Blockchain based land registry system using Ethereum Blockchain

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Abstract- Land registry in India as well as in many parts of the world is very slow and cumbersome process. There are also many intermediaries involved in the process of land registration. Developing a system that not only accelerate the process of land registration, but also make it easier for Buyers, Sellers and Government registrars to transfer the land ownership from seller to a new buyer, is only possible by creating a distributed system that store all the transactions made during the process of land buying. In this paper we'll try to explore the possibilities and problems solved by using a blockchain based system for land ownership transfer. The system that we are trying to implement is based on Ethereum Blockchain that will store all the transactions made during the process of land ownership transfer. Using the concept of smart contracts of blockchain technology we can triggers various events like access of land documents to a land inspector and fund transfer event from buyer to seller after successful verification of the land ownership transfer. This system will solve the problems faced by all the three parties during the land registration and will also remove the intermediaries like property dealers. This system makes the process of land registration resilient and decrease the cases of fraud in the process. Using the system, validation of the lands is also possible as immutable transactions are being stored in the public ledger.

Keywords – Ethereum (ETH), Blockchain (BC), Cryptography (CRYP), Ledger (LED), Distributed Transaction (DT), Land Registration (LR)

I. INTRODUCTION

For land, being a high-valued asset, it is very important to have accurate records which identify the current owner and provide the proof that he is indeed a owner. These records can be used to:

a)   protect owner's rights

b)   prevent sale frauds

c)   resolve disputes

d)   make sure ownership is correctly transferred to a new ownership

Thus, it is crucial to maintain correctness and completeness of this information, and prevent unauthorized, fraudulent changes. [5][8][12]

Currently people rely on third party, i.e., government agencies that are responsible for keeping track of ownership information. This third party keep all the records in the centralized database. Hence to transfer the ownership, it becomes difficult and slow to first find verify the land and then transfer the ownership.[16]

It is possible to keep track of the property ownership if we have a distributed system which stores all te land history and share it among the interested buyers. This would remove the intermediaries. And seller can directly contact the buyer. Thereby removing the extra cost and time that is needed to be spent on the intermediaries.

At minimum a blockchain based ledger is needed that stores the transactions done in the process of land ownership transfer. This problem is solved by Satoshi Nakamoto in his paper about bitcoins when he created[1][4]:

a)   storing the information in a blockchain,

b)   for correctness protocol rules can be used,

c)   and for identifying the owner public key cryptography can be used.

Ethereum is an free open source platform which helps developers to build and deploy decentralized applications such as smart contracts and other complicated legal and financial applications [15]. Ethereum is kind of a programmable Bitcoin where developers can use the underlying blockchain to create markets, shared ledgers, digital organizations, and other endless solutions application to a problem that need immutable data and agreements, all without the need for a moderator or realtor. Released in 2015, Ethereum is the brainchild of the prodigious Vitalik Buterin, who saw the potential uses of Bitcoin's underlying blockchain technology as the next steps in speeding the expansion of the blockchain community. Ethereum is now currently the cryptocurrency with the second highest coin market cap and is expected by some to surpass Bitcoin as both a valued investment and as the world's most popular cryptocurrency.[2][9]

Hence Ethereum is best suited for creating a ledger that stores transactions during the land ownership transfer process. The aim is to create a ledger along with some smart contracts that will triggers the various events that are going to happen on the system during the process of ownership transfer.[10][11][17]

The roles in the system are:

• Buyer: Buyers needs to register himself by providing the documents issued by government. Then he can see the land which is available.

• Seller: seller needs to register himself as a seller, he will upload photos of the land, along with the documents of the land. Moreover, he needs to pin the land on the map.

• Land inspector: An official from land registration government agency, he inspects the documents once any seller approves the request of buyer to buy the land.

II. CURRENT LAND REGISTATION PROCESS IN INDIA

Buying a piece of land in India is very crucial and you need to pay due diligence to the entire process. Especially, you have to make sure all the papers are clear from title defects and other legal issues.[5][7]

It is best to register your land with the help of reputed legal professionals and lawyers as they scrutinize each and every document and offer the advice on whether to proceed further or not.

Procedure for land registration:Document verification: As the first step, all the documents related to the land should be verified.

a) Drafting of the deed: Irrespective of the way you have obtained the land, it is important you have the correct deed. For instance, if it is a gift, a gift deed is required. If it is a purchased one, a sale deed mentioning the contract, payment, terms and conditions agreed by the seller and the purchaser, tenure of the payment, etc. Encumbrance certificate: This document confirms that the land has no legal liabilities like loans and mortgages.

b) Preparing stamp paper: To execute property transaction and related documents like conveyance deed, sale deed and sale agreement, a fee has to be paid to the government. It is called stamp duty. You need to get the stamp paper from authorized vendors.

c) Execution of the deed: The deed must be executed at the Registrar's office and both the parties have to be presented to duly sign the documents. If anyone of the parties either seller or purchaser is not available, then a Power of Attorney can be given to proceed with the execution.

d) Registration: As a final step, once all the documents are reviewed and found to be perfect, the land will be registered. Personal documents like PAN, Aadhar, etc. Unlike residential and commercial buildings, for land, there is no field inspection by the authorities.[13]

There are following challenges involved in current land registration process:

2.1.   The Involvement of middlemen and brokers

Middlemen and brokers are the crucial part of every big business as they know more about market offerings. Buyers and Sellers usually prefer to take help from these to get reliable support as a result, buyers acquire a deeper understanding of the market and identify lower/higher prices for the transaction. Middlemen gather required information from traders, identify errors, interpret and facilitate the implementation of real estate transactions, since real estate is big business, it involves a huge number of players, including brokers, lenders, intermediaries and local governments. It leads to additional costs, making the entire ecosystem expensive.

2.2.   The increasing number of fraud cases

There have been several cases of impersonators posing as the seller of a property. If an impersonator successfully pretends as a property owner, they may receive the full amount of after completion and escape with the funds. In many of the cases, both sellers and buyers were unaware of the fraud until discovered by the land registry as part of a spot check exercise.

2.3.   Time Delays

There have been several cases of imposters posing as the seller of a property. If an imposter successfully pretends as a property owner, they may receive the full amount of after completion and escape with the funds. In many of the cases, both sellers and buyers were unaware of the fraud until discovered by the land registry as part of a spot check exercise.[14]

III. THE PROCESS OF LAND REGISTRATION ON OUR PLATFORM

Stakeholders involved in the Blockchain Land Registry Platform:

•   Buyer: A person who is interested in buying the land and uses the platform to search the property, request access and interact with the seller and get the land title ownership.

•   Seller: A person who is interested in selling the land and uses the platform to manage property's details and transfer land title to buyers

•   Land Inspector: a person who audit the land transferring process and act a legal body under who's supervision this buying and selling is done.
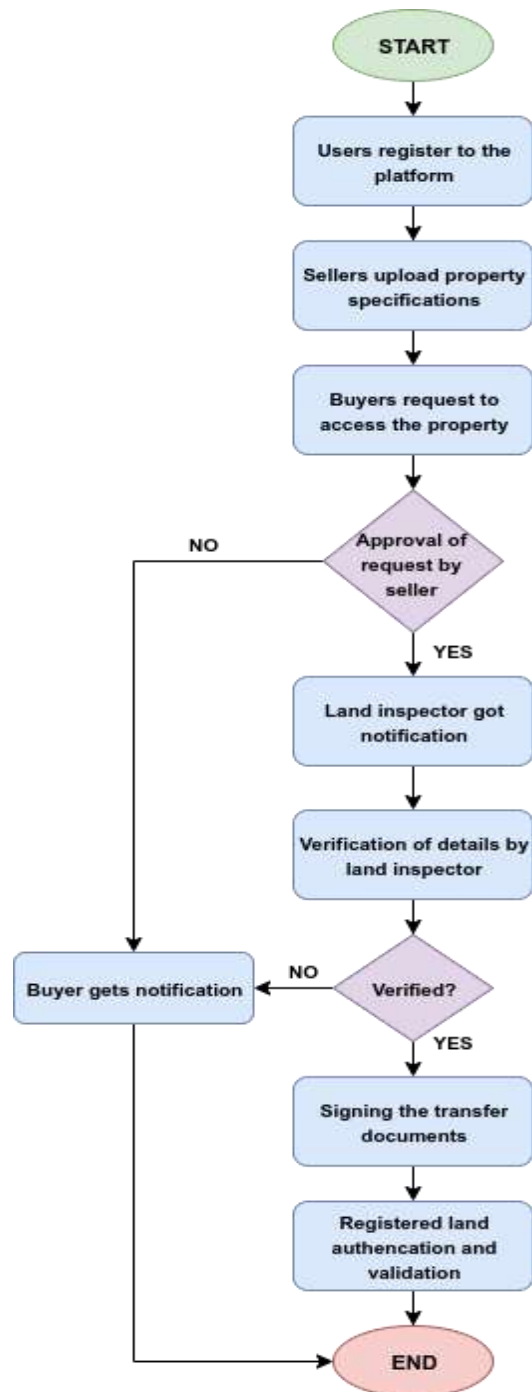
Fig. 1 Flow Chart for Land Registry

Stepwise approach for land registration:

Step 1: Users register to the platform:

Users who either want to sell or buy properties register to the blockchain land registry platform.

They can create the profile on the platform with details like name, government-issued ID proofs and designation. A hash for the identity information submitted by the users gets stored on the blockchain.

Step 2: Sellers upload the property specifications on the platform:

Sellers can upload properties' images and documents on the platform and pin the land's location on the map. The transaction corresponding to the seller's action of listing the property details is recorded on the blockchain.

Once the property's details are uploaded to the platform, it is made available to all users who have signed up as a buyer.

Step 3: Buyers request access to the listed property:

A buyer interested in any specific property can send a request to access its specification to the seller.

Sellers receive notification for property access requests. They can either deny or accept it by looking at the buyer's profile.

Buyers can view the previous ownership records of the property and send a request to purchase it and initiate the transfer.

Transactions corresponding to the requests made by both sellers and buyers are recorded on the blockchain to ensure authenticity and traceability.

Step 4: Sellers approve the transfer request and land inspector gets the notification:

If the seller approves the land ownership transfer request, the land inspector gets the notification to initiate the transfer of property. Smart contracts trigger to provide land documents' access to the land inspector.

After the land inspector verifies the documents, they schedule the meeting for ownership transfer with buyer and seller.

The meeting record is also added to the blockchain to solve property related disputes if occur in the future.

Step 5: Verification of transaction by Land Inspector and initiation of transfer:

Land inspector verifies the documents submitted by buyers and sellers and uploads the authenticated records to the blockchain land registry platform.

Sellers and buyers sign the property ownership transfer document in front of the land inspector on the same platform.

The signed document gets saved in the database and transactions corresponding to it are recorded on the blockchain.

The transfer is initiated and smart contracts trigger to send funds to the seller and title's ownership to a new buyer.

The seller no longer needed to wait for funds to transfer, as soon as all authentication conditions meet funds will be transferred in no time.

Step 6: Registered Land Document Validation and Authenticity:

In case of any disputes, any authorized party can claim the verification by uploading all documents(authenticated) , and

an unbiased party search by passing it to a hash function

If hash generated after uploading the document is the same as that of the hash created at the time of signing the document, then the document is authenticated and no modifications have been made to the document.

IV. SMART CONTRACTS TO TRIGGER THE EVENTS

4.1.   For Land verification

In the below contract function create land

Will create a new structure instance for a land to be registered and its field. Al the verification of documents will be done after the lab details are being saved.

The function verifyLand will just update the land status to verify, this function can only be accessed privately.

Function updateLand will be further update of any changes occurs in land

All 3 functions are meant to update data in contact

When these data changes this will create a transaction, which will cost some ether

Contract:

```
pragma solidity >=0.4.22 <0.6.0;

contract Land {

  struct Landreg {

    uint area ;

    string location ;

    string addr ;

    address owner ;

     bool verificationStatus ;

    }

 Landreg[] public lands;

 function createLand(uint area, string memory location,  string memory addr, address owner) public

 {

    Landreg memory newLand = Landreg({

      area : area ,

      location : location ,

      addr : addr ,

       owner : owner,

       verificationStatus : false

    });

    lands.push(newLand);

 }

 function verifyLand(Landreg memory land) private view returns(string)

 {

    require(land.verificationStatus == true);

     return "land is verified" ;

 }

   function updateland(Landreg memory land , uint area, string memory location,  string memory addr, address owner, bool vs) private {

      land.location = location ;
```

```
        land.area = area ;

        land.owner = owner ;

        land.addr = addr ;

        land.verificationStatus = vs;

    }

}
```

4.2.   For User verification

In below contract function create new user every time called. Update will just update the existing user. This contract keeps records of user existence and changes in their profile.

Contract:

```
pragma solidity >=0.4.22 <0.6.0;

contract User {

  struct Userreg {

      string name ;

       string documents ;

      uint age ;

       string ty ;

       string addr ;

       bool isverified ;

    }

    Userreg[] public users ;

     function createuser(string memory name , string memory documents , uint age , string memory ty, string memory addr ) public{

          Userreg memory newReg = Userreg({

             name : name ,

             documents : documents,

             age : age ,

             ty:ty ,

             addr : addr  ,

             isverified : false

          }) ;

       users.push(newReg);

    }

     function update(Userreg memory usery , string memory name , string memory documents , uint age , string memory ty, string memory addr , bool isverified ) public {

        usery.name = name ;

        usery.documents = documents ;

        usery.age = age ;
```

```
        usery.ty = ty;

        usery.addr = addr;

        usery.isverified = isverified;

    }

}
```

V. VARIOUS TRANSACTIONS INVOLVED IN THE BLOCKCHAIN

• Seller uploads a land:

When the seller uploads any land with relevant documents on the platform, he will make a transaction that will be stored in a blockchain. Hence blockchain will have transactions for every land uploaded on the system.

• Requests made by seller and buyer:

When buyer requests the that he/she is interested in buying the land. The transaction corresponding to that request will get stored in the blockchain.

• Record of meeting between land inspector, buyer and seller:

The record of meeting attended by all the three stakeholders will get stored in the blockchain to resolve further disputes. This will ensure the buyer for the authentication of the land and seller both.

• Documents signed:

Once the buyer and seller sign the documents about successful land purchase. The corresponding transaction about the signed documents along with new ownership of land gets stored in the blockchain.

All the above transactions will be stored in a ethereum blockchain and can be further useful, if there is any disputes regarding a particular piece of land or anything.

Thereby making a digital, immutable record system for lands.[3][6]

VI. LIQUIDATION OF LAND PROPERTY AS AN ADDITIONAL FEATURE

Lands are non-liquidated properties. Using the blockchain technology and digitization of land registry process done by the platform, we can get the Government prices of a land (in India every land has some price that is decided by the Government of India). Using that price, we can give our users an equivalent amount cryptocurrency. The cryptocurrency can be further transformed into currency. The area corresponding to the cryptocurrency converted will get depleted from the ownership of the user.

VII. CONCLUSION

In this paper the authors proposed a seamless, easy to use and hustle-free platform which can be used for making the land registration easy. There are many problems such as involvement of brokers or middleman, time delays, etc. This platform will eliminate the problems associated with land registration in India as well as in many parts of the world. The steps involved in the process of land registration are discussed in details in the paper. Making land registration paperless will not only make the process easier but also secure the papers of ownership of land from various man-made and natural disasters. The blockchain technology is emerging very rapidly due to secure features it offer. Hence using blockchain to save the land record transaction is the way to create the immutable records. There are many additional features that can be added to the platform of land registry. Nowadays, land is not a liquidated asset. By using the platform land assets can also be liquidated using the cryptocurrency, that maps with the land record created by a seller on the platform. Hence the scope is wide and there can be many use cases of the platform created.

REFERENCES

[1] Nakamoto, Satoshi. Bitcoin: A peer-to-peer electronic cash system. Manubot, 2019.

[2] Baliga, Arati. "Understanding blockchain consensus models." Persistent 2017.4 (2017): 1-14.

[3] Vos J. Blockchain-based land registry: panacea illusion or something in between?. InIPRA/CINDER Congress, Dubai. European Land Registry Association (ELRA) 2017 Oct.

[4] Anand A, McKibbin M, Pichel F. Colored coins: Bitcoin, blockchain, and land administration. InAnnual World Bank Conference on Land and Poverty 2016.

[5] Oprunenco A, Akmeemana C. Using blockchain to make land registry more reliable in India. LSE Business Review. 2018 Apr 13.

[6] Alketbi A, Nasir Q, Talib MA. Blockchain for government services—Use cases, security benefits and challenges. In2018 15th Learning and Technology Conference (L&T) 2018 Feb 25 (pp. 112-119). IEEE.

[7] Barbieri M, Gassen D. Blockchain–can this new technology really revolutionize the land registry system. InLand and Poverty Conference 2017: Responsible Land Governance 2017.

[8] Graglia JM, Mellon C. Blockchain and Property in 2018: At the End of the Beginning. Innovations: Technology, Governance, Globalization. 2018 Jul;12(1-2):90-116.

[9] Benbunan-Fich R, Castellanos A. Digitization of Land Records: From Paper to Blockchain.

[10] Valenta, Martin, and Philipp Sandner. "Comparison of ethereum, hyperledger fabric and corda." [ebook] Frankfurt School, Blockchain Center (2017).

[11] Gencer AE, Basu S, Eyal I, Van Renesse R, Sirer EG. Decentralization in bitcoin and ethereum networks. arXiv preprint arXiv:1801.03998. 2018 Jan 11.

[12] Deininger, K., & Feder, G. (2009). Land registration, governance, and development: Evidence and implications for policy. The World Bank Research Observer, 24(2), 233-266.

[13] Zevenbergen, Jaap. "Systems of land registration aspects and effects." Publications on Geodesy, 51 (2002).

[14] Hanstad, Tim. "Designing land registration systems for developing countries." Am. U. Int'l L. Rev. 13 (1997): 647.

[15] Bogner, Andreas, Mathieu Chanson, and Arne Meeuw. "A decentralised sharing app running a smart contract on the ethereum blockchain." Proceedings of the 6th International Conference on the Internet of Things. ACM, 2016.

[16] Wüst, Karl, and Arthur Gervais. "Do you need a Blockchain?." 2018 Crypto Valley Conference on Blockchain Technology (CVCBT). IEEE, 2018.

[17] Vujičić, Dejan, Dijana Jagodić, and Siniša Ranđić. "Blockchain technology, bitcoin, and Ethereum: A brief overview." 2018 17th International Symposium INFOTEH-JAHORINA (INFOTEH). IEEE, 2018.