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Applications for Systematic Smart Contracts on Blockchain

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Abstract

Despite the current surge in interest in blockchain technology, there are still a number of technical difficulties, including scalability and security. This paper thoroughly analyzes blockchain applications and smart contracts, their main problems, and suitable fixes. It will help to pinpoint any gaps and future research. It also indicates the topics on which contemporary research has focused. 292 publications from the top digital libraries were chosen for the study. After a thorough review process employing predetermined inclusion and exclusion criteria, only 28 publications were taken into account.

Keywords: *Applications, Systematic, Smart Contracts, Blockchain*

1. Introduction

Blockchain is a peer-to-peer distributed ledger technology that records transactions for contracts, sales, and other business-related activities [1]. A blockchain ledger is a collection of connected transactions that are grouped into sequentially connected units called blocks. Blockchain uses cryptographic techniques to guarantee transaction security. Some of the key advantages of blockchain technology include decentralization, permanence, non-repudiation, anonymity, and audibility [2]. With the help of this technology, decentralized consensus, or agreement between unreliable parties, is made possible without the need for a central certifying agency. Consensus is produced by cryptography-enabled algorithms that run on a distributed network of peers and allow (in the case of Bitcoin) virtual currencies that are not backed by a central bank [3]. For instance, autonomous program execution is now possible thanks to blockchain technology. the Ethereum blockchain, which enables smart contracts and brings a revolutionary form of distributed computing [4]. Smart contracts are essentially a piece of computer code that runs on an EVM, a decentralized virtual machine. Our research of the literature led us to the conclusion that blockchain technology will usher in one of the next technological revolutions [5].

Numerous studies have been written about the blockchain, with the majority of them concentrating on the following subjects: different consensus protocols; the blockchain's monetary component; its many application domains, including the Internet of Things, healthcare, education, voting systems, and government; and the security aspect [6]. Other analyses focus on attempts to attack and vulnerabilities in blockchain-based smart contracts. In this essay, we look at current research on the challenges and limitations of blockchain. The following sections serve as the paper's organizational framework. In Section 2, the review procedure is described. The conclusions and results are presented in Section 3. Section 4

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includes the researcher's findings as well as some recommendations for additional investigation [7].

2. Process of Systematic Review

We employ systematic literature review (SLR) to review the literature [8]. By categorizing the papers, SLR enables us to offer a visual summary, and a map of the results, and our goal is to present an overview of research to detect gaps [9]. Peterson's concept states that we should concentrate on 5 steps when doing a systematic mapping study. Extracting the information acquired comes after first creating the study questions. completing the last phase by responding to the research queries and identifying research gaps, as shown in Figure 1 [10].

Figure 1. 5 steps of the process which are used for selection of primary studies.

The primary goals of this study are to: (1) Locating and Defining issues or Problems; (2) Designing the Research Proiece; (3) Collecting Data; (4) Interpreting Research Data; and (5) Report Research Findings

a. Papers are screened for inclusion and exclusion

The principal articles' sources We took 292 peer-reviewed papers in the blockchain and smart contract fields [11]. Then, we regarded 60 publications as being the majority of studies about this field. Papers that did not utilize English as the primary language, did not have complete text available, or had a different definition of blockchain than that used in computer sciences were omitted. Due to duplication, 32 papers were eliminated, leaving only 28. To collect and organize the necessary data, we created a data extraction form [11].

Task 1: What blockchain-related academic subjects are hot right now?

We created a variety of classification systems for the papers we studied. First, we grouped them according to their focus on cryptocurrencies, blockchain-based apps, security flaws found, and suggested vulnerability detection solutions. We found that each category's percentage distribution was 17%, 31%, 34%, and 18%, respectively [12]. We learned from the articles we studied that blockchain technology can be used in numerous financial industries, various business services, transaction processing, and even market forecasting [13].

For instance, it can be used for peer-to-peer blockchain-based implementations of prediction market systems, digital payments, and cryptocurrency exchange and payment. Numerous additional industries and fields, including the pharmaceutical business, integrity verification, governance, healthcare administration, privacy and security, voting systems, the Internet of Things, and education, can benefit from the application of blockchain technology [14]. To improve security and dependability in distributed networks, blockchain may provide a variety of implementation strategies. Additionally, it can be used to keep academic records

connected to reputational awards in the field of education [15]. Then, we discovered that some of the publications dealt with smart contract-related topics. They largely concentrated on codifying performance, security, and privacy issues. A classification approach that covers the key issues with blockchain applications is shown in Figure 2 [16].

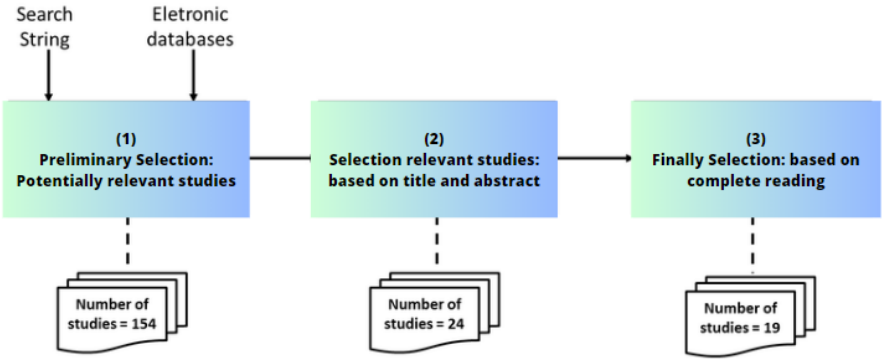
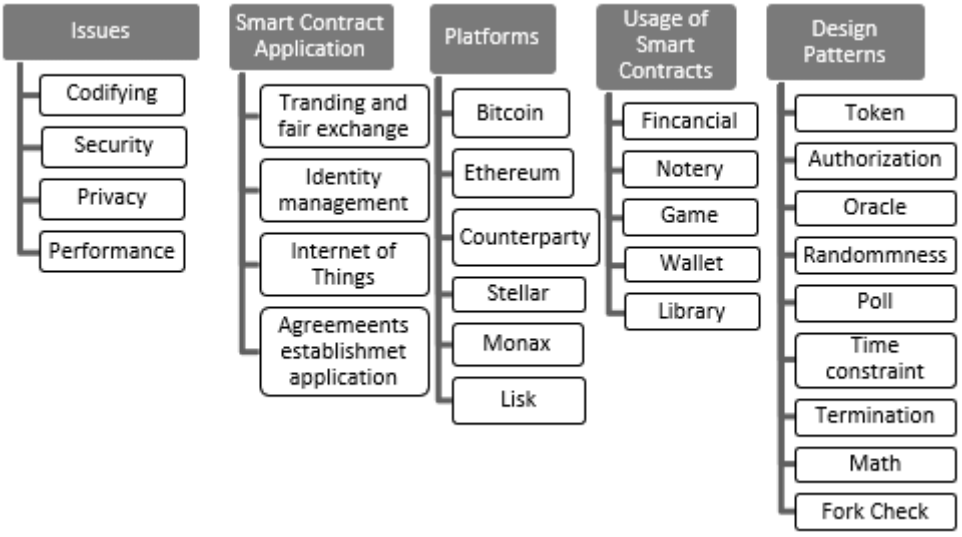


Figure 2. Selection process of primary studies.

After examining the papers, we discovered that two of the most well-known systems using the smart contract idea are Bitcoin and Ethereum [17]. A classification strategy for smart contracts is shown in Figure 3, with the following categories: security concerns, smart contract applications, platforms, smart contract usage, and design patterns [18].



Source: Research Gate

Figure 3. Classification Scheme Related to Smart Contracts

Task 2: What are the blockchain and smart contract's security flaws?

Endpoint flaws, public and private key security issues, blockchain integration platforms, lack of full-scale testing, a lack of rules and regulations, untested code, and smart contract flaws are some of the most prevalent vulnerabilities [19]. We should be concerned about smart contracts because there is mounting evidence that more than 40% of Ethereum smart contracts, including the DAO and the $32.6 million wallet theft in June 2017, are insecure. Both malicious miners and users can take advantage of specific classes of vulnerabilities, claim the authors. The most frequent faults in smart contracts were analyzed and attempted to be fixed by various researchers to make the creation of smart contracts safer [20]. Recent research suggests methods for contract code static analysis to find vulnerabilities. All audited smart contracts are made to comply with a security standard by Quantumstamp. The decentralized security mechanism they built enhances the blockchain architecture [21].

Task 3: What changes have been made to publications throughout time?

Primary research publications for our investigation were released after 2014. Looking more closely at the historical development of publishing Two papers (7%) were published in 2014, one paper (4%) in 2015, six papers (21%) in 2016, eight papers (29%) in 2017, and eleven papers (39%) in 2018 [22].

Task 4: Determine which research gaps exist.

After doing the comprehensive mapping analysis, we discovered that the gaps were mostly related to performance and scalability difficulties [23]. Future study may focus on implementing and operating secure smart contracts on various blockchain implementations. Blockchain is now being used in numerous significant sectors, not just in applications centered on digital currencies. According to our analysis of the literature, the use of blockchain in education is a crucial area to concentrate on [24]. Blockchain technology and smart contracts can be used to secure and issue certificates, implement a distributed application for credit transfer and automatic recognition, conduct digital transactions to collect payments from students, use student identification within educational institutions, and track intellectual property, among other things. Implementing a blockchain-powered smart contract application for the education sector to validate digital properties may be an intriguing future project [25].

3. Conclusions

The topic of blockchain technology has seen an increase in interest recently from both academics and businesses. We listed the most recent research areas and provided a comprehensive viewpoint on blockchain applications and smart contracts. We identified their primary implementation and vulnerability issues, as well as the accompanying remedies, using a comprehensive literature study. We discovered a gap in the use of blockchain in education. Blockchain and smart contract deployments in education are now in the pilot stage. Some ongoing projects are centered on managing credentials and transcripts, managing fees for students, and managing student records. In a later project, we'll create a platform for intellectual property management using blockchain and smart contracts. As an example, a platform might provide a safe and effective way for scientists to exchange their research. Managing ownership rights on the blockchain will allow for a democratic ecosystem and equal rights for publishing your data.

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