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Software Project Synopsis

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1. CONTEXT .

The 2nd decade of 21st century saw the advent of blockchain technology which completely transformed the way software was developed earlier.Today, blockchain is what the iPhone was in 2007. Revolutionary and disrupting, it can soon become a common part of day-to-day life with transparency in business operations.

2. PROBLEM

Property Registry is one of the use cases that involve a lot of intermediaries to put trust in the system. The existing solutions in place are out of date. Tracking who owns which pieces of property is challenging when you have thousands of land records to maintain and mostly all these records are not digitized or take a long time to get digitized.

3. SOLUTION

The transparent nature of blockchain can make it possible to trace how property changes hands. Blockchain's immutable, auditable and traceable features are enticing governments around the world to implement the decentralized technology in the land registry process.In our project we try to make a system that is trustworthy and transparent in the dealings of property records.A solution of Decentralised application or DAPP is proposed through this project which will be one stop shop for buying, selling or registration of land transfer.

Feasibility Study Report

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1.INTRODUCTION

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.

1.1 PURPOSE

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.

1.2 CURRENT SYSTEMS AND PROCESSES

The involvement of middlemen and brokers makes the process expensive and tedious. There are a lot of fraud cases due to fake ownership. There is a significant time delay – two to three months from registration to completion.

Land registration is prone to error as human interation increases the probability of errors. Current digitized method of property registration occurs on a centralized server which has the following disadvantages – can be misused, tamperable, lack of transparency, inefficient. Multiple Agencies such as - Land Records, Survey, Courts, Bank, and Registration Department) and the lack of coordination amongst them

1.3 System Objectives

The idea of introducing a land register with a blockchain-based solution, or replacing or at least extending an existing one, is due to the manifold application possibilities of blockchain technology. And the Objective is to provide :
1)Faster implementation of a pending ownership transaction in the land register,
2)Automated notifications of ownership changes or changes in the land register,
3)Greater transparency of transactions for customers around the change of ownership in the land register,
4)Allowing digital archives for contracts and files among stakeholders, More flexibility and robustness,
5)Greater security for land registry actors through more transparency.

1.4 Issues

Blockchain is best at transmitting small amounts of data. However new updates resolving this are already in implementation. The blockchain technology is still at its nascent stage and there are still some looming legal and administrative ramifications. It is also hard to talk about to users because of its complexity.

1.5 Assumptions and Constraints

Assumptions

1. Since it is a relatively new technology, the common people must be made aware of the benefits and uses of a complex technology like Blockchain.

2. There should be no legal ramifications - the government or concerned higher authorities must comply with implementing this new technology.

Constraints

1. Data must be accurate when it is entered, and records must include enough information to be authoritative about the properties they are referring to.

2. Competition analysis can be necessary before setting up a blockchain. Many blockchains allow anyone to see what has happened earlier in the blockchain, which means competition sensitive information may be visible to rivals. This, as well as other issues – e.g. restrictions on making horizontal joint ventures – need to be dealt with

2. RECOMMENDATIONS AND CONCLUSION

In general, blockchain technology could have possible application in Property Registration. There are some limitations and questions yet to be discussed, but certain processes could surely benefit from implementation of blockchain technology. Mainly trust in data stored in Property Registration in case of developing and transitional countries and time needed for registering changes in data stored in Property Registration, since currently, it could take several months, in case of Sweden, to between one and two years in case of Serbia, to transactions to be registered in Property Registration. Possibility of implementing entire Property Registration in blockchain is still opened for debate. Property Registration have a large amount of data stored in them, both legal and spatial, and in case of application of permisionless blockchain, main limitations would be that only hash codes of documents could be stored in blockchain, requiring some other way of storing documents, either for example in torrents or InterPlanetary File System. On other hand there is a possibility of using permissioned blockchain, that are for example implemented using Hyperledger technology, that would allow certain documents to be stored in blockchain. There is limited number of peer reviewed papers on possible application of blockchain in Property Registration so this field is still in early stages of development and only couple of case studies, so further research in this field is necessary if benefits of blockchain technology could be brought to Property Registration.

Use Case Analysis Document

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4. USE CASE TEMPLATE

5. USE CASE	Blockchain based User registration,Land registration ,transferring ownership of land	
Goal	Use of Blockchain technology to improve the existing problems in property registration.	
Purpose	To make the process of property registration easy,fast,secure by implementing on Blockchain technology	
Preconditions	User should have ethereum account and some ETH in it for Gas fees	
Success Condition	User is able to register himself,add property,other users are able to see all properties,land inspector is able to transfer the ownership of properties	
Failed Condition	User not able to access data	
Primary Actors	Contract owner Land Inspector Users i.e. Seller/Buyer	
Trigger	Contract Deployment ,User registration	
DESCRIPTION	Step	Basic Course of Action
	1	Contract Deployment
	2	Adding Land Inspector
	3	User 1 say seller registers himself
	4	User 2 say buyer registers himself
	5	Land Inspector verify them
	6	User 1 Adds property,Land Inspector verify the property
	7	User 2 send request to buy the property,user 1 accepts the request, User 2 makes payment
	8	Land Inspector verifies payment and transfers ownership

Software Requirements Specification

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1.SCOPE

The goal of this project is to replace existing property registration systems with the help of completely online and decentralised blockchain based property registration sytem.Hence Scope include the following functionalities-

1.Developing a backend with smart contracts written in it incorporating all the rules and regulation of a property registration and transfer mechanism.This smart contract would be written in solidity programming language over an etherum blockchain.

2.Creating a Decentralised application or DAPP in flutter with following functionalities-

- Addition of property by the user
- Verification of user's documents and property by the Land Inspector
- Storing of user's documents
- Buying and selling requests for the property by the user
- Acception or rejection of the requests by the Land Owner
- Payment transfer from the property buyer to the seller.
- Verification of payment by land inspector and transfer of ownership

6. SPECIFIC REQUIREMENTS

1.Smart Contract –
This is the heart of the complete solution.The backend of this project is a smart contract written in a solidity programming language.This smart contract contains all the specifies rules and regulations regarding the property dealings.This technology can program conditional transactions and build turing complete smart contracts giving it the ability to emulate human behaviour. Smart contract architecture consists of logic, properties, ledger.These smart contracts are executed with the help of ethereum blockchain.

2.Decentralised Application or DAPP-
Decentralized applications provides blockchain features and services to the outside world for interactions . Web frontend is outside the blockchain protocol and it can only link into the blockchain smart contract using artifacts generated by the smart contract compile process.
DApp is one of the most important components, which does not run directly on the blockchain and includes user interfaces for buyers, sellers, notaries and land registries.

3.IPFS-
As the project deals with storing of sensetive personal information of the users Interplanetary File storage system should be preferred.It is a decentralised file storage sytem and provides high throughput ,data distribution and low latency.

4.metamask-

A software cryptocurrency wallet which is used to interact with ethereum blockchain.It allows user to access their ethereum wallet through a browser extension which is used to interact with DAPP.

5. Ropstan Testnet-

Before launching the smart contract on the mainnet developer tests smart contracts in production like environment called as Testnet. Ropstan Testnet is a proof of work testnet.This means its best like for like represention of ethereum.

6.Truffle suite-

To test the working of the smart contract ,deployment of a contract and management of blockchain transactions truffle suite is to be used.It comes with smart contract compilation and deployement environment and asset pipeline for ethereum testing of contract becomes easy.The built in blockchain explorer Ganache examines all the blocks and transactions to gain the insight of what's happening under the hood.

Software Project Plan

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1.GOALS

The main goal of the project was to build a solution which consisted of a decentralised application. The complete setup should serve the following purpose：

1. Provide a interface for the user to buy/sell their properties.
2. Provide a interface for the land inspector to verifiy the transactions involved in property dealing and transfer the land ownership.
3. User should be able to carry out the deals easily and in transperant manner.
4. Solution should be able to handle multiple users.
5. Generate a digitally verified ownership transfer document.

Project Goal	Priority	Comment/Description/Reference
Functional Goals:		
Buyer / Seller solution	2	providing seamless, secure, cheap and fast transfer of land between buyer and seller
Land Inspector solution	2	giving land inspector the authority to transfer ownership of land to eliminate possibility of fraud
Technological Goals:		
Write a Smart contract	1	Incorporate all the rules and regulations in form of a smart contract
Develop front end UI	3	Develop a interface for the application

System Implementation Document

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1. IMPLEMENTATION

There are 5 main components of the project -

1. Flutter
2. Smart Contract
3. Truffle
4. Metamask
5. web3.js

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.

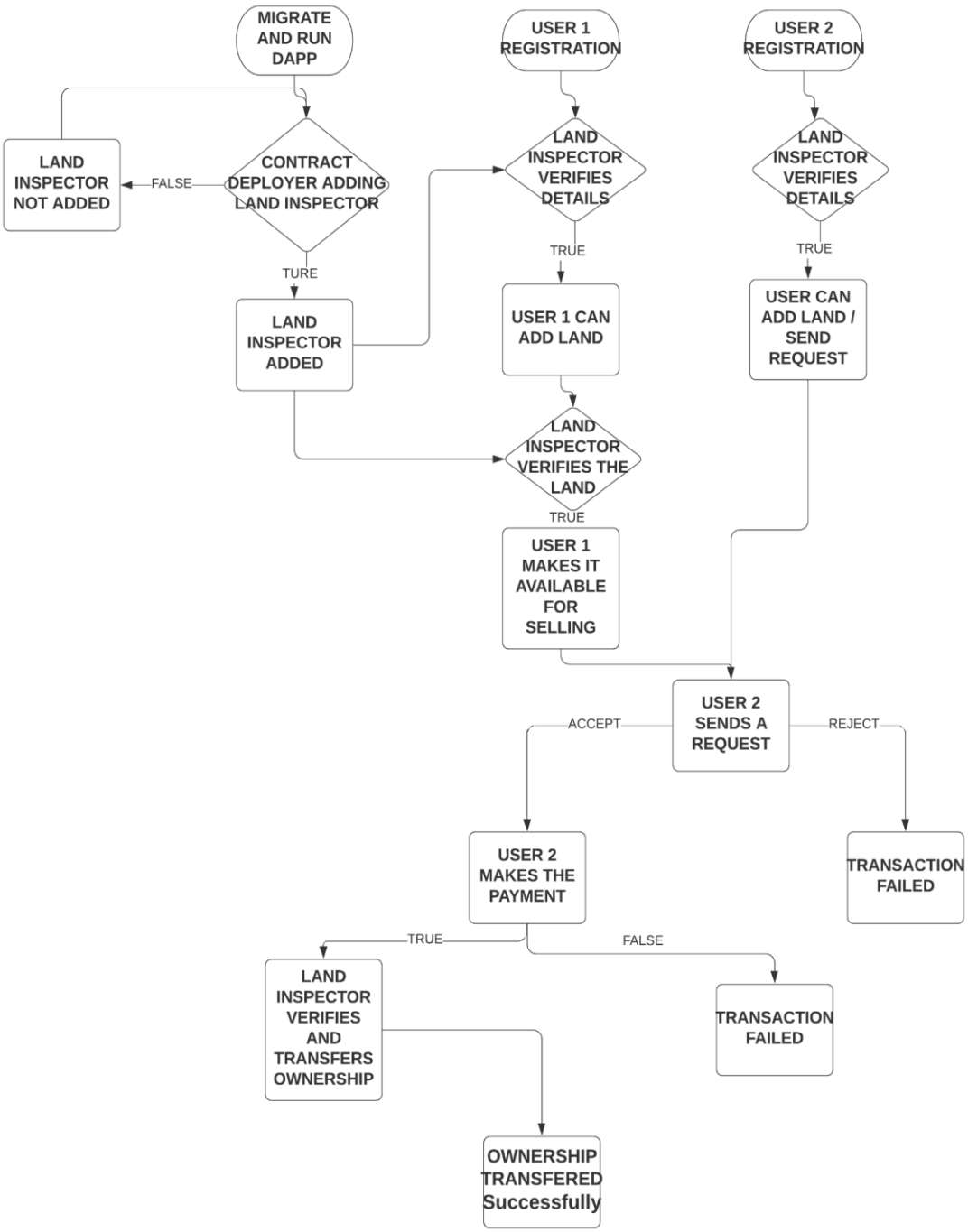
Smart Contract - Blockchain is to bitcoin, what the internet is to email. A big electronic system, on top of which you can build applications. Currency is just one. Bitcoin supports an optional and special feature called scripts for conditional transfer of values. Ethereum blockchain extended the scripting 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.

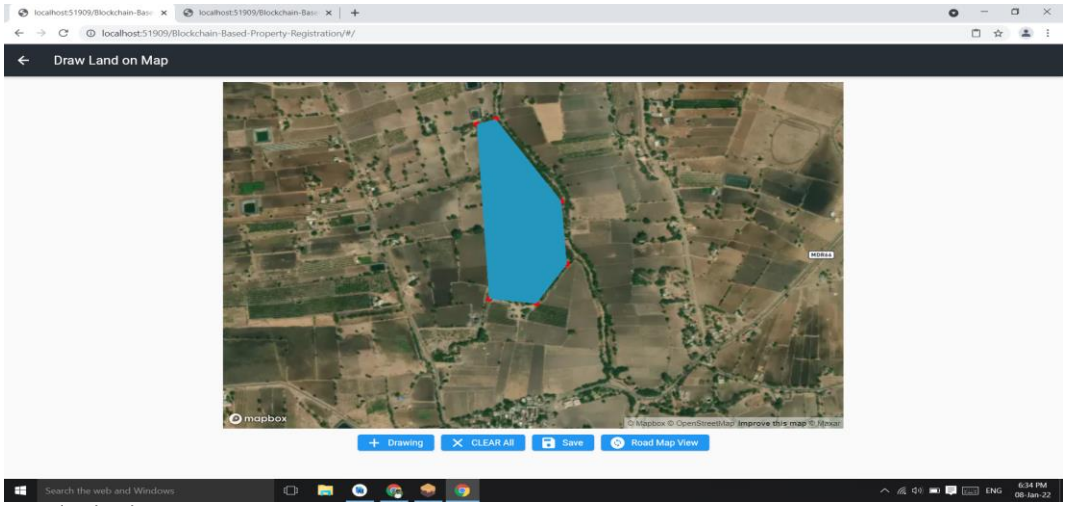
Flow Diagram –



Project Flow -

6.1

- 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 FileCoin.
- 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 there land on map as we can see below image.



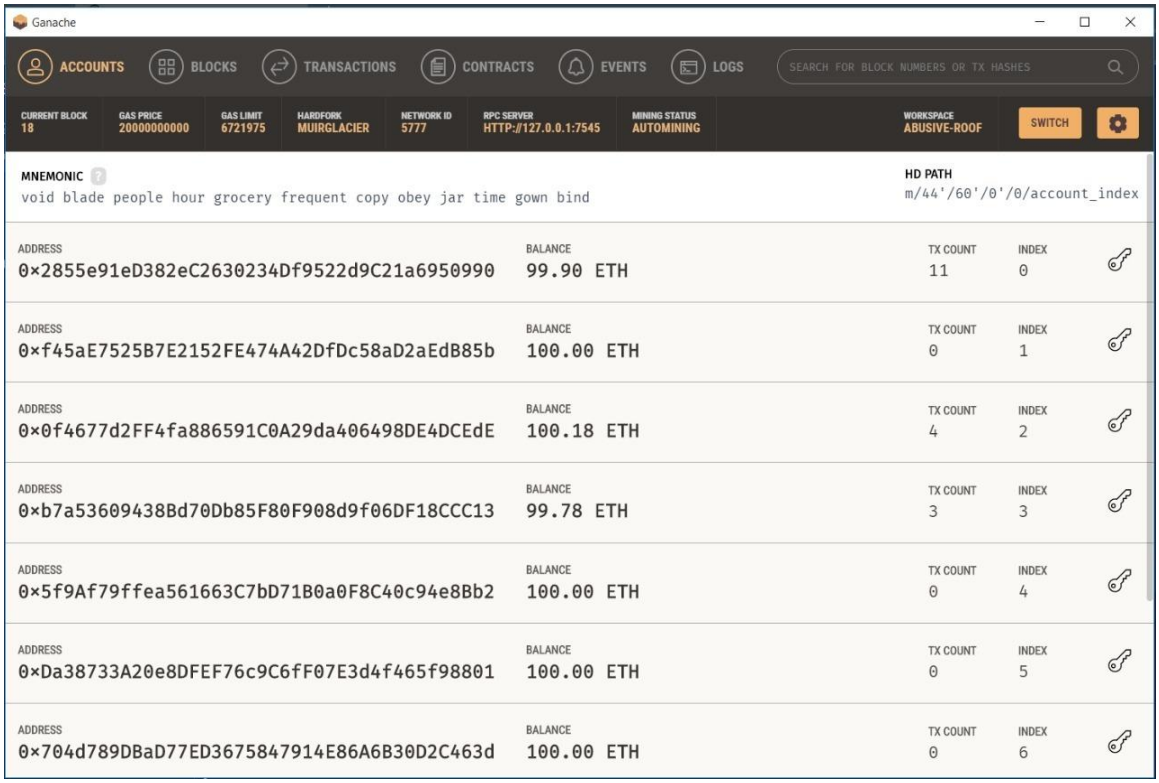
Drawing land on map

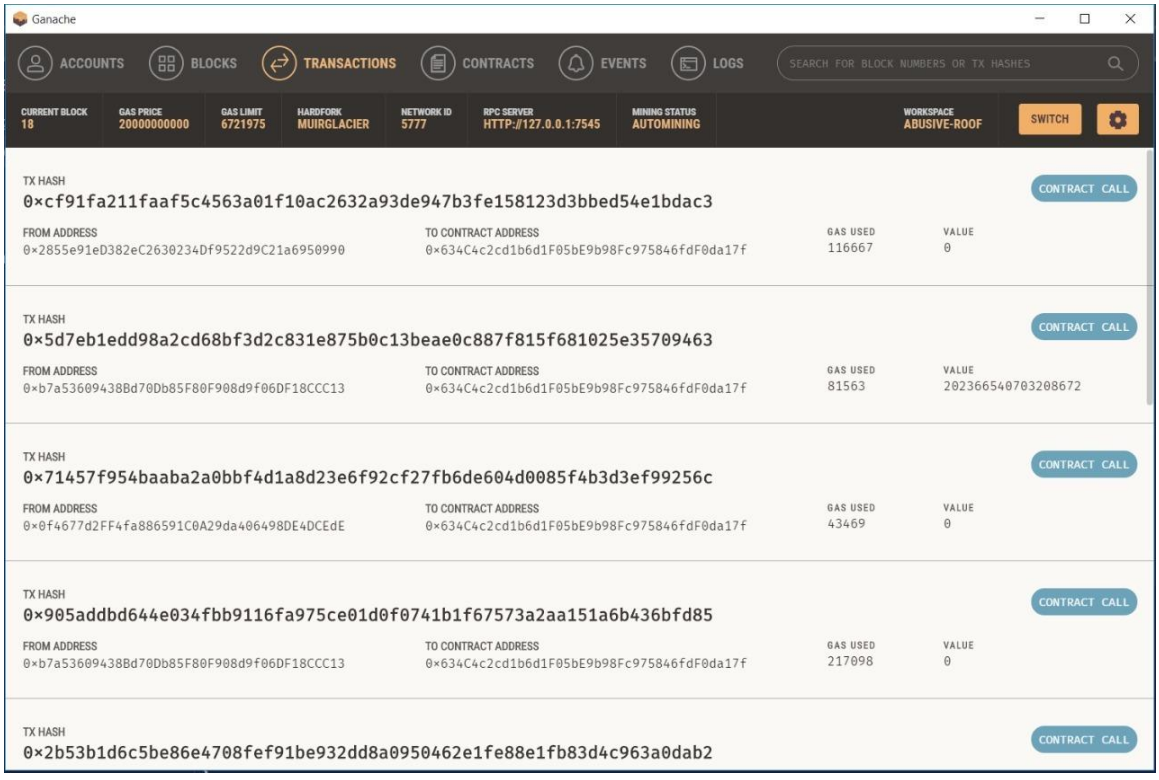
- After land adding,only the Land inspector can verify it.
- After land has been verified by the land inspector, user i.e owner of that land can make it on sell.
- Once it is on sale, all other users can see all the lands in the land Gallery option. Here they can see all land details,area on the map 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 transfering 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 his my land option.

2. 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.

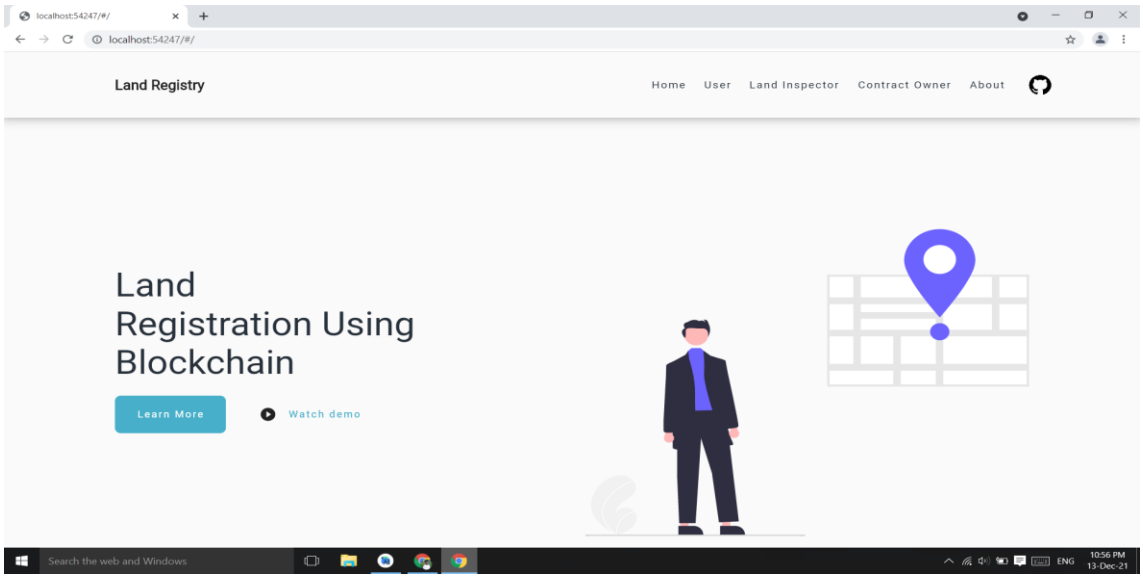
Ganache - Ganache is an Ethereum simulator that makes developing Ethereum applications faster, easier, and safer. It includes all popular RPC functions and features (like events) and can be run deterministically to make development a breeze. We have used ganache for testing to create blockchain locally.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

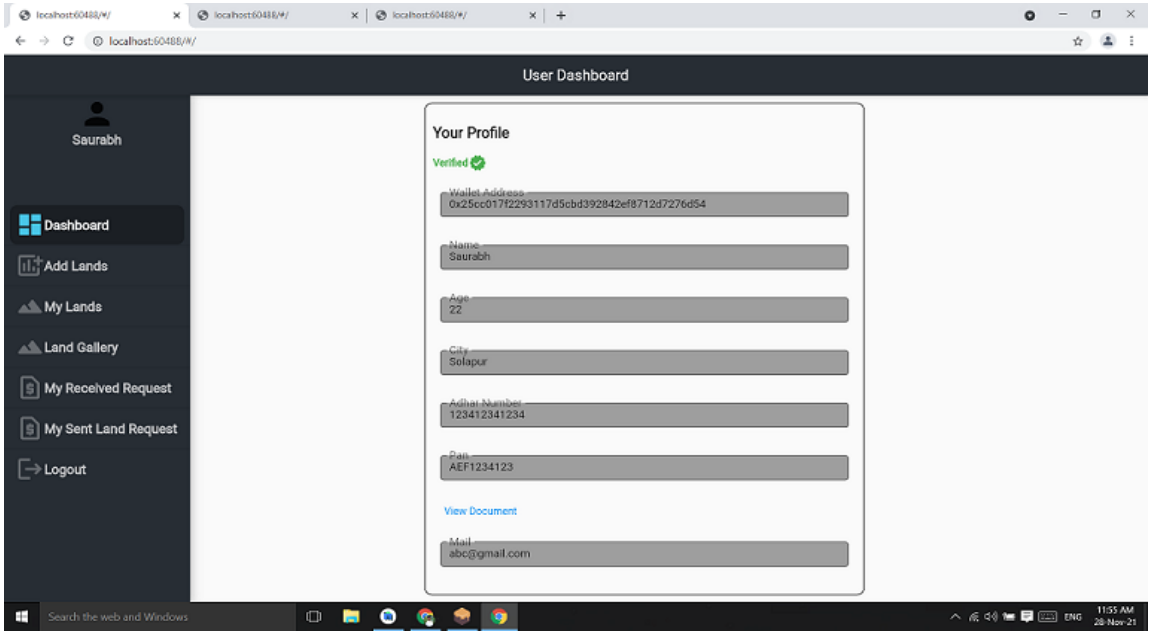

Ganache
ACCOUNTS
BLOCKS
TRANSACTIONS
CONTRACTS
EVENTS
LOGS
SEARCH FOR BLOCK NUMBERS OR TX HASHES
CURRENT BLOCK 18
GAS PRICE 20000000000
GAS LIMIT 6721975
HARDFORK MUIRGLACIER
NETWORK ID 5777
RPC SERVER HTTP://127.0.0.1:7545
MINING STATUS AUTOMINING
WORKSPACE ABUSIVE-ROOF
SWITCH
MNEMONIC
void blade people hour grocery frequent copy obey jar time gown bind
HD PATH
m/44'/60'/0'/0/account_index
ADDRESS 0×2855e91eD382eC2630234Df9522d9C21a6950990 BALANCE 99.90 ETH TX COUNT 11 INDEX 0
ADDRESS 0×f45aE7525B7E2152FE474A42DfDc58aD2aEdB85b BALANCE 100.00 ETH TX COUNT 0 INDEX 1
ADDRESS 0×0f4677d2FF4fa886591C0A29da406498DE4DCEdE BALANCE 100.18 ETH TX COUNT 4 INDEX 2
ADDRESS 0×b7a53609438Bd70Db85F80F908d9f06DF18CCC13 BALANCE 99.78 ETH TX COUNT 3 INDEX 3
ADDRESS 0×5f9Af79ffea561663C7bD71B0a0F8C40c94e8Bb2 BALANCE 100.00 ETH TX COUNT 0 INDEX 4
ADDRESS 0×Da38733A20e8DFEF76c9C6fF07E3d4f465f98801 BALANCE 100.00 ETH TX COUNT 0 INDEX 5
ADDRESS 0×704d789DBaD77ED3675847914E86A6B30D2C463d BALANCE 100.00 ETH TX COUNT 0 INDEX 6


Ganache
ACCOUNTS
BLOCKS
TRANSACTIONS
CONTRACTS
EVENTS
LOGS
SEARCH FOR BLOCK NUMBERS OR TX HASHES
CURRENT BLOCK 18
GAS PRICE 20000000000
GAS LIMIT 6721975
HARDFORK MUIRGLACIER
NETWORK ID 5777
RPC SERVER HTTP://127.0.0.1:7545
MINING STATUS AUTOMINING
WORKSPACE ABUSIVE-ROOF
SWITCH
TX HASH 0×cf91fa211faaf5c4563a01f10ac2632a93de947b3fe158123d3bbed54e1bdac3 CONTRACT CALL
FROM ADDRESS 0×2855e91eD382eC2630234Df9522d9C21a6950990
TO CONTRACT ADDRESS 0×634C4c2cd1b6d1F05bE9b98Fc975846fdF0da17f
GAS USED 116667
VALUE 0
TX HASH 0×5d7eb1edd98a2cd68bf3d2c831e875b0c13beae0c887f815f681025e35709463 CONTRACT CALL
FROM ADDRESS 0×b7a53609438Bd70Db85F80F908d9f06DF18CCC13
TO CONTRACT ADDRESS 0×634C4c2cd1b6d1F05bE9b98Fc975846fdF0da17f
GAS USED 81563
VALUE 20236654070320867 2
TX HASH 0×71457f954baaba2a0bbf4d1a8d23e6f92cf27fb6de604d0085f4b3d3ef99256c CONTRACT CALL
FROM ADDRESS 0×0f4677d2FF4fa886591C0A29da406498DE4DCEdE
TO CONTRACT ADDRESS 0×634C4c2cd1b6d1F05bE9b98Fc975846fdF0da17f
GAS USED 43469
VALUE 0
TX HASH 0×905addbd644e034fbb9116fa975ce01d0f0741b1f67573a2aa151a6b436bfd85 CONTRACT CALL
FROM ADDRESS 0×b7a53609438Bd70Db85F80F908d9f06DF18CCC13
TO CONTRACT ADDRESS 0×634C4c2cd1b6d1F05bE9b98Fc975846fdF0da17f
GAS USED 217098
VALUE 0
TX HASH 0×2b53b1d6c5be86e4708fef91be932dd8a0950462e1fe88e1fb83d4c963a0dab2 CONTRACT CALL

3. RESULTS

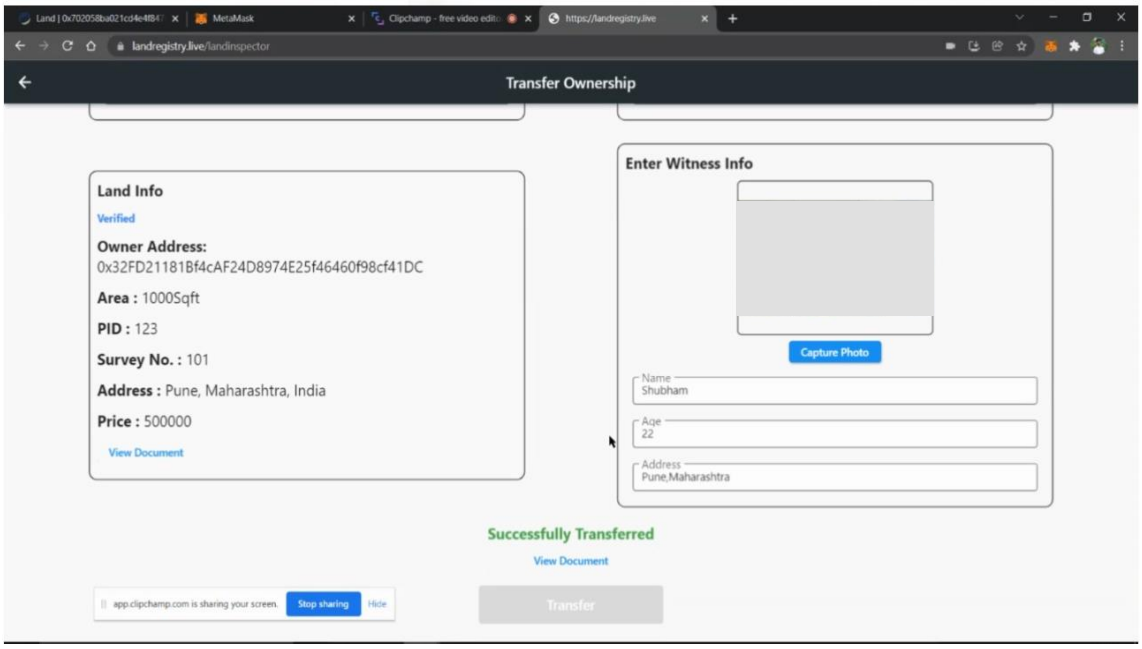
Login Page - On the front screen, one can login as a user, land inspector, or contract owner. The contract owner can add a land inspector and see all the added land inspectors. The land inspector's dashboard consists of the functionality to verify user, verify land and transfer ownership. If we login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

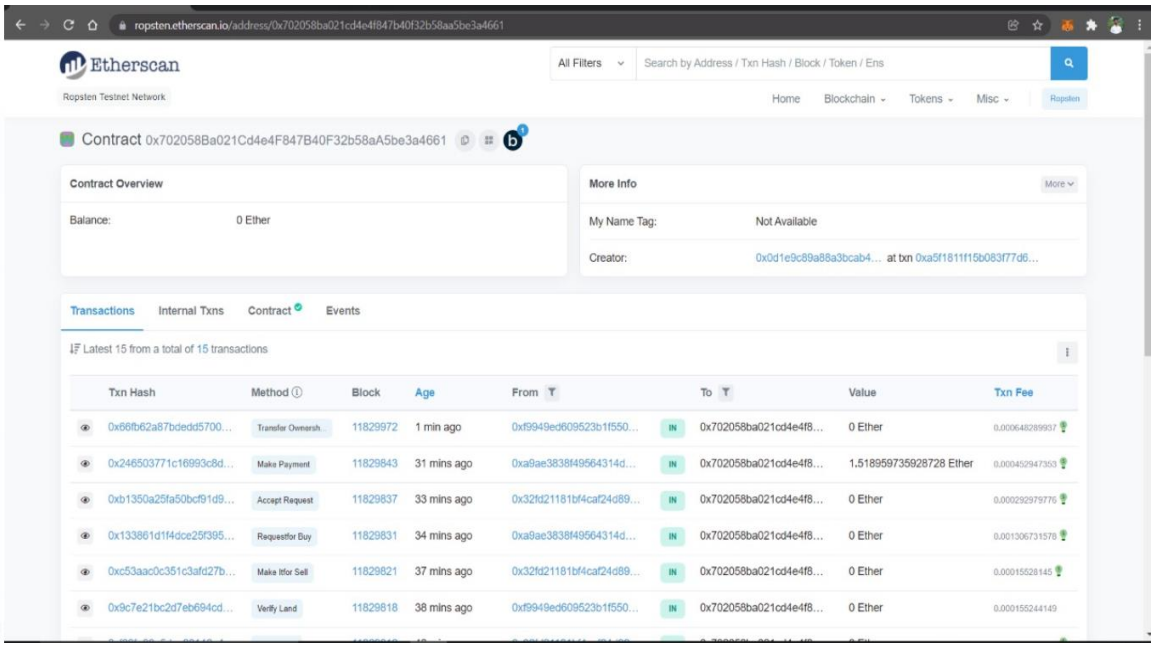




Working - First user adds his land details which are verified by the land inspector. To buy or sell land, user must send a request to land inspector. After the request has been

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.





4. CHALLENGES

There are certain limitations with using blockchain technology for property registration -

- Amount of data - blockchain is best at transmitting small amounts of data
- Technology is still early.
- Hard to explain and talk about to users.
- There must be a clear legal basis for enforcement of agreements made while setting up the blockchain.

5. 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 netowork-Currently the blockchain network is deployed on the ropsten testnet 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 realtime 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 realtime.

CONCLUSION

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.

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