European Journal of Business Startups and Open Society

Vol. 3 No. 07 (July - 2024): EJBSOS

http://inovatus.es/index.php/ejbsos

DECENTRALIZED LEDGER SYSTEMS IN E-GOVERNMENT

Otaboev Nodirbek Oybek ugli

Tashkent State University of Economics, Uzbekistan

Annotation: Blockchain is a decentralized database made up of information blocks linked together through cryptographic hashes. Each block includes a series of transactions or other data, along with a hash from the preceding block. This creates a chain in which each block references the previous one. A key characteristic of blockchain is its decentralization. It operates on consensus, meaning that network participants must agree on any changes to the database. This ensures that all participants share a unified version of the database, providing transparency and secure data storage and transmission.

Keywords: *Smart contracts, distributed ledger systems, digital innovations, the digital economy, procurement, and electronic governance.*

Introduction

Purchases. Smart contracts can help reduce the costs of the procurement process by automating many stages, starting with the submission of an application for participation in a tender and ending with payment to suppliers. This can improve the transparency of the process and reduce the risk of corruption.

Taxation. Smart contracts can help automate the process of paying taxes and fees, reduce the number of errors and fraud, and reduce the time for processing tax reports. Smart contracts are immutable computer programs written on the blockchain and invoked by blockchain participants.

Smart contracts provide automation and control flow logic for any system supported by the blockchain. Smart contracts should be considered as software functions in all aspects, and smart contract management mechanisms should be deterministic. The determinism of smart contracts is a characteristic that maintains the ledger in a stable, consistent state, ensures the finality of transactions and avoids soft and hard forks. The determinism of the actions of smart contracts is usually left to the discretion of the developer. Thus, it must ensure that automated actions are performed as planned, and the results of these actions leave the data in a consistent state, regardless of the node(s) on which they are performed. The actions of a smart contract should lead to the same result every time the contract is executed . The use of smart contracts in e-government has already become a reality in many foreign countries. Let's look at some examples.

USA. In the US, smart contracts are used in various fields, including voting, taxation and property management. For example, in the city of Virginia Beach, smart contracts are used for property management, which allows for transparency of the transfer of ownership rights and reduces the time for its implementation. In Wyoming, smart contracts are used to register businesses, which makes the process easier and faster.

Denmark. In Denmark, smart contracts are used in e-government to simplify the process of taxation and property rights management. For example, smart contracts are used to automatically calculate taxes on the income of individuals and companies, which reduces the time for processing tax reports and reduces the number of errors.

Estonia. Estonia is one of the most advanced countries in the use of smart contracts in e-government. Smart contracts are used for voting, tax reporting and property rights management. For example, smart contracts are used to register companies, which makes the process easier and faster.

Literature review

Bitcoin is a digital currency that brings disruptive innovation to the traditional transaction environment which relies on third parties (Chang and Chen, 2020). Blockchain, as the underlying technology, has recently received much attention from industry and academia (Saberi et al., 2019). The heart of blockchain is the recording of all transaction data into blocks and the linking of those blocks into a chain (Queiroz and Wamba, 2019). Each block has a body with transaction data and a header with the hash value of the block before it, which is customarily called the "parent" block. This lets each block be linked vertically to be found or identified easily (Zheng et al., 2017). Fig. 1 illustrates the architecture of blockchain. The blocks with timestamps are chained by hash values, which are unique, and can prevent fraud because any changes in the block will immediately cause a change of the hash value (Nofer et al., 2017) The three fundamental mechanisms of blockchain that make it unique are the distributed ledger, encryption, and consensus mechanism (Beck et al., 2017). There are two main architectures of software systems: centralised and distributed (Tama et al., 2017). A blockchain-based database can be considered a distributed system with an implementation layer that offers protection for data integrity (Drescher, 2017), because in this distributed system, all the transactions will be consistently recorded in the ledgers of all the participants. Rather than relying on a central server to store and validate data, each node in this network has a duplicate of the ledger, which can be updated independently (Trump et al., 2018). To prevent unauthorised changes, the transaction data will be encrypted using various algorithms and signed with a digital signature (Gorkhali et al., 2020). Chandel et al. (2019) indicated that the Elliptic Curve Cryptography (ECC) algorithm and the Rivest-Shamir-Adleman (RSA) algorithm are the two most common encryption algorithms in blockchain, both of which belong to asymmetric encryption.

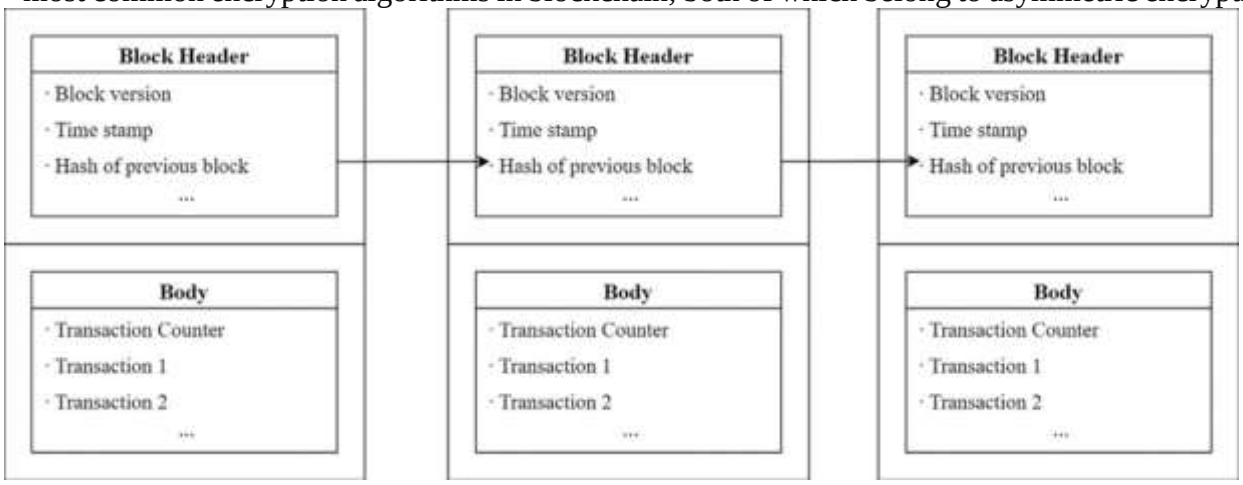


Fig. 1. Blockchain architecture.

Research methodology

Advantages of using smart contracts in e-government

The use of smart contracts in e-government can bring many benefits, including:

• Reduction of costs for processes related to the conclusion and execution of contracts.

• Increasing the transparency of processes in e-government.

• Reducing the time to complete processes and increasing their efficiency.

• Reducing the risk of corruption and fraud in e - government .

By definition, e-government is the use of ICT to provide governments, citizens and businesses with means

of interaction, communication, information exchange and provision

of services to various stakeholders. For example, E-government 1.0 used the World Wide Web and available ICTs to achieve

efficiency. EG 2.0, thanks to portal services supported by Web 2.0 technologies, has become more citizen-oriented, promoting citizen participation and strengthening e-democracy. Technological

The evolution shaping EG assumes that EG 3.0 will use Web 3. ICTs such as Distributed ledger technology (DLT), artificial intelligence, semantic web and the World Wide Web.

Analyses and results

We can give you an example of issuing a driver's license based on smart contracts and write an algorithm and pseudocode.

An example of a pseudocode algorithm that describes the process of automating the issuance of a driver's license:

1. The user fills out an application for a driver's license and uploads the necessary documents.
2. The system checks the availability of all necessary documents and the correctness of filling out the application.
3. If all the data is correct, the system calculates the validity period of the driver's license in accordance with the law.
4. The system checks for criminal records and fines for traffic violations in databases.
5. If the check is passed successfully, the system assigns the date and time of passing the driver's license exam.
6. The user passes the exam in accordance with the rules established by law.
7. If the exam is passed successfully, the system generates a driver's license and sends it by mail to the specified address.
8. If the exam is not passed, the system provides the user with the opportunity to retake the exam after a certain period of time.

This algorithm automates the process of issuing a driver's license, starting with filling out an application and downloading the necessary documents, and ending with sending a ready-made driver's license by mail. The system checks for the necessary documents, checks for criminal records and fines, assigns an exam and generates a driver's license if the exam was passed successfully. If the exam was not passed, the system provides the user with the opportunity to retake the exam.

Below is an example code that describes some automation logic that makes a decision to issue a driver's license in e-government based on the age of the applicant and the results of the driving test:

Table 1

```
if applicant_age >= 18 {
  driving_test_result = conduct_driving_test()
  if driving_test_result == 'pass' {
    issue_driving_license()
  } else {
    send_notification("Sorry, you did not pass the driving test.")
  }
} else {
  send_notification("Sorry, you must be at least 18 years old to apply for a driving license.")
```

In this example, the program first checks the age of the applicant (applicant_age). If the applicant has reached the age of 18 or more, the program conducts a driving test using the function conduct_driving_test(). If the result of the driving test is successful ('pass'), the program issues a driver's license using the issue_driving_license() function. If the applicant has not passed the driving test, the program sends a notification using the send_notification() function.

If the applicant is under the age of 18, the program sends another notification that says that the applicant must be at least 18 years old to apply for a driver's license.

This code can be used to automate the process of issuing driver's licenses in e-government, where the program automatically decides whether to issue a driver's license based on the age of the applicant and the results of the driving test. Uzbekistan also has the potential to use smart contracts in e-government. One of the possible applications of smart contracts in the electronic government of Uzbekistan may be the automation of the process of registration and transfer of ownership of real estate. Smart contracts can be used to simplify the property registration process and reduce possible errors related to the human factor.

In this flowchart, the age of the applicant is checked first. If the age is greater than or equal to 18, a driving test is performed. If the test result is 'pass', then a driver's license is issued. If the test result

is 'fail', a notification is sent that the test failed. If the applicant is under the age of 18, a notification is sent that in order to obtain a driver's license, you must be over 18 years old. Note that the flowchart represents only a sequence of actions and conditions in the code, but does not reflect the actions themselves or functions such as **"conduc_driving_test()" or "send_notification()".**

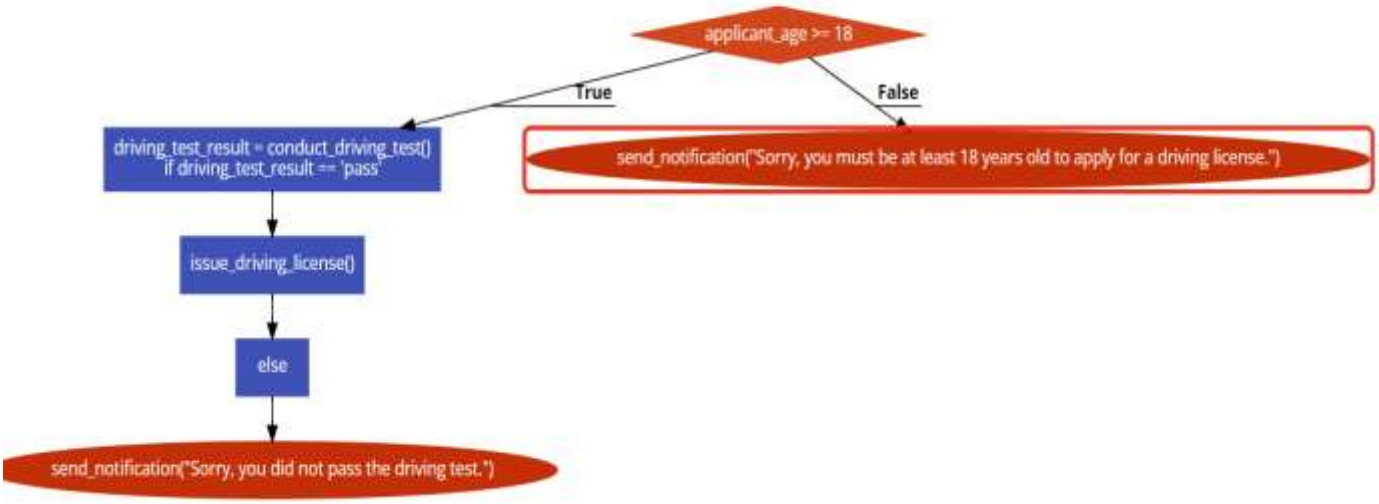


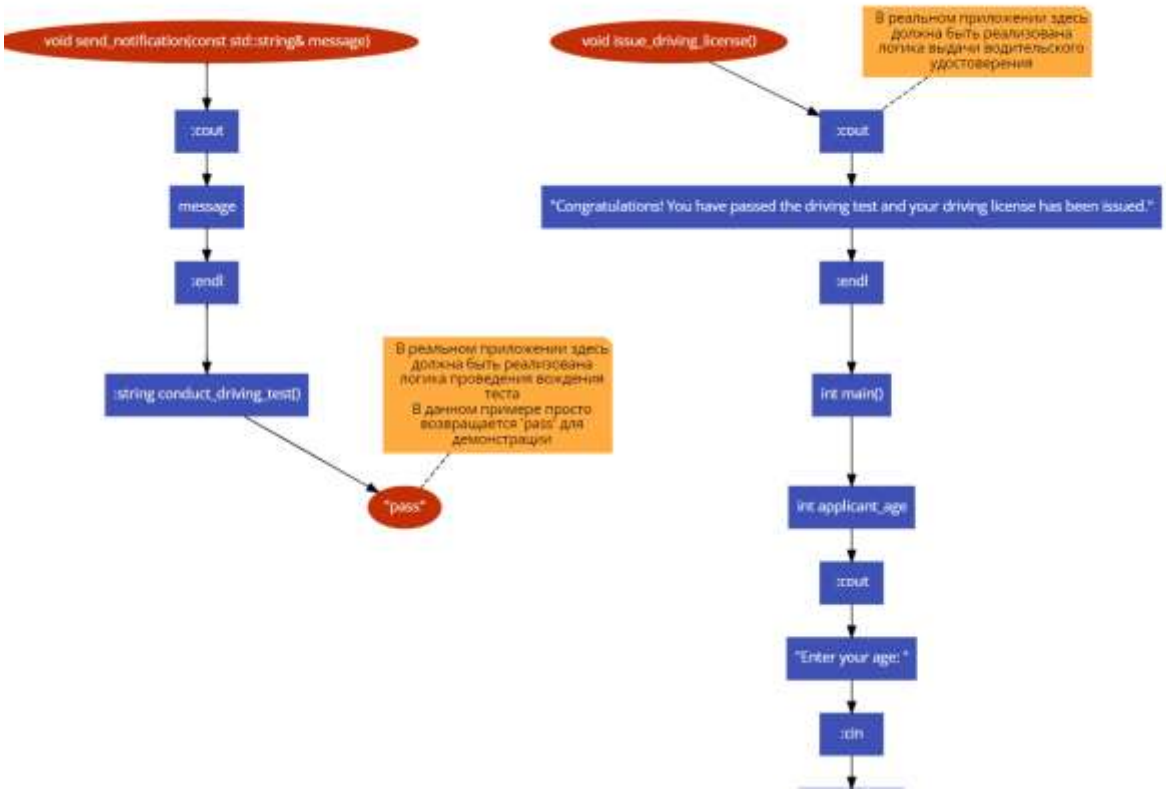
Fig. 2. Issuing a driver's license based on smart contracts

We can also write this code in C++. C++ is one of the programming languages that is used to write smart contracts for blockchain platforms such as Ethereum. However, standard Ethereum smart contracts usually use the Solidity language. But we can use C++ to write a smart contract, we may need to use the appropriate library or tool that provides C++ integration with the blockchain platform. Some blockchain platforms provide the ability to use C++ to develop smart contracts, but support may vary. EOSIO is a blockchain platform that uses C++ to write smart contracts.

Table 2

```
#include <iostream>
#include <string>

void send_notification(const std::string& message) {
   std::cout << message << std::endl;
}

std::string conduct_driving_test() {
   // В реальном приложении здесь должна быть реализована логика проведения вождения теста
   // В данном примере просто возвращается 'pass' для демонстрации
   return "pass";
}

void issue_driving_license() {
   // В реальном приложении здесь должна быть реализована логика выдачи водительского удостоверения
   std::cout << "Congratulations! You have passed the driving test and your driving license has been issued." << std::endl;
}
```

```
int main() {
    int applicant_age;
    std::cout << "Enter your age: ";
    std::cin >> applicant_age;

    if (applicant_age >= 18) {
        std::string driving_test_result = conduct_driving_test();

        if (driving_test_result == "pass") {
            issue_driving_license();
        } else {
            send_notification("Sorry, you did not pass the driving test.");
        }
    } else {
        send_notification("Sorry, you must be at least 18 years old to apply for a driving license.");
    }

    return 0;
}
```



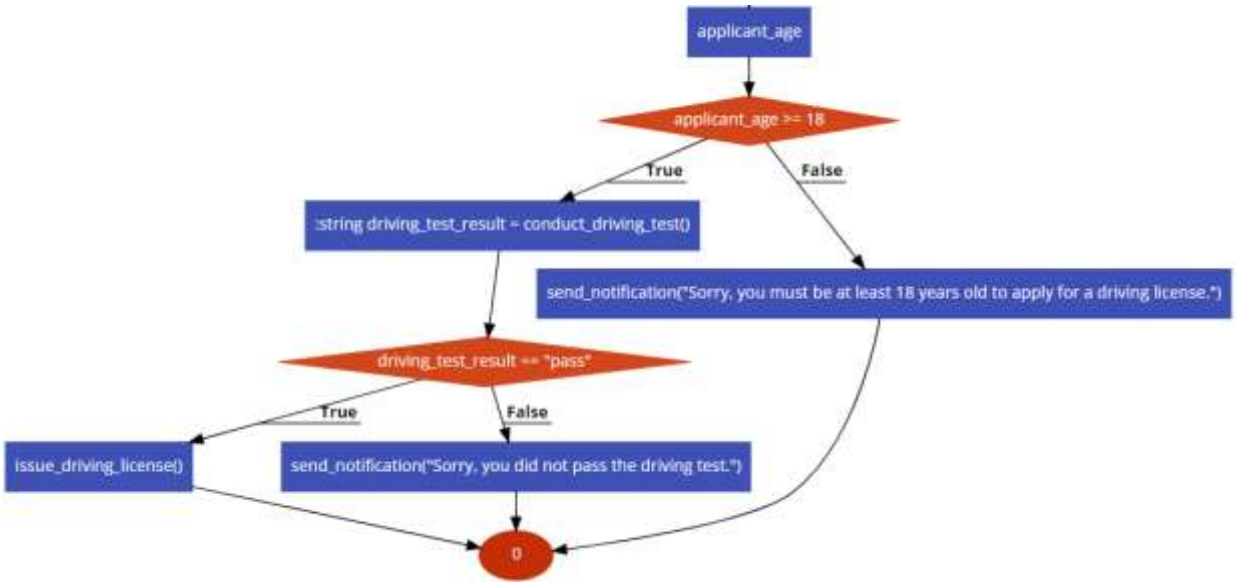


Fig. 3. Issuing a driver's license based on smart contracts C++

Another possible application of smart contracts in the electronic government of Uzbekistan may be the automation of the process of concluding contracts and managing them between government agencies and private companies. Smart contracts can ensure transparency and security of the contracting process, as well as reduce the amount of time and resources spent on the implementation of this process. In addition, smart contracts can be used to automate the process of issuing various permits and licenses, such as construction permits or licenses to trade certain goods. This can speed up the process of obtaining the necessary documents and reduce the amount of time required to process applications.

However, for the successful implementation of smart contracts in the electronic government of Uzbekistan, a good information infrastructure is needed, as well as appropriate legal and technical regulations governing their use. It is also important to ensure the security and protection of data to prevent possible attacks and information leaks. We can consider one example of an algorithm and code for automating the process of registration and transfer of ownership of real estate in Uzbekistan.

Conclusion

In conclusion, blockchain technology has the potential to revolutionize e-government by enhancing transparency, security, efficiency, and trust in government processes. By leveraging the decentralized and immutable nature of blockchain, e-government systems can benefit from improved data integrity, reduced fraud and corruption, streamlined administrative processes, and increased citizen participation. Blockchain technology can be applied to various e-government use cases such as secure identity management, voting systems, public procurement, land registration, and healthcare records. It enables the creation of tamper-proof digital records, eliminates the need for intermediaries, and provides a high level of data security through cryptographic algorithms. However, the adoption of blockchain in e-government is not without challenges. Issues related to scalability, interoperability, legal frameworks, privacy, and standardization need to be addressed for successful implementation. Additionally, there is a need for collaboration among government entities, technology providers, and other stakeholders to ensure smooth integration and widespread adoption of blockchain solutions.

Overall, blockchain technology holds great promise for transforming e-government systems, fostering transparency, efficiency, and trust between citizens and governments. As the technology continues to evolve and mature, it is crucial for governments to explore its potential and carefully assess its benefits and challenges to make informed decisions regarding its implementation.

References :

1. Ahmadi, V., Benjelloun, S., El Kik, M., Sharma, T., Chi, H., Zhou, W., 2020. Drug governance: IoT-based blockchain implementation in the pharmaceutical supply chain.

2. In: 2020 Sixth International Conference on Mobile and Secure Services (MobiSecServ). IEEE, pp. 1–8.
3. Ahmadi, V., Benjelloun, S., El Kik, M., Sharma, T., Chi, H., Zhou, W., 2020. Drug governance: IoT-based blockchain implementation in the pharmaceutical supply chain.
4. In: 2020 Sixth International Conference on Mobile and Secure Services (MobiSecServ). IEEE, pp. 1–8.
5. Babich, V., Hilary, G., 2019. Blockchain and other distributed ledger technologies in operations. Found. Trends® Technol. Inf. Oper. Manag. 12 (2–3), 152–172.
6. Bach, L.M., Mihaljevic, B., Zagar, M., 2018. Comparative analysis of blockchain consensus algorithms. In: 2018 41st International Convention on Information And
7. Communication Technology, Electronics And Microelectronics (MIPRO). IEEE, pp. 1545–1550.
8. Beck, R., Avital, M., Rossi, M., Thatcher, J.B., 2017. Blockchain technology in business and information systems research. Business & Information Systems Engineering
9. 59 (6), 381–384.
10. Bos, J.W., Halderman, J.A., Heninger, N., Moore, J., Naehrig, M., Wustrow, E., 2014. Elliptic curve cryptography in practice. In: International Conference on Financial
11. Cryptography And Data Security. Springer, Berlin, Heidelberg, pp. 157–175.