1016/j.ijinfomgt.2019.04.013

[13] Land Registry Direct. (2001, March 1). Property Management, 19(1). https://doi.org/10.1108/pm.2001.11319aab.017

[14] Asif, R., & Hassan, S. R. (2023, August 31). Shaping the future of Ethereum: exploring energy consumption in Proof-of-Work and Proof-of-Stake consensus. Frontiers in Blockchain, 6. https://doi.org/10.3389/fbloc.2023.1151724

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

[15] Shinde, Disha & Padekar, Snehal & Raut, Siddharth & Wasay, Abdul & Sambhare, S.. (2019). Land Registry Using Blockchain - A Survey of existing systems and proposing a feasible solution. 1-6. 10.1109/ICCUBEA47591.2019.9129289.

[16] Ansah, B. O., Voss, W., Asiama, K. O., & Wuni, I. Y. (2023, February). A systematic review of the institutional success factors for blockchain-based land administration. Land Use Policy, 125, 106473.