

# My Land My Will - A Novel Blockchain Based Land Registry System

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**Abstract**— In India, land registration has always been a tedious task involving a horde of people, starting from the seller and buyer to the middlemen. The process of land registration is decades old, costly, time consuming and in the form of paperwork. Discrepancies in documents, such as counterfeit titles and a complete loss of the record, were extremely prevalent. Such circumstances result in costly judicial fights between opposing parties. Since the digital era has arrived, there have been attempts to digitalize and centralize this system, but issues like security and transparency are still exist. A blockchain is a distributed, immutable ledger that makes recording transactions and tracking assets easier. The immutability, auditability, and traceability of blockchain are luring governments all over the world to use the decentralized technology in property registration. In this proposed solution, a blockchain-based land registration system is designed and developed using high-end technologies to accelerate the process of registration. An additional 'Will' feature for registered properties has also been added. It has been concluded that the developed system can be successfully used based on its experimental use. It is a good alternative to the current procedure as it is modern and can yield better results.

**Keywords**—Land Registry, Blockchain, Ethereum, Smart Contracts, ReactJs

## I. INTRODUCTION

Land registry in India as well as in many parts of the world is a very slow and cumbersome process. A lot of cases where someone claims another's land, transaction frauds occur, documents are lost, and many more such issues have also been observed. Due to the thousands of land records that must be maintained, the current scenario in land registration indicates that it is faulty and less reliable [1]. The ledgers are kept in the form of paperwork or on less secure database systems. There is a high risk of this paperwork being misplaced, databases being hacked, or data being tampered with. Because land registrations necessitate monetary transactions, there is a risk of corruption, which increases the number of fraud cases.

A blockchain is a distributed, immutable ledger that makes

recording transactions and tracking assets easier. On a blockchain network, anything of value may be recorded and sold, lowering risk and costs for all parties involved. Blockchain technology can provide us with a much more secure and reliable system for maintaining thousands of land records, as well as reducing the chances of corruption and data hacking. Smart contracts offer a viable alternative to distributed databases (which is necessary for a country like India which has a large population, thus increasing the number of land records). Blockchain can allow one to digitalize the entire land registration process.

The Indian government has launched numerous projects to build a Smart India/Digital India, and this project is a step toward the simple and hassle-free digitization of land registry process. It provides transparency by eliminating the possibility of corruption by ensuring verified transactions between concerned authorities, buyers, and sellers, as well as the absence of illegitimate transactions. Because there is currently no such government-regulated platform, the idea behind developing this project was to make the land registration process more resilient and to have a national impact [2].

The aim is to design a blockchain based land registry system that will help in securely maintaining all the records. This system will solve the problems faced by all the parties during the land registration and will make the process of land registration resilient and decrease the cases of fraud in the process. The system will also have a feature for users to add a will for their registered properties stating their heir. This will help in easy transfer of property in case of the owner's demise without any discrepancies [3].

## II. LITERATURE REVIEW OF CURRENT SCENARIO OF LAND REGISTRY IN INDIA

### A. Process of land registry

The process of document registration, signing deeds, getting documents notarized, verification of such data, changes in ownership, and other property transactions are all referred to as land registration. These deeds include documents like

survey documents, property maps, property tax receipts, record of rights, etc. The current owner of a land is responsible for property's past ownership records to be kept in check during such transactions. This process in our country is taken care of by the concerned authorities of each state as

every state has its own property registration departments, having specific requirements concerning forms and registration charges [4].

Since these data records can be very large and distributed among various states, it is difficult to keep them up to date which results in discrepancies among the data. Though measures have been taken in the past to resolve this issue, the success rate was negligible. There were cases of redundancy in the data in terms of actual property boundaries as they were never properly set up on the maps [5].

The current process of land registration is mentioned below:

- Firstly, the seller and the buyer have a verbal agreement on the sale or purchase of the property.
- After the agreement of the verbal contract, it is written down on paper, which is accomplished by the creation of a sale paperwork.
- After the deed is prepared, it is essential to make the payment of pay stamp duty. It varies from state to state (3-7 percent)
- The next requirement is to carry out and register the sale deed by visiting the Sub-registrar of Assurances office and submitting all the necessary documents.
- The final step is to have the property's mutation recorded in the land and income records. This can be done by going to the local municipal government.

This procedure appears to be outdated and sluggish.

#### B. Issues in Land Registry

- **Space Constraints:** It is very difficult and time-consuming to maintain land records that are nearly a century old as all this paperwork requires a lot of space to be stored in. Therefore, digitization of all documents and information is necessary, as well making them available to the general public will be a step towards eliminating the current difficulties.
- **Lack of uniformity:** Different states have different languages which makes it difficult for people who are not familiar with the language to understand the contents of the documents. Thus, in addition to digitizing, records should be maintained in a unified language understood by all, such as English.
- **Fear of destruction of records:** Physical records have the risk of being torn, damaged, lost, stolen, misplaced, etc as a result of a force of nature such as earthquake, flood or a fire. Thus, the need to upload the originally verified documents on a designated software arises.
- **Frauds:** As mentioned above data can be easily destroyed. In the absence of proper proof of ownership, the land registry becomes more prone to frauds.
- **Lack of single window Title verification:** In India, land ownership is presumed based on a variety of documents and records kept by numerous government agencies, making title investigation a laborious and time-consuming procedure. For example, registered documents are at the registration department, cadastral maps at survey departments, etc. It is found that this data may not be up to date or consistent with each other or maybe missing, which

makes verification almost an impossible task to achieve [6].

Blockchain is a completely transparent, decentralised and secure system. Therefore, It appears as the most suitable solution to the current problems in the land registry system [7,8].

#### III. BLOCKCHAIN AS A SUITABLE SOLUTION

Blockchain gives a better approach to the land registry process because of its following advantages -

- **Viable alternative to distributed databases:** The blockchain system is nearly impossible to hack and cannot be manipulated. It can also hold a massive amount of data which is a plus point as land records can be humongous.
- **Accelerated Process:** The current process can be old-fashioned and slow. To register a land or transfer property one has to fill forms, fill up the deed, sign it, get it notarized and stamped, then submit it and wait for the approval of this paperwork by the government authorities. With the proposed digitized system in this paper, no one will have to go through all this hassle and can simply do that anywhere, without physically appearing at any office. Blockchain has the ability to confirm genuineness, therefore land can be registered or transferred legally by the landowners without involving third parties for verification [9].
- **Reduction in Frauds:** Nowadays, it is very easy for any fraudster to fabricate data and impersonate title ownership digitally, using different software that can edit data. On the other hand the proposed application in this paper enables users to submit property relevant documents on the Blockchain network, where concerned authorities may sign and confirm it, and this can be used to prove your ownership and avoid any fabrication by retaining immutable records [10].
- **Transparency:** Blockchain can be used to track the ownership history of any piece of land. Loan or mortgage procedures can be time-consuming due to administrative challenges. Smart Contracts, on the other hand, aid in the simplification of this procedure by automating validated transactions. As a seller or buyer, one can use the proposed application to generate a digital, decentralized ID and complete the transaction. The registrar will first confirm the transfer, then payment will be made, ownership will be transferred to the new buyer, and the entire transaction will be recorded in the system, making the process smoother and faster than it is now [11,12].

#### IV. PROPOSED SOLUTION OF BLOCKCHAIN BASED LAND REGISTRY SYSTEM

The generic architecture for the proposed system is shown in figure 1. Suitable technologies used to facilitate the proposed work flow have been discussed below:

##### A. Technologies Used

- **Smart Contracts:** In this system, smart contracts are used as the backend, which is nothing but a simple programme that runs upon the meeting of certain conditions and is stored on Blockchain [13,14,15].
- **Solidity:** To write our smart contract we used solidity language (version 0.8.0) .

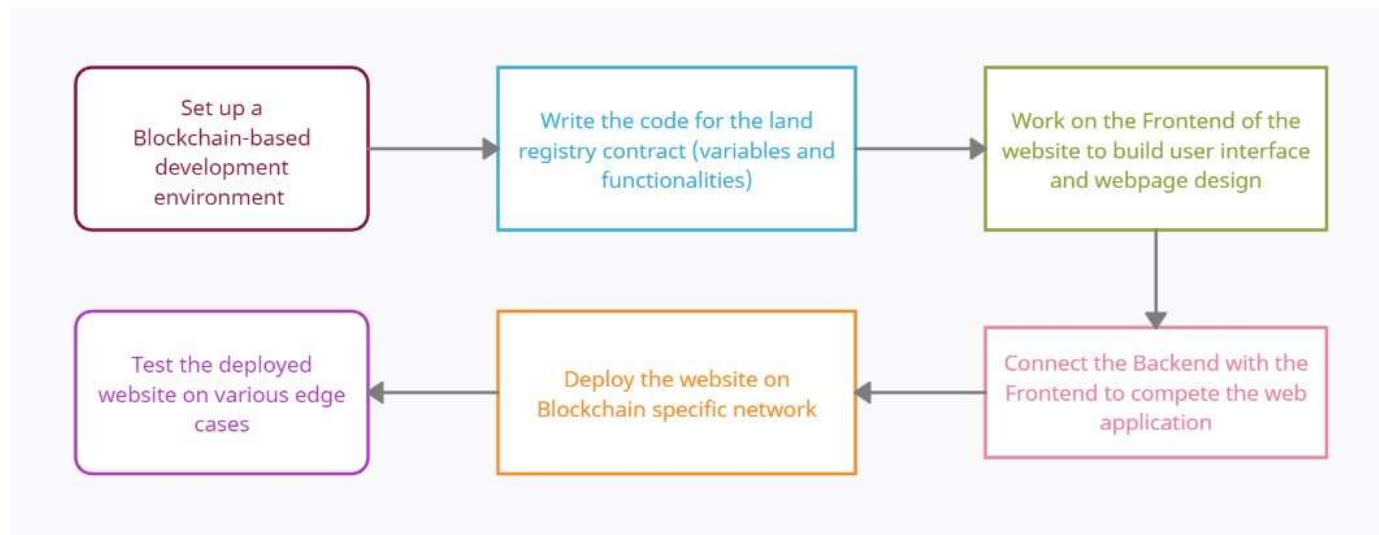


Fig. 1 Generic proposed architecture of the Blockchain based land registry system

- Ethereum: To run and deploy the proposed dApp, Ethereum blockchain is used. The smart contract was built and executed on the Ethereum platform, which provides an Ethereum virtual machine as the smart contract's runtime environment.
- Hardhat: Hardhat has been used as the development environment to compile, test, and debug the code on various test cases. It provides one with a blockchain server that runs on the developer's machines locally. It creates several false accounts with fake ETH tokens in order to perform transactions, and test the code without the need to perform these transactions on any public blockchain with real ETH tokens.
- Meta Mask wallet: It is a widely used cryptocurrency wallet that allows one to access their Ethereum wallet via a mobile app or an extension. It has been used to connect securely to this decentralized application, manage and store account keys, send and receive ETH-based tokens and currencies, and perform and broadcast transactions.
- ReactJS : To build a user side interface, ReactJs is used. It is a NodeJS framework that has been used as the development environment, because JavaScript provides extensive support for blockchain-based applications.
- Government Official - A person who manages the whole system, verifies the sellers, buyers and all the information provided.
- Seller - A person who utilizes the system to sell properties and transfer land titles to buyers.
- Buyer - A person who wants to purchase land & utilizes the system to search for it, request access, & communicate with the seller in order to obtain possession of the land title.
- Land - The details of the property that a seller wants to sell are entered and are displayed to the buyer.

After defining the stakeholders and other entities, mappings were defined. The mappings are used to associate addresses with values. Mappings are like hash tables that can store key value pairs. For example, mapping a seller's address to its details etc. 17 such mappings have been defined:

- landsDetails
- GovtOfficialMapping
- SellerMapping
- BuyerMapping
- RequestsMapping
- RegisteredAddressMapping
- RegisteredSellerMapping
- RegisteredBuyerMapping
- SellerVerification
- SellerRejection
- BuyerVerification
- BuyerRejection
- LandVerification
- LandOwner
- RequestStatus
- RequestedLands
- PaymentReceived
- WillsDetails

### B. Design and Implementation

After carefully studying the process of land registry and taking all the current issues into account, an algorithm was devised to create a system facilitating land registry and Will creation using Ethereum Blockchain and ReactJS along with various other tools and libraries [16,17].

To define a smart contract, stakeholders have been identified by the developers and entities involved in the land registry and will creation process. All the roles are explained as follows –

Further, modifiers have been defined to control the behaviour of the functions such as restricting which stakeholder has the permission to call a particular function. For example, `onlyGovtOfficial()` modifier is defined, and if this is added to any function's definition, that function can only be called by the government official who acts as the admin. 8 such modifiers have been defined:

- `onlyGovtOfficial`
- `onlyVerifiedLand`
- `onlyRegisteredSeller`
- `onlyRegisteredBuyer`
- `onlyRegisteredAddress`
- `onlyUnregisteredAddress`
- `onlyVerified`
- `paid`

Finally, functions were defined for each step involved in the land registry and will creation process. The first function created is the constructor, which takes in the details of the government official, who acts as the admin of the website. The constructor is the first function called when the contract is deployed. 17 such functions have been defined that can be used to go through the complete process of land registry and Will creation:

- `verifySeller`
- `rejectSeller`
- `verifyBuyer`
- `rejectBuyer`
- `verifyLand`
- `registerLand`
- `registerSeller`
- `registerBuyer`
- `updateSeller`
- `updateBuyer`
- `requestLand`
- `approveRequest`

- `landPayment`
- `ownershipTransfer`
- `createWill`
- `deleteWill`
- `transferWillProperty`

To make the blockchain based land registry system easy to use for people of all age groups, a user interface was built for the system. ReactJS - a framework of NodeJs, was used for this. An admin page for the government official who acts as the admin of the website was created. Every request made by each user go through the admin first, who verifies every transaction going through the system. A separate home screen was also created for all the sellers and buyers which displays all the features available.

The EthersJS library is used to connect the land registry smart contract with the frontend react app. For that, a function connecting the forms and buttons in the frontend code to the functions in our contract was written.

The working of the website has been explained in the flowchart in figure 2.

### C. Work Flow

First, a React App was created. Then a sample hardhat project inside the react app was created. After that, a smart contract named "LandRegistry" was written, defining the stakeholders' entities involved in the land registry process. Further created were mappings, variables and modifiers and functions for each step of the land registry and will creation step. Next step was writing the code for creating the user interface for the system using various libraries provided by ReactJS. After that, connection of the smart contract with the frontend application using the EthersJS library was established. And then the smart contract using the hardhat test network was deployed and tested the network against all the edge-cases.

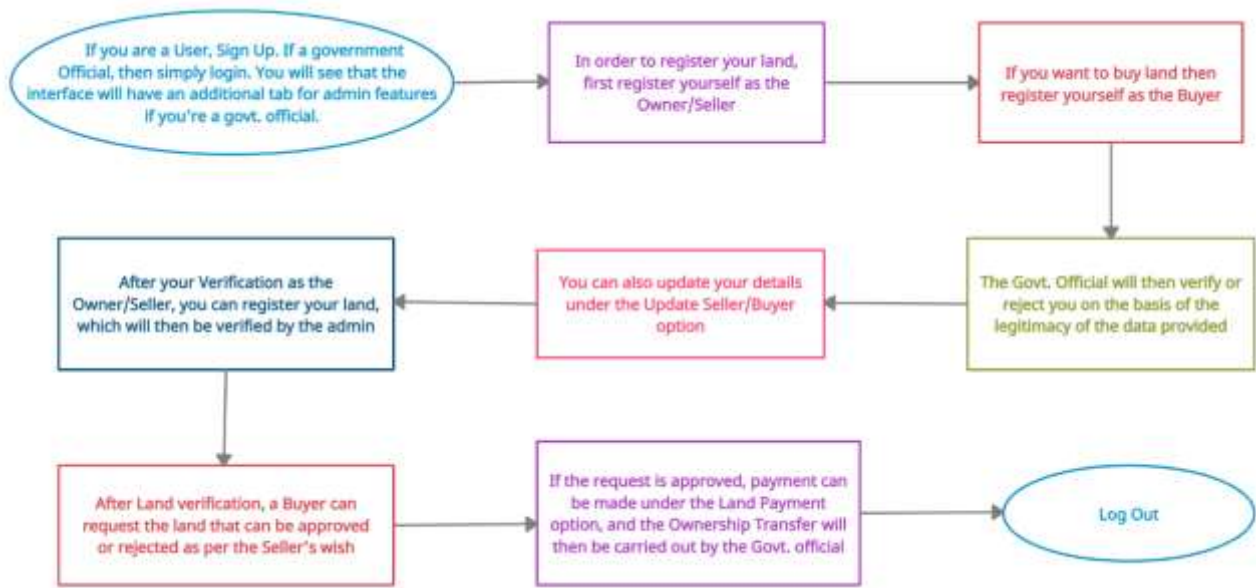


Fig. 2. Working of the website

V. RESULTS AND DISCUSSION

The proposed system has been developed into a complete web application for a seamless land registry and Will creation process. Ethereum Blockchain was used as the secure database. A smart contract named “LandRegistry” was written along with mappings, modifiers and functions. The functions are defined to follow the land registry process step by step. The user interface was built using ReactJS and its different libraries. EtherJS is used to connect the backend part of the website to the frontend. Figure 3 shows the home screen of the website which is visible to all the users. A government official is made to act as the admin of the whole system. Every transaction goes through the admin first. Figure 4 shows the admin screen with all the functionalities present for the admin. Figure 5 shows the interface available to the user if they want to register as a seller. The other user functions also have a similar interface. Figure 6 shows how the transaction goes through metamask wallet. Lastly, figure 7 shows the console output “Seller Registered”, from which its verified that the website works properly in all aspects. The complete working of the website has been explained in the flowchart in figure 2. [18].



Fig. 5. Seller Registration

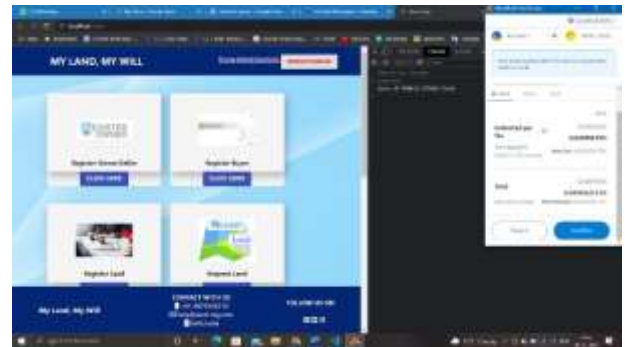


Fig. 6. Transactions using Meta mask



Fig. 7. Console Output showing seller is successfully registered



3(a)



3(b)

Fig. 3. Home Screen



Fig. 4. Admin Screen

VI. CONCLUSION

In this paper, a better approach to the current land registry process has been proposed. The traditional land registry process has many issues, involvement of middlemen, discrepancy in documents, expensive and time consuming are to name a few. Blockchain has been used to build the proposed system. Using Blockchain a decentralized, transparent and secure system is built. A complete web application has been created using ReactJS for the frontend. By using the application, users can also add Will for their properties. It provides a smooth, hassle free and user-friendly experience, which makes the land registry process easy for people of all ages. The proposed system successfully eradicated almost all the issues in the current land registry system.

In future, wide range of payment options (for example-EMI) and modes (for example - Net Banking, UPI etc.) can be added to the system. Functionality for mortgage services can be integrated into the system.

## REFERENCES

- [1] Krishnapriya S, Greeshma Sarath, Securing Land Registration using Blockchain, *Procedia Computer Science*, Volume 171, 2020, Pages 1708-1715, ISSN 1877-0509
- [2] <https://www.ibm.com/in-en/topics/what-is-blockchain>
- [3] Vinay Thakur, M.N. Doja, Yogesh K. Dwivedi, Tanvir Ahmad, Ganesh Khadanga, Land records on Blockchain for implementation of Land Titling in India, *International Journal of Information Management*, Volume 52, 2020, 101940, ISSN 0268-4012
- [4] <https://www.business-standard.com/about/what-is-land-registry#collapse>
- [5] <https://www.iifl.com/blogs/guide-property-registration-process>
- [6] <https://blog.ipleaders.in/top-5-issues-maintaining-land-records-india-can-addressed/#:~:text=LACK%20OF%20UNIFORMITY%20AND%20POOR%20MAINTENANCE%20OF%20LAND%20RECORDS&text=Different%20states%20and%20different%20languages,the%20contents%20of%20the%20documents>
- [7] Ramya U.M., Sindhuja P., Atsaya R., Bavya Dharani B., Manikanta Varshith Golla S. (2019) Reducing Forgery in Land Registry System Using Blockchain Technology. In: Luhach A., Singh D., Hsiung PA., Hawari K., Lingras P., Singh P. (eds) *Advanced Informatics for Computing Research*. ICAICR 2018. *Communications in Computer and Information Science*, vol 955. Springer, Singapore.
- [8] Fran Casino, Thomas K. Dasaklis, Constantinos Patsakis, A systematic literature review of blockchain-based applications: Current status, classification and open issues, *Telematics and Informatics*, Volume 36, 2019, Pages 55-81, ISSN 0736-5853, <https://doi.org/10.1016/j.tele.2018.11.006>.
- [9] Svein Ølnes, Jolien Ubacht, Marijn Janssen, Blockchain in government: Benefits and implications of distributed ledger technology for information sharing, *Government Information Quarterly*, Volume 34, Issue 3, 2017, Pages 355-364, ISSN 0740-624X
- [10] Laurie Hughes, Yogesh K. Dwivedi, Santosh K. Misra, Nripendra P. Rana, Vishnupriya Raghavan, Viswanadh Akella, Blockchain research, practice and policy: Applications, benefits, limitations, emerging research themes and research agenda, *International Journal of Information Management*, Volume 49, 2019, Pages 114-129, ISSN 0268-4012
- [11] O. Ali, A. Jaradat, A. Kulakli and A. Abuhalimeh, "A Comparative Study: Blockchain Technology Utilization Benefits, Challenges and Functionalities," in *IEEE Access*, vol. 9, pp. 12730-12749, 2021, doi: 10.1109/ACCESS.2021.3050241.
- [12] Chauhan, Anamika, Om Prakash Malviya, Madhav Verma, and Tejinder Singh Mor. "Blockchain and scalability." In 2018 IEEE International Conference on Software Quality, Reliability and Security Companion (QRS-C), pp. 122-128. IEEE, 2018.
- [13] Chauhan, Anamika & Rishabh, & N S, Lokesh & Mittal, Pratham. (2022). A Deep Dive into Blockchain Consensus Protocols. 10.1007/978-981-16-4016-2\_54.
- [14] Zibin Zheng, Shaoan Xie, Hong-Ning Dai, Weili Chen, Xiangping Chen, Jian Weng, Muhammad Imran, An overview on smart contracts: Challenges, advances and platforms, *Future Generation Computer Systems*, Volume 105, 2020, Pages 475-491, ISSN 0167-739X
- [15] Khan, S.N., Loukil, F., Ghedira-Guegan, C. *et al.* Blockchain smart contracts: Applications, challenges, and future trends. *Peer-to-Peer Netw. Appl.* **14**, 2901–2925 (2021). <https://doi.org/10.1007/s12083-021-01127-0>
- [16] Soner, S., Litoriya, R. & Pandey, P. Exploring Blockchain and Smart Contract Technology for Reliable and Secure Land Registration and Record Management. *Wireless Pers Commun* 121, 2495–2509 (2021).
- [17] Land Registration: Use-case of e-Governance using Blockchain Technology," *KSII Transactions on Internet and Information Systems*, vol. 14, no. 9. Korean Society for Internet Information (KSII), 30-Sep-2020.
- [18] J. Golosova and A. Romanovs, "The Advantages and Disadvantages of the Blockchain Technology," *2018 IEEE 6th Workshop on Advances in Information, Electronic and Electrical Engineering (AIEEE)*, 2018, pp. 1-6, doi: 10.1109/AIEEE.2018.8592253