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ASSESSMENT OF THE EFFICIENCY OF USING SMART CONTRACTS FOR INTELLIGENT ANALYSIS OF USER ACTIONS IN SOCIAL NETWORKS

Abstract. With the development of digital technologies, smart contracts are becoming an important tool for improving social networks. The research examines the integration of smart contracts for intelligent data analysis and process automation. These self-executing blockchain-based applications could revolutionize the way data management, content monetization, and user engagement are approached. The developed system provides automation of transactions, payments to authors, protection of personal data and decision-making in communities. This makes it possible to monitor user interaction in real time and analyze their activity, automatically recording and processing data without the intervention of intermediaries. This approach provides high transparency and accuracy, which makes it effective for researching social trends, identifying public opinion leaders, and evaluating content impact. Smart contracts also help streamline processes that previously required human intervention, keeping all actions and transactions stored on the blockchain transparent. This increases user trust and creates a fairer environment for interaction on the platform. Therefore, the developed system includes several technological aspects, such as blockchain, smart contracts, intelligent data analysis, as well as the integration of these technologies in social networks.

Keywords: smart contracts, social networks, blockchain, intelligent data analysis.

Introduction

The intelligent analysis of social networks has become increasingly important in the digital era, as vast amounts of data are produced every day. These networks offer valuable insights into human behavior, interactions, trends, and opinions, making them essential tools for industries like marketing and political research. However, the challenge lies in effectively and securely analyzing these massive datasets. Traditional methods often struggle with issues of scalability, transparency, and security, especially when dealing with sensitive information [1].

Smart contracts, a key component of blockchain technology, present a promising solution. They enable decentralized, automated, and transparent processing of social network data, eliminating the need for intermediaries and minimizing risks such as data manipulation or unauthorized access. This integration allows for real-time, tamper-resistant data analysis, ensuring the reliability and security of the results [2].

Additionally, smart contracts can be designed to trigger specific actions automatically based on predefined conditions, making data analysis more dynamic and responsive. For example, marketing strategies can be deployed automatically when certain trends are identified on social media platforms [3]. The combination of advanced data analysis techniques with blockchain's decentralized structure also enhances user privacy, addressing growing concerns over data misuse.

This thesis examines how smart contracts can transform social network analysis by improving security, scalability, and automation [4]. It explores the mechanisms that enable trustless data processing through smart contracts and discusses their potential applications across various industries. The aim is to provide a comprehensive understanding of how blockchain can help realize the full potential of social network analysis.

Statement of the problem

In the era of digitalization and the growth of social networks, analyzing user actions is becoming crucial for various applications, including targeted advertising, recommend-dation systems, sentiment analysis, and market research. Traditional centralized systems that manage data analytics often have limitations related to security, transparency, and user privacy. Smart contracts, as a key technology within blockchain, offer the potential to

automate and decentralize many of these processes by providing tamper-resistant, transparent, and trustless systems. However, the effectiveness of using smart contracts for intellectual analysis of user actions in social networks remains underexplored. The main problem lies in determining the feasibility, efficiency, and limitations of smart contracts when applied to the analysis of large-scale social network data in a decentralized and secure manner.

Analysis of recent research and publications

The article [5] explores how blockchain-based smart contracts are being deployed and utilized in various fields, including their technical challenges and comparative analysis across platforms like Ethereum and Hyperledger Fabric. It highlights key issues such as performance and scalability when applying smart contracts to real-world applications like social networks.

In article [6] examines the convergence of blockchain and AI technologies, addressing how these two technologies complement each other in applications such as social networks, where intelligent data analysis can be performed through decentralized smart contracts.

This paper [7] discusses smart contracts' role in blockchain technology, including their application to automated systems like user interactions in social networks. The research emphasizes challenges like trust and legal enforceability, which are crucial in social media contexts.

This article [8] delves into how blockchain can redefine privacy, security, and decentralized control in social media platforms. It explores the feasibility of integrating smart contracts for automated moderation and content management.

Focused on privacy concerns, this research [9] examines how smart contracts can ensure user data is protected while allowing decentralized control and automated analysis of user actions within social networks.

The article [10] discusses the architecture and potential of decentralized social media platforms, focusing on the implementation of smart contracts to analyze user data without relying on centralized entities.

The paper [11] proposes a method for automating content analysis and user behavior tracking in social networks using smart contracts, highlighting efficiency and real-time processing.

This research [12] evaluates the use of smart contracts for incentivizing user engagement and contributions on decentralized social media platforms, ensuring trust and transparency.

Investigates the role of smart contracts in ensuring transparent and decentralized moderation of user-generated content in social networks, eliminating the need for centralized control described in [13].

A technical paper [14] that assesses the performance and scalability of smart contracts when applied to user data analysis in social networks, offering solutions to enhance system throughput and user experience.

The purpose of the study

The purpose of the study is to evaluate the effectiveness of smart contracts in facilitating intellectual analysis of user actions on social networks. This includes assessing the performance, security, and scalability of smart contracts for processing and analyzing social media data in a decentralized manner. Additionally, the study aims to explore the limitations of current blockchain platforms and propose possible improvements or alternatives for future development.

Presentation of the main material

Social networks involve interaction between users, tracking their activity. Applications of smart contracts are performed on blockchain platforms and allow the execution of agreements directly between parties without intermediaries [5]. In social networks, smart contracts are used to automate various processes and improve security, transparency and decentralization, etc. In addition, the use of smart contract technology helps to manage copyright. Thus, the content published on social networks is protected. If the user intends to use this content, the system automatically collects a license fee, and the author in turn receives a reward. Using smart

contract technology, it is possible to organize decentralized voting in communities. Each user in social networks will be able to vote using tokens, and decisions are made automatically based on votes using auxiliary tools.

Fig. 1. Using of smart contracts in social networks

Figure 1 shows a diagram of user interaction with smart contracts in social networks. The user initiates actions, such as content sharing, data permissions, or transactions, through smart contracts. The user's requests, like payments, data control, or content licensing, are encoded into these contracts. These self-executing contracts automatically handle the user's interactions with the social network. They ensure that the terms and conditions are met, such as automating payments, managing data rights, and verifying ownership, without the need for intermediaries. The social network interacts with the smart contracts to retrieve or execute the user's requests. It could involve automating tasks like content monetization, handling data privacy preferences, or distributing rewards.

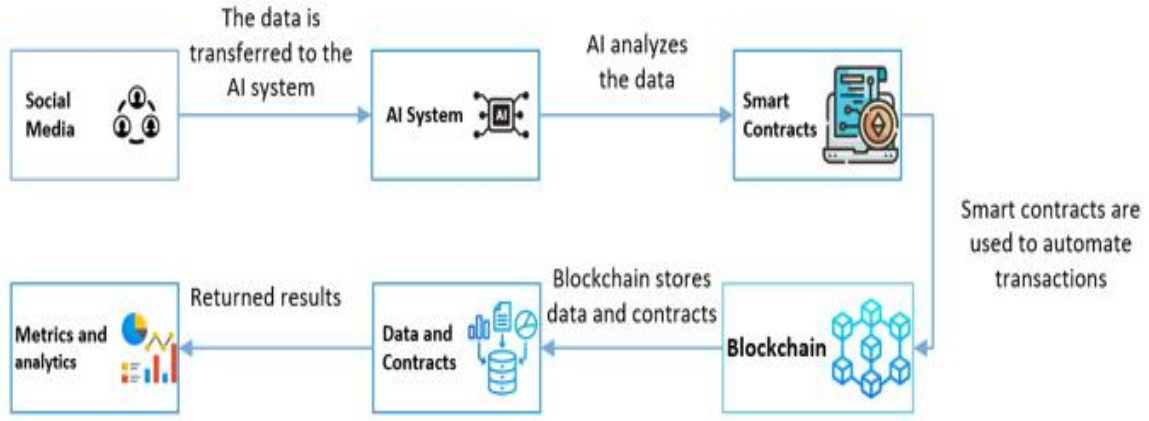

Fig. 2. Common system architecture using smart contracts

Figure 2 represents the collected data from social networks are processed using machine learning algorithms and a smart contract template is automatically formed. After that, they are stored in blockchain systems. Such a developed architecture will help to visualize the results, and the system will be flexible to change with different data sets.

The system gathers vast amounts of data from these interactions, which can then be analyzed to gain insights into user behavior, preferences, and relationships. Intelligent data analysis using AI employs machine learning algorithms to process this information. Doing so helps to identify trends, patterns in behavior, or user preferences, enabling the automatic processing of large datasets and allowing for predictive analysis. Blockchain technology working as a decentralized system, securely stores data and smart contracts, offering protection against tampering while ensuring transparency and data availability. Smart contracts are self-executing agreements that handle processes like transactions or content licensing, operating automatically once

predetermined conditions are met, thus streamlining and automating these processes. An analytical platform functions as a tool for calculating results, determining key performance indicators (KPIs), and supporting decision-making. It helps understand how users interact within the platform and identify prevalent trends.

The developed architecture of the system allows you to keep metrics of the average execution time of the smart contract. Thus, it is possible to understand how much content is displayed on the page when the user performs an action. To evaluate the efficiency of smart contract execution, the following indicators can be used

$$T = \frac{\sum_{i=1}^{N} t_i}{N} \quad ,$$

where N is the number of transactions, t corresponds to the execution time of a certain transaction.

The data was collected from the YouTube social network using the YouTube Data API. In addition, JavaScript was chosen to measure the time to milliseconds to complete a request for a user's written comment and save the data in text format.

To begin with, it was done setting a unique api authorization key to the YouTube Data API and specifying the ID of the video for which you want to get comments. In addition, the number of comments that should be received as a result is specified. After that, using the Javascript programming language, you need to describe an asynchronous function that measures the start time of the request using the performance.now() method. During the execution of the request API using the fetch() method, a request is made to the server and the response is processed.

During such a process, the response from the server is converted into JSON format and the final time is recorded and the total request execution time is calculated. At the end of the algorithm, there is a function call to save comments with the execution time of each request to a text file using a Blob object and display it in convenient text format according to the selected template.

Tabl. 1. Average time of execution smart contract according to user actions

Transaction number	User action	Average time of execution smart contracts, s
T_1	Like of posts	1.5
T_2	Repost	1.8
T_3	Comments	2.0
T_4	User subscribe	1.7
T_5	Saving posts	1.6

In Table 1, you can see how the average user performs actions in social networks using smart contract technology. Compared to traditional methods, smart contracts can automate many processes that are performed manually or through intermediaries in traditional approaches. These are usually tasks related to transactions, moderation or agreements between users [16, 17].

In addition, thanks to the use of smart contract technology, it is possible to ensure the transparency of all actions and transactions, since they are recorded in the blockchain and are available for verification by any user. By eliminating intermediaries and manual routine work, smart contracts reduce transaction costs and improve transaction speed [18].

Also, using of smart contract technology, user data is protected. This happens with the help of decentralized solutions that reduce the risk of losses.

Therefore, traditional approaches have certain limitations in efficiency, scalability and security and can be significantly improved with the help of a developed architecture.

In addition, the developed architecture allows to obtain the number of successful attacks or errors in smart contracts. Thus, it is possible to track errors and test the vulnerability of social networks. The

application of blockchain technology will also help to calculate the metric of the number of transparent transactions.

In summary, it can be stated that with the help of the developed architecture, it is possible to evaluate the speed of processing, the quality of the collected information, and the feasibility of using smart contract technology to obtain optimal metrics collected from social networks.

Conclusions

Additionally, smart contracts enable trustless interactions, where users don't need to rely on a central authority or third parties to manage their data or transactions. This reduces the risks of fraud and manipulation. The automated nature of smart contracts also lowers operational costs and improves efficiency, ensuring faster and more reliable execution of agreements.

The use of smart contracts in social networks can significantly increase the transparency, automation and security of various processes, giving users more control over their data and monetization. Due to the decentralized nature of the blockchain, it can facilitate the creation of more democratic and autonomous platforms where users are the main beneficiaries.

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