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PAPER

Refining the Process of Credit Transfer of MOOCs with the Utilization of ChatGPT and Blockchain

A. Y. Al-Zoubi[1](✉), Mamoun Aldmour[2]

[1]Princess Sumaya University for Technology, Amman, Jordan

[2]Computing Department, School of Digital, Technologies and Arts, Staffordshire University, Stoke-on-Trent, United Kingdom

zoubi@psut.edu.jo

ABSTRACT

Transferring credits between universities worldwide is challenging and time consuming, and usually follows strict and complicated administrative guidelines. Students may encounter severe difficulties during such a process, primarily if they rely on those credits to transfer to another school or graduate on time. Universities may also find it challenging to compare massive online open courses (MOOCs) to courses offered in their traditional programs due to the need for more uniformity in course content and academic rigor. Administrators and professors may struggle to determine whether students have acquired the knowledge and skills necessary for credit transfer through the MOOC. The power of ChatGPT (Generative Pre-trained Transformer) may be employed in identifying and matching courses to MOOCs. At the same time, blockchain technology may provide a speedy and smooth process for credit transfer. A pilot structure that enables students to sign up for an MOOC and determine course equivalency without the challenges typically connected with credit-transfer issues or the recognition of courses taught outside their university is presented, piloted, and tested, significantly impacting the entire credit-transfer process.

KEYWORDS

MOOCs, ChatGPT, blockchain, credit transfer

1 INTRODUCTION

Credit transfer between universities is still challenging and needs to be improved for students worldwide. Students run into many issues during the procedure, which is typically drawn out and time consuming, including problems with course equivalency, credit acceptance, and administrative obstacles. Determining whether a specific course is equivalent to a class at another university can be challenging because universities have different course curricula. As a result, the credit-transfer process might become muddled and take longer. Additionally, certain universities might accept credits from only some institutions or have strict requirements for accepting transfer credits. If students depend on those credits to transfer to a different school or graduate

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on time, delays may cause them to feel frustrated and disappointed. In addition, eliminating administrative obstacles can make the transfer process more accessible and convenient. Current practices may require a lot of paperwork, official transcripts, and dealing with formalities. This might be overwhelming, especially if the student needs to transfer credits quickly [1]. Although many higher education systems worldwide have regulatory frameworks that permit the integration of MOOCs into the educational process, the practice still needs to find wider acceptance. This may be because universities and students need to be better informed about the potential for using MOOCs in the educational process. However, there has been some success in incorporating MOOCs into campus-based curricula, either by incorporating the course into a blended learning format or partially substituting MOOCs for conventional systems in academic programs. Some colleges use MOOCs to develop online master's programs [2]. Accordingly, universities worldwide are hesitant to accept credit transfer, especially in science and engineering programs, due to factors such as accreditation and quality concerns, standardization, course equivalency, and pedagogy. For instance, MOOCs are frequently perceived as providing education of a lower caliber than traditional university courses. The need for face-to-face interaction with professors, opportunities for practical learning, and the lax academic standards in some systems bring this on. Consequently, universities might be hesitant to accept credits earned through MOOCs, especially for science and engineering programs, where practical skills and knowledge are crucial [3]. In particular, MOOCs are not typically accredited by traditional universities or other academic bodies, which raises questions about whether the course material adheres to academic standards. As a result, it is challenging for universities to accept MOOCs as a substitute for traditional university courses. Moreover, there needs to be more uniformity among MOOCs, which can make it easier to compare the subject matter and degree of difficulty of MOOCs with their courses. The level of a student's knowledge and the degree to which it satisfies the university's academic requirements can be determined only with standardization [4]. Furthermore, MOOCs employ a different pedagogy than standard university courses, making evaluating students' knowledge and comprehension intricate. MOOCs may offer an inadequate opportunity for hands-on learning in science and engineering programs, where laboratory experience is crucial. Universities may find it difficult to compare MOOCs to their own curricula due to the need for more consistency in course content and academic rigor among different MOOCs. Because of this, evaluating whether students have acquired the knowledge and skills required for credit transfer through n MOOC can be hard to decide on the part of administrators and professors alike [5]. This paper proposes a new framework that combines ChatGPT and an Ethereum blockchain platform to address some of the issues related to MOOC credit transfer. The procedure entails looking for a list of suitable MOOCs equivalent to a specific predetermined course in the study plan, feeding it to the blockchain, having it reviewed by professors and department members comparing it to the target course, and finally receiving approval to register for the MOOC. Implementing the suggested structure enables students to register for an MOOC and determine course equivalency without the difficulties typically associated with credit-transfer issues or the recognition of courses taught outside their university.

2 MOOCS AND CREDIT TRANSFER

Higher education has been hailed as being transformed by MOOCs, which give students access to top-notch educational materials, free or at a low cost, anywhere in the world. Over 180 million students have registered for MOOCs, which are offered by over 900 universities worldwide and have been adopted by tens of thousands of renowned organizations and significant corporations [6]. The MOOC landscape has also seen increased platforms, instructional languages, and national initiatives. The number of students enrolled in MOOCs nearly doubled in 2020 because of the COVID-19 pandemic and the enactment of stringent travel restrictions. MOOCs are a cutting-edge practice that can significantly influence universities globally. In addition, MOOCs are increasingly being offered as courses in traditional university and higher education programs, either as stand-alone courses or as part of degree programs, particularly on well-known platforms such s Coursera and edX, where the number of participants and methods is steadily increasing. University of Illinois at Urbana-Champaign, University of Pennsylvania, University of Queensland, University of British Columbia, Technische Universitat Munchen, The Hong Kong University of Science, and Technology, Indian Institute of Management Bangalore, Nanyang Technological University, University of Geneva, and Imperial College London are just a few examples of universities around the world that have incorporated MOOCs into their curricula. However, the difficulty in transferring credits has limited the potential impact of MOOCs because students frequently need help to get formal recognition from universities and higher education authorities for their academic accomplishments. There are doubts about the legitimacy and credibility of credentials based on MOOCs because there needs to be a standardized system for evaluating their rigor and quality [7]. The International Credit Mobility scheme within the European Erasmus program is a prime example of a credit-transfer process. The student's home university serves as the originating institution in this program. The host university is designated as the receiving institution, and the student studies at this partner university for one or more semesters. The two universities must agree upon the student's courses before the semester begins. The receiving institution securely transmits the student's grades and other pertinent course data to the originating institution after the student has satisfactorily completed the program's requirements [8].

3 BLOCKCHAIN TECHNOLOGY

In 2008, blockchain technology was first presented as a potent database system that could transparently track data in a business network. Data is kept in blocks that are chained together in a blockchain database. Since chains cannot be added, removed, or changed without the consent of network nodes, the data is chronologically consistent. Therefore, blockchain technology is an excellent option for building an unalterable or immutable record to track orders, payments, accounts, and other transactions. The blockchain system has protections to stop unauthorized transactions and keep them in the exact location where everyone can see them [9]. Three technologies are used to create a blockchain. The first is private key cryptography, which starts transactions on the blockchain. In addition, peer-to-peer (P2P) is a decentralized communication model between two peers, also known as nodes. Multiple copies of the data are stored on those nodes as validated transactions. Third, smart contracts specify the protocols used by transactions that are carried out. Therefore, a blockchain is a series of interconnected blocks that are connected by hash pointers. As a result, each block includes the previous block's hash, which helps the nodes monitor the flow of data throughout the network and ensures data integrity, making it nearly impossible for an attacker to hack the data. The blockchain becomes immutable when one block is modified because its removal would affect all other blocks in the network. The Bitcoin cryptocurrency was first used to track transactions using blockchain technology. Due to its unique qualities, including decentralization, security, dependability, privacy, and data accuracy, blockchain technology has been used increasingly in various applications in recent years. Blockchain is currently used in many applications, including e-government, logistics, supply chain, and healthcare. Three types of blockchains exist: private, public, and consortium. Unrestricted access and participation in a public blockchain are both possible. Users can see and verify all transactions on the blockchain because it is open source. The number of people who can join the network and take part in validating transactions is limited in a private blockchain. Several organizations control the network in a semi-decentralized system, known as a consortium blockchain. The system enables participating organizations to turn into nodes, verify transactions, and communicate with others [10]. Figure 1 summarizes the fundamental workings of blockchain. Using the Metamask wallet app, users create smart contract-related transactions sent to all P2P participating computers or nodes within a specific blockchain network. All transactions are issued to storage pools and are regarded as "pending." Users pay fees to cover the cost of the computational resources needed to process and validate transactions on the blockchain. The blockchain network's developers established a set of validation rules that users, or "miners," use to check the transactions they choose from the pool. The blocks containing the verified transactions are hashed and sealed. Network nodes engage in a competitive process called "block mining." A new block is created and broadcast to network nodes after successful mining by a node. The block is added to the blockchain once other computers on the network affirm that the block on it is accurate.

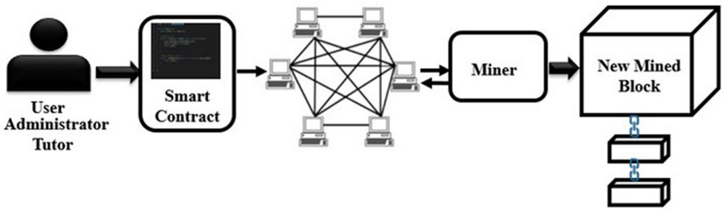


Fig. 1. User interaction with blockchain-MOOCs credit transfer system

4 BLOCKCHAIN IN EDUCATION

Educational institutions have launched several initiatives to use blockchain technology to store the data of their faculty and students—for example, to manage a student's record, i.e., certificates and wallets that contain information about the student's academic records and their qualifications, learning style, and class activities. Many writers and blockchain technology experts have noted this trend [11]. At the moment, certificates are distributed by educational organizations either on paper or electronically. The digital certifications store the digital signatures connected to those digital certifications on a public blockchain using blockchain technology. Users receive personalized, signed digital certificates directly. Therefore, comparing a certificate's digital signature/hash to the hash stored on the blockchain is the only way to confirm its authenticity. Employers and academic institutions that recognize credentials frequently need to verify the legitimacy of the institution issuing the diploma and its issuer. Organizations can use blockchain technology to use digital certificates to confirm that the educational organization has a government license or specific quality for certifications. A blockchain can permanently and immutably store a certificate's proof of validity and the certificate itself. The student's profile would be immediately visible and verifiable, as well as their entire educational history concerning credits. Additionally, learners would keep track of any documentation of their formal or nonformal education. A blockchain would instantly verify these documents' authenticity once they have been shared. Keeping track of intellectual property and encouraging its use and reuse, educators could announce the release of available educational resources, keep track of the references used for copyright reasons, and decide on the degree of reuse. The system could monitor the reuse and repurposing of intellectual property connected to a smart contract that would pay authors according to how their intellectual property was used. Students would use blockchain-based cryptocurrencies to pay for their tuition. Students might receive "vouchers" for tuition assistance set up to release payments in installments based on specific performance standards, such as grades. An educational institution's admissions office might store student information as part of a certification. Those students might use that information to identify themselves to other departments. Many universities and higher education institutions have used blockchain technology for a variety of purposes, including the storage of credentials and transcripts, the issuance of certificates and micro-credentials in different formats, protection of the privacy of student data, accreditation, recognition and credit transfer, streamlining administrative procedures, and maintaining lifelong learning passports [12]. The advantages of blockchain in higher education can increase efficiency, security, and transparency in some facets of academic life. The potential benefits of blockchain technology for the education sector go beyond simply documenting academic success. With blockchain technology, which provides a secure and reliable platform for tracking student-learning outcomes and acquired skills, collaboration and partnership between educational institutions could be significantly improved. Additionally, the operating costs for infrastructure, services, and academic programs may be reduced by using blockchain technology. An additional benefit is its use in accreditation and improving the standard of online education. More advancements in how students are taught and learned could result from educational institutions' continued exploration of the capabilities of blockchain technology.

5 CHATGPT IN EDUCATION

A notable advance in artificial intelligence is the development of natural language processing, which opened the door for the creation of chatbots that can converse in a manner akin to that of a human being. Due to its remarkable ability to communicate with people, the large AI language model ChatGPT4, which has received much attention, is a shining example of such technology. ChatGPT uses deep machine learning to process and produce natural language text. The creation of ChatGPT paves the way for more developments in this field and represents a significant development in natural language processing and AI in general. ChatGPT can learn human language's complexities and nuanced aspects. With the ability to comprehend the context of a given prompt and produce appropriate responses, ChatGPT was trained on various text data, including books, articles, and online conversations. This has allowed it to engage in complex discussions and provide accurate information on multiple topics. This is a significant advancement compared with earlier language models, which frequently needed assistance in determining the meaning and intent of a given text. ChatGPT's capacity to perform high-level cognitive tasks and produce a high-caliber text that is difficult to distinguish from human writing is another crucial feature. It can provide precise and trustworthy answers to questions that would otherwise be difficult to find through web searches due to its capacity to elicit knowledge and tackle challenging academic problems [13]. Several attempts have been made to integrate ChatGPT into educational settings because of the technology's potential benefits. For example, ChatGPT has many potential applications, including individualized instruction, student support, and teacher empowerment.

Because it is a language model trained on many data, it can provide personalized learning experiences, increase student engagement, and provide teachers with different forms of support [14]. Some efforts have been made to incorporate ChatGPT into educational settings to benefit from its capabilities. As an illustration, ChatGPT has been incorporated into chatbots to aid students in their academic endeavors. Inquiries from students are understood by chatbots using natural language processing, which also allows them to provide quick answers, pointers, and specialized learning materials. ChatGPT can also assist students with their writing assignments by providing feedback on their grammar, syntax, and style. Students can develop ideas and organize their essays by being given suggestions for relevant reading material. Additionally, ChatGPT has been applied to create engaging, stimulating, native-language practice sessions for students using language-learning apps. In addition, ChatGPT can assist teachers by providing customized learning resources for their students, offering advice on lesson plans and instructional strategies, and responding to frequently asked questions. By asking questions about course selection, degree requirements, and academic policies, students can get academic advice from ChatGPT in this location. The versatility of ChatGPT is impressive because it can produce a variety of outputs, including essays, poems, prompts, contracts, lecture notes, and computer code. Even though its fluidity is frequently impressive, its accuracy and originality are only sometimes guaranteed [15]. A "large language model" that predicts words based on enormous amounts of data it has been trained on powers ChatGPT's technology. Similar generative artificial intelligence systems enable users to produce music and art. ChatGPT is thus very convenient for teaching as it helps professors write questions, provide examples, and break down complex ideas into simple, understandable terms. It might improve taught courses, offer syllabi revisions, and prepare content. Many professors are enthusiastic about possibly incorporating generative AI into academic settings, while others are at least curious. These tools could help professors and students brainstorm, start essays, demystify complex ideas, and improve rough drafts. Furthermore, these academics contend that it is their responsibility to prepare students for a world in which such technologies will be widely used and make it easier to create everything from business emails to legal contracts. In any case, ChatGPT is introducing a new paradigm shift in artificial intelligence that goes beyond algorithmic intelligence to linguistic intelligence, where interactive activities between natural and artificial, real and virtual, and human and machine play an active and significant role online and in real time [16]. For research purposes, ChatGPT is currently accessible online. The platform interface is accessible by the user and is similar to many chatting applications. Data from up to 2021 was used to train it. The user can be warned not to share sensitive or private information by the system, but the conversation with the system can be reviewed to train and improve the system. The system warns users if ChatGPT responses contain potentially offensive or deceptive information. The platform interface is accessible by the user and is similar to many chatting applications [14].

6 PROPOSED MOOCS CREDIT-TRANSFER SYSTEM

One of the endless applications of ChatGPT is that it can assist students, faculty members, and heads of departments in identifying courses that are offered in other universities in partnership and exchange programs or MOOCs available online that can replace a specific course in the study plan. For ChatGPT to function as a robust and flexible chatbot that can assist users, an API was designed to link it to an HTML page. A backend server was created to handle API requests using Java and integrated into ChatGPT using existing libraries or software development kits (SDKs) provided by OpenAI. One example is the OpenAI JavaScript API client, a downloadable JavaScript package that connects the proposed application to the OpenAI API. The API endpoints were identified to allow the HTML page to communicate with the backend server. The endpoint accepts the user message and returns a response generated by ChatGPT. The HTML page uses JavaScript to send requests to the server and display the responses. A frontend framework was built based on the Reactjs library. The API and HTML pages were tested to ensure their functionality and then deployed to a cloud platform for user access. The user asks the intelligent search engine about the course in question, its content, and similarity to the original course in the study plan. The user will ask the question with a specific syntax clarified in advance on the webpage of the application platform designed specifically for this project and posted online at www.chatchain.info, shown in Figure 2, where the focus of the example illustrated is the credit transfer of MOOCs.

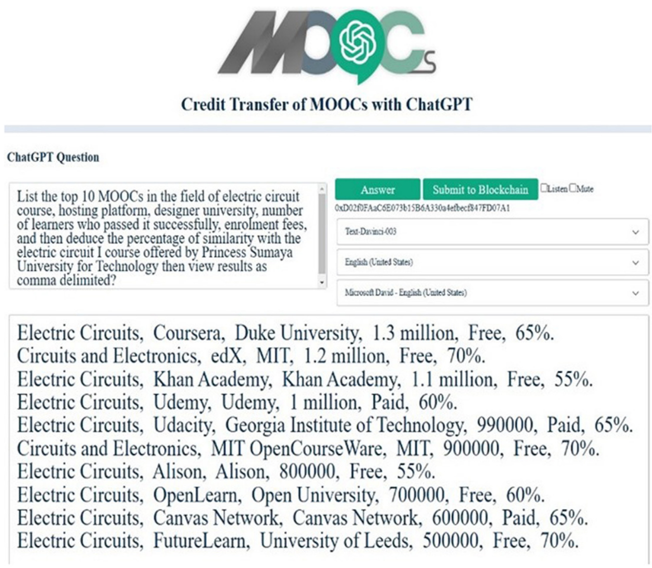


Fig. 2. Student entry of field and details of MOOCs under consideration

The name of the MOOC within the subject matter of the specialty of the student is entered, together with other pertinent information such as the hosting platform, number of students enrolled, number of participants who completed it, fees, and the percentage of similarity with the target course that needs to be replaced. The interface then generates a list of all detected MOOCs in Excel CSV format. This is essential for the subsequent data manipulation stage, with an Ethereum blockchain platform as its backbone. The MOOCs table is uploaded onto the private Ethereum platform upon submission by the user. The platform is accessed by authorized personnel, including the registrar, dean, head of the department, and faculty members involved, as shown in Figure 3. The information is stored in the blockchain memory space and IPFS in an arrangement that can be analyzed and displayed clearly for the authorized personnel to view.

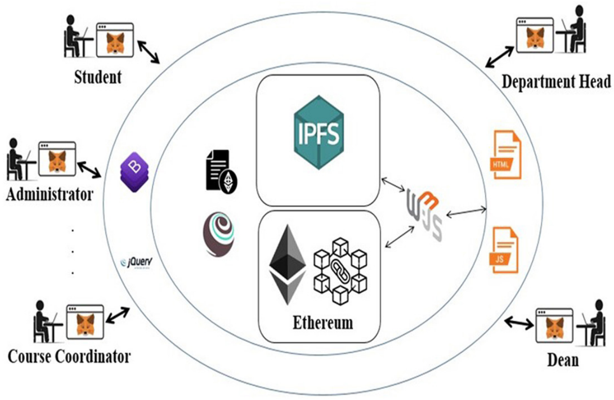


Fig. 3. Proposed blockchain storage and decision-making system

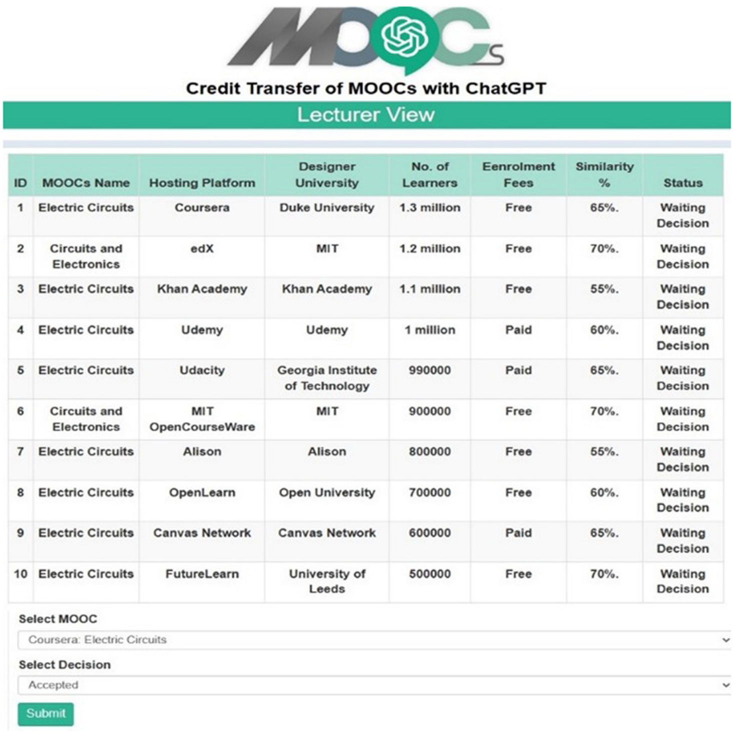
The Ethereum platform and its related IPFS are separated into three layers: the front end, the back end, and the framework. The web application dashboard makes up the front end, created and designed using HTML, CSS, and JavaScript. The dashboard handles several tasks, including user login and a page to submit students' questions to the ChatGPT and then submit the results to the blockchain and IPFS [17]. Additionally, the dashboard makes connecting to the Ethereum blockchain environment easier using the MetaMask browser extension. Alternatively, Web3.js makes up the back end. The JS library serves as a middleware for data flow from the user interface dashboard to the blockchain environment, data encryption/decryption, and MySQL database, which houses students' login information. The private Ethereum network and IPFS servers comprise the blockchain environment's third layer. The IP address of the node, the block timestamp, and a number are all given to the smart contract as its hexadecimal address. The initial setup for the Ethereum blockchain environment includes local servers and IPFS-specific machines. Setting up the Ethereum node, web-server programs, and MySQL database server was the first step in the credit-transfer procedure. The dashboard was created in a second step, which involved communicating and interacting with the Ethereum nodes using a variety of programming languages, including HTML, CSS, and JS. Visual Studio Code (VSC) was used as an integrated development environment (IDE) for the system's development and deployment and used Truffle as a testing framework for developing blockchain applications. It is a popular choice for DApp development on Ethereum because it has a built-in solidity compiler that can produce machine-level bytecode run by an Ethereum node and support testing, debugging, and deploying smart contracts. So, trustable, secure, and automatically smart contracts carry out transactions. Deploying several Ethereum nodes running Geth and enabling the chain's decentralization then prepare the private blockchain for integration. As a result, the generated data are dispersed among all connected nodes to the blockchain. The third step involved reading the MOOCs' information table from the ChatGPT API, similar to the playground. Geth creates accounts in the form of a public hash key with 42 hex characters and a private hash key with 66 hex characters. The private key is used for logging into the system like a password, while the public key is given to users as an anonymous identity. The account then allows the user to use the private key as the identifier to connect to the Ethereum platform using the MetaMask extension in the system browser. If the user is listed as authorized personnel, they are eligible. If not, an error message is shown. The administrator organizes the list in a dashboard with attributes and the corresponding authorized personnel. The migrated smart contract will approve the transactions and stream the data when the user accesses the dashboard home page on the client side using the private key. The solidity-mapping array accommodates the streamed data, after which it can be sent to an IPFS location for proper recording and archiving. When the lecturer/mentor accepts a specific MOOC, the information is simultaneously retrieved from IPFS and the blockchain-mapping array. Almost immediately, a choice can be made in the decision-making process regarding whether to accept the MOOC as a replacement course or if further action or search is necessary. The decision-making process is overseen by a smart contract, written in solidity; the smart contract is initially migrated and deployed using the Truffle framework. The smart contract is assigned an address in hexadecimal format, the account public address, block timestamp, hash in hexadecimal format, and zero nonce value in the node. Data storage performance and security were improved by using IPFS to store data in a hashed fashion. The information is decentralized, stored in IPFS, and encrypted. IPFS was configured and initialized on the node using the official Go implementation of IPFS (Go-IPFS).

7 RESULTS AND DISCUSSION

Prompt Engineering was utilized in training ChatGPT to produce consistent answers to inquiries [18]. Several steps were followed in the training process, including high-quality data, rigorous validation, and ongoing refinement, all of which were integral components of the Prompt Engineering process. To store the ChatGPT-blockchain system's responses, the system was tested over two months by periodically asking the same questions, using the techniques and methods developed through using effective and efficient prompts. During the initial training phase, the question format and syntax were critical in ensuring that ChatGPT generated a response that allowed authorized personnel to select a particular MOOC and corresponding course. The process is illustrated in Figure 2, which shows a specific questioning pattern developed through the Prompt Engineering methodology. This training phase was crucial in identifying the best format for the query and response, which could then be quickly uploaded to the blockchain for decision-makers to view. The first step in the Prompt Engineering training process involved assembling a significant dataset of relevant queries and responses with various topics to prevent ChatGPT from favoring any specific question. After data collection, the dataset was preprocessed using the efficient techniques and methods developed through Prompt Engineering to eliminate irrelevant or redundant information, including cleaning, formatting, and normalization. Following training, the system underwent validation to ensure that it produced reliable and accurate results, using the rigorous validation principles of Prompt Engineering. This entailed evaluating the system using an original dataset that it had never seen before and comparing the results to what was expected, identifying any errors or inconsistencies, which could be addressed and resolved using the continuous improvement principles of Prompt Engineering [18]. Enquires about courses in different disciples offered in various universities and higher education institutions were made using the proposed ChatGPT-blockchain system. The lecturer or other authorized personnel view is shown in Figure 4. The lecturer views the results of the MOOCs equivalence process at the blockchain side displayed in the output HTML page to decide which MOOCs are suitable for replacing the target course. All authorized personnel can view the result on the blockchain simultaneously, and everyone can select the appropriate MOOC independently. Once all agree on a particular MOOC, a decision is made to grant the student permission to register and undertake it online. Once the student passes the MOOC, it automatically enters the system as part of the graduation requirement. It must, however, be emphasized that the percentage of similarity between the MOOC and the target course is the most crucial parameter in the decision-making process and hence the success of the proposed system.

8 CONCLUSIONS

A ChatGPT-blockchain system is proposed to simplify the credit transfer process of a course from one university to another. This is particularly viable for universities that enter exchange partnerships within the Erasmus+ international credit mobility projects. The system was piloted successfully in granting students in advance the permission to register in an MOOC that resembles the content of a given target course within the student's study plan. The system's backbone consists of an API that connects to ChatGPT and an Ethereum platform that stores the data generated about the MOOCs similar in content to a target course. The system was tested, trained, and validated for accuracy and reliability. The decisive factor in the success of the proposed system was its ability to compare the content of the target course and the similar MOOCs available online and give an accurate value of percentage similarity upon which a decision is made.



ID	MOOCs Name	Hosting Platform	Designer University	No. of Learners	Eenrolment Fees	Similarity %	Status
1	Electric Circuits	Coursera	Duke University	1.3 million	Free	65%.	Waiting Decision
2	Circuits and Electronics	edX	MIT	1.2 million	Free	70%.	Waiting Decision
3	Electric Circuits	Khan Academy	Khan Academy	1.1 million	Free	55%.	Waiting Decision
4	Electric Circuits	Udemy	Udemy	1 million	Paid	60%.	Waiting Decision
5	Electric Circuits	Udacity	Georgia Institute of Technology	990000	Paid	65%.	Waiting Decision
6	Circuits and Electronics	MIT OpenCourseWare	MIT	900000	Free	70%.	Waiting Decision
7	Electric Circuits	Alison	Alison	800000	Free	55%.	Waiting Decision
8	Electric Circuits	OpenLearn	Open University	700000	Free	60%.	Waiting Decision
9	Electric Circuits	Canvas Network	Canvas Network	600000	Paid	65%.	Waiting Decision
10	Electric Circuits	FutureLearn	University of Leeds	500000	Free	70%.	Waiting Decision

Fig. 4. Lecturer or other authorized personnel view of MOOCs

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10 AUTHORS

A. Y. Al-Zoubi, Princess Sumaya University for Technology, Amman, Jordan (email: zoubi@psut.edu.jo).

Mamoun Aldmour, Computing Department, School of Digital, Technologies and Arts, Staffordshire University, Stoke-on-Trent, United Kingdom (email: a030236k@student.staffs.ac.uk).