CERTIFICATEVERIFICATION SYSTEM USING BLOCKCHAIN AND CHATBOT

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Abstract:

The field of blockchain has advanced significantly during the last few years. The application of blockchain technology has the potential to completely transform education by giving people new, affordable, and creative methods to learn, as well as by changing how educators and students collaborate. Blockchain technology can also be usedto issue digital certificates that are unchangeable. By making certificate verification processes faster, more dependable, and decentralized, blockchain technology can improve the current shortcomings of certificate verification systems. There is a lot of scholarly interest in this topic because of the use of blockchain in education. However, studies on the use of blockchain technology for academic credential verification are still in the early stages of development. stage. In this work, we focus on a thorough assessment of the literature on blockchain-based systems for academic degree verification in order to shed additional light on the area. Therefore,the goal of this survey is to gather all pertinent research into a systematic literature review that emphasizes the major contributions made throughout the years by different scholars, with an emphasis on the past, present, and future. Using thePRISMA framework, we have found 34 research that are relevant out of 1744 publications publishedbetween 2018 and 2022. In addition to identifying research gaps that the scientific community needs tofill and investigate, we highlighted six primary themes that were covered by the research publications that were analyzed.

Index Terms: Blockchain platforms; smart contracts; Certificate verification ; academic certificate verification; security and transparency; fraud prevention; Ethereum ,Documents

Introduction:

The way people study and engage with educational institutions is evolving in the era of digital transformation, just as education itself.Additionally, there is a huge demand for increasinghuman knowledge due to the growth of social life. An increasing number of people these days, from lifelong learners to doctorate candidates, use internet resources to advance their education. According to Infante et al. [1], the number of students enrolled inMassive Open Online Courses (MOOCs) rose from 300,000 to 220 million between 2011 and 2021. While there are obstacles associated with the increasing demand for digital, online courses, there are also enormous opportunities for educational institutions. Different study strategies, including

online, part-time, and short-term classes, give students access to a wide range of courses covering a variety of subjects, from professional to soft skills. However, over time, the value of many certificates obtained online is declining due to a lack of community confidence [2], [3]. The main reason forthis is that these certificates

are simple to counterfeit. Moreover, a lot of online colleges grant degrees with little coursework [4]. A recent Forbes analysis estimates that the global market for fraudulent degrees and transcripts produced by degree mills is worth $7 billion annually [5]. Therefore, this issue needs to be resolved in order to stop having a harmful influence

on society in the future. Because it is difficult to tellthe difference between real and false certificates without specific tools and information that thecertificate issuer can only supply, the certificationauthority has historically verified diplomas orcertificates.

Blockchain has become a promising technology thatrecords and validates transactions automatically in recent years [6]. To put it simply, blockchain is a cryptographically secure technology that creates an unchangeable digital data structure for recordingasset transactions between users of a peer-to-peer network, whether it be public or private. Transparency, trust, speed, and the removal of the single point of failure in the centralised system are among the key attributes of blockchain technology.

Although blockchain is actually used in money and business, its applications in the field of education have gained popularity recently.

Blockchain technology has the ability to completely transform education by bringing more accessible and cost-effective learning options and changing the relationship between schools and their students [8]. The administration of student tuition payments is a labor-intensive process involving many parties, including parents, students, scholarship foundations,private lenders, state agencies, and the often massive bureaucracy of university finance departments. Withthe aid of blockchain technology

LITERATURE REVIEW:

Blockchain technology can totally change education by offering more affordable and accessible learningoptions and altering the way that schools and students interact [8]. Parental involvement, student participation, scholarship foundations, private lenders, state agencies, and the frequently enormous bureaucracy of university finance departments are all involved in the labor-intensive process of administering student tuition payments. With the help of blockchain technology
The Blockchain-based Authenticated Key Exchange Protocol (BAKE) is a document authentication method that uses blockchain technology. This can satisfy the computational demands and security requirements of situations where strangers must build confidence in an unreliable setting. Through

Blockchain transactions, several unknown parties authenticate holders of common secrets and complete the session key exchange under the presumption of privacy protection [2].A novel approach based on public ledgers that can truly eliminate any one is blockchain technology. Additionally, it offers very high security and dependability for information revocation and certificate distribution [3]. This technology can be applied in a variety of fields, including cyber security, healthcare, identity management for citizens, supply chain tracking, banking, and many more. It is also compatible with cryptocurrency and certification systems. This is alla result of its transparent and safe information management system.

Blockchain:

A person going by the name of Satoshi Nakamoto (or a group of people) first introduced the idea of blockchain in 2008. Every node that is a member of

the blockchain network maintains a record of all thedata in the network, which is a shared distributed ledger regulated by a set of rule.

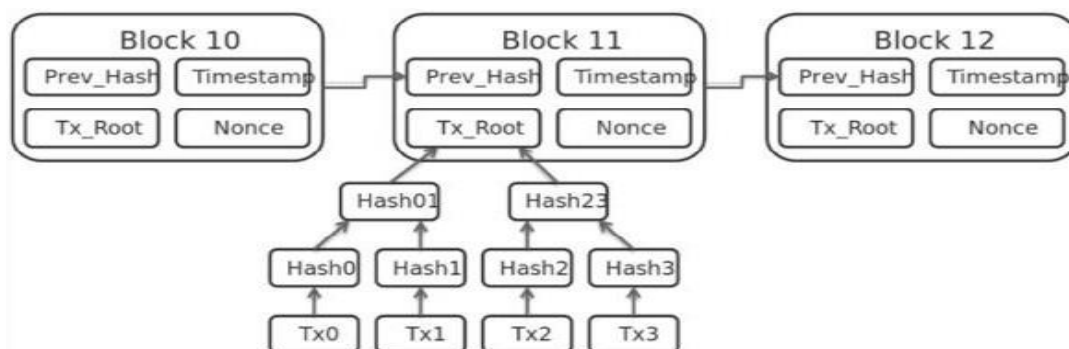Fig. 1 from https://en.wikipedia.org/wiki/Blockchain shows the basic structure how the blocks in blockchain areconnected with each other and content in them.

Ethereum:

Ethereum is an open-source operating system and blockchain-based computing platform with smartcontracts. The cryptocurrency that may be moved between accounts on the Ethereum network is calledether. Additionally, it offers a decentralized Ethereum virtual machine that is capable of running programs on a network of public nodes that is believed to be Turing complete. The internal transaction price mechanism is called gas. Ethereumoffers the smart contract-based decentralized application development platform.
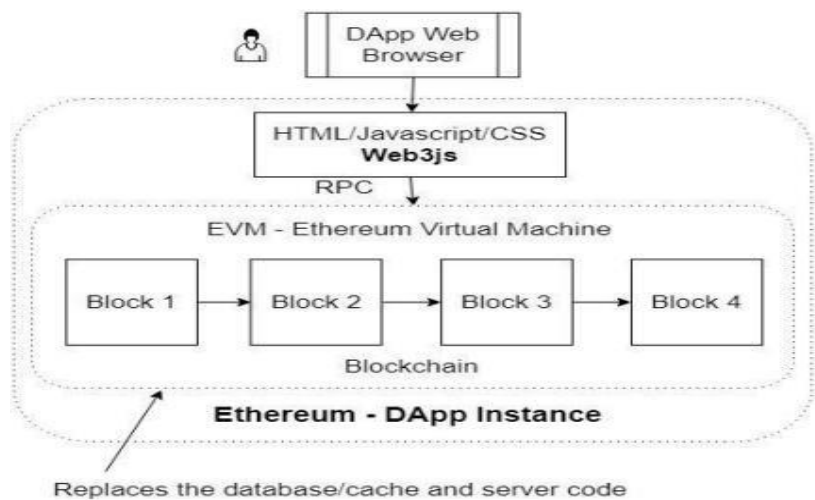

Fig. 2 Ethereum Dapp Architecture

A decentralized application, or Dapp, is a kind of blockchain-enabled website that operates on a peer-to-peer computer network.

The smart contract serves as a backend code in this. Web3js is used to connect the Dapp to the smart contract. With the help of an HTTP or IPC connection, a user can communicate with a local or remote Ethereum node usingthe Web3js library.

Intelligent Contract

A smart contract is a piece of computer code that runs on top of a blockchain and has a set of guidelines that specify how the parties to the contract are to communicate with one another. The code within the contract will runwhen a specific event takes place.
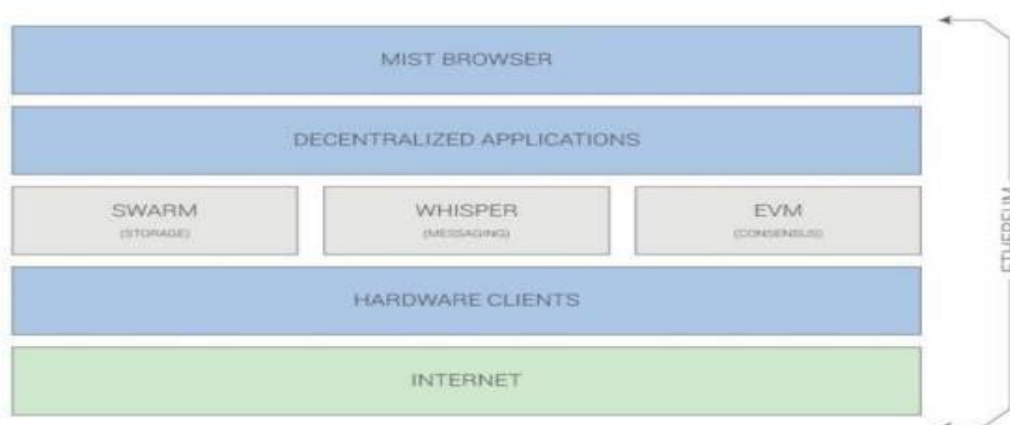

Fig. 3 Web 3.0 Tech Stack

The Virtual Machine for Ethereum:

The term "Ethereum sense" describes a group of protocols that specify a framework for decentralized software. The Ethereum Virtual Machine ("EVM"), which can run code with any level of computational complexity, is at its heart. Ethereum is referred to as "Turing complete" in computer science. Programmers can use existing programming languages, such as JavaScript, to construct apps that execute on the EVM.

System Design :

Based on pertinent technologies, a blockchain certificate system will be created in this study. The Ethereum platform will be used to program the system's application, which the EVM will manage. Three user groups will be involved in the system (Fig. 4). In addition to being able to explore the system database and give certificates, schools or certification units will also have access to the system. Through the scheme, the authorities will award certificates to students who meet specific conditions. The students will be allowed to ask questions on any certificates they may have obtained after receiving their certificates. System upkeep will fall under the purview of the service provider [5].

Method :

In order to generate unchangeable certificates based on blB. ProcessTo create the blockchain based unmodifiable certificates, initially the university needs to get registered. Each university will be having its wallet address from which it is going to send transaction. University can be added only by the owner of the smart contract. Once added the university can access the system and can create certificates with data fields. Each created certificate will be stored in the Inter planetary file system(IPFS) which in turn will return the unique hash generated using SHA-2S6 algorithm. This will serve as unique identity for each document. Along with this generated hash and detail of certificates, all this data will be stored in the blockchain and the resultant transaction id will be sent to the student. Anyone can use this transaction id to verify the certificate details and can view the original copy of certificate using IPFS hash stored along with data. And it is almost impossible to modify this certificate or to create fake certificate with same data. Hence with this we can solve the problem of counterfeit certificates. Anyone can use this transaction id to verify the certificate details and can view the original copy of certificate using IPFS hash stored along with data. And it is almost impossible to modify this certificate or to create fake certificate with same data. Hence with this we can solve the problem of counterfeit certificates. There were multiple phases involved in the creation of the rule-based chatbot for document interaction and issuance. The first step was determining the chatbot's requirements, which included the kinds of papers that could be requested, their formats, and the procedure for issuing them. The following step was to choose the right tools and technology for the chatbot's development after the requirements were determined. We employed the Dialogflow platform, a well-liked and approachable chatbot building tool that allows for a number of external system interfaces. In addition, we managed and stored the document templates and data using Google Sheets. Creating the chatbot's rules and the conversation flow were the tasks of the third stage.
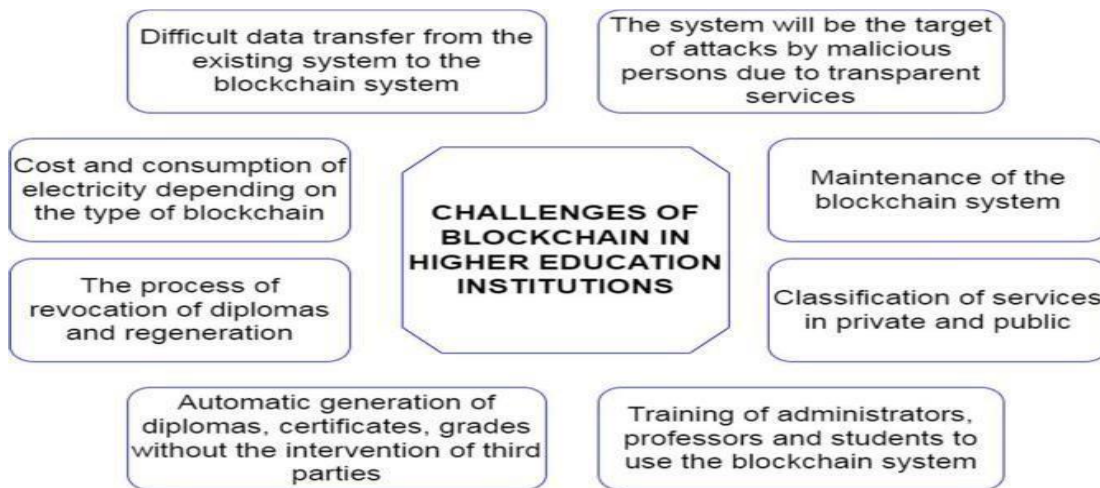
FIGURE 4. The challenges of implementing the blockchain system in higher education institutions.
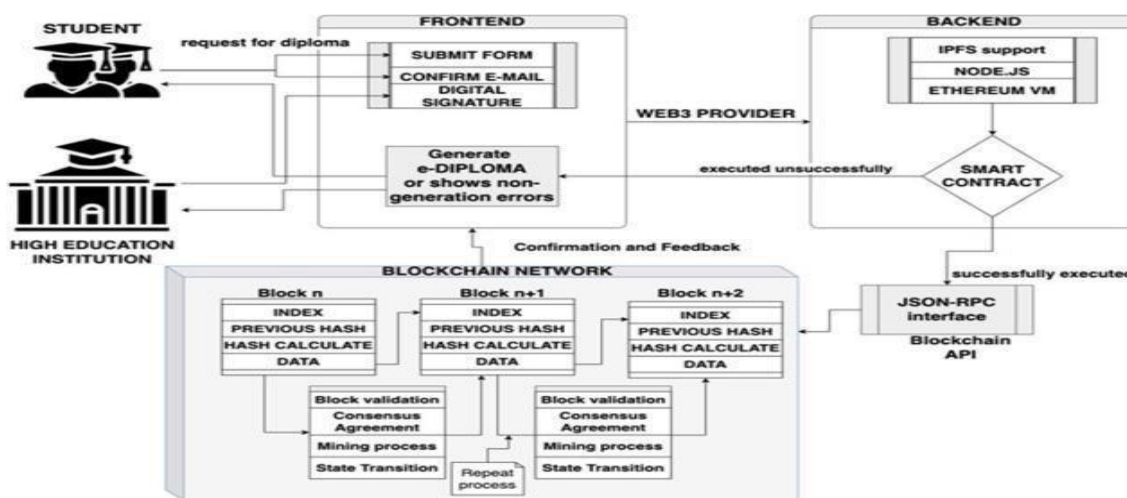

FIGURE 5. The challenges of implementing the blockchain system in higher education institutions.

PROCEDURE:

To finish this SLR (Systematic Literature Review), we adhered to the guidelines provided by Moher et al. [19]. SLR's primary objective is to identify the most efficient techniques through data analysis. This approach follows a rigid set of guidelines and posestargeted, specific inquiries. The quality of the research is assessed in detail, and any biases introduced by the reviewers are identified and methodically eliminated. Moreover, a researchmethodology needsto be developed [44].A four-stepPRISMA technique was employed in our search strategy to guarantee the identification and assessment of all relevant studies. This is an overview of the search procedure in Figure 4. Establishing a research topic, specifying a set of search terms, and choosing the bibliographic databases to examine were the first steps in thePRISMA process for creating a research protocol. Inthe second step, the inclusion criteria were applied, and in the third, the exclusion criteria. The gathering and analysis of the data marked the completion of the process.
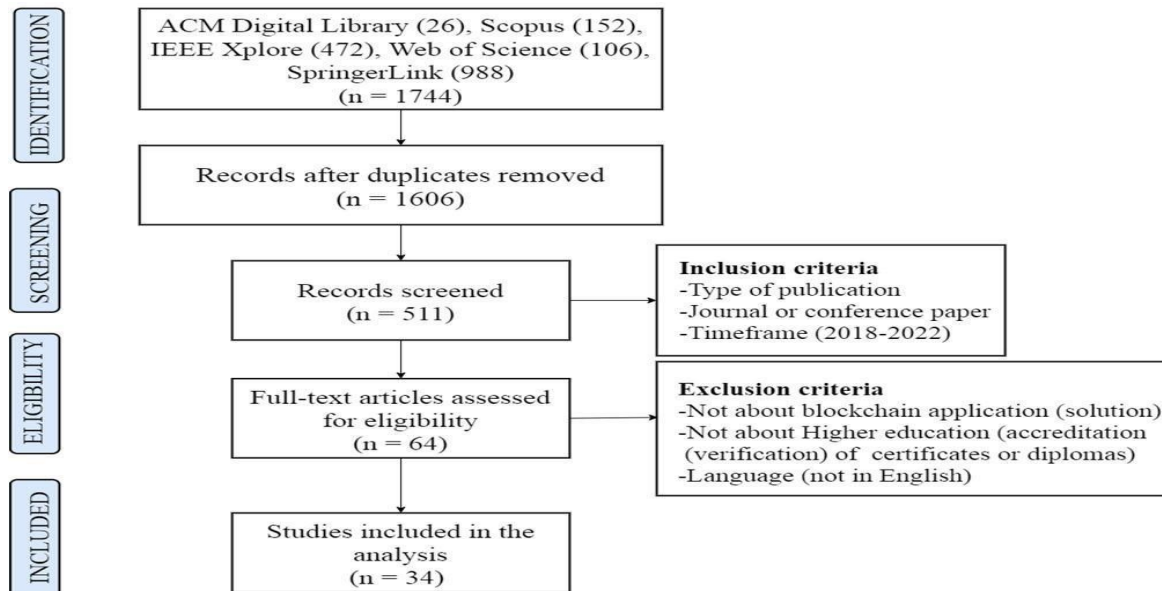
FIGURE 6. PRISMA search methodology.

CHATBOT:

Chatbots have become incredibly popular in a number of businesses in recent years due to their capacity to provide effective and engaging customer support. Artificial intelligence (AI) and natural language processing (NLP) have advanced, enabling chatbots to become more intelligent and adaptable to a wide range of user requirements and preferences.Presenting the concept and execution ofa rule-based chatbot for document interaction and issuance is the goal of this phase. The chatbot's interface is made to make it simple and easy for users to request and receive documents. By using a rule-based methodology, the chatbot ensures correctness and consistency in document issuance by responding to user inquiries and requests in accordance with predefined criteria.

This part will cover the tools and technologies utilized in the chatbot's creation, as well as the determining the chatbot's requirements, which included the kinds of papers that could be difficulties encountered along the way. The study will also showcase the chatbot's capabilities, such as its interactive user features and document issuing process. Additionally, it will go over the value of user experience in chatbots and how the chatbot's design took that into account. Lastly, the study will make recommendations for future developments aimed at enhancing and broadening thechatbot'capabilities.Overall, this part will highlight the potential uses and advantages of rule-based chatbots for improving user engagement and document issuance procedures, as well as the possibility for future developments in the chatbot development space. demands, guaranteeing precision and uniformity in the distribution of documents.

Functionality:

The rule-based chatbot for document issuance and interaction offers several key functionalities that make it a valuable tool for users. These functionalities include:

1. Document Request: The chatbot allows users to request different types of documents, such as certificates, reports, and invoices, by following a structured conversation flow that adheres to the document issuance process.
2. Document Generation: Once the user requests a document, the chatbot retrieves the relevant data from Google Sheets and generates a document in the required format. The chatbot then sends the document to theuser via email.
3. User Interaction: The chatbot is designed to be interactive and user-friendly, providing users with options to choose from and guiding them through the conversation flow. Additionally, thechatbot is able to recognize and respond to common user queries and requests, providing quick and efficient solutions.
4. User Authentication: To ensure the security and privacy of user data, the chatbot requires users to authenticate themselves using their email address and a one-time password (OTP) sent via email. This authentication process ensures that only authorized users are able to request and receive documents.

Conclusion:

Among the numerous organizations that have begunusing blockchain as a new technology are higher education institutions. Blockchain technology can be used to create digital certificates that are unchangeable, and by making certificate verification processes more streamlined, reliable, and decentralized, it can help overcome some of their current drawbacks.The state-of-the-art in blockchain adoption for academic credential verification, including diploma verification, is examined in this literature study. To define the review's parameters, three research questions were created. A thorough quantitative and qualitative step-

by-step filtering process has been applied to the original corpus of 1744 articles that satisfied the search parameters.

The number of publications examining this subject has increased consistently over the time period under examination, according to our study of the screened records. There was an exceptionally significant increase in the quantity of publications published in 2022. The PRISMA framework criteria resulted in the inclusion of only 34 publications for the final investigation. Using a qualitative analysis of the reviewed papers, the following six themes were identified: blockchain classification, automatic generation of certificates (diploma), security and transparency, modification of current architectures, blockchain technology to prevent forgeries, and conceptual models and frameworks. Relevant examples from the filtered references that satisfied all the requirements for this study were included for each subject. The results of the literature review have led us to identify a number of barriers that need to be overcome before blockchain technology is widely used for diploma verification. Some of these problems include process automation, smart contract immutability, costly maintenance, inadequate knowledge transfer, off-chain transfer, big data management via blockchain systems, energy consumption, adaptability, and identity verification. Some of these challenges have been examined with directions in mind. We think that this study's conclusions will stimulate more blockchain development research to learn more about the technology's potential applications in educational settings.

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