

Smart Contract Definition for Land Registry in Blockchain

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Abstract- Land Registry System in India is a very time-consuming process involving many middlemen, thus increasing the fraudulent cases. These problems can be eliminated by the usage of Blockchain Technology for Land Registry Management in India. This paper highlights issues, such as minimal transparency, accountability, incoherent data sets with different Government Departments relating to the same portion of land and delays in the current Land registry management process. The paper describes the current process of land records maintenance and land registration in the country. It emphasizes on the importance of smart contract for land registry applying the Blockchain.

Keywords: Blockchain, Smart Contract, Solidity, DApp, Land Registry

I. INTRODUCTION

Blockchain technology allows building of applications for storing data in the form of distributed ledgers. Distributed ledgers are digital record books, copies of which are with multiple people and get updated simultaneously, making alteration to the data without the knowledge of all who have copies of the ledgers is virtually impossible. The blockchain solution incorporates many key benefits of the technology, such as immutability in transactional records. Due to which no one can ever doubt on its authenticity. Records are permanently linked to the system so no one can ever interfere with or forge a record of their own. These records can be viewed at any time, by any party. This immutability and security attribute of blockchain differentiates it from other existing decentralized technologies. This is the reason for blockchain being considered by experts as the most suitable architecture for dealings involving multiple stages and various actors such as trade finance, property transactions and specifically for land registration process [15].

As it permits payments to be done without the involvement of any financial organization like banks or any intermediary. Blockchain can be used in different financial service areas like digital assets, remittance and online payment [2], [3]. Moreover, it can also be applied into other areas including smart contracts [4], public services [5], Internet of Things (IoT) [6], reputation systems [7], security services and Land Registration system. No other technology is associated with such a high level of security and flexibility for universal applications as blockchain technology.

II. ISSUES IN PUBLIC SECTORS

Public Sectors are full of human interaction where trust issue becomes the most common problem faced by any individual or company. Buying a piece of land in India is very crucial and you need to pay due diligence to the entire process. Especially, one have to make sure all the papers are clear from title defects and other legal issues. 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.

III. PROCEDURE FOR LAND REGISTRATION

Document verification is the first step for registration. 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.

B. Encumbrance certificate:

This document confirms that the land has no legal liabilities like loans and mortgages

C. 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. Commonly known as stamp duty. One need to get the stamp paper from authorized vendors.

D. Execution of the deed:

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

E. Registration:

It is 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.

IV. CHALLENGES FACED IN LAND REGISTRY

A. *Middlemen, Brokers:*

In every business the Middlemen and brokers are an integral part play a crucial role as they are the one who stores great knowledge about what are the market present value. Buyers and Sellers being a layman, make a call to them to have a in depth knowledge of the market and prices either lower or higher for the trade. The information about traders and errors in land documents are due to calculation of the implementation of real estate transactions by middlemen. The process also gets expensive as it includes a great number of players, including local governments, brokers, lenders, and intermediaries.

B. *Fraud cases:*

There are enormous cases of pretenders posing as the seller of a land or property. If an imposter gets successful in pretending as an owner, they can easily escape with the funds. In many of the cases, both the parties i.e. the sellers and purchasers were ignorant of the fraud until exposed by the land registry as part of a spot check exercise.

C. *Time Delays:*

A long duration is required in Land Registry process to complete the registration. Time duration of approximately two to three months from completion to registration is needed.

D. *Human error/intervention:*

Human interaction increases the probability of errors. This makes the land registry process more vulnerable and it also increase the chances of errors in the entire land registry system.

V. BLOCKCHAIN TECHNOLOGY

“A blockchain is basically a distributed database of records or public ledger of all transactions or digital events that have been executed and shared among participating parties”. Each transaction in the public ledger is confirmed by consensus of most of the members in the system. Information that has entered once can never be erased [1]. For every single transaction ever made, the blockchain contains a sure and verifiable record of it. The technology blockchain has arrived in 1991 but get its edge when Satoshi Nakamoto used it in bitcoin [16]. Bitcoin is the most popular cryptocurrency that work on blockchain technology. The blockchain can be considered as the best solution for the old age problem "trust". Blockchain terminology arrives as it is a chain of block attached through data structure linked list. The peer to peer network and the global updating ledger being used by blockchain to make it non hackable and do valid trustworthy transactions. Peer-to-peer in nature, distributed ledger technology is shared, transparent and decentralized, making it ideal for application in finance and countless other areas such as manufacturing, banking, insurance and the Internet of Things [12] [14]. Peer-to-peer systems are typically designed around the assumption that all peers will willingly

contribute resources to a global pool [13]. Blockchain is considered as technical as well as an economic innovation [8].

VI. SMART CONTRACT

“A smart contract is a computer protocol intended to digitally facilitate, verify, or enforce the negotiation or performance of a contract. Smart contracts allow the performance of credible transactions without third parties. These transactions are trackable and irreversible”. It can be considered as a computer program that is running at the top of blockchain. Smart Contract contains a set of rules which can *automatically* start executing the program when specific set of rules agreed the event. Transparency can be maintained by the smart contract. The Smart Contract deals with businesses, finance, contract law and Information Technology [10]. The Smart Contract Verifies the Agreement, makes an agreement, and transacts an agreement. Smart contract can help us to exchange money and property transparently while avoiding the services disputed by the arbitrators [11]. A smart contract cannot be changed at any time, or no one can compromise the contract with its irreversible property. Contracts are distributed making it impossible for an attacker to force control because all other participants would be notified of the malicious attempt and would by general consensus declare it invalid. As a result, the contract would be blocked by everyone in the network, like a transaction on the blockchain. The rules of the transaction processes are commanded by the smart contract applications, it eliminates the issue of trust from these. It is not required by the users to know the transaction rules as they are dictated by the smart contract. Hence, malicious actions and misinterpretations are ruled out by the system since they are carried out automatically according to the defined protocol [9]. By using smart contracts individuals and small companies can communicate without knowing each other and feel secure for their money because it is the contract that regulates the result. The smart contract in Ethereum network is written in solidity.

A. *Solidity:*

Solidity is a high level language, which is been influenced by languages like C++, Python and JavaScript. It is made from mixer of python, JavaScript and C. The syntax is quite similar to the JavaScript programing language. Solidity is being statistically typed and supports many of the above language features. The contracts or agreements are said to be smart as the transaction will place as soon as the agreements or rules are agreed, due to which it is also known as self-executing contracts. The smart contracts remove the middleman as where physical contracts need it for authentication. It is a high level, contract based programming language. It works on ethereum virtual machine.

B. DApp

The word itself is not defined and it can mean different sets of things for different people. David A. Johnston defines that an APP will be considered DAPP if it completes the following criteria. The application need to be essentially open source, it should be operated autonomously, and none of its units should control its most tokens. The application can customize its protocol in response to proposed improvements and market response, but all changes should be decided by its users unanimously. To avoid any central point of failure, records of application and operation of the application must be stored cryptographically in public, decentralized blockchain. The application should use cryptographic token which is essential for access to the application and the price should be contributed by the value in the token of the application

VII. BENEFITS OF LAND REGISTRY PLATFORM ON BLOCKCHAIN

A. Efficiency in time span

The information acquires by the Middlemen cannot be accessed by the buyer or seller or they might not have the proper authority to operate in transaction environment. But through the blockchain technology a transparency has come as distributed database come with blockchain implied to land registry model. In this model no centralized authority is needed to access the data. At present, owning a land is too slow and old process, the title is just a piece of paper. Deed needs to be filled, sign it, get authorities with rubber stamping and the documents need to be send to the government, which ensure the papers are written and then transfer the property. This might take several working days However; implementing blockchain in land registry platform can fasten the process. There is no need of third party verification as with the blockchains potential to prove authenticity, buyer can buy property from legitimate owners.

B. Improving security

In today's digital world, it get too easy form the editing software to create the fake ownership. Through Blockchain the immutable records are been saved in ledger. Each document is verified through consensus, and smart contract. So from blockchain, the security get increased which get us a proof of existence, transaction, proof of ownership and exchange.

VIII. TRANSPARENCY THROUGH SMART CONTRACTS

Smart contracts are self-executing contracts with the proper terms of the agreement between both the parties. This agreement between the buyer and seller is directly written into lines of code. The code and the agreements contained therein exist across a distributed, decentralized blockchain network.

There is only few number of the buyer who takes property directly. Usually people take loans, which is a too slow process because of banking and administrative issues. Here the contracts termed as smart contract come into play, which leads to make process simpler to complete, by automating verification of transactions. With blockchain in the land registry platform, the seller and the buyer can create, unique decentralized id. In comparison with traditional method this makes transfer of ownership more quickly and seamlessly. When register confirms the property, the smart contracts in blockchain get active and the transaction from buyer to the seller get stores in blockchain ledger. This makes it always possible to track down the records.

Step 1: Registration of users (BUYER/SELLER)

Blockchain land registry platform have a client side application through which the buyer and seller register them. The details need to create the profile is full name, ID proofs issued by the government and designation. A unique hash need to be submitted by the users as an identity information and it is stored on the blockchain.

Step 2: Property details uploaded by the sellers.

Properties images and paper, has to be upload by the seller on the platform and mark the correct location of the lands on the area map with specific measurements. Every detail is being recorded in the database ledger. Now buyer can see and check the details as stored by the seller.

Step 3: Request generated form the buyer's side

The interested buyers can send a request to seller for accessing its specification. Property access requests are received by the seller. Seller by looking at the buyers profile can either deny or accept the request.

Step 4: land inspector

In the blockchain land registry platform, the buyer and sellers submit their documents, it is being verified by land inspector and then the land inspector add the authenticated recorded in the blockchain ledger. In the presence of the land inspector on the land registry platform, Both seller and buyer sign the documents, the land inspector check each and every required field and then save them in the database and the trade get register in the blockchain. The smart contract sees the request and transfers the ownership to the buyer.

Step 5: Authenticity and Validation of documents

The hash value of the document upload by the owner is same to the hash value to the time of buying the property (signing) then the documents is 100 percent authenticated , documents are original and no changes have been made to the document.

IX. CONTRACT

The below code is a contract for land registration written in solidity.

```

1  pragma solidity >=0.4.0 <0.6.0;
2
3  //Land Details
4  contract landRegistration{
5      struct landDetails{
6          string state;
7          string district;
8          string village;
9          uint256 surveyNumber;
10         address payable CurrentOwner;
11         uint marketValue;
12         bool isAvailable;
13         address requester;
14         reqStatus requestStatus;
15     }
16
17
18
19     //request status
20     enum reqStatus {Default,pending,reject,approved}
21
22
23

```

In the above code, line 1 tells about the version of solidity that we are using.

```

19     //request status
20     enum reqStatus {Default,pending,reject,approved}
21
22
23
24     //profile of a client
25     struct profiles{
26         uint[] assetList;
27     }
28
29
30     mapping(uint => landDetails) land;
31     address owner;
32     mapping(string => address) superAdmin;
33     mapping(address => profiles) profile;
34
35     //contract owner
36     constructor() public{
37         owner = msg.sender;
38     }
39     modifier onlyOwner {
40         require(msg.sender == owner);
41         _;
42     }

```

```

//adding village admins
function addSuperAdmin(address _superAdmin,string memory _village ) onlyOwner public {
    superAdmin[_village]=_superAdmin;
}

//Registration of land details.
function Registration(string memory _state,string memory _district,
    string memory _village,uint256 _surveyNumber,
    address payable _OwnerAddress,uint _marketValue,uint id
) public returns(bool) {
    require(superAdmin[_village] == msg.sender || owner == msg.sender);
    land[id].state = _state;
    land[id].district = _district;
    land[id].village = _village;
    land[id].surveyNumber = _surveyNumber;
    land[id].CurrentOwner = _OwnerAddress;
    land[id].marketValue = _marketValue;
    profile[_OwnerAddress].assetList.push(id);
    return true;
}

```

```

//to view details of land for the owner
function landInfoOwner(uint id) public view returns(string memory,string memory,string memory,uint256,bool,address,reqStatus){
    return(land[id].state,land[id].district,land[id].village,land[id].surveyNumber,land[id].isAvailable,land[id].requester,land[id].requestStatus);
}

//to view details of land for the buyer
function landInfoFolser(uint id) public view returns(address,uint,bool,address,reqStatus){
    return(land[id].CurrentOwner,land[id].marketValue,land[id].isAvailable,land[id].requester,land[id].requestStatus);
}

// to compute id for a land.
function computeId(string memory _state,string memory _district,string memory _village,uint _surveyNumber) public view returns(uint){
    return uint(keccak256(abi.encodePacked(_state,_district,_village,_surveyNumber)))/1000000000000000000;
}

```

```
//processing request for the land by accepting or rejecting
function processRequest(uint property,requestStatus status)public {
    require([land[property]].CurrentOwner == msg.sender);
    land[property].requestStatus=status;
    if(status == requestStatus.reject){
        land[property].requester = address(0);
        land[property].requestStatus = requestStatus.Default;
    }
}

//availing land for sale.
function makeAvailable(uint property)public{
    require([land[property]].CurrentOwner == msg.sender);
    land[property].isAvailable=true;
}
}
```

```
// to compute id for a land.
function computeId(string memory _state,string memory _district,string memory _village,uint _surveyNumber) public view returns(uint){
    return uint(keccak256(abi.encodePacked(_state,_district,_village,_surveyNumber)))/1000000000000000000;
}

//push a request to the land owner
function requestToLandOwner(uint id) public {
    require([land[id]].isAvailable);
    land[id].requester=msg.sender;
    land[id].isAvailable=false;
    land[id].requestStatus = requestStatus.pending; //changes the status to pending.
}

//will show assets of the function caller
function viewAssets()public view returns(uint[] memory){
    return ([profile[msg.sender].assetList]);
}

//viewing request for the lands
function viewRequest(uint property)public view returns(address){
    return([land[property].requester]);
}
}
```

```
//buying the approved property
function buyProperty(uint property)public payable{
    require([land[property]].requestStatus == requestStatus.approved);
    require(msg.value >= ([land[property]].marketValue+([land[property]].marketValue/10)));
    land[property].CurrentOwner.transfer([land[property]].marketValue);
    removeOwnership([land[property]].CurrentOwner,property);
    land[property].CurrentOwner=msg.sender;
    land[property].isAvailable=false;
    land[property].requester = address(0);
    land[property].requestStatus = requestStatus.Default;
    profile[msg.sender].assetList.push(property); //adds the property to the asset list of the new owner.
}
}
```

```
//removing the ownership of seller for the land. and it is called by the buyProperty function
function removeOwnership(address previousOwner,uint id)private{
    uint index = findId(id,previousOwner);
    profile[previousOwner].assetList[index]=profile[previousOwner].assetList[profile[previousOwner].assetList.length-1];
    delete profile[previousOwner].assetList[profile[previousOwner].assetList.length-1];
    profile[previousOwner].assetList.length--;
}

//for finding the index of a particular id
function findId(uint id,address user)public view returns(uint){
    uint i;
    for(i=0;i<profile[user].assetList.length;i++){
        if(profile[user].assetList[i] == id)
            return i;
    }
    return i;
}
}
```

X. CONCLUSION

Blockchain Technology has a very useful role in the Land Registration Process because of the various security and immutability features it offers as well as it removes the middlemen involved in the process of land registry. The irreversible and non-hackable attributes of a blockchain are appealing Governments around the globe to implement Blockchain solutions in the Land Registry Process. In India there are numerous fraud cases in land registry process, and it is also a very time-consuming process. By utilizing digital signatures in all stages of land registry, the total time of doing a deal is reduced from several months to few days. The implementation of smart contracts would quicken up the process by automatically updating the ledger, instead of buyers having to transfer ownership through an application form.

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