Blockchain-based land registration system

The case of Uzbekistan

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Outline

Introduction

Land registration includes gathering information such as type of ownership and land size. Presently, the complete procedure of land registration maintenance is particularly time consuming because the process necessitates the storage of vast quantities of written records. The core problem with this technique of land registration maintenance is that a further reference from these hard copies requires plenty of labor. Therefore, this procedure is much complex and takes a long time. Besides, the existing method is insecure because the complete procedure is non-transparent, very slow, and selling a particular land more than once necessitates accurate recording. To remove the procedure of bookish recordings, there has been a number of techniques implemented to formulate the automation of land registration data maintenance. This technique is initially started to store the data in enormous databanks. However, this strategy tends to be ineffective in respect to information safety because the data elements can simply be compromised, and data manipulation might occur in poorly managed datasets. Blockchain is a decentralized system that retains a historical evidence of all peer-to-peer interactions (Sajana et al. 2018). Employing blockchain to implement a land register minimizes the fraudulent undertakings, and results in the proposed system safer. Because duplicating the blockchain is more likely complicated, utilizing this technology to construct a land register allows preventing any criminal property transactions. Agreements and possession information are kept in a decentralized manner. Since the Blockchain execution excludes the necessity for physical interaction, it makes simpler to track data transactions and hence increases overall safety for system users (Sarath and Lal, 2015). Blockchain offers the possibility of establishing a solid digital identity system. Each block in the blockchain system denotes the data in the property operation, which contains information such as the id, number, owner, the contract price, payment type, and the most recent transaction details.

Even though in 1992 Blockchain system was discovered, the name was familiarized as Bitcoin cryptocurrency. Due to financial appeal of Bitcoin and other cryptocurrencies, the opportunities in vast technical infrastructure have obscured provided by Blockchain system. Blockchain is a decentralized distributed database system. All operations that occur in the system are organized into a block structure and linked together as an integrated chain by linking to the initial block. As a result of the high degree of security provided by blockchain technology, information acquired on the system is exact and could not be altered. Blockchain system enables to work on a distortion-proof digital ledger which could be applied not only with financial records but also with all transactions that let us to keep whatever we price. This price could be anything and can be described as using code. Among the examples are farming, voting and healthcare. As a result of

many range of examples as well as the many benefits it provides, some experts refer to the blockchain technology as the "New Internet." Blockchain, it is believed, will enable the Internet's communication structure to exchange information. "Distributed Notebook" is the root for this ambitious strategy, since it is one of many duplicates that are kept by all participants in a network and is the fundament for Blockchain system. All operations carried out on a Blockchain system is recorded and kept in the digital ledger of all members. The necessity for third parties for instance, banks or notaries is eliminated. Another way of saying this is that Blockchain technology's distributed ledger structure functions as a digital notary. A growing number of researches are being conducted on this new technology, and major corporations choose to operate in this system.

In recent years, blockchain system has been a most popular technologies because of its advantages. Additionally, several big research institutes have studied and done researches on this technology to examine its prospective. Gartner, globally a major information technology research and consulting firm, performed a study on Blockchain technology. They prepared the report named "Hypecycle" curve in "Emerging Technologies" that represents the maturity life of the evolving technologies. It is clear from this report that Blockchain technology has exceeded its highest of inflated expectations and continued moving towards the trough of disappointment phase. According to this scenario's assessment, the impossible outlooks regarding blockchain system will begin to disappear, but this will result in disappointment; it is anticipated that as technology becomes more realistic, the number of circumstances in which technology is actually beneficial is expected to rise. Likewise, if the technology is developed in this manner, it would achieve its peak efficiency over the next 5-10 years. According to the evaluation, unresolved problems will be resolved, inadequacies will be corrected, and the system achieves its maturity level by the end of this time.

Even though blockchain system has a wide range of applications, it has only just begun to be used in a number of fields, particularly after 2015. GIS (Geographic information system) is a high-potential technology that can be utilized in conjunction with Blockchain system (Yli-Hummo et al. 2006). Different fields of smart property are thought to benefit from possibilities provided by Blockchain system such as diversity and information. In many applications, GIS and blockchain are utilized in conjunction with each other. In terms of popularity and future growth, land registration is one of these applications. In spite of the fact that the standards for land registry systems differ from country to country, the Blockchain-based system will have the same eye-catching benefits and conveniences. This project will provide how to implement the land registration system that meets Uzbekistan’s criteria.

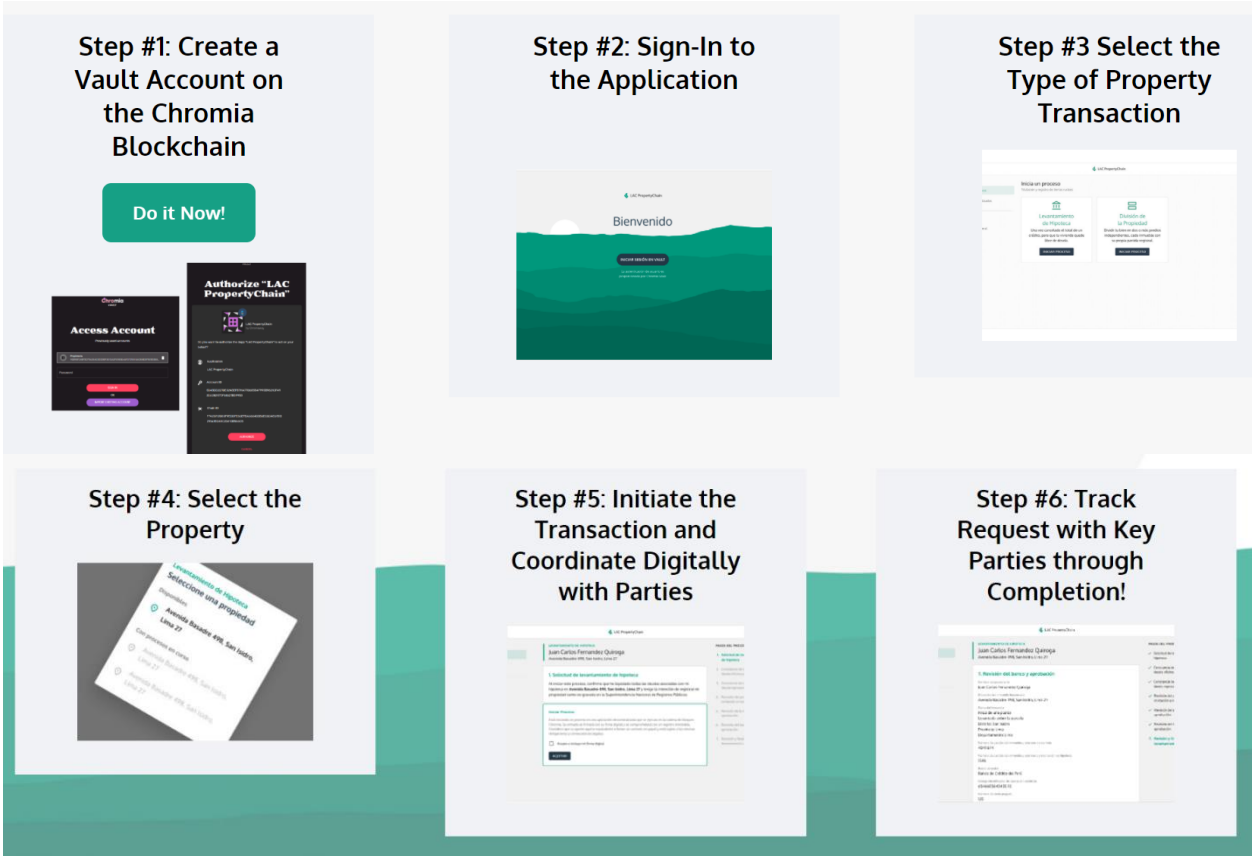
Related works

In the healthcare industry, each patient's medical history should be treated with the highest privacy. Blockchain system is being utilized as a decentralized way to offer security for client medical data (Venugopal and Sarath 2016). Authentication, encryption, and data retrieval are the three phases of security implementation. Quantum cryptography and Advanced Encryption Standard (AES) encryption are employed to provide end-user security. The SHA algorithm is used to retrieve data (Christo et al. 2019). Financial firms have also begun to use blockchain technology to prevent system vulnerabilities and safety concerns in online transactions.

Bitcoin provides a peer-to-peer distributed and decentralized digital currency. This kind of system has the extra benefits of integrity, lower third-party costs, and quicker operations. The authentication of a digital transfer is relied on cryptographic evidence, and thus no third party is engaged, providing a trustworthy payment system. The problem of double spending is also avoided by using a distributed timestamp server that generates the mathematical evidence of transaction chronologically. A digital signature can be used to authenticate an identity of a user. Every person will use their private key to complete transactions, while other nodes will verify the payment's legitimacy by using the person's public key. If a hacker wishes to meddle with a transaction block, the PoW of all prior blocks and all blocks following it has to be repeated, as well as the work of honest nodes must be suppressed. This is impossible without the agreement of the whole chain, making hacking a blockchain network a time-consuming job. In terms of purchasing and selling real estate, intermediary brokerage fees may add up quickly. It is a squandering of both time and money. Smart contracts relying on blockchain guarantee that events are logged sequentially and that an online ledger is kept for the same. The Evarium platform is a digital property investment concept that provides shareholders with lower costs and higher income sharing for commercial property exchanges. Smart contracts are coding language-based agreements whose data is mostly managed using service-oriented cloud computing capabilities. However, implementing smart contracts in the current Evarium system is extremely difficult since it necessitates a huge number of cross-dependent smart contracts which should not result in concurrent disputes. A further issue that is not solved is the issue of high dispersion. According to Lemieux (2007), Blockchain is a new innovation that has the capability to drastically alter the recording of land ownership as well as real estate transaction. His research was focused on methods of Blockchain based land registration created in Brazil, Georgia, Honduras, Ghana, India, Japan, and Sweden as a result of regulatory obligations. Pilot apps in these nations' selected regions are discussed, and it is expected that the quantity of full-time users would rise. According to Spielman (2006), Blockchain technology has a dramatic influence on

the registration of land procedure and would favorably affect the path of the system. It is recommended that by beginning to manage current land registration with Blockchain technology, transaction productivity will rise, fraud faced during real estate exchange transactions could be avoided, transactions could be managed to carry out with increased protection, traceability, and openness, and there could be less susceptibility to different factors. If the instances of land registration with blockchain technology is studied, it can be noticed that apps in Brazil, Honduras, and Sweden stand out. The Factom that is a Blockchain technology firm located in the United States, has created a Blockchain-based land registration system for the nation of Honduras. Honduras has been considered the very first country to adopt Blockchain system for the registration of land. The primary factor the Honduran government sought to transition to a land registration by blockchain system has been to avoid the violation of land registration system. That is why, the government of Honduras made a radical move and decided to construct a Blockchain land registration with Factom. From the beginning of November 2015, the system has been operated for three months (Lemieux, 2017). Brazil is considered one another example that has moved the land registration to blockchain system, with ownership transfers taking 13 stages. The government of Brazil chose to adopt Blockchain technology to assure correctness, transparency, accountability, as well as enhanced reliability in operations, together with lowering expenses and anomalies, and a solution created by Ubitquity were introduced through in Rio Grande do Sul Province in the second quarter of 2017. By analyzing the data collected as a consequence of the system, which was operational for three months, it was discovered that the mistakes in the recording system reduced and that archiving was made much easier (Allison, 2018). While Sweden is of the other nation that has moved land registration processes to a Blockchain system, the motivation for doing so varies somewhat from other governments. Based on statistics from Sweden's "World Bank Business Index," Sweden is among the most dependable nations regarding registration of land transactions. Although the major motivation for nations, namely Brazil and Honduras to transition to Blockchain technology is to minimize inconsistencies in the system of land registrations, Sweden is not considered in this scenario (Lemieux, 2017).

ChromaWay, a Swedish business that administers the property transfer procedure in seven phases, took the use of Blockchain technology and moved the processes to Blockchain technology by achieving a digital innovation. Progress is currently being done to extend the technology that was utilized during 2017 (ChromaWay Land Registry, 2018).



Screenshot of Chromaway property chain application for property registration.

Because of the successful status of the ChromaWay company and the successful project in the case of Sweden, the government of Ukrain has begun working to implement the same system in Ukrain projects. Likewise, Andre Pradesh, an Indian state, has stated that it would begin using land registration system created by ChromaWay blockchain system.

Land registration

The procedures of registering the land may tend to change depending on the local functions of countries. Every country in the world is considered to adopt its local structure based on certain functions. For this reason it is not logical to develop land registration system which is created internationally due to the difference in the local structure of countries. Initially, we planned to develop application for Uzbekistan in the beginning level. Thus, for developing the system and a road map, we have developed a plan. In the first stage, we conducted special research based on the processes of land registration in Uzbekistan. During the research or examinations, the requirements necessary for conducting the research analysis were identified and the system was developed based on those requirements. During the process of designing Blockchain-based system, the most suitable option which is Blockchain infrastructure choices were selected. In the final stage, we

were able to establish the system which can satisfy the requirements Uzbekistan specified in the configuration.

The process of land registration in Uzbekistan

There are majority of stakeholder included in the processes of land registration in Uzbekistan and such processes tend to differ depending on the local laws. There are several types of land registration. For example, in some countries land registration is controlled entirely by the government institutions but in some countries, some external stakeholders like notaries and lawyers are included in land registration processes. In the case of Uzbekistan, we have determined that land registration processes are completely controlled by the government authority and there is not any intervention of external stakeholders like notaries or lawyers. There are total 8 steps which are involved in land registration process and in the following we will discuss each of them briefly:

1. When the owner of the land and the buyer would agree with each other, they approach to the special organization which is specialized in determining the fair value of property involved in agreement.

2. The formal letter about the absence of property's debt is taken from the same municipality.

3. 2% of the fair value is deposited into the bank in the form of title deed by the owner and receiving parties of agreements. The title deed can be compromised through circulating capital fee by bank.

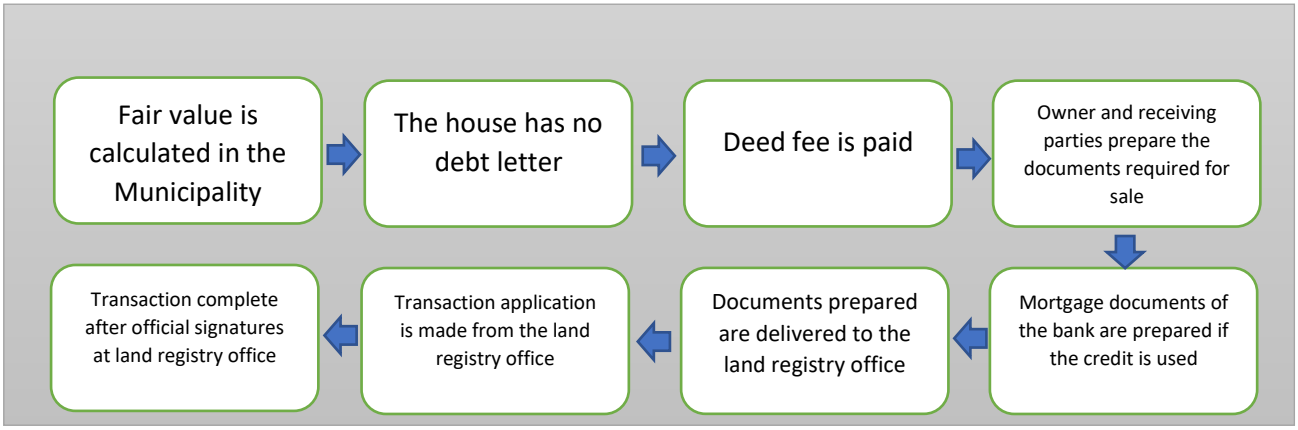
4. In the case, when the buyer wants to pay the fee with bank loan, it is essential to prepare necessary documents by negotiating with bank.

5. When the owner and buyer of the property make exchange, they would prepare necessary documents including identity card copy and photo. Furthermore, the owner of property would bring the deed document in person.

6. All the documents such as payment receipts, mortgage documents and other related documents are collected together and sent to the land registration office.

7. For accomplishing the deed transfer, the appointment is organized by the land registration office.

8. After the final evaluations and control of land registration office, if the property has no debt, the owner is obliged to sell the property. After that the owner and buyer are invited to the land registration office in person and then buyer transfers the physical money to the owner and all the necessary signatures are taken and the transfer of property is finalized.



Current land registration process: Uzbekistan

The land registration process takes approximately 2-3 days to be completed in Uzbekistan when there is not any flaw in the documents mentioned above and all the steps are made at maximum speed. Most of time is spent on making physical applications to various institutions and to prepare physical documents.

Based on the local regulations and laws of Uzbekistan, if the owner of the property wants to sell the property within 5 years after buying, he or she is forced to pay a liable tax which estimated through determining the difference in purchase and sale prices. Such kind of tax is called increment value tax. It is essential to determine the increment value tax accurately since public investments should be ensured to return equally to all living citizens. For maintaining the public welfare, it is important to identify the real sales values of properties. There are some situations in which the seller shows that he or she is selling their houses at lower prices than the actual. Such actions are made in order to avoid from paying increment value tax.

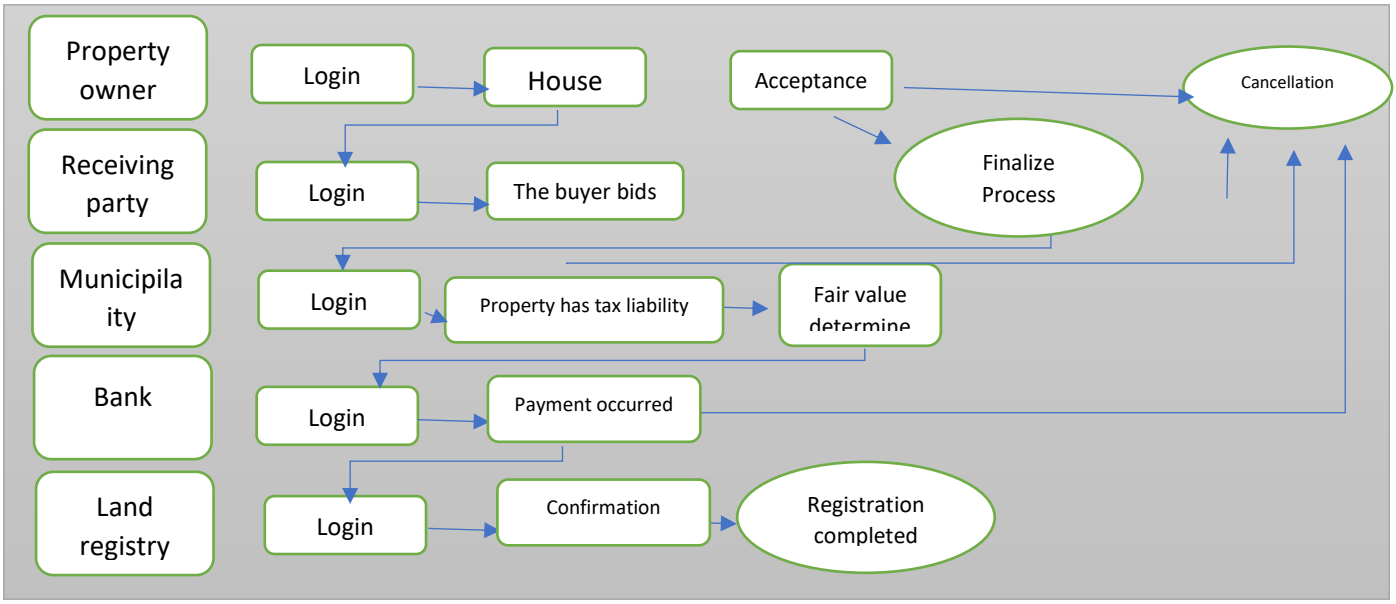
System Design

After investigating the current local was based on land registration process, all the operational steps and necessary documents are determined. After that, it is possible to start Blockchain-based system. The application of Blockchain-based system would start working when the owner and the buyer of a property enter the system and the agreement information about the transfer. After this situation, the control and management of the land registration system is conducted completely by the system.

When the reconciliation information is entered into the system, the property can be put up for sale and sales code is created by the system randomly. The system would include the buyer of a property and from this point on, the buyer would be able to examine the spatial, attribute and

agreement information about the property. After all the attributes are confirmed in the same way as it was agreed before, the system gives the transaction confirmation.

Then, the owner and buyer of the property have achieved to the agreement level on the system, the internal transactions are carried out by the municipality to identify the fair value of a property and to confirm that the property owns no debt. After the completion of municipality's transactions, the banks of both parties are involved so as to transfer the fee to the owner of property. There would not be any process related with physical money transfer and instead of this all the transactions are accomplished through digital approval mechanism in which banks are digitally involved in the process. One of the most common problems in land registration process is trying to avoid from increment value tax by sellers in which the real value of property is showed lower than its actual value. Such problem can be eliminated through applying bank transactions digitally and thus may increase transparency. In the next stage, the banks approve the money transfer after which the land registration office examines all the available documents briefly and in detail. If there is not any obstacle detected, the bank would approve the transfer of property. The transfer of money and property is done at the same time after the process of taking signatures are done.



Application infrastructure decision

Hyperledger includes one of the most popular and useful system which is called Fabric. This application plays a basis role in terms of developing applications and solutions based on modular structure. It is ensured completely that Hyperledger Fabric provide plug-and-play to all components such as consensus and membership services. Fabric is also considered as the first Blockchain which is specialized in running the written applications depended on a certain standard in programming languages and there is not any dependence on the crypto currency. It is possible to integrate the model of mobile membership created by Fabric with industry standard identity

control. For backing up the flexibility, completely new Blockchain design is presented by Fabric and together with Blockchain model, Fabric offers solution to problems including resource consumption and the optimization of performance. For this reason, it is decided to apply Hyperledger Fabric and additionally, for the installation and the display of network on Hyperledger Fabric, it is preferred to use Hyperledger Composer. Due to the easy interface of Composer tool, it offers easy development of Blockchain smart contract structure and also, it would offer high levels of flexibility and easy to use at the point of network distribution.

D. The establishment stage of the designed system was started after the Blockchain contract service provider was identified. After the proper application of system design, it was possible to determine the flow. It is essential to identify all parties thoroughly before taking up the system development and also for determining the sequence of transactions depending on the system flow. In total, six stakeholders were determined in the designed system and they are owner party, receiving party, the land registration office, the seller's bank, the municipality in which the property is connected, the receiving party's bank. Together with the approvals lf these participants, it is possible to accomplish the completion of process flow in the offered system in sequential order.

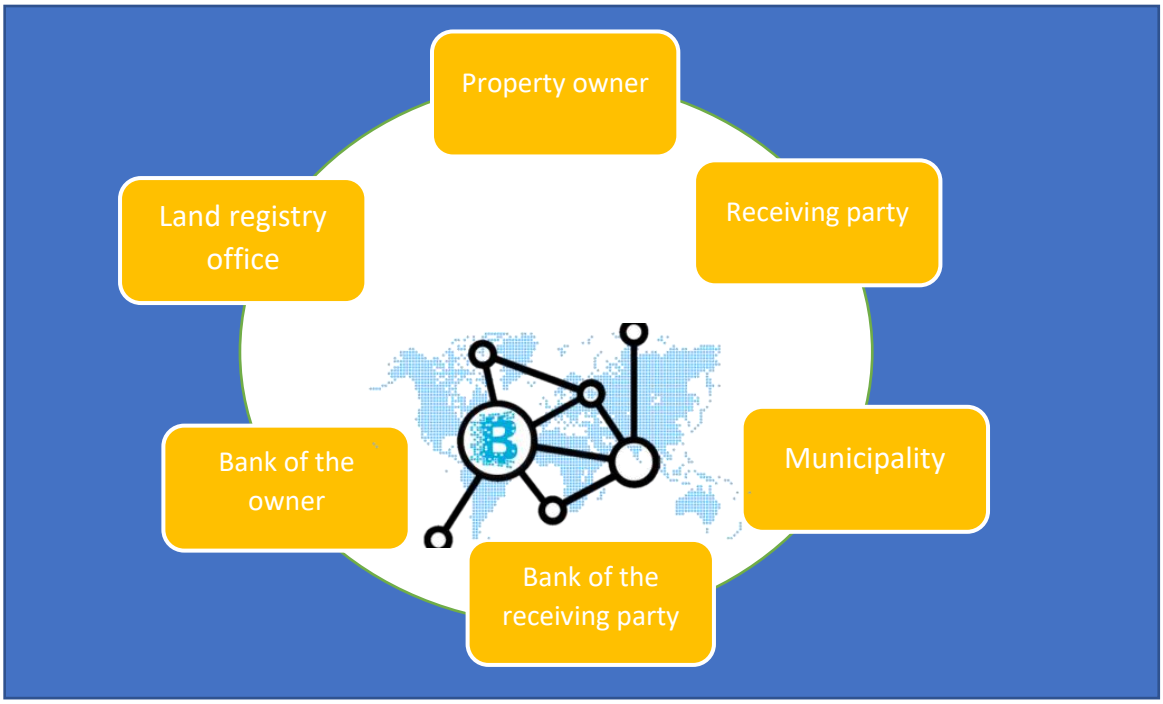


Fig. 5. Nodes of the Blockchain Based System

It was the first development stage to determine the parties which are eligible to participate in the Blockchain-based system. It is also essential to identify the smart contract structure after determining parties involved in system. The smart contract structure is applied in order to identify the order in which transactions are made between parties and which approval mechanism is applied

during the process. However, Hyperledger Fabric proposes completely different approval mechanism. We have conducted research analysis in order to determine which approval mechanism best suits to our system flow. Finally, it was decided to use sequential approval mechanism which is called Proof of Authority (PoA). Because, in the case of our transactions, there would be sequential approval mechanism between parties and also, no mining effort is required completing the transaction. Through the use of PoA method, parties accomplish sequential transactions and thus, approve the line with flow identified in smart contract structure. Therefore, it is possible to analyze that the method being applied is compatible with the system designed. Additionally, it is important not to forget identify the conditions including the maximum approval time of parties when determining the smart contract structure, since the acceptance or rejection status is always labeled automatically. The template can be designed after the approval of mechanism and smart contract structure. Then, it is possible to start the stage of visualization. Precisely, the display of block structure, traceability and transparency are increased and evaluated its working system, it was decided to provide display with the block history in every process flow.

Firstly, the owner of property logs on the system through applying the designed system and then, he or she can choose the property which is intended to put up for sale from the list of properties which belong to him. After that, the owner would enter all the necessary information or reconciliation including price, the information about buyer. When the owner enters all information in the form of reconciliation, the flow of smart contract is developed by the owner part and then, the property sales code can be generated by the system in which the receiving party is also included into the transaction. Moreover, the owner logs into the system through using his sales code and thus, reveal all the spatial information of property and brief information on reconciliation. Such process would allow the buyer to check the information and analyze whether this property is appropriate for him. If he finds the property inappropriate, it is possible to stop the following steps of agreement and thus, the flow is canceled and all the processes are completed. In the case when the buyer finds the property suitable for him, the system approves and the process is proceeded.

If the transaction is approved by the receiving party, the municipality which is located near the property is included in the transaction automatically. The main duty of municipality is to identify the fair value of the property and to check the absence of debt. If there is some amount of debt is determined, the municipality would cancel the transaction and stops the process. However, if there is not any debt related to the property, the fair value is determined and the system approves together with proceeding the process. The banks of owner and buyer are included after the approval of municipality in order to conduct the payment transaction. If the bank of the owner confirms the receipt of transaction, the bank confirms the payment through the system. The form of performing

the payment is agreed between the bank and the receiving party. Because there are several forms of payment such as bank credit, installment, cash and others. It is not the duty of a system to interfere the agreement between the bank and receiving party. When the transaction of money is approved by the bank of the owner, it would be possible to proceed to the next stage. If there is any obstacle or disagreement is determined by banks while the transaction of payment, the process can be cancelled. After the banks of both parties the transaction of money, the land registration office is included in the process. If there is not identified any obstacle related to sale, the land registration office reviews the whole process and approves the transaction. After the confirmation of office, the transfer of money and property occur at the same time. Finally, if the exchange of hand and money is achieved successfully, the whole process is completed successfully.

Conclusion

In conclusion, the establishment of Blockchain-based system for land registration in Uzbekistan can be viewed as attractive even with the requirements of Uzbekistan because of considerable advantages of system. However, there are some advantages of this system such as being able to determine the fair price of property and can prevent the situation if the owner is showing lower price in order to avoid from increment value tax. It is possible to see the productivity of regional investments done by the government, and the tax generated through increment value tax can be directed to other investments in other regions. Through this way, it is possible to ensure whether the investments are distributed equally across all regions. With the use of Blockchain-based system, it would be possible to predict obstacles for evaluating the increment value tax accurately and also, the transparency and security of a system would allow the prevention of flaws in estimating taxes. Furthermore, the outbreak of COVID-19 pandemic showed the high importance of moving towards digitalization. With the use of digital systems like Blockchain-based system, the amount of physical activities are minimized and processes included in the transaction can be accomplished safely with digital advancements. There are several problems which should be handled to apply this system internationally and eliminate its problems. Initially, for applying this system in real life, some legal arrangements must be done and the government authority should update the functioning of the system. Also, the availability of confirmation of transactions in the process would be another important point of the system and this can be applied as legal evidence for proceeding the stages. For spreading the use of system globally out of Uzbekistan, it would be important to comply with the requirements of those countries where it is being applied. Therefore, it is essential to consider country-specific personalization while applying the process.

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