Applicability of Blockchain Technology in Land Registry Services

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Abstract- **Blockchain technology has application in the field related to information. It is included as a technology for the new generation secure application with high level of transparency. It is a type of decentralized and secure database that facilitates a transparent management in a distributed environment. Blockchain is also adopted in India by the steps taken by Reserve Bank India in 2018 under the notice for the identification of the potential application fields related to the blockchain technology in India. This paper describes the prospect related to blockchain technology in Indian scenario for the government sector that fits well in current status and minimizing the issues in acceptance public service schemes. This is providing an application of blockchain in land registry system with multiple consensus mechanism in the platform of blockchain. It gives the analysis related to the total mining time for a specific consensus mechanism over the long interval transaction in the process of handling land registry and allocation records under the involvement of the direct benefits using Technology of Blockchain scheme.**

Keywords: **Blockchain,** **Land** **Registry,** **Parallel Computing**

1. Introduction:
Blockchain mechanism is taken as becoming ''next important technology'' – one related to the best suitable of the suite related to the advancement stated of having ''disruptive'' results in the social and the economical future applications. Such techniques are known as disruptive as it is claimed that, initially after taking root in simple application in specific areas related to the economical functions, they will gradually proceed towards the higher level, event they will replace the previous technologies, and bringing about large variation in the ways in which applications are accomplished, deliver minimization of cost and enhancement of the system performance [1], [2]. Blockchain is generally a specific example related to the Technology of Distributed Ledger (DLT). in a specific sense, the blockchain supports the DLT to information storage based application type that is verified by cryptography in a users group by a pre-defined networking protocol, without the supervision related to the a centralized entity & authority [3]. Blockchain mechanism is recognized as being a significant asset for governments to maintain

services with the future applications: it is observed that the blockchain is profoundly transforming the public sector production based application type and delivery [4]. Moreover, the expectation based application type that innovative technologies will bring the positive transforms automatically may be leading to optimistic executions and efficient assessments of routine tasks [5], [6]. Putting aside utopian analysis, the risks and benefits related to the blockchain for public services need to be carefully considered. An analysis of the recent literature on the blockchain scheme showing that by far maximum part of the attention is paid to the bitcoin and other cryptocurrencies. For example, a search by the use of Scopus indicating that, in 2022, nearly $2/3^{rd}$ (61%) related to the total number of publications are focusing over the blockchain applications are about bitcoin actually. However, in current decades, a segment related to the scholar articles on development and application of blockchain in the public sector organization is emerged. These literature articles are producing significant visualization of the possible potential of blockchain applications in the services related to the public sector organization. Presently, these observations are consisting a diverse amount of information relatively, in the sense that they are producing across a very large range related to the disciplines that bridges both Social Sciences & Sciences. Presently, a comprehensive literature survey related to the potential advantages, risks and cost criteria of blockchain application in services provided by public sector organization, which are bringing together all the existing analysis in a perspective of multidisciplinary applications, is missing. It is this gap that this work is seeking for addressing by conducting a literature survey in systematic manner. Meanwhile, early stage applications & multiple types of projects related to the blockchain application are started by public and governments bodies all over the world are increasing [7]. Most of these applications & projects associating the use of blockchain in order for improving economical efficiency, accountability and transparency related to the bureaucratic mechanism.

2. Proposal Algorithm
The proposed algorithm related to the three major process: import of the LRS database in the MATLAB software, algorithm of the blockchain mechanism and verification of data base, and the approach of mapping the data base. As the database are imported for the MATLAB software, the

mechanism of consensus and technique for mapping of the data base are chosen through the user on the basis of the presumption of the nodes of blockchain. The hashed database transmission performed for the data segments, in which multiple type of applications over the server may be applied over the database. The main part related to the proposed algorithm are explained in the section below:

• Data Importing into the MATLAB software: The land record database may imported either through the CSV filetype (for the dynamic block-chain types) or through the modeling file of websites (in dynamic and static modes of blockchain) in the MATLAB software by the use of the Parallel computing-MATLAB toolbox or EPANETCPA application on a single-time interval or time sequence database, alternatively. These database on importing in MATLAB software as matrix that representing networking configurations tables(example networking type ,nodes , its coordinates and the quantity related to the edges). After that, the database is store in a format of the block and its own hash value generation is performed after the process of the verification of the database. The authenticated blocks are only added for the chain having different information of the blockchain, like ID of the node, nonce and value of self-hash.The value of the nonce represents the abbreviation of the "Number-Only-Used-Once" that is utilized in the duration of hashing related to the data base.

• **Algorithms for Blockchain and verification of data :** These two operations are the important step related to the all system based on blockchain. The algorithm of the blockchain oversees the verification & communication operations related with the specified algorithm for verification of dataset (called the consensus mechanism). Briefly the approach of blockchain in this report targets for the operation of re-hash the database on the basis of the cooperation related to the defined consensus mechanisms. In short, it concatenates the land registry id is validated on the mechanism of consensus, and in parallel the hash generated in past if linked previously having the block, except to the Genuis block. An algorithm of the consensus mechanism have a set of rules that every peers are following depending on the schemes of blockchain and enforcement of the process verification related to the block and the respective transaction. Algorithm development on five consensus mechanisms is performed in this project work, named as: PoT, Proof-of-Work (PoW), Proof-of-Assignment (PoA), Proof-of-Authentication (PoAuth) & Proof-of-Vote (PoV). PoAuth&PoA were described in the [35] project due to the process of the LRS fast speed is required, voting-dependent, and verification in real-time processes. IoTw is the leading blockchain mechanism that is developing blockchain to the manufacturers and industries, and it is at the topmost level related to the flexibility as well as the security of telecommunication on the basis of smart devices [35].

A comparative overview related to the Iotw on the basis of other conventional blockchain projects of industry(e.g., IoTex and IoTa) may be observed [35]. In this way, PoV, PoA and PoAuth are designed for attaining proper integration to the land registry organization. PoW is the primitive type consensus mechanism and applied first time in bitcoins. In this mechanism it asks every user for verification of the transaction, and the database is accepted if the validators is approving the transaction .

The mechanism of PoT enquires to the peers that has the topmost reputation for verification of the database. It consist of a table of reputation value measures on the basis of all nodes of blockchain in which each node gets a increment in the reputation metric on approval of database. The Peer selectee finally is recognized depending on the node having the reputation with highest value, and the table of reputation metric has a largest threshold related to the ReputationThreshold for avoiding overflow related to the reputation that may change based on the size of network. generallyPoT is improved successfully energy efficiency, but it also conveys the networking in a semi-centralized framework. However, PoV is a presently designed as an algorithm that depends on the vote system of the function of hashing [36]. They are related to an approach that asking to every peers of the blockchain for verification of the database & whether the sum up related to the feedback have more than 3/4 validation index of the database. Then, the block & its respective transaction is approved and joint the chain.Here, PoAuth&PoA are novel schemes that are also investigated for provide alow-processing and quick verification scheme. PoA algorithm randomlyselects a node of network when asking for verification of the database . It is highly crucial for selection of a high speed scheme of database mining for supporting real-time database having for the simplified process related to the verification, but there should be a perfect chance that the choice of the random verifier may be a malicious node. PoAuth is an algorithm proposed for the nodes of a network that applies the self-authentication as proof to the transmission of the database. Such type of approach is suitable on the IoT based applications that are not having any requirement related to the a high level of security. They applies a bloom filter for matching the authentication of the nodes and it may be applied right away on the assets that are traditional.Mapping related to the Database - There are two modes of database mapping for connecting the blockchain on base type blocks verification. In dynamic type blockchain, the transaction related to the data are chained for each time stamping. As all the time stamped datbasea within the one-time interval are confined in a single block, this is known as the keyword transaction for each time stamping. In contrast,this is known as transactionper time stamp when complete database of under single time stamp are chained within single transaction / block .
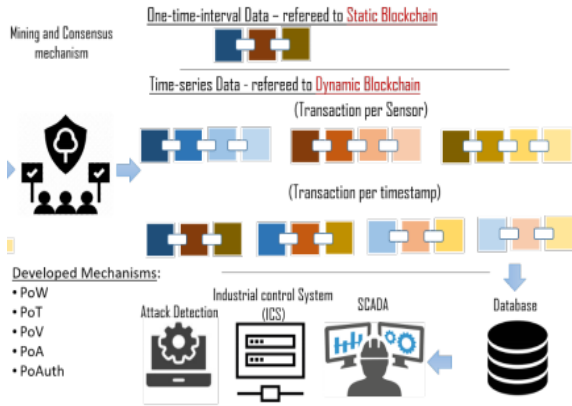
Figure 1: architecture of Blockchain mechanism system.

The Input File of the simulated work is started from the MatLab file. The code initially needs user input for choosing the execution related to the static or dynamic blockchain. The static type option of the blockchain targets for importing only small-time span related to the a land allotment registration system modelling data in the blockchain where one-transaction monitoring for all-time interval readings occurs for a block, however another execution is related for dynamic kind of blockchain related to the different formats for import of the data time-series either from CSV files or from net. For importing the time-series data in the dynamic type execution of blockchain mode, a file for data-flow has is provided for the simulation related to the developed algorithm. Several land registry and allocation based operational parameters (e.g., the initial land holder of plot at a given area or land cost related to the a certain area) is selected for validation and chained upon verification. Moreover, in this process the user is asked for selection of the consensus mechanisms to be applied during execution. When the PoAuth method is selected, then all the blocks is to be authenticated by matching the specified ID value on the basis of the list related to the nodes in the algorithm. Furthermore, the approach of the data-mapping may be selected related to the either transaction per timestamp.
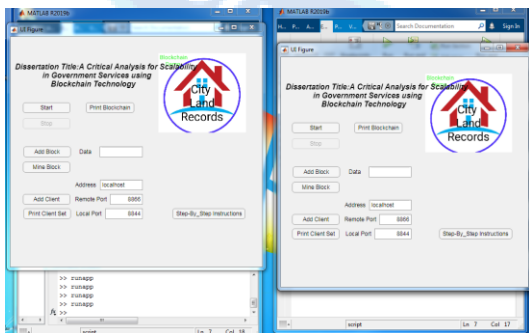
3. Results and Discussions

Figure 2 :Graphical user interface running parallel for user and land registry office.

Five consensus mechanisms are developed in this algorithm, are:
Proof-of-Work (PoW), Proof-of-Trust (PoT), Proof-of-Assignment (PoA), Proof-of-Vote (PoV), Proof-of-Authentication (PoAuth)PoW: The Total mining time = 2361.94949080939
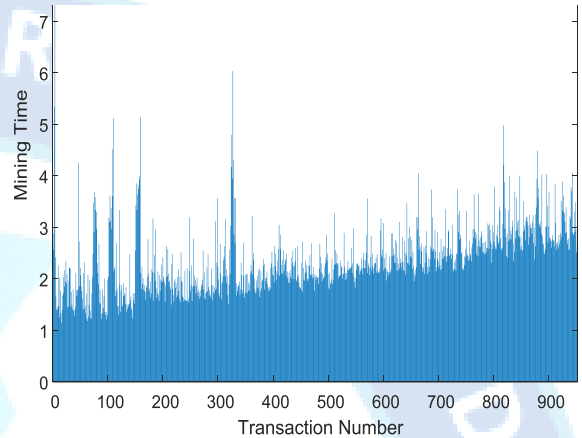

Figure 3: Mining time with respect to Transaction numbers for Proof of work consensus mechanism.

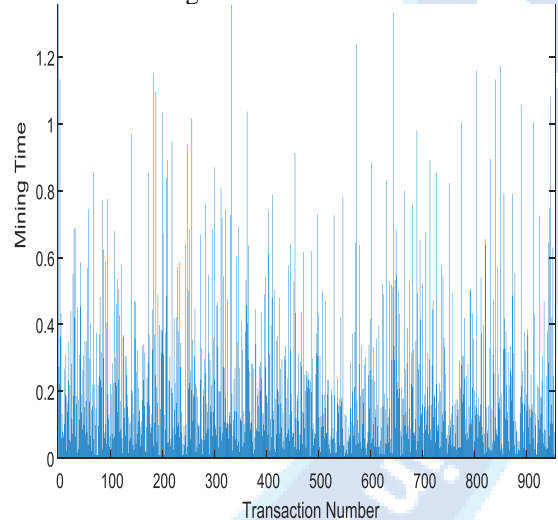POT: The Total mining time = 222.43977795186

Figure 4: Mining time with respect to Transaction numbers for Proof of trust consensus mechanism.

Report generated during running related to the block chain algorithm for land registry process on MatLab command window:
newBlock = Block with properties: index: 618
data: {' 1997 62666 56956 51551 78513 4285 96173 75569'}
previousHash: '0087754a3805981d70a7d76c5108b8d2'
selfHash: '0064e4001273def5df27e41caabe60fd' nonce: 7

YEAR PLOT1 PLOT2 PLOT3 PLOT4 PLOT5 PLOT6 PLOT7
USER
USERUSERUSERUSERUSERUSER

1997   62666   56956   51551   78513   4285   96173   75569

newBlock =   Block with properties: index: 619
data: {' 1997 62666 56956 51551 78513 4285 96173 75569'}
previousHash: '0064e4001273def5df27e41caabe60fd'
selfHash: '00d7f134852d2ee0a76d963e79ca5612'
nonce: 49

YEAR   PLOT1   PLOT2   PLOT3   PLOT4   PLOT5   PLOT6   PLOT7
            USER
USERUSERUSERUSERUSERUSER

1997   62666   56956   51551   78513   4285   96173   75569

newBlock =   Block with properties: index: 620
data: {' 1997 62666 56956 51551 78513 4285 96173 75569'}
previousHash: '00d7f134852d2ee0a76d963e79ca5612'
selfHash: '00a1bafe7dcfad66d85b751c88f48608   nonce: 170

newBlock =   Block with properties: index: 626
        data: {' 1997 62666 56956 51551 78513 4285 96173 75569'}
previousHash: '002417550a1757926d3f4953fce637c6'
selfHash: '006253bcf0730eda653a3653291af92f'   nonce: 5

YEAR   PLOT1   PLOT2   PLOT3   PLOT4   PLOT5   PLOT6   PLOT7
            USER
USERUSERUSERUSERUSERUSER

1997   62666   56956   51551   78513   4285   96173   75569

newBlock =   Block with properties: index: 627
data: {' 1997 62666 56956 51551 78513 4285 96173 75569'}
previousHash: '006253bcf0730eda653a3653291af92f'
selfHash: '00a0fe73706163e586d537e05f262795'
nonce: 220

YEAR   PLOT1   PLOT2   PLOT3   PLOT4   PLOT5   PLOT6   PLOT7
            USER
USERUSERUSERUSERUSERUSER

1997   62666   56956   45160   78513   4285   96173   75569

Property related to the plot 3 transfered from user 51551 to user 45160

newBlock =   Block with properties: index: 628
data: {' 1997 62666 56956 45160 78513 4285 96173 75569'}
previousHash: '00a0fe73706163e586d537e05f262795'
selfHash: '00d430b90af5663c570e8f0695e86357'
nonce: 46

YEAR   PLOT1   PLOT2   PLOT3   PLOT4   PLOT5   PLOT6   PLOT7
            USER
USERUSERUSERUSERUSERUSER
PoA:The Total mining time = 210.924275615738
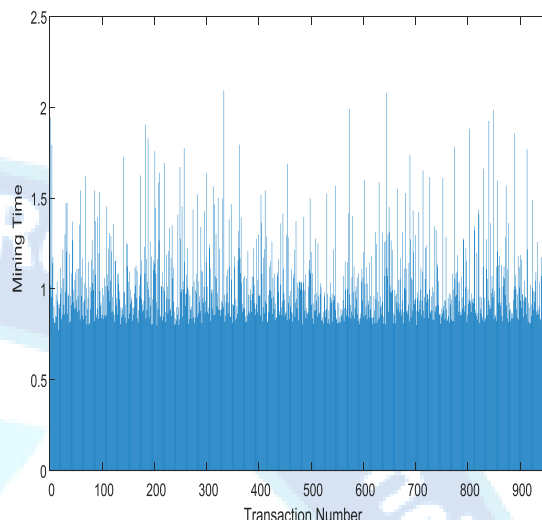

Figure 5: Mining time with respect to Transaction numbers for Proof of Assignment consensus mechanism.
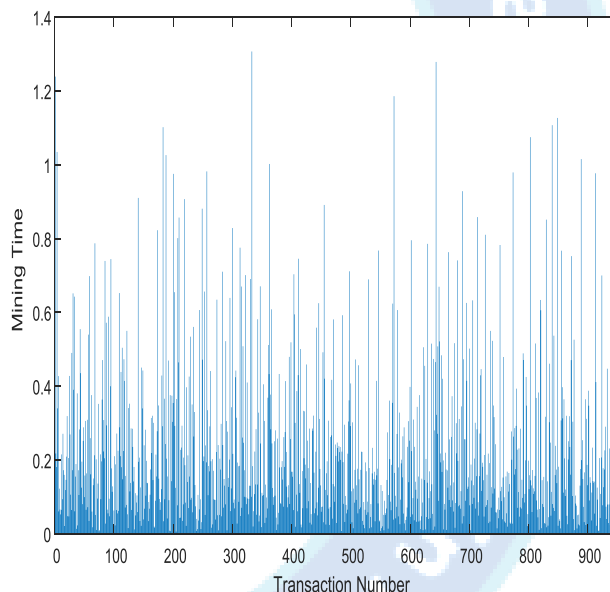PoV:The Total mining time = 973.146133508659

Figure 6: Mining time with respect to Transaction numbers for Proof of vote consensus mechanism.
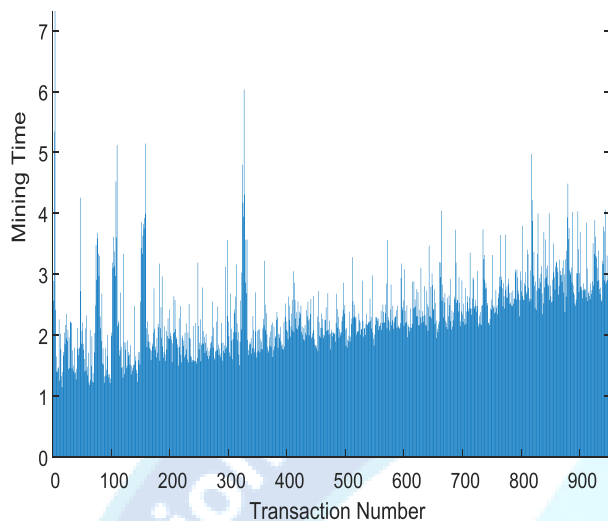PoA: The Total mining time =   25919

Figure 7: Mining time with respect to Transaction numbers for Proof of Authentication consensus mechanism.

Table 1: Total mining time under different types related to the consensus mechanism.

S.No.	Algorithm	Total mining time
1.	PoAth: Proof of Authentication	25919
2.	PoW:	2361
3.	PoT:	222
4.	PoV:	973
5.	PoAs: Proof of Assignment	210

4. Conclusion:

The advantages related to the use of blockchain technology in land registry and allotment system is that the administrative burden for accounting the services is drastically reduced. It do not need for doing anything related to the updates at different levels individually, everything will be done online during the registration process. All the transaction based application type are done in real time. The advantage of blockchain is that all the transactions under land authority allocation to a new user are transparent and tamper proof . Everyone can validate the transactions, that how these the property rights have been moved under different stages related to the land registry process. It makes the whole process very easy. It reduces the chances for fraud and mistakes that may happen. And finally, the authority will be satisfied because they can see everything from the transaction log, during the registration time and they can verify whether some frauds have happened or not. This work concluded on the basis of the critical comparative analysis of traditional government service delivery versus blockchain enabled land registry system on the basis related to the mining time involved under different consensus mechanism involved in the system. It also elaborates the scalability issues involved on the basis of the system.

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