A Novel blockchain-based scientific publishing system

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Abstract
Scientific publication industry is dominated by a few publishers that use centralized systems which decrease the quality of studies as well as making the publication process longer. To eliminate the traditional publication system deficiencies, we proposed a decentralized blockchain based scientific publication platform. Our proposed system using Ethereum smart contracts to accelerate the publication process, decreased the biased evaluation process while reducing the publication cost. The proposed model also improves the quality of the scientific studies by adding new features to the publication process. The suggested system has been implemented by using Ethereum Virtual Machine (EVM) which consists of front-end, middleware, and back-end. When author submit an article, the system find most suitable editors, and reviewers for related fields automatically. After the publication process finishes, editors, reviewers, cited authors and other contributors get rewarded as a system token-based cryptocurrency.

Keywords: scientific publishing system, publication challenges**,** blockchain, ethereum, smart contract, security

1. Introduction

A scientific publication is a written and published report describing the details and results of an original research based on scientific writing rules. In other words, the current scientific publication system makes research available to the scientific community in a journal or other source document form where the original research results can be referenced. In this case, other authors can repeat experiments and examine the results [1] as well. Scientists publish their research and results in the form of summaries, thesis, conference reports and articles in order to announce their work to a wide audience. However, these publications do not always meet the current publication criteria. Moreover, even if a scientific article passes all tests, if it is published on the wrong platform, it will not be used efficiently.

There are many problems that cause the quality of scientific articles to decrease, slow down the publication process and cause the publications not to be published in the right place [2] in the current publication system. Sometimes, not enough good research reports can pass the tests, be accepted, and thus become a valid publication. In another situation, an incorrect or non-expert reviewer may be appointed in the evaluation of the publications. This causes the publication not to be evaluated correctly. At the same time, the number of scientific publishers is not very large. Therefore, the evaluation process of publications takes a very long time. There are many numerous problems like these in the scientific publication process. In response to these problems, blockchain-based systems have begun to be developed [3]. In this study, a blockchain-based method using decentralized Ethereum smart contracts is proposed in order to contribute to the solution of all these problems.

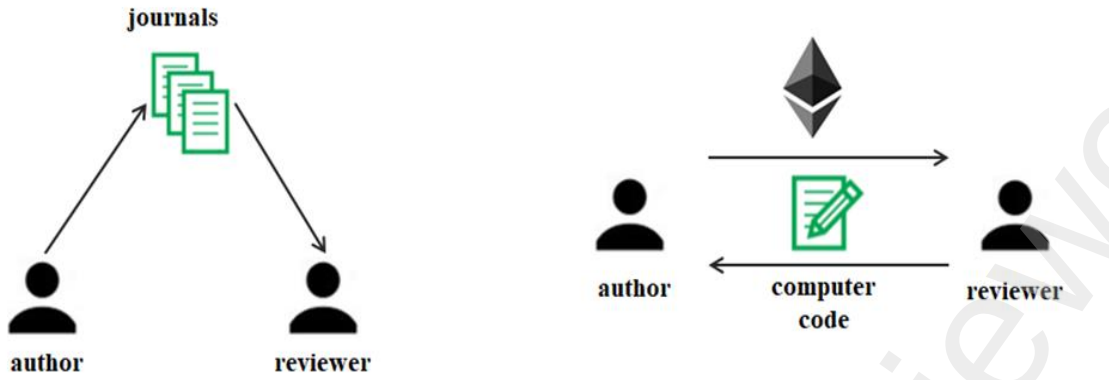

Fig.1. (a) Traditional publication system; (b) Ethereum smart contract based publication system

Ethereum is an open-source protocol or more accurately blockchain-based operating system (software platform), which is public and accounts with chain modeling. Etherum's structure, which uses Solidity software language and developed with different certificates, has enabled the placement and operation of code pieces called Smart Contracts on Ethereum [4, 5]. In summary, smart contract is the realization of the purpose of the contract autonomously, that is, spontaneously, without the additional discretion of the parties, in the event that the contractual terms agreed upon by the parties are fulfilled [6]. In scientific publishing platforms, decentralized alternative studies are still in development, despite the many functions they promise. Despite suggestions such as review proposals using cryptocurrencies, voting and storage of publications, no clear success has yet been demonstrated [7]. In this study, a new model is proposed that uses blockchain and Ethereum smart contracts to create an effective decentralized scientific publishing platform. A comparison of systems using traditional publication platforms and Ethereum-based smart contracts is given in Figure 1.

The proposed model is based on the Ethereum Virtual Machine and consists of three basic components. These components are front-end, middleware, and back-end. Firstly, the author sends a new article to the system and the system lists the journals most suitable for the article. It also assigns more than one editor to the article. The appointed editors make a preliminary decision. However, the system defines the reviewers. These selected editors and reviewers are automatically decided by the Ethereum-based smart contracts system with the points determined according to the research fields. Afterwards, the article is forwarded to the selected reviewers. When the evaluation process is completed, every person who contributes to this process, such as those who are in the pre-evaluation process, editors, reviewers, and the owners of the cited article receives the payment in cryptocurrency. In addition, the proposed system aims to increase the quality of scientific studies with its features. The process of the system and its features are listed below:

- Article information is entered into the system and the system lists the appropriate journals by evaluating metrics such as journal area, acceptance period, acceptance rate.
- Editors and reviewers are appointed by the system to determine the most appropriate. Owners of publications cited in the article cannot be editors or reviewers for this article.
- If the evaluation process has ended and it will not be accepted, the reviewers and editors comment on the article. If the article is suitable for a different journal, the same editor and reviewers can evaluate

the article according to the journal. If there is no need for re-evaluation, the article can be published directly in a different journal.

- If the evaluation process is over and accepted, the article is published in the journal. There are two versions of the published article. Other authors can improve the quality of the article by contributing on the first version and receive an award.
- After the article is published, the authors can be paid tokens according to the number of citations they receive at 6-month intervals.
- Reviewers with successful evaluation scores can also be given more tokens as a reward.

With this proposed new system, a fast, efficient and impartial broadcasting process is provided. With this system, monopolization in the broadcasting process is also prevented. Articles are published publicly for a small fee, so that everyone can benefit from scientific contributions while reducing the cost of publication. The existence of such a system can make a great contribution to both the publishing world as well as the scientific literature.

The rest of the article is organized as follows. Section 2 gives basic information about scientific publication systems, the studies carried out in this field are explained and evaluated. Section 3 explains the methodology of the proposed system. In Section 4, the results of the proposed system are given and evaluations are made. In Section 5, the limits of the system and its areas of improvement are discussed. Finally, the conclusion and future research directions are given in Section 6.

2. Related Work

To clearly define the problem and explain the solutions, we first presented how the current scientific publishing system works. Then, what kind of challenges that current system is facing are listed, and how blockchain technology can decrease the current deficiencies are presented. Finally, the state-of-the-art-methods related to blockchain based scientific publishing systems in the literature are reviewed.

2.1 Scientific Publication System

Scientific publishing is one of the most profitable industries in which its annual profits are competing with those of big technology companies. The scientific publishing industry is dominated by a few publishers [8] and those publishers did not update their publishing system to adapt to new technological developments. Besides, the traditional publication system has several problems which decrease the quality of scientific papers as well as decelerate the publication process. These problems are high publication cost, slow and biased review process, copyrights held by publishers, lack of rewards for contributors, lack of connection among researchers, etc. On the other hand, the blockchain based publishing system is proposed to eliminate the deficiencies of the current traditional publishing system and advance the quality of scientific studies. The platforms such as Orvium, ARTiFACTS, Everipedia and Steem have started to provide knowledge sharing for scientific publication systems [9].

2.1.1 How traditional publishing system works

With the increasing use of the internet, data sharing among scientists has become easier. The big publishers such as Black & Wiley, Elsevier, Springer, and Taylor & Francis use these technological developments in computer-based systems and knowledge sharing to make more profit and reputation in the publishing industry. However, they could not display the same success to improve the quality of scientific studies as well as sharing information among the researchers. The limitations of the current traditional publication system has a direct effect on regular human life because scientific developments lead to technological developments [8]. Figure 2 shows the general view of the scientific review process for the current traditional publishing system.

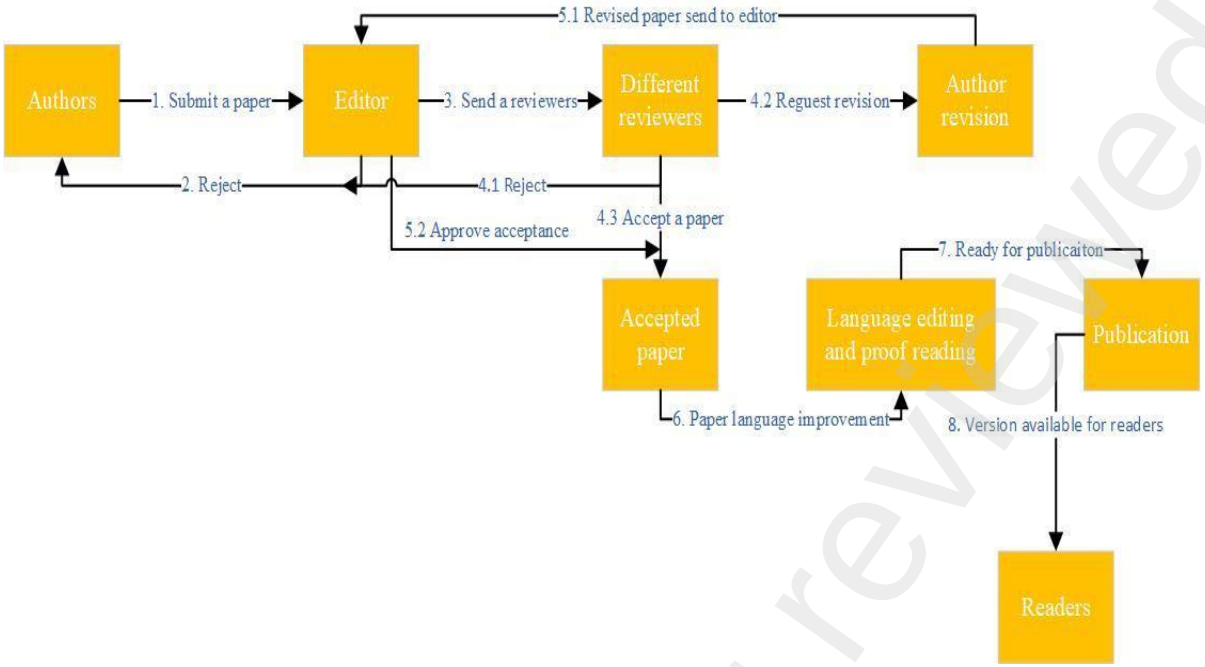

Fig. 2. General view of traditional publishing process.

In the current publishing system, the publication process can be summarized as the following (Figure 2):

0. The authors search for suitable journal
1. Authors submit for selected journal
2. Editor checks the paper and decides the reject paper directly
3. Editor assign reviewers
4. Reviewers check the paper and decide to reject, require revision or accept
5. Revised paper send to the editor, and accepted paper approved by editor
6. Accepted paper send to the publication stage for language editing and proofreading
7. Ready paper put into the publishing queue and if the journal require article processing charge (APC), the authors pay the APC fee
8. Paper is published and accessible to readers (In this stage, some journals require subscription fee)

In the traditional publication system, the whole process from author to journal, and journal to publication approximately takes from six to twelve months. Sometimes, this process can take even more. This long process delays the publication time and becomes troublesome for most authors. During the publishing process, the current publishing system faces several challenges. This challenges can be listed as the following:

Challenge 1- Difficult to set up a new journal: Most of the journals are owned by only a few publishers. These publishers do not want new publishers which can reduce their revenue. Because of that there are several constraints to create new journals and keep these journals alive among the big publishers. Besides, there are a lot of different criteria to increase the related journal index which also make challenges to create new successful journals.

Challenge 2- Difficult to find an appropriate journal: It takes a lot of time to find the right journal for the right study. Most of the publishers' journal finders are not working properly to find the right journal which results in delay for the scientific studies.

Challenge 3- No rewards for authors and contributors: It is hard to find appropriate editors, reviewers for specific domain knowledge, and other contributors to the paper. This kind of problem arises because

most of the journals are not paying to the article contributors for their valuable contributions during the evaluation process. Besides, the authors, who contribute to the specific field and get many citations, do not get rewarded as well. Lack of rewards discourages everyone who wants to contribute to world science.

Challenge 4- Biased review process (Lack of transparency): The review process is biased and not transparent. Most of the time journals cannot find appropriate reviewers who have deep knowledge in related fields. Because the reviewers who have domain knowledge into related specific fields want to receive reward for their valuable evaluation. Since journals are not paying to reviewers, finding appropriate reviewers becomes so challenging. This situation extends the time of the reviewing process as well as raising issues about transparency.

Challenge 5- Copyright ownership held by publisher: In the traditional publishing system, even though all the work has been done by authors, the copyright ownership is helded by journal publishers which means to copy the work as well as use research data freely.

Challenge 6- Lack of reusability: There are not enough connections and data sharing among researchers. When scientists claim new ideas, most of the time they start from scratch instead of adding new features to the existing works. This is because there is no information sharing among researchers. Besides, most scientists could not perform experiments conducted by different scientists [10]. Current publishers do not encourage scientists to share their data with other researchers which results in time consuming for similar studies.

Challenge 7- Not enough Integration between data and its results: Most of the journals do not require and encourage scientists to link their data used during the experiment and their results. This case prevents scientific verification and reduces the data sharing among the researchers.

Challenge 8- Difficult to eliminate plagiarism: In the current publication system, it is hard to eliminate plagiarism. This is because most of the journals rely on plagiarism checker programs such as iThenticate, Grammarly, and CopyScape. These programs are working based upon the predefined list properties which can be easily evaded by paper writers.

Challenge 9- High cost: Most of the journals require a high publication fee from the authors to publish their works. This discourages scientists to work hard and pursue new ideas to publish. On the other hand, journal publishers request subscription fees from institutions, and universities without doing the hard work. Publishers demand money in both cases when authors publish the article and subscription fee to see other scientific studies.

Challenge 10- Long publication time: After authors finish their works, it takes on average six to twelve months even longer in some cases to publish their works. Such a long time discourages scientists from publishing new articles. Even researchers forget about their work details when they receive evaluation results from the journals.

2.1.2 How blockchain-based publishing system works

Blockchain is a new decentralized distributed ledger consists of series of blocks [11]. The blockchain technology provides a proof-of-work model and provides transparency across the distributed network which makes the overall system trustworthy [12]. A smart contract is a computer program which relies on agreement between two entities and runs on Ethereum blockchain automatically [13, 14]. The blockchain and smart contract technologies together provide novel infrastructures which allow decentralized trustworthy environments.

Recently, the blockchain with smart contracts are used to to solve different problems in several different area such as retail market, delivery system, an

automated financial system, a secure internet of Things devices, detecting malware, secure cloud computing applications, etc. It has also started to be used in scientific publishing platforms as well. The blockchain based scientific publishing system brings many advantages over the traditional publishing system. As far as we know, recently there are only a few platforms that have started to provide knowledge sharing for researchers including Orvium, ARTiFACTS, Everipedia and Steem. In addition, there are only a few scientific papers which proposed the idea of a blockchain based scientific publishing system. As far as we know, our paper is the most detailed paper which explains the blockchain based publishing system. The blockchain based smart contract platform for scientific publishing system can be seen from figure 2.

Blockchain based scientific publishing system is still in the early stage, and the platform details are not clear in the literature yet. Our proposed platform will be one of the more extensive scientific studies in this content. Thus, detailed scientific publishing system architecture will be given in our proposed design section. In blockchain based systems, in many cases smart contracts (Ethereum-based automatic computer code blocks) are used for many transactions. In this content, we can summarize this process as the following. First the author submits an article through a web application of the platform, then the platform automatically proves authorship and adds it to the blockchain. In this process, the system cuts down a small percentage of payment as a cryptocurrency from the authors by using smart contracts as well. In this stage, the first version of the paper is also available for readers. The platform also provides a list of appropriate journals for related articles, the authors only need to choose from the list. After a journal is selected, the system assigns editors for articles, and editors choose a list of reviewers. The system uses smart contracts to specify the reviewers from the lists. After reviewers make a decision about the paper, the necessary updating request is sent to the authors. Finally, after proper editing takes place, the paper is published and the last version of the paper is available to the general public with a small fee which is paid as a cryptocurrency.

2.1.3 Comparison of traditional versus blockchain based publishing system

Blockchain based publishing systems have several advantages over the traditional publishing system in several ways. Less biased publication process, less publishing cost, reward all contributors, authors hold copyright, etc. Table 1. shows the comparison of traditional versus blockchain based scientific publishing systems. It can be clearly seen from Table 1, the blockchain based publishing system is superior to traditional systems in many ways.

Table 1. Comparisons of traditional versus blockchain based scientific publishing system

Comparison Parameter	**Traditional publishing system**	**Blockchain based publishing system**
Time to publish	long	short
Time to access article	long	short
Publishing cost	high	low
Access cost	high	low
Reward	no	yes
System support	low	high
Copyright ownership	publisher	authors
Link data with article	low	high
Knowledge sharing	low	high
Biased evaluation	high	low
Score for editors and reviewers	no	yes

2.2 State-of-the-art-Studies on Scientific Publishing System

As far as we know, there are not many studies which are proposed in the literature about blockchain based scientific publishing systems. The blockchain based scientific publishing system methods are given in a research article [10, 15, 16, 17]. We discussed each related article based upon the proposed method, main idea, and advantages-disadvantages.

According to the Schaufelbühl et al. traditional scientific publishing system is handled by just a few publishers, which makes the publication process inefficient [15]. To make the scientific publication system more efficient, they proposed a blockchain-based scientific publication platform which is called EUREKA. The EUREKA provides ownership rights for article owners, and rewards editors and reviewers who contributed to a paper. The suggested system was implemented on Ethereum blockchain which consists of front-end and back-end. The front-end and back-end components communicate via REST API to perform necessary jobs in the background. The article has many deficiencies including: The proposed framework was poorly presented, and it did not give enough information how the proposed framework exactly worked. In addition, the proposed framework performance and limitations were not discussed sufficiently as well.

A Blockchain based scientific publication platform which is called Eureka was presented by Niya et al. [10]. The authors stated in the paper that the Eureka platform incentive model increases the quality of scientific studies. The proposed platform consists of three major components including front-end, back-end, and smart contracts. The front-end Daap (Decentralized Application) is used as an interface to interact directly with Ethereum blockchain. The back-end interacts with the front-end, it listens to contracts and updates the dashboard when it is needed. The Smart Contracts bind the Eureka to the Ethereum decentralized blockchain platform. When a new paper is submitted, first, the time stamped is added into a blockchain and then review is processed and added into the smart contract. To improve the quality of the paper, the contributions are paid as token-based cryptocurrency. Even though the proposed framework improves the traditional scientific publishing system, it is not clear how this all process will be handled with different journals and make the block chain process trustworthy. Besides, the implementation was carried out on a test case, and was not tested in a real world scenario.

Mackey et al. proposed a blockchain model which is using shared governance for scientific publication processes [16]. The suggested blockchain based model validates inclusion by using a DAO (Decentralized Autonomous Organization). The DAO uses the organizational rules which are performed by smart contracts. The DAO consists of reviewers, editors, related scientists in the field, and publishers to manage and control the proposed framework. The model consists of frontend, backend, and Ethereum Network. The frontend was embedded in current publication interfaces which have MetaMask to store users sign in transactions as well as wallet information. The frontend used NodeJS to access the chain Database which is located in the backend. The backend communicated with Ethereum Network by using Ethereum JavaScript API. The Ethereum Network has smart contracts which are performed for publication management workflows. The paper claimed that the proposed framework enhanced the integrity and transparency of the scientific publishing system. The presented blockchain based scientific paper is not entirely novel which is adopted from a similar framework from the literature. In addition, the proposed framework was not implemented and tested. To improve the paper quality, the proposed framework should be implemented and tested on active

collaboration with the current scientific publishers.

Stojmenova Duh et al. introduced a blockchain-based decentralized scholarly communication model which relies on strategic game playing by researchers [17]. According to the paper, the academic world puts a lot of pressure on researchers to rapidly publish scientific papers. However, this pressure decreases the quality of the research papers. Besides, the review process is not transparent and it is biased which decreases the quality of the scholarly communication, as well. The strategy behind the proposed model is to introduce new ideas rather than publishing the scientific studies in a short period of time. In the introduced model, the smart contracts were used to provide a modifiable continuous peer-reviewing process for research papers. When authors submit the research contents into the blockchain based platform, the content subset is hashed and added into the blockchain system to guarantee authorship. Users who contribute to the paper contents earn system tokens. This incentive reward system enhances the overall paper quality. There are some drawbacks in the paper which need to be addressed. The proposed idea was not presented fluently, and the contributions of the paper are not clear. The implementation of the idea was not given elaborately and the algorithms of the proposed system were not mentioned as well. Besides, the limitations of the proposed idea was not discussed at all.

2.3 Evaluation of Blockchain Based State-of-the-art Studies on Scientific Publishing Methods

Since the idea of blockchain based publishing systems is quite new, there are not many research papers in this regard. The papers that we evaluated in the literature reviews are suffer from many aspects, these deficiencies can be listed as follows:

1. They did not clearly discuss the problem
2. The proposed framework was not poorly presented
3. It is not clear how proposed framework exactly work
4. The proposed methods are not well presented
5. Only 1 or 2 papers have a test case and implementation
6. The implementation details of the methods are not well presented
7. The limitations of the proposed methods are not given

The proposed method explains the challenges the current system has and makes necessary contributions in each step to make the system work better. Besides, we add extra features to the idea of a blockchain based scientific publish system to make the publication process fast and more efficient. The details of the proposed system given in the following section.

3. Proposed Method

This section is divided into two subsections, namely design and implementation.

3.1 Design

In our proposed model, in all transactions, the smart contracts are participating to perform decisions automatically and trigger smart decisions during the publication process. Figure 3. presents our proposed blockchain based publication platform. A user (or author) should have a wallet to keep Scientific Journal Platform (SJP) tokens for the submission process. In other words, the user needs to have enough balance to continue for the submission. Surely, the user can access the system with his/her own wallet number and be able to own tokens if needed. After the user obtains enough tokens and passes the balance check via the system, s/he will have the ability to submit his/her manuscript. As soon as the manuscript is submitted, the responsible editor checks its eligibility in terms of scope, journal format, and plagiarism detection (iThenticate report). If the manuscript passes the pre-check conducted, the editor requests reviews from the related

reviewers. As enough of the reviewers accept the request, the review process begins.

In the proposed model, the number of reviewers can be declared based on the user request. The user can determine the number of the reviewers with regard to the cost of the review. When a reviewer completes his/her review, he/she submits the review via a smart contract to the SJP. The reviewer can prefer to fill out the review on the website form or upload a review document. After the reviewer completes the task in time, the editor evaluates the quality of the review to prevent fake reviews. The editor also can check the time of the review and apply a late fee to force the reviewers to complete the submissions on time. Accordingly, based on the quality of the review, the editor provides a rate for the review. Then, it is stored in the smart contract and the backend. If the paper is rejected for a related journal, the author can select a different journal from the journal list. In this process, all the reviewers comments and editor decisions will be available to the current journal editor. Based on the journal quality, the paper can be accepted with revision (in this case no re-evaluation) or can be sent to the new reviewers.

Our proposed blockchain based publishing model accelerates the publication process while decreasing the publication time and cost. Besides, all parties who support and contribute to the paper (editors, reviewers, cited authors, etc.) receive some amount of SJP token-based cryptocurrency. The smart contracts are included for the review process to reduce the biased evaluation for the article. The novelty of our blockchain based scientific publishing system can be summarized as follows:

1. The authors hold copyright
2. Reasonable publication cost
3. Reasonable access cost
4. Speeding up the publishing process
5. To link article with its data
6. Reward for all contributors
7. Authors vote for editors and reviewers
8. No need to resubmit for rejected article
9. Easier to create new journals
10. Link journals to social platform for more contributions and transparency

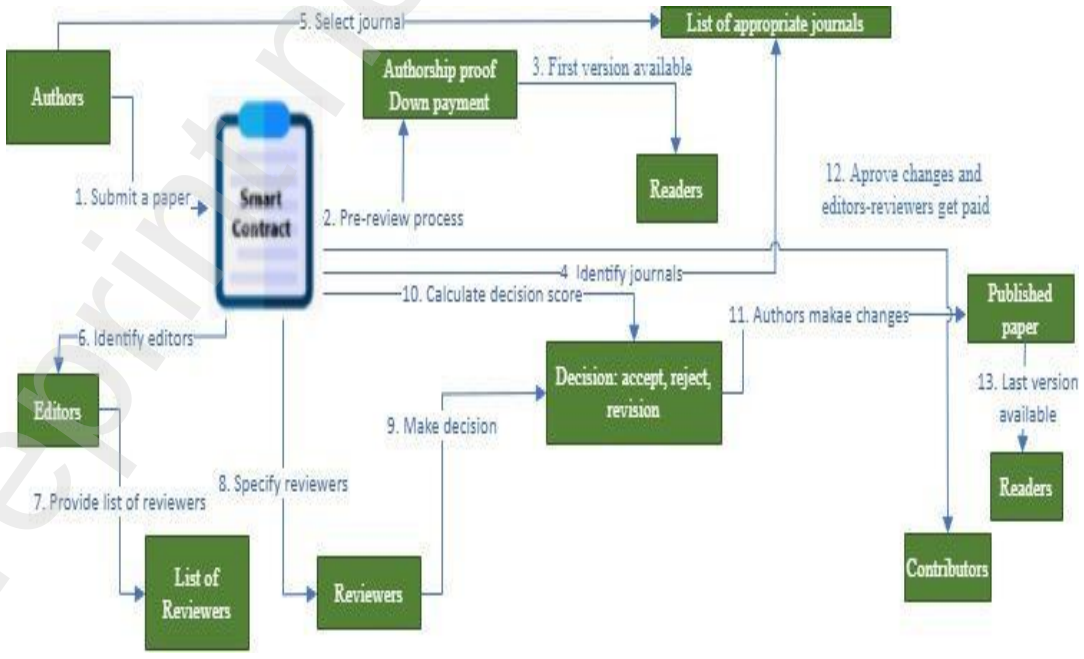

Fig. 3. Proposed blockchain based publishing system

3.2 Implementation

As seen in Figure 4, our method has three main components including front-end, back-end, and Smart Contracts to connect Scientific Journal Platform (SJP) token to the Ethereum Blockchain. In this section, we present details of these components.

3.2.1 Front-End

We implemented a Decentralized Application (DApp) to interact with the Ethereum blockchain. User Interface API is created by using Asp.Net with C# programming language. Accordingly, we integrated Dapp browsers that use MetaMask extension to provide a way for the user to submit her manuscript to the smart contract. Unlike Eureka scientific publishing platform, SJP accepts manuscripts as files rather than URLs [18].

3.2.2 Back-End

In SJP, we use SQL database to keep related documents and information. Frontend communicates with the database via REST API JSON protocols. In addition, we run our local tests on Ganache which is an open source platform that enables us to test our smart contracts without any cost [19]. We manage the database and interact with the Ganache by using Node.js application.

3.2.3 Smart Contracts and Scientific Journal Platform (SJP) Token

A user can submit a paper by using a web browser that has the MetaMask extension. Such web browsers give the ability to access the Dapp by using the standard web3.js JavaScript API that enables the generic JSON RPC specification for providing an interface for the RPC methods.

Accordingly, we implemented a Scientific Journal Platform (SJP) token, which contains ERC-20 standard and all sub-standards that are used for integrating smart contracts on the Ethereum blockchain [20]. We implemented transfer ve call for transfer (called transfer() and transferFrom(), respectively) functions based on ERC-677 token [21, 22]. For both functions, specific parameters such as address to, address from, and token units can be provided to the functions as parameters. The functions are provided in Figure 5.

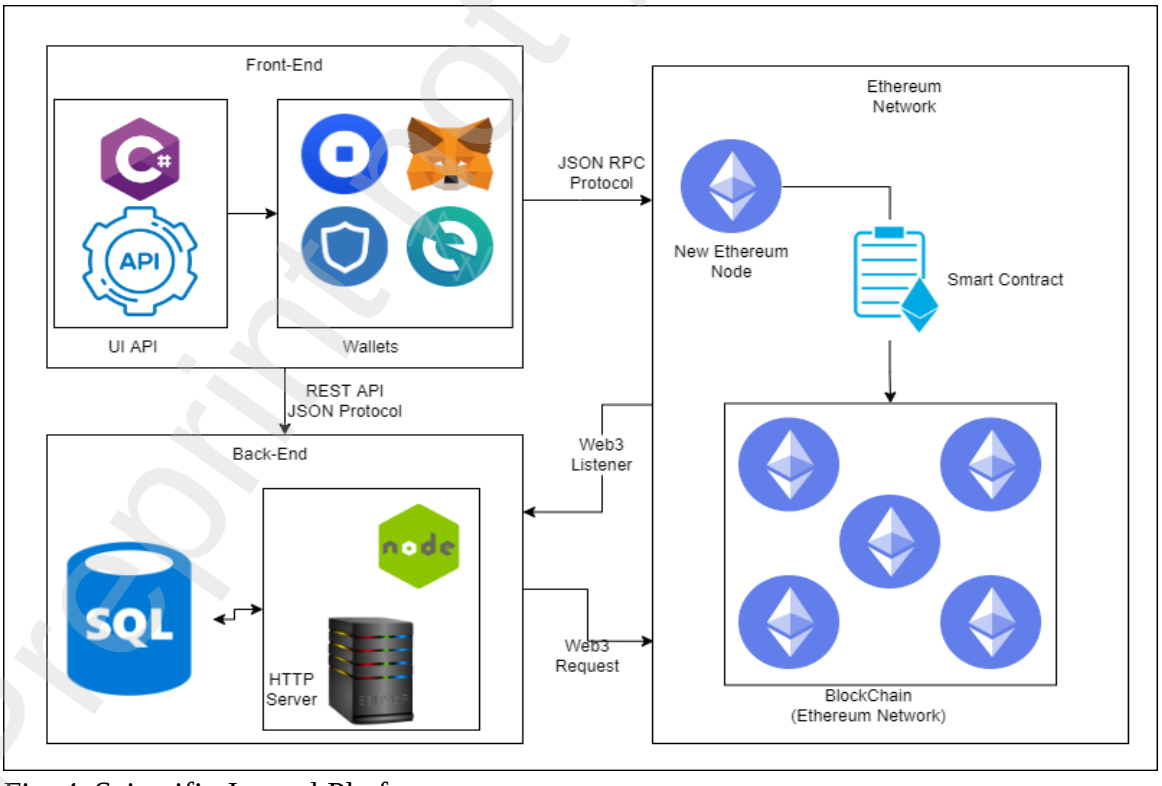

Fig. 4. Scientific Journal Platform

```
function transfer(address to, uint tokens) public returns (bool success) {
        balances[msg.sender] = safeSub(balances[msg.sender], tokens);
        balances[to] = safeAdd(balances[to], tokens);
        emit Transfer(msg.sender, to, tokens);
        return true;
    }

    function transferFrom(address from, address to, uint tokens) public returns (bool
success) {
        balances[from] = safeSub(balances[from], tokens);
        allowed[from][msg.sender] = safeSub(allowed[from][msg.sender], tokens);
        balances[to] = safeAdd(balances[to], tokens);
        emit Transfer(from, to, tokens);
        return true;
    }
```

Fig. 5. Transfer() and transferFrom() Functions.

```
       function totalSupply() public view returns (uint) {
                return _totalSupply  - balances[address(0)];
            }
            function balanceOf(address tokenOwner) public view returns (uint balance) {
                return balances[tokenOwner];
            }
            function allowance(address tokenOwner, address spender) public view returns
(uint remaining) {
                return allowed[tokenOwner][spender];
            }
            function approve(address spender, uint tokens) public returns (bool success)
{
                allowed[msg.sender][spender] = tokens;
                emit Approval(msg.sender, spender, tokens);
                return true;
            }
```

Fig. 6. TotalSupply, balanceOf, allowance, and approve Functions.

In addition, the SJP token contract assures that whether a user has enough balance or not. Also, it allows the user to transfer SJP tokens and pay transaction costs using SJP tokens. These processes are conducted by using the implemented balanceOf(), totalSupply(), allowance(), and approve() functions that are provided in Figure 6.

4. Results and Discussion

For many years, the scientific publication process has faced many problems. Due to the limited number of scientific publishers, evaluations take a long time, possible biased evaluations, and the article being published in a journal in the wrong field are just a few of these problems. With the method developed in this study, it has been tried to avoid or reduce these problems to the minimum extent. In this context, a blockchain-based method based on Ethereum smart contracts has been proposed. The features of this developed method, the contributions and results provided to this field thanks to these features are listed as follows:

- **Listing the appropriate journal for article publication:** During the listing of the appropriate journal, filters such as the area of the

journals, the average publication time, and the average article acceptance rate were used. In this way, the possibility of publishing the articles in a wrong journal outside the scope of the field is prevented. Besides, an appropriate journal list accelerated the publication process.

- **The most suitable editors and reviewers are appointed by the system:** With the rule determined at this stage that the cited authors, the authors from the same institutions, and region cannot be an editor or a reviewer for the article, the biased evaluation process is decreased. In addition, the most cited authors with domain knowledge are assigned as editors and reviewers in our proposed system.
- **Fast evaluation process:** If the article is not accepted and the opinion is that the article is suitable for a different journal, the previous editor and reviewers evaluation is taken into account for the for the evaluation process in new journal (the paper quality is not good enough for high quality journals can be good enough for less prestigious journals). In this way, the process of submitting separately for each journal is eliminated in terms of the author and the expected time for evaluation is saved. If the evaluation process is over and accepted, the article is published in the journal.
- **There are two versions of the published article**: With this feature, the ability of other authors to contribute on the first version ensures that quality articles are presented to the literature.
- **Most cited articles' authors get paid in 6-month intervals**: In 6-month intervals, in each field most cited papers authors get reward as a system token. This feature encourages authors to work hard and publish high quality scientific studies.
- **Reviewers with successful evaluation scores can also be awarded more tokens:** This allows the reviewers to keep the evaluation period short and to make more careful, detailed and high quality evaluations. In addition, this feature contributes to both sides, increasing the evaluation quality of the reviewers as well as the publication quality of the authors.

5. Limitation of the Proposed Method

A system has been developed that aims to prevent monopolization in the scientific publishing system, accelerates the process of publishing articles and can make an unbiased evaluation. In addition to the very important contributions made, our system has some limitations. These are listed below:

- Data is limited and data loss may occur.
- Many people still have not mastered the use of blockchain.
- MetaMask wallet is used in the system and there may not be many users with this wallet.
- The reviewer assignment system can also be improved by adding machine learning techniques.
- There may not be enough editors or reviewers to be appointed in the system.
- The developed system has been tried and tested, but should be tested with real publishers.
- The system can be made more consistent by adding more rules to the system.

It is planned to further develop the proposed system by adding the above-mentioned shortcomings and limitations to future studies.

6. Conclusion

Computer-based systems and related technologies are improved day by day to

meet the business and scientific requirements. The scientific publication industry still did not change their publication model to increase productivity. The current scientific publishing industry is dominated only by a few publishers that use centralized systems, and faces a lot of problems related to the publication process. These deficiencies are mainly: long evaluation process, high publication cost, lack of rewards for evaluators, and high biased process. These insufficiencies decrease the quality of scientific studies while delaying the publication process.

Blockchain technologies provide decentralized environments to many scientific fields to improve the efficiency of the current models. The blockchain and smart contracts together allow decision-making more efficiently as well as provide proof of work for many industrial applications. In this paper, we utilized the blockchain and Ethereum smart contracts to build a decentralized efficient scientific publishing platform. We implemented our model based on Ethereum Virtual Machine (EVM). The system consists of three main components including front-end, middleware, and back-end. First, the author(s) submit a scientific paper to our new publication system. The system automatically finds the most appropriate journals and then assigns more than one editor to the paper. After editors make their first decision, the selected reviewers receive the paper. Editors and reviewers (reviewer list given by the editors, appropriate reviewers chosen by the system) are automatically chosen by the system for given scores based on each field. At the end of the evaluation process, each contributor such as editors, reviewers, cited paper authors receive money as a system token-based cryptocurrency.

The proposed system is fast, efficient, and makes the publication process easier. The system lowers the publication cost, making the publication process fully traceable, and make the scientific papers globally available to anyone with a small fee. Our system also allows copyright ownership for authors, provides journals with decentralized models, and integrates the scientific papers with related data or datasets. The suggested system also improves the quality of the scientific studies by adding new features to the publication process. These features are summarized as the following:

- Authors referenced in the article should not be editors or reviewers for the related article.
- To increase the scientific paper quality, the process is progressed according to the evidence that the authors, editors and reviewers are not related to one another.
- Authors should be paid tokens based upon the number of references they receive at 6-month intervals after the article is published.
- The author(s) enters the article information, the system returns the most suitable journals according to the best criteria (money, acceptance rate, journal quality, acceptance period, etc.)
- New metrics are taken into consideration to choose the most appropriate editors and reviewers.
- More tokens are given as an award to the reviewers with good evaluation scores.
- If the peer-review process is over and it will not be accepted for the current journal, the reviewers and the editors comment for paper in which journal can be published (If paper is appropriate for different journal, the same editors and reviewers can evaluate the papers, if no need to evaluate again, the paper can be publish in different journal directly).
- There are two versions of published paper such that for the first version other authors can improve the paper quality by getting rewards.

As a future work, we aim to extend our implementation and try our system with real publishers. In this process, we will test our system with some journals from different platforms and evaluate the feasibility of the proposed model in a real production environment. In addition, more rules will be added to the proposed model in order to improve the quality of scientific studies while decreasing the biased evaluation process.

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