Land Registration System Using Blockchain Technology

Aakash Shrestha[1], John Saud[2], Niraj Kumar Rauniyar[3], Sindhu k[4]

[1,2,3]*EIGHT SEMESTER, DEPT. OF CSE, SAMBHRAM INSTITUTE OF TECHNOLOGY, BENGALURU-560097*
[4]*ASST PROFESSOR, DEPT. OF CSE, SAMBHRAM INSTITUTE OF TECHNOLOGY, BENGALURU-560097, INDIA*

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Abstract – *Land registration is a critical process that involves the legal recording of land ownership, rights, and transactions. The current land registration systems in many countries often face challenges such as corruption, inefficiency, and lack of transparency. Land Registration is a use case which involves lot of middlemen and central authorities in the process which then puts trust in the system. Keeping traces of who owns which part of land is challenging when there are hundreds or thousands of land records to maintain. Using Blockchain will remove the middlemen in the system and also will reduce corruption and increase speed of the process. Land Registration is a simple decentralized application which is build using the Ethereum Blockchain principals. We can use this registration procedure as an substitute to bypass the existing system flaws. Here the user who owns the land registers his land details and also enters market value of the land by providing all the necessary proofs. A government authority who traditionally looks into land registry is assigned as a land inspector can do the registration process. Lands coming under a particular village can be registered to the system only through the inspector who is assigned to that village. The smart contract used here is written in such a way that the owner has to transfer his property completely to the buyer and no transaction of the land can be partial. Even we allow a government authority is involved in registration process, the entire process is transparent and the transaction happens only between the two clients.*

Key Words: **Blockchain, Ethereum, Smart Contracts, Ganache, Metamask, Ganache, Truffle.**

1. INTRODUCTION

A blockchain is a continuously expandable list (chain) of records (blocks) that are connected via encrypted data exchange. Each block typically contains a reference to the previous block, a timestamp, and transaction data. One of the most popular blockchain applications is the crypto-currency Bitcoin. Due to the fact that the transaction data on all applications (clients) are visible for everyone and traceable stored, this system is considered tamper-proof and transparent.

With the use of blockchain, it is possible to run a continuously expandable list of bookings decentralized and the respective proper state must be documented because many participants are involved in the bookkeeping. This concept is referred to as Distributed Ledger technology (decentralized booking technology). What should be booked and documented with it, is irrelevant. Crucially, later transactions build on previous transactions and confirm them as correct by demonstrating knowledge of past transactions. Bookings do not necessarily have to be property transfers, but it can also be a formal confirmation of the existence of all necessary documents by the notary so that a notarized land purchase agreement can be made. Thus, individual processing steps of the process of transfer of ownership could be speeded up and made more transparent, so that the parties involved can at any time have an overview of the status of proceedings.

2. LITERATURE SURVEY

Blockchain for Land Administration" by Tarek Zein and Rohan Bennett (2018): This paper explores the use of blockchain technology in land administration, including land registration. It discusses the benefits and challenges of using blockchain for land registration and provides a case study of a blockchain-based land registry in Sweden.

"A Comparative Analysis of Land Registration Using Blockchain Technology" by Ismaila Temitayo Sanusi et al. (2019): This study compares the use of blockchain technology for land registration in Nigeria and Ghana. It analyzes the benefits and challenges of using blockchain for land registration and evaluates the feasibility of implementing blockchain-based land registries in these countries.

"Blockchain-Based Land Administration: A Review of Applications and Potentials" by Julius Oladele Ogunyemi et al. (2021): This paper provides a comprehensive review of blockchain-based land administration systems, including land registration, around the world. It evaluates the strengths and limitations of these systems and identifies the key challenges and opportunities for further research in this field.

Analyzing various test cases Arturo Castellanos and Raquel Benbunan-Fich: proposed digitization of land records. They experienced that the internal process plays a feasible role in Blockchain digitization of land records. Digitizing land record will reduce the time delay caused in traditional process and speed up the process. A survey in Georgia and it has been found tha t the rate of fraud is reduced after implementation of Blockchain in land records.

A model proposed by Rishav Chatterjee we can only consider Registration Document and Khasra number (a plot or survey number given to a particular piece of land in villages). Chain code is the logic behind the entire system. Chain code was used to ensure that the land record are genuine. The Chain code used in Khasra Blockchain does alteration in the Khasra, but it is tied with the registration blockchain also. Any such binding needs a valid registration.

3. PROBLEM STATEMENT

Land registration is a crucial process for establishing and maintaining property rights, and it is a complex process that often involves multiple intermediaries, paper-based documentation, and high transaction costs. The current land registration system is vulnerable to fraud, corruption, and inefficiency, which can lead to disputes over property ownership, impede economic development, and deprive vulnerable groups of their property rights.

Therefore, there is a need for a more secure, transparent, and efficient land registration system that can prevent fraud, reduce disputes, and promote sustainable land management. Blockchain technology has the potential to address these challenges by providing a decentralized, tamper-proof, and transparent system for land registration.

Building trust and community acceptance is crucial for the adoption and sustainability of a blockchain-based land registration system.

In summary, the problem statement for land registration using blockchain technology is how to design and implement a system that can overcome the limitations and challenges of the existing land registration system, provide secure property rights, ensure compliance with legal and regulatory frameworks, and build trust and community acceptance. This requires addressing technical, legal, and social challenges and developing a sustainable, scalable, and interoperable system that can be adopted by different countries and communities.

4. FLOW DIAGRAM
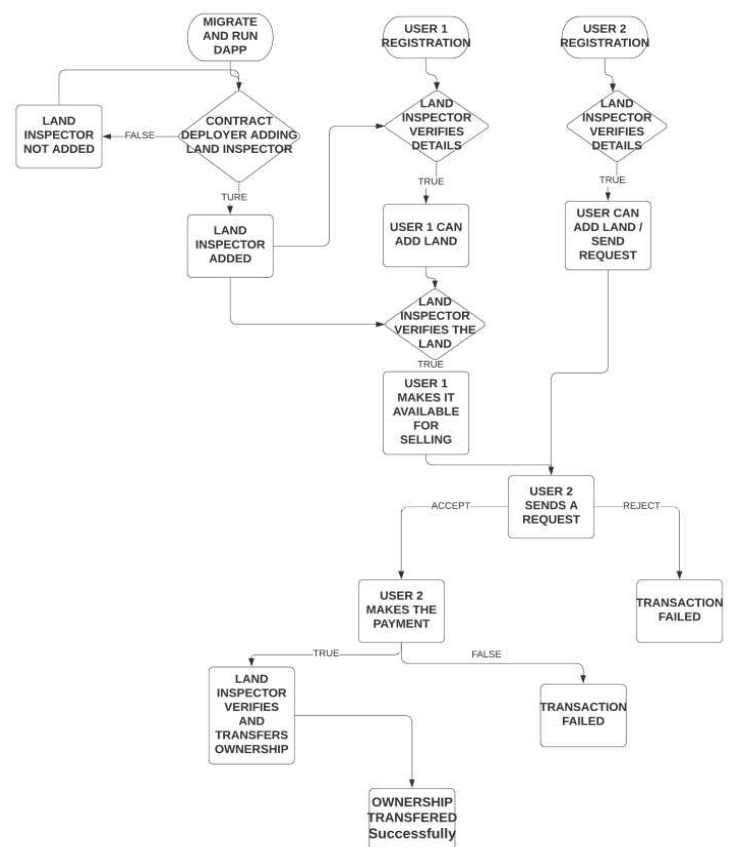
4.1 PROJECT FLOW

- User logs in by entering his private key or connecting his metamask wallet.

- If user is logged in for first time, then they have to enter all his details and upload their identity document.

- For storing documents, we have used IPFS based on File Coin.

- After successful login, user can now move to his dashboard.

- As of now, the user is not yet verified and only the land inspector can verify him.

- For this, the contract owner will first add the land inspector.

- After land inspector is added, he can log into his account.

- Land inspector can view the registered users. He can view the documents and verify the users.

- Now the users are verified.

- Users can now add their lands. They can add all the details of land, land document and user can also draw their land on map as we can see below image.
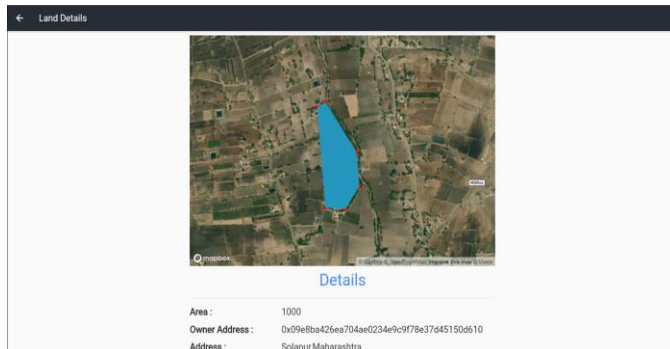

Fig: Drawing land on map

- After land adding, only the Land inspector can verify it.

- After land has been verified by the land inspector, user i.e., owner of that land can make it on sell.

- Once it is on sale, all other users can see all the lands in the land Gallery option. Here they can see all land details, area on the map and can send request to buy the land.

- Owner of land can see all received requests and can reject or accept the request.

- After the land owner accepts the request, user who has sent the request can make payment from his account to buy the land.

- Finally, the land inspector can see all the payments done and will verify the payment and then transfer the ownership. While transferring land, land seller, buyer and one witness has to be present. Land inspector will capture their photo, will take information from the witness and then transfer the land.

- After transferring land, app will create digitally signed document and it will be automatically uploaded to the database.

- Then seller can see the bought land in my land option.

4.2 IMPLEMENTATION

Flutter - We have made frontend of our project using Flutter. Flutter is open source and created by Google. It is a cross platform SDK. Using single codebase we can create application for Android, IOS and Web application. Currently with newer version of Flutter we can also create apps for Windows, Linux and Mac os. On the front screen, one can login as a user, land inspector, or contract owner. The contract owner can add a land inspector and see all the

added land inspectors. The land inspector's dashboard consists of the functionality to verify user, verify land and transfer ownership. If we login as the user, we have the options of adding lands, land details, seeing all lands, sending and receiving land requests. We have used truffle IDE to set up the DAPP.

Smart Contract - Blockchain is to bitcoin, what the internet is to email. A big electronic system, on top of which you can build applications. Currency is just one. Bitcoin supports an optional and special feature called scripts for conditional transfer of values. Ethereum blockchain extended the scripting feature into a full blown code execution framework called smart contract. A smart contract provided the very powerful capability of code execution for embedding business logic on the blockchain. With addition of code execution comes serious consideration about public access to the blockchain hence, the classification of public, private and permissioned blockchain based on access limits. In this project we have implemented a smart contract as the backend which consists of all the terms and conditions for a smooth and secure transfer of property registration.

Truffle - Truffle is a world-class development environment, testing framework and asset pipeline for blockchains using the Ethereum Virtual Machine (EVM), aiming to make life as a developer easier. Truffle is widely considered the most popular tool for blockchain application development with over 1.5 million lifetime downloads.

Metamask - MetaMask is a software cryptocurrency wallet used to interact with the Ethereum blockchain. It allows users to access their Ethereum wallet through a browser extension or mobile app, which can then be used to interact with decentralized applications.

Web3.js - Web3.js talks to The Ethereum Blockchain with JSON RPC, which stands for "Remote Procedure Call" protocol. Ethereum is a peer-to-peer network of nodes that stores a copy of all the data and code on the blockchain. Web3.js allows us to make requests to an individual Ethereum node with JSON RPC in order to read and write data to the network. It's kind of like using jQuery with a JSON API to read and write data with a web server.

5. DEVELOPMENT AND TESTING

Truffle - Truffle is a one stop ide for testing and developing decentralized applications like our project. It is very common to write and compile Solidity code manually which is fine for small projects. However, as our project is growing bigger and bigger, it is good to have an automatic way of smart contracts development. In addition, testing Solidity code is crucial to avoid any problematic situation caused by a bug in the smart contract. There are different frameworks available for taking care of the development process. Truffle is one of them and is often regarded as the Ethereum Swiss Knife framework as it is a development environment, testing

framework and asset pipeline for Ethereum. We have used truffle for our project for deployment and testing.

Ganache - Ganache is an Ethereum simulator that makes developing Ethereum applications faster, easier, and safer. It includes all popular RPC functions and features (like events) and can be run deterministically to make development a breeze. We have used ganache for testing to create blockchain locally. On this we deploy our smart contract, carry out transactions. We can carry out as many transactions as we want for testing purposes.
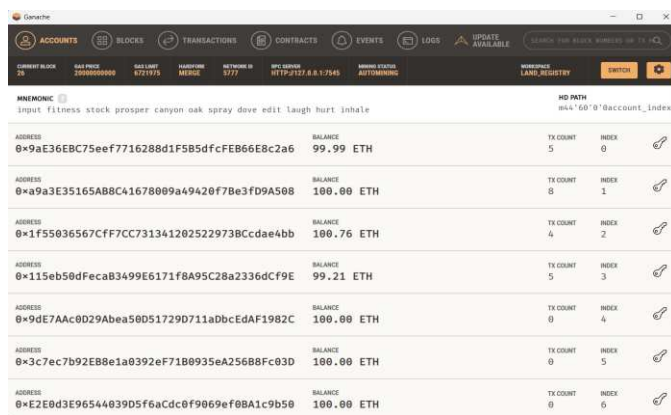
Fig: ganache
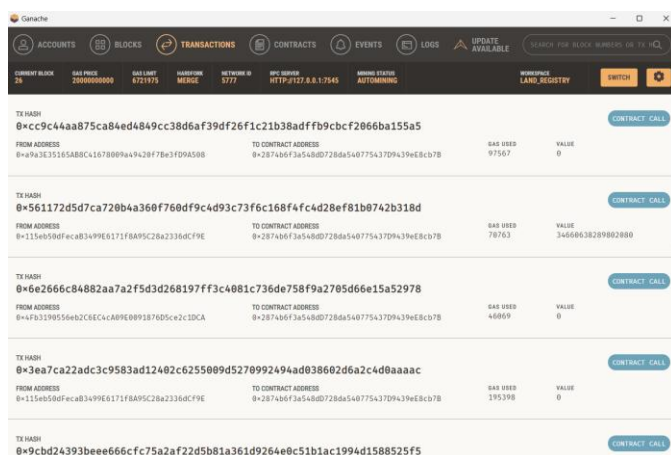
Fig: ganache transaction

6. RESULTS AND DISCUSSION

Login Page – On the front screen, one can login as a user, land inspector, or contract owner. The contract owner can add a land inspector and see all the added land inspectors. The land inspector's dashboard consists of the functionality to verify user, verify land and transfer ownership. If we login as the user, we have the options of adding lands, land details, seeing all lands, sending and receiving land requests.
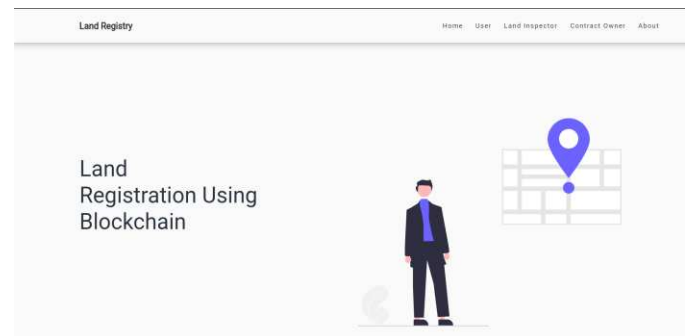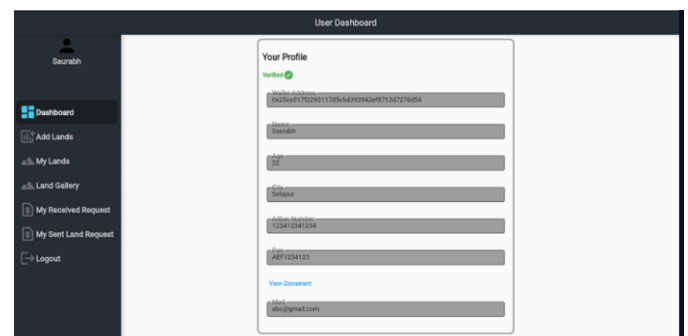

Fig1: Login page

Fig2: User profile

Working – First user adds his land details which are verified by the land inspector. To buy or sell land, user must send a request to land inspector. After the request has been 26 accepted by land inspector the users can make the transactions. The transaction is verified by the land inspector. After the transaction is verified, the ownership is transferred.
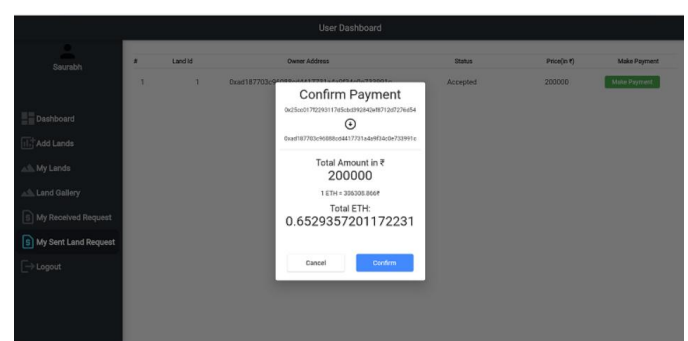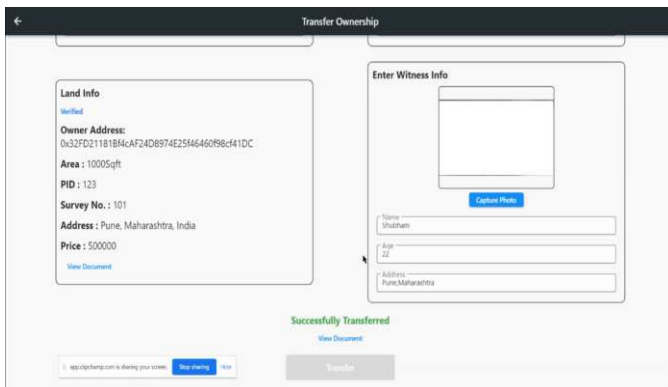

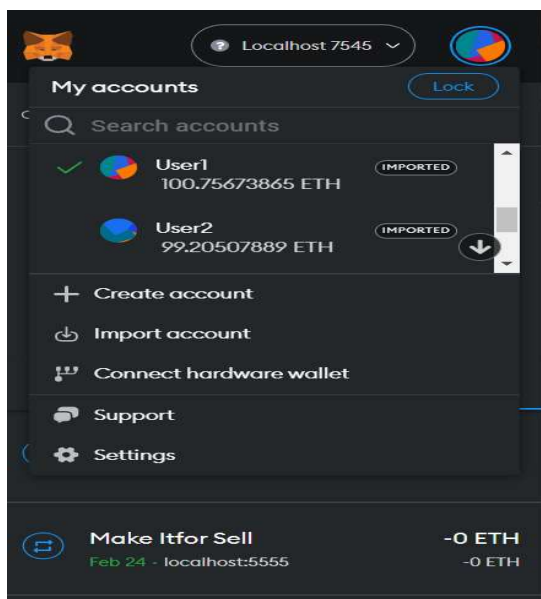Fig3: Payment

Fig4: Land Ownership Transfer

Fig5: Metamask

In figure 5, the User2 is buyer and the money is added to the User1 who is seller of the land.

7. FUTURE SCOPE

Blockchain is a social revolution and is making its way through all important areas especially where security is a concern. It is a social revolution and we have to take our best efforts to harness this technology to the best of our ability. There is good scope for improving the current solution for cloud storage. The application serves basic functionalities but can be extended to provide some advanced features.

Deployment on mainnet or a private Ethereum network- Currently the blockchain network is deployed on the ropsten test net which uses ETH from faucets which has no real value and therefore no market for tesnet ETH. So going further we would deploy it on a Mainnet or a private ethereum network depending upon our requirements so that it gets connected with real world.

Hosting the DAPP on a cloud platform- When deployed in real-time the number of users on the application would increase so to scale our application we will host it on a cloud platform such as AWS**.**

Collaboration with government agencies- The final stage of our project is to reach out to government and test our DAPP with their collaboration to collect real world inputs and see how our project stands in the real-time.

8. CONCLUSIONS

The conventional property registration system has several flaws that demanded focus of researchers to address the same issues. Among many issues, tampering of record, misuse of property and unethical practices concerning poor finance management, that lead traditional property system an area for research. This study provides a solution for controlling transparency and provides a trusted property registration system over the Blockchain. The infrastructure offers many features to the stakeholders related to the buying and selling of property. The transparency, integrity of the record, and trust factor is ensured via a tamper-proof ledger.

REFERENCES

[1].ALEXANDRU OPRUNENCO AND CHAMI AKMEEMANA. USING BLOCKCHAIN TO MAKE LAND REGISTRY MORE RELIABLE IN INDIA, AVAILABLE: https://www.undp.org/blog/using-blockchain-make-land-registry-more-reliable-india

[2]. GOVT OF INDIA SITE FOR BLOCKCHAIN IN LAND RECORDS: https://blockchain.gov.in/landrecords.html

[3] DESIREE DANIEL AND CHINWE LFEJIKA SPERANZA.THE ROLE OF BLOCKCHAIN IN DOCUMENTING LAND USERS' RIGHTS,AVAILABLE: https://www.frontiersin.org/articles/10.3389/fbloc.2020.00019/full

[4]. RESTORING TRUST IN PUBLIC LAND REGISTRIES, GEORGIA AVIALABLE: https://www.newamerica.org/digital-impact-governance-initiative/digital-impact-and-governance▯initiative-projects/digi-blogs/project-capsule-georgia-land-titling-system/

[5].I. KARAMITSOS, M. PAPADAKI, AND N. B. AL BARGHUTHI, "DESIGN OF THE BLOCKCHAIN SMART CONTRACT: A USE CASE FOR REAL ESTATE," JOURNAL OF INFORMATION SECURITY, VOL. 9, NO. 03, P. 177, 2018.AVAILABLE: https://www.scirp.org/pdf/jis_2018062815280747.pdf

[6].SOLIDITY PROGRAMMING DOCUMENTATION, AVAILABLE: https://docs.soliditylang.org/en/v0.8.11/

[7]ETHEREUM BLOCKCHAIN DEVELOPER'S DOCUMENTATION:
https://ethereum.org/en/developers/docs

BIOGRAPHIES

Aakash Shrestha is pursuing BE. CSE in Sambhram Institute of Technology, Bangalore. Worked as a leader in final year project on blockchain based land registration.

John Saud is pursuing BE. CSE in Sambhram Institute of Technology, Bangalore. Worked in final year project on blockchain based land registration.

Niraj Kumar Rauniyar is pursuing BE. CSE in Sambhram Institute of Technology, Bangalore. Worked in final year project on blockchain based land registration.

Mrs. Sindhu K , Assistant Professor, Department of Computer Science & Engineering, Sambhram Institute of Technology, Bangalore. She guided through this whole project .