# Blockchain-Based Land Record System

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**Abstract.** In today's world, having access to land records is a must and being able to see who owns the land property is important to allow cross-verify ownership of the land in order for business purposes or for personal use. In India, maintaining the land record with the current population is a challenging task, and the current system was causing incomplete registries, leading to fraudulent activities. The current system being used by the government is inconsistent and has a lot of intermediaries who have access to the system and make changes to it. The use of Blockchain is increasing day by day, the government is trying to adopt technology, and web3.0 is the future we are heading; adding Land Records in Blockchain is very useful because it provides transparency for everyone. Allowing citizens to view the land record with a visual representation with maps will ensure everyone has access to these land records.

## 1 Introduction

In India, keeping track of land data is a challenging task due to the population and the transactions being conducted for transfer of ownership on a daily basis is a lot. The current methods being used by the central government are outdated which are causing delays and leading to downtime, leaving a backlog. You may come across errors in paperwork that may contain missing, duplicate, or forged documents and which is a major concern since land is such an important asset for livelihood for every citizen The current system used by the Indians involves third parties and brokers to purchase land in India. So whenever more human intervention or human interactions is involved, the more it will cause fraud and corruption. The process is lengthy for updating the ownership in the land registry, and clearing the legal issues is a hassle. In the current scenario, digitization is unstoppable, and it allows everyone to have information in an instant. Blockchain Technology removes security concerns for a process like land registrations.

Land registration is a scheme in which a government institution records ownership and land-related rights. Land documentation must be kept up to date because the land is a valuable asset. These documents prove land ownership, simplify transactions, and prevent fraudulent property transfers. Land registration processes have begun to be digitized by the government. However, the entire process has not yet been fully digitized. The amount of internet security threats are on the rise these days. In addition, as the race to develop security measures and

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standards heats up, new attack tactics emerge. Blockchain technology can solve this problem to overcome the above challenges.

Blockchain technology is a decentralized and distributed ledger used to store data that provides immutability, a tamper-proof validated ledger that can be accessed from multiple computers. This technology helps validate that the records which are stored are consistent; it provides an increased capacity for the whole network. Blockchain provides better security due of the distributed network, in which if a node is hacked or compromised, the originality of the data is retained. A blockchain is a list where the data is stored in blocks that keeps on increasing where we complete a transaction or multiple transactions in a single block. These blocks are connected to each other and each one of them contains the cryptography hash of the previous block, just like a linked list in the data structure, it contains the timestamp of the transaction and transaction data recorded in the block. Thus, this technology is suitable in Land Record systems where you need to store the record of the current and the previous owner history.

The Blockchain network can have both a public and private which can provide transparency and security at the same time. Due to immutability, data once entered into the block, cannot be changed at all. This reduces the fraudulent cases and the possibility of changing the data to none. Providing the records as a visual representation using maps helps everyone keep track of their asset or contact the individuals wherever required.

## 2 Literature Review

Krishnapriya S et al [1] In this paper, the author has mentioned implementation of the Blockchain-based Land Registration. The Proof of Work algorithm has been used to verify every transaction on the chain, mine the block in order to add new information to the block and have distributed the mined block to every node. Implemented the SHA256 hashing algorithm for finding the hash for every block in the blockchain.

R.C. Suganthe et al [2] In this paper author has provided a solution for the Land Registration system with help of blockchain to improve the current state in which we operate and provide security. Their proposed system is to use EVM (Ethereum Virtual Machine) and use PoW (Proof of Work) concept to add or update the blocks which have gas fees. Also created an interface for adding or updating the records.

Mahbub Alam Majumdar et al [3] In this paper author has come up with a solution to introduce Council Protocol over delegated proof of Stake. He has also mentioned the structure of a block. The author has also mentioned the Node Hierarchy in their system to allow access to different types of information according to the individual access.

Ishita Mishra et al [4] This paper is about how the author is going to complete the aim of the author is to allow a marketplace where buyer and seller can interact and this transaction can be reviewed by an authority to update the transaction. Implementing use of Proof of Work concept and POSTMAN API to complete the project.

Disha Shinde et al [5] This study offers a blockchain-based method for storing property documents securely. When a person buys land under their system, the government authority will give them a tangible copy of the property paperwork. The mothed used to store the documents in the InterPlanetary File System (IPFS), which is a decentralized database. The IPFS is a network that creates the document's hash. After the smart contracts' conditions are met, this hash allows to securely store the records in the Ethereum blockchain.

Arturo Castellanos, Raquel Benbunan-Fich published the paper [6] This is a case study in which the author studied Land Registry in Honduras and Land Registry in Georgia. This research aids in identifying the key elements influencing the digitizing of the land records and the global adoption of blockchain for applications such as land registries. The author is

certain that information systems can guide the creation and implementation of blockchain-related projects in the public sector, especially in developing nations.

N.S. Tinu [8] In this paper it focuses on the consensus algorithm, which is one of the core technologies of blockchain. A consensus algorithm helps to solve mathematical puzzles and to increase the security of the blockchain for every transaction. Also, the author mentioned taxonomy, the main aim of taxonomy is to identify and characterize.

Sai Apurva Gollapalli et al [9] In this paper the author has mentioned how Blockchain has an increased the transparency and integrity maintenance along with the probability factor. The Blockchain-based land registration system provides a secured, transparent and decentralized method to store the land records.

Centre of Excellence in Blockchain Technology, National Informatics Centre Published the Article [10] "Land Records". It is an article that describes the challenges in storing the data on the blockchain, and how to use the records which are stored on the blockchain with the existing system. Mentioned the benefits of the land records on the blockchain.

# 3 Methodology

In order to solve the problems mentioned earlier, blockchain technology is implemented by Ethereum Blockchain to replace the current system available. For doing this project we have built two smart contracts based on the Ethereum Blockchain. In order to write the smart contracts, we have to use Solidity Language. Our project has two different types of users, the first one is a citizen user who has the right to only access the data and the second one is a government official who is going to add the records, update and also access them. Developing smart contracts for these two types of users. Developing a website for the users where the users can access the records, and government officers can add or update records to the blockchain. Using React.JS which is a tool for Web3.0 development. To view the land record on a map it is developed using Google Map API and creating a polygon to highlight the land using geocoordinates.

Using the Ethereum blockchain where the user follows the following steps:

• Registry Officer Login: The admin logins into the portal to add a new land registry, update the land, or view the current property details.

• Register Land: The admin adds the details of the land and the owner details if not present in the current system.

• Updating: The admin verifies the document and completes the KYC to update the block in the blockchain.

• View Land Records: The user visits the site to view the land records and enters details like plot no, state, district, and city to fetch the owner & land details.

# 4 Overview of Proposed Model

The main objective of our project is to create a platform for all types of users to view land records efficiently and easily using blockchain. This will lead to:

No broker requirement, which will help cut down 3rd party involvement as anyone will be able to access exact land data and point of contact. This will be helpful when a user is seeking land. Strengthened security, will help prevent frauds, false records, stealing of data and breaches. 100% genuine data from years ago can be able to be accessed as blockchain has consensus, decentralization and cryptography features. Once deployed, advancements such as transactions, digital registries, and 3D assets can be made easily and move India toward a truly safe and secure digital India. Effective against power loss and no internet connectivity and there will be no downtime. Single Mode of Access across the country.

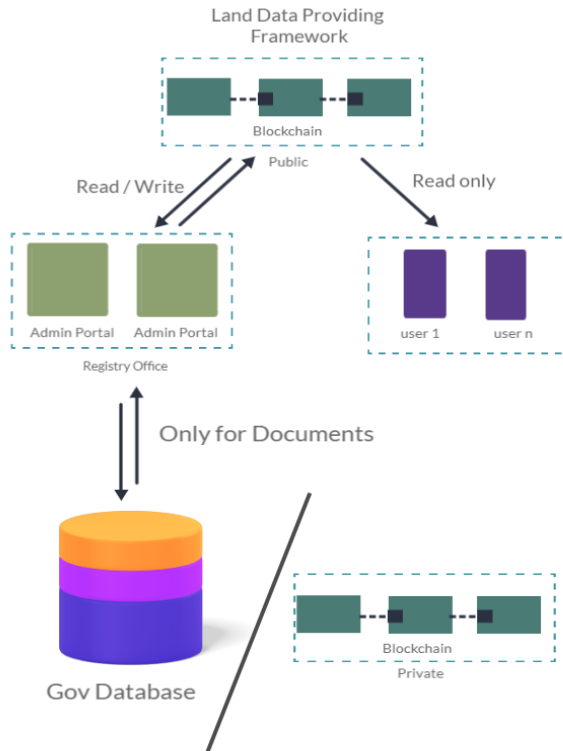# 5 Proposed Model Architecture



**Fig. 1.** Architecture Diagram of Proposed System.

There are two portals in our Architecture - a Admin Portal (Read/Write Permissions) b. User Portal (Read Permission), Admin Portal will be installed on Government Registry Office, and can only be controlled by the government operator to store and edit land data on the blockchain, and anyone can use user portal through our web application to only see land data on blockchain.

```
1
2   status                  true Transaction mined and execution succeed
3
4
5
6   transaction hash        0x6523d76ea9148f3c7cdecbd54d127eb3439dcf5ba06802ceb14e9a5e6eb1271b
7   from                    0x5B38Da6a701c568545dCfcB03FcB875f56beddC4
8
9
10  to                      LandReg.addLand(int256,string,string,string,string)
11                          0xd9145CCE52D386f254917e481eB44e9943F39138
12
13
14
15  gas                     161912 gas
16
17
18  transaction cost        140793 gas
19
20
21  execution cost          140793 gas
22
23
24  input                   0x171...00000
25
26
27  decoded input           {
28                           "int256 landid": "1",
29                           "string ownername": "TANUJ",
30                           "string landtype": "register",
31                           "string geolocation": "1",
32                           "string amount": ""
33                          }
34
```

**Fig. 2.** Blockchain transaction.

The blockchain model will store land data in JSON format, which can be retrieved through RPC-JSON protocol after deploying it on the blockchain mainnet from web3.js, our model will contain land information like (geolocation points of land, seller and buyer's details, agreed amount, timestamp etc.).

# 6 Algorithm

Blockchain technology is implemented in different ways for different applications, so according to our needs, we have to decide which kind of tools and technologies are to be used and how we will implement them. We have implemented our project on the Ethereum blockchain, which uses Elliptic Curve Digital Signature Algorithm, or ECDSA. It uses the Keccak-256 hash function for finding the hash value for the given data. Keccak-256 is the part of SHA-3 i.e., Secure Hash Algorithm Version 3.
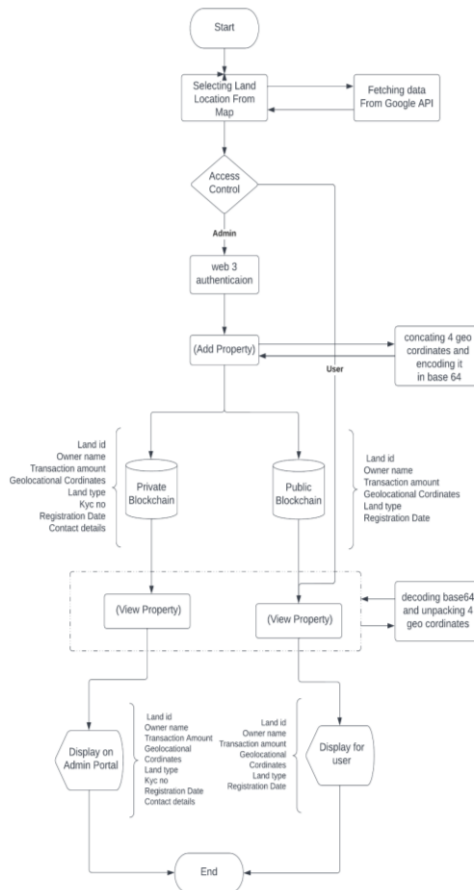
**Fig. 3.** Flow of User Page.



**Fig. 4.** Flowchart for accessing land records.

## 7 Terms Used

### 7.1 Blockchain

A blockchain is a decentralized database that is shared between network nodes and which is a type of data storage system that stores information electronically. Blockchains are known for their use in transactional systems in the industry, where it help to keep a secure and decentralized record of transactions. The blockchain's originality guarantees better accuracy and security of records, allowing to trust the system without requiring a trusted intermediary party.

### 7.2 Ethereum Blockchain

Ethereum is a decentralized blockchain network that is free to use. It allows anyone to create and use blockchain-based decentralized applications. Ethereum is an open-source project maintained by many people throughout the world, just like Bitcoin. No one controls or owns Ethereum. It was created with the intention of being adjustable and versatile. On the Ethereum platform, it is simple to construct new apps, and with the recent Homestead release, those apps are now much safer to use.

### 7.3 Solidity

Solidity is a high-level object-oriented language derived from C++, Python, and JavaScript for creating smart contracts. Smart contracts are computer programs that control how accounts behave in the Ethereum chain. Solidity is a statically typed curly-braces programming language that is used to develop smart contracts and is also aimed toward the Ethereum Virtual Machine (EVM).

### 7.4 Smart Contract

Smart contracts are simple programs that are used to automate and streamline the implementation of an agreement so that all parties, without the need for any intermediaries that run on a blockchain.

### 7.5 React JS

ReactJS is a front-end JavaScript library for creating user interfaces using UI components that are open-source. Meta and a community of individual developers and businesses support it. With frameworks like Next.js, React may be used as a foundation for developing single-page, mobile, or server-rendered applications. React, on the other hand, is solely concerned with state management and rendering that information to the Document Object Model (DOM), so constructing React apps frequently necessitates the usage of different frameworks for routing and client-side functionality.
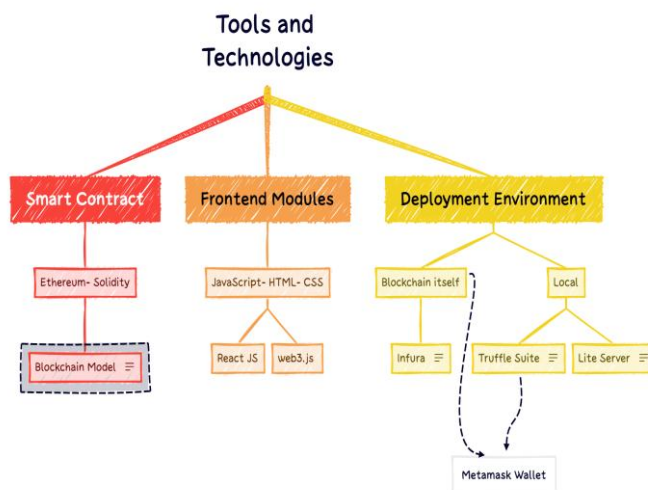
**Fig. 5.** Tools and Technologies used in Proposed System.

## 8 Results and Discussion

**Table 1.** Comparative table of traditional, existing, and our proposed system.

| Traditional Paper-based Land Records System | Digital Land Records Management Programme ("DLRMP") | Digital Land Records Management Programme ("DLRMP") |
|---|---|---|
| Wastage of investment in resources for maintaining physical records. | Lack of technical competency. | Hybrid Blockchain (Provide Privacy and Transparency). |
| Poor handling of records which leads to errors or missing records. | Lack of physical infrastructure - downtime. | Distributed Ledger which provides 24/7 service. No downtime. |
| Not Secured. | Chances of data loss or hacking. | Protected against Security Vulnerabilities. |
| Lack of technology to keep track of records. | Complex System with inaccurate information. | The smart contract verifies all the legal checks and the legal ownership & transfer of assets from one person to another. |
| | Multiple Web Portals with less synchronization. | Single-mode of access. (Synchronized) |
| | Multiple Bodies managing the current system. | Single Body can manage this system. |

The Digital Land Records Modernization Program (DLRMP) removes data loss problems, but its accuracy depends on the data. This program helps in digitizing India, which is at 93% for India. Digitization will be required to put existing documents on the blockchain, making record accuracy even more important. Maharashtra and Rajasthan, for example, have proposed a framework for decisive titles rather than presumptive titles. In these states, if the titleholder defaults on the title, the government will compensate the titleholder. This would

undoubtedly assist in speeding up the digitization process and experimenting with the blockchain via APIs that connect to state land registries. As a result, all states must work toward decisive land titling. The government has also started the initiative for map digitization which is at 69% for India. But this does not overcome the security concerns such as hacking, malicious attack or misuse of access and downtime which is a major concern. By using blockchain technology, the above issues can be resolved and the web3 will provide power to operate 24/7. By using our proposed system there everyone will be able to assess the land records. It reduces fraud since everyone has easy access to the land records and the data stored is immutable. It reduces the time required to process the Registry.
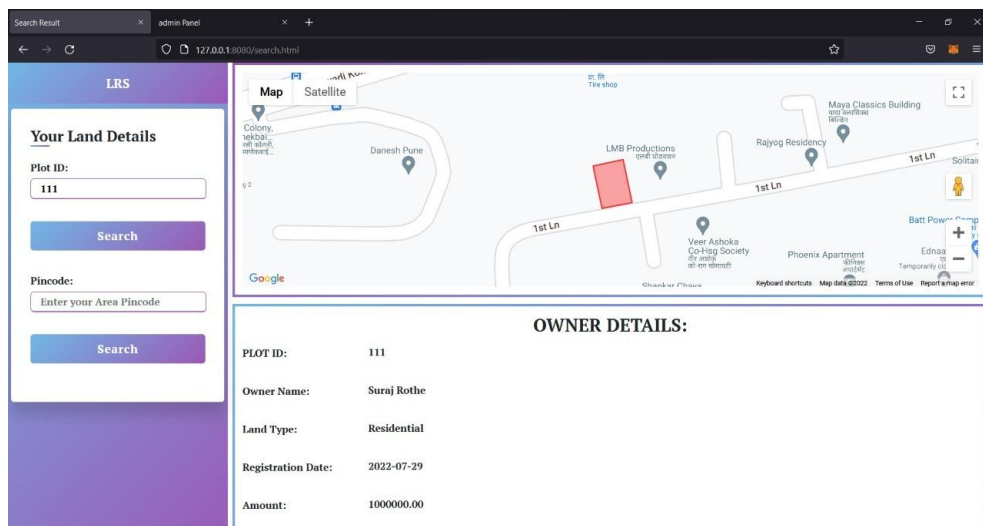


**Fig. 6.** Prototype of the result.

## 9 Scope of Research

In the 21st century, we are moving towards the complete digitalization of everything but in India, a large amount of the land registry is still done in a traditional paper-based system. And recently the government has started the DLRMP i.e. Digital Land Record Management Program which is a hybrid system with some amount of paperwork. Both the systems i.e. Paper-based and DLRMP which is not much secure. In DLRMP there is a chance of data loss if the database got attacked by the hackers. Blockchain is a distributed ledger that is the most secure technology currently known. Records are stored in a decentralized manner so it is the most secure method to store the records and also it provides immutability. For storing data and accessing data from the blockchain we require smart contracts. Solidity language is used to write the Smart Contracts. We have to develop two smart contracts, one for normal users and the second for government officers. The normal user has right to only access the information from the blockchain where the government officials have the right to add new records, to look at the existing records. To view the land record the portal is built using the Google Map API and highlighting the area of land using geocoordinates.

## 10 Limitation and Future Scope

India is the world's biggest and fastest-growing country, but the banking infrastructure is not much developed. Also, a large no. of people lacks technical knowledge, and due to this we are unable to completely Digitalize the process of Land Transfer. The Government officials also have shown a lack of understanding of the technology for digitizing land records. The lack of training of government officials has for the technology made them indecisive in adopting the technology. Another point is that we do not have access to the official database to implement our project better but if the government allows accessing the database, then we can update or put all the existing details of the land. Also, if the government allows access to the database, then we can use the concept of the parallel database and one private blockchain that will be maintained by government officials and restricted to the state. In future we can include 3D assets like flats to provide a completely robust system. Additionally, when the current banking sector and the government completely start using the digitalization of the Land Transfer procedure then we can add a Marketplace where citizens can buy and sell their lands efficiently. In the future, Complete Transactions can happen through cryptocurrency authorized by the Indian Government after launching Digital Rupee via the RBI. Also Building a Machine Learning Model to Predict the Authenticity of the Record for transfer of Records from Current System to Blockchain System.

## 11 Conclusion

Blockchain provides Privacy and Transparency with the help of a Hybrid Blockchain. By using Blockchain we are protected against Security Vulnerabilities and Distributed Ledger which provides 24/7 service with no downtime. Records are Immutable which helps keep the land records tamper-proof. The smart contract verifies all the legal checks and provides the legal ownership of land. Blockchain helps to keep track of asset transactions from one person to another easily.

## References

1. Krishnapriya S, Greeshma Sarath, Securing Land Registration using Blockchain 2020 Third International Conference on Computing and Network Communications, 2020, Vol 171, pp. 1708-1715

2. R. C. Suganthe, N. Shanthi, R.S. Latha, K. Gowtham, S. Deepak Kumar, R. Elango Blockchain enabled Digitization of Land Registration 2021 International Conference on Computer Communication and Informatics (ICCCI), 2021, pp. 1-5

3. 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.

4. 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

5. 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

6. Castellanos, Arturo & Benbunan-Fich, Raquel Digitization of Land Records: From Paper to Blockchain 2018 Thirty Ninth International Conference on Information Systems, San Francisco 2018

7. A. Thosar, M. Hame, A. Sarode and P. Kaur Land Registry Management using Blockachain 2020 International Conference on Smart Innovations in Design, Environment, Management, Planning and Computing (ICSIDEMPC), 2020, pp. 335-340

8. N.S. Tinu A Survey on Blockchain Technology- Taxonomy, Consensus Algorithms and Applications International Journal of Computer Sciences and Engineering, Vol.6, Issue.5, pp.691-696, 2018

9. S. A. Gollapalli, G. Krishnamoorthy, N. S. Jagtap and R. Shaikh Land Registration System Using Block-chain 2020 International Conference on Smart Innovations in Design, Environment, Management, Planning and Computing (ICSIDEMPC), 2020, pp. 242-247

10. Centre of Excellence in Blockchain Technology, National Informatics Centre (NIC), Ministry of Electronics & Information Technology Land Records blockchain.gov.in. https://blockchain.gov.in/landrecords.html (accessed: Mar. 25, 2022)