Blockchain based Land Registry

7/12 extract storage of land details

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Abstract : Land assets hold huge value to farmers as well as other landowners. The Indian system of storing 7/12 extracts on paper, although in digitized format now, has been a source of fraud and cheating. The current system provides digitized records of the paper trail bearing ownership credentials. However, this system depends on Third Party involvement & centralization of data making it susceptible to integrity damages. In our Blockchain-based system we eliminate Third Party involvement by providing a Decentralized system, thus zeroing in on any possible vulnerabilities. The system provides consensus-based validation of blocks of transactions in the blockchain. The system also validates smart contracts upon initialization of a transaction to comply with the Government's smart contract attestation body and taxation norms of ownership transfer.

Index Terms **– Blockchain, Land Registry, Blockchain based asset management.**

I. INTRODUCTION

Middlemen and trusted third parties have become an integral part of all businesses and this is also true for land-based transactions. Land-based transaction although have been digitized in the past decade in our government it still has been a source of fraud and cheating. Land is of vast significance to farmers as their daily bread is dependent on the land. The current system is inept in the sense of providing with safe and secure way of transactions. The proposed system ensures safe transactions by eliminating trusted third parties. Blockchain provides a decentralized and credible alternative to the current system.

1.What is Blockchain:

A blockchain is a chain of blocks that contains a set of transactions or some data. It is a distributed, decentralized system formed through a peer-to-peer network of nodes wherein the chain acts as a digital ledger that stores a transaction or in simple terminology any piece of data. Every peer connected to the network stores a copy of the ledger. On the blockchain, no peer can have a different copy of the ledger; it must be completely synonymous to the copy of the ledger present on other nodes[26].However, due to varying network latencies, a few nodes can take time to update the copy of the chain locally. Blockchain technology has a lot of potential to affect all recordkeeping, including initiation authorizing recording and reporting transactions. Changes in business processes can affect back-office activities. When one participant wants to send value to a different, all the opposite nodes within the network communicate with one another employing a pre-determined mechanism to test that the new transaction is valid. Once Transaction is accepted in the network, all copies in the ledger is updated with new information. Multiple transaction are combined in a single block and added to the ledger .Each block contains information that refers back to previous blocks and thus all blocks in the chain link together in the distributed identical copies. The participating nodes in a Blockchain can only append blocks to the chain, provided that they have the required permissions to start a mining process on their own, they cannot alter or remove any previous blocks because it would render the chain invalid since changing the data inside of a block changes its hash value, which would not corroborate with previous blocks. Hence, if a Blockchain is functionally sound with the conceptual constraints then it works immutably without the requirement of an arbitrator.

2. Problem statement

Develop a Secure, Transparent and Decentralized system to manage storage of 7/12 extract using Blockchain based land registry.

3. Objective:

The aim of this project is to modernize the way data is handled and secured in the 21st century. It will also secure channels of land transactions and prevent any malicious activity to the misfortune of someone.

4. Scope of Blockchain in our project

The focus of this report is to explain blockchain technology and how it could potentially impact the current system of land deals using the 7/12 extracts in some Indian states (Maharashtra, Gujrat etc) Middlemen ad trusted third parties have become an integral part of all businesses and this is also true for land-based transactions. Land-based transaction although have been digitized in the past decade in our government it still has been a source of fraud and cheating. Land is of vast significance to farmers as their daily bread is dependent on the land. The current system is inept in the sense of providing a safe and secure way of transactions. The proposed system ensures safe transactions by eliminating trusted third parties. Blockchain provides a decentralized and credible alternative to the current system.

5.Relevance

A blockchain is, in the simplest of terms, a time-stamped series of immutable record of data that is managed by a cluster of computers not owned by any single entity. Each of these blocks of data (i.e. block) are secured and bound to each other using cryptographic principles (i.e. chain) [10]. In an age where the world is digitizing at a rate faster than ever before, we should be making sure that we are keeping up with the pace and up with the technological advancements that are happening. Land assets in general, which is mutually inclusive of the 7/12 extract, when digitized it provides us with a better way to store, view and update data in an efficient manner. Using a blockchain based system to update and store key data allows us to update the data with a timestamp that is stored on every node and is validated, so there is no question of anyone committing changes to the blockchain without the network peers knowing about it. The system provides very high levels of accountability since no one can change the contents of a blockchain because it then breaks the chain because if the hash value of a Block is changed, it changes the values of the successive block also.

I. LITERATURE SURVEY

In [2] the author has proposed a solution to the current proof of delivery models that are centralized and rely on trusted third parties. So the author has proposed a blockchain-based solution to provide a decentralized system that eliminates the need for trusted third parties to ensure transparency, traceability and credibility. The permission less Ethereum blockchain is used to ensure accountability and integrity. In the paper, the author shows how to implement, verify and test the proper functionality of the proposed Proof of Delivery solution and also provides security analysis and gives an estimate of the cost consumption in Ether gas

In [3] the author has proposed a solution to counterfeits and false ownerships using the Bitcoin blockchain. The author has proposed a Product Ownership Management System for products attached with RFID. The system can be interpreted as a convulsion of Internet-of-Things and Blockchain. The author has used Ethereum platform to implement the proof of concept. Results have shown that, typically, the cost of managing the ownership of a product with up to six transfers less.

In [4] the authors review how blockchain can allow the automation of multi-step processes. The authors find different problems and provide blockchain and IoT combinations as a solution. The author also highlights different issues that have to be considered before deploying the blockchain network in IoT setting. The authors ultimately come to the conclusion that IoT-Blockchain together than act as a revolutionary combination of management of supply chains as well as efficient automation of those processes.

In [5] the author of the paper presents different use cases of Blockchain in several areas of work like finance, medical, asset management et al. The author speaks about the general way of record keeping in these areas of work and how Blockchain can replace old methodologies of record keeping through its applications. The author also speaks about different topologies of Blockchain that are currently in use today and how they pertain to different areas of work as per their functionality. The author puts forward real world use cases and how they were translated into Blockchain applications. The author has given the implications of using Blockchains and how to secure data that might be sensitive which should not be included in the open ledger present on the nodes.

In [10] the author proposes a permission based electronic KYC or electronic Know-Your-Customer system using a Blockchain. For every client, a standard KYC verification will be done only once which can be circulated to all the organisations connected to the Blockchain, this clears the customer as well as the organisation from the hassles of submitting a KYC repeatedly. The implemented Blockchain will also ease problems related to storage of customer data and it will become easy to transfer data from one financial organisation to the other.

In [11] the author presents a white paper regarding the development of Blockchain and its application in the real world. The authors argue a case that Blockchain will revolutionize the way data and information is managed, and that in the coming years we could expect blockchain to entirely take over the data and asset management methodologies that are currently used.

In [12] the authors talk about the general idea and the concept of Blockchain technology and the fundamental idea of Bitcoin, and how it received extensive attention recently. They also talk about how Blockchain works around storing ledgers and how it facilitates transactions between peers. Blockchain-based applications are coming to pace with other upcoming technologies in Information Technology, they also explore its functionality in different work areas. The authors also talk about the challenges that blockchain faces, mainly that of scalability and security. The paper presents a comprehensive overview on blockchain technology. The authors provide a comprehensive overview of the different types of Consensus algorithms that are currently in use and how they impact the Blockchain. They have briefly spoken about the future trends in Blockchain that we can expect to see.

In [13] the authors conduct a concise and conclusive analysis of the popular consensus algorithms that exist today. They talk about the popularity of cryptocurrency and the cropping up of new, virtual currencies or coins based wholly on the concept of Blockchain: a distributed digital ledger in which cryptocurrency transactions are recorded after having been verified. The transactions within a ledger are verified by multiple peers or "validators," within the cryptocurrency's peer-to-peer network using one of many varied consensus algorithms for resolving the problem of reliability in a network involving multiple unreliable nodes.

In [14] the authors speak about smart contracts and their importance in a Blockchain and how since the advent of blockchain, smart contracts have become one of the most sought-after technologies because of the high customizability they add to transactions. The authors also talk about how smart contracts can help facilitate the direct and seamless transitions of transactions or data from one source to another using just by using a small piece of if-else code. However, smart contracts are still in their early stages, developers and organisations do not yet understand the overall implications of the smart contract on the Blockchain and how it in effect will look like when implemented across larger blockchains, users, developers and the organisations that are built on top of smart contracts. The study aims to contribute to the body of knowledge of smart contracts within blockchain technology.

In [23] the authors speak about a blockchain that can execute smart contracts efficiently. They propose a new mechanism is proposed for securing a blockchain applied to contracts management such as digital rights management. The authors propose a new mechanism that uses a hybrid blockchain and new consensus algorithm based on proof-of-stake that chooses validators on the basis of their credentials. The mechanism makes it possible to prevent an attacker from monopolizing resources and to keep securing blockchains.

In [19] the authors talk about implementing blockchain based ID as a service, or BiDaaS. The authors talk about the existence of Cryptocurrencies as, currently, the only functional aspect of the concept of blockchain and how we can look at implementing the concept in multiple new ways and methods with newer practical applications that previously might have seemed dubious The authors focus on using blockchain to secure Identities through the blockchain. The proposed blockchain-based ID as a service (BIDaaS) is explained with one practical example that shows how the proposed solution can work as an identity and authentication management infrastructure for mobile users of a mobile telecommunication company.

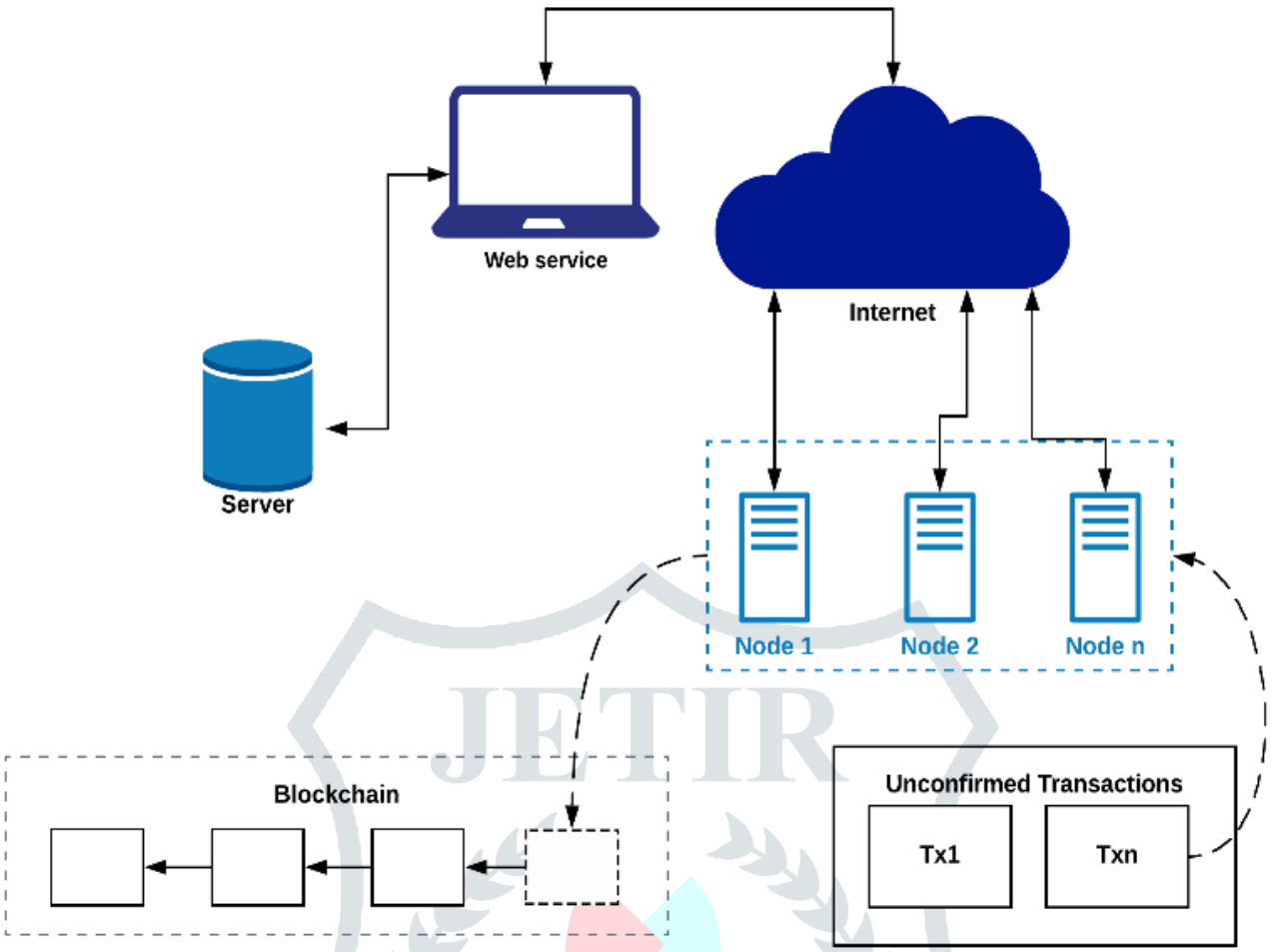
II. PROPOSED SYSTEM

We propose a system that makes the use of a python blockchain on the backend with a web UI that a user can use to input data. The user will use an HTML based web UI to input the entire information about the asset the user holds. The information will be signed by the user with the author's name. On posting the information, the chain arbitrator can send a request to mine the information on to a block, upon sending the request the nodes connected to the network will start the mining process and generate a block. The consensus algorithm proposed in the blockchain checks the chain for the longest available chain and
replaces the chain on all the nodes connected to the blockchain. Only the chain arbitrator can mine a block since it keeps the blockchain permissioned and disallows random entities from mining blocks on to the blockchain that are irrelevant to the application. After the arbitrator requests a block to be mined, the blockchain will mine the block on to the chain with its generated hash. Once a record is updated on the blockchain, it becomes immutable and cannot be changed. Since the subject document here is a 7/12 extract, the legal aspects related to it do not allow direct transfer of title. So the record updated on the blockchain will not be transferred directly to another entity under any circumstance.

Advantages of proposed system:

Using blockchain systems for handling transactions provides utmost transparency in term of transaction details and helps us understand the chain of entities involved in a certain transaction. The world is going digital and paper-less, so the earlier we go digital, the more at par we are with change and changing technologies.[8]

III. SYSTEM ARCHITECTURE



IV. IMPLEMENTATION DETAILS

We build our application using a python coded blockchain that makes the use of a naive consensus algorithm with an HTML front end with CSS styling to add data into the blockchain.

Our blockchain will give the user the ability to add data through the front end, however, the user itself does not have the option to mine the data since it makes the blockchain susceptible to changes that are undesired. The mining function is accessible only to the Arbitrator of the chain. The application uses the JSON, or JavaScript Object Notation format to store data since it provides good serialisation and structuring of data in key-value pairs, it is a somewhat faster alternative to XML and helps facilitate communication better between the client and the server.

One block of the blockchain contains the following parameters—

Index: which is the unique ID of the block. **Transactions**: In technical terminology, data is usually referred to as transactions. However, since we are not building a blockchain that uses Coins, these transaction spaces will store the data that the user has input. **Timestamp**: It is of imperial importance in every blockchain that a timestamp of the when the Block was created is present. In our case, we will be using Epoch time, or universal Unix time or POSIX time which is time after January 1, 1970. It is possible to check the correlation of the epoch time and standard time.

Previous hash: The blockchain is like a linked list, but one that which contains the hash value of every preceding block. This creates a chain. However, the first block of every blockchain is called a genesis block. It is the initial block that does not hold any data. The genesis block is generated manually in this case.[27]

Every blockchain's most important characteristic is the use of the hash function. The blockchain we are proposing makes the use of SHA256 algorithm to calculate the hash of the data input. Further the hash is converted into a serialised JSON string and stored in the Block. While computing the hash of a block, we do not simply take the hash computed. To increase the difficulty of the hash we add a constraint that the hash must start with n leading zeros. A nonce is a random number that we use to change hash values until the hash which satisfies our constraints is found. The number of leading zeros decides the difficulty level of computation. The longer the zeros, the more time it takes to compute the hash.[27]

Before blocks are added to the chain, it is necessary to verify that the data is not altered. Before a new block is added to the Blockchain, we check if the previous hash value is equal to that of the hash present in the previous block, we also check if the difficulty level of the computation is satisfied or not, in case these constraints are not satisfied, block is not added.

Consensus algorithm: We propose using a simple naive consensus algorithm that checks the entire chain for the longest present chain in the network. This consensus algorithm helps us estimate who has the most work done. Algorithms like Proof Of Stake and Byzantine Fault tolerance are better used on open systems that make use of mining for coins.[6]

Mining process: The mining process is the part of the Blockchain process where we mine blocks and compute the Consensus algorithm. A block is mined only when the Consensus algorithm and nonce is satisfied as per constraints. Since our blockchain is

not an open blockchain, we need to give the Arbitrator the power to add nodes to the chain network. Upon adding the nodes to the chain, they also have to be made aware of their peers.

Interfacing: Python has a microframework called Flask, it is a lightweight Web Server Gateway Interface. Essentially our Flask application will be used for initialising an instance of our web application. We create end points to interact with our Python blockchain. We use the WSGI to add data into our blockchain, we also create an end point that helps us query all the added data and the entire blockchain that rests on the nodes.

V. RESULT

Evaluation Metrics

The performance of the implemented system is evaluated on the Execution Time, Latency, Throughput

Average Latency: In the context of blockchain, the confirmation of transaction happens only after the inclusion of transaction into the ledger. So latency of a transaction can be defined as the time taken by a transaction to complete from the submission of transaction to the network. [28]

Transaction Latency = Confirmation time - submission time

$$\text{Average Latency} = \frac{\sum_{\#Transactions} TransactionLatency}{\#Transactions}$$

Transaction Throughput: This can be defined as the rate at which transactions are committed into the blockchain network. We have to remember that in a blockchain network, the transactions can be marked invalid in case of any error in the verification so while computing the throughput only the valid transactions are taken into consideration.[28]

Transaction Throughput=Valid Transaction committed/Total time taken

VI. CONCLUSION

Today's paper laden and cumbersome digital processes can be improved with the help of Blockchain based Land registries. Ultimately, it will support and strengthen land governance policies and systems worldwide. Today's paper-laden ways of land governance is hectic and demand manual human labour, this blockchain solution can provide an automated system without the need of any third party and provide means of transaction. The concept of blockchain still being new adapts well to the land governance problem providing a tamper-free safe and decentralized solution.

VII. FUTURE WORK

Newly available Hyperledger tools can be used for more flexibility and efficiency. In this paper we use the blockchain to store transaction details of the 7/12 extract in land asset transactions. Future transactions can be made purely blockchain based with cryptocurrency and wallet-based peer to peer system. After the implementation of this paper we observed addition of a database to store more details and with hash of the block can not only increase efficiency but also reduce cost of the system. Blockchain is vast field and can impact modern asset management systems.

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