

Proposed Model For Using Block Chain To Secure The University Management System In Online Education

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ABSTRACT

In light of the Corona pandemic that is sweeping the entire world, and one of its negative effects was forcing the world to social distance between its members in an attempt to limit the spread of this epidemic, and one of the sectors that were directly affected by this epidemic and what led to it of social distancing is the education sector with all its institutions, Where educational institutions of all kinds were forced to resort to the education system through the Internet, it was necessary to think of a way to secure important data and information circulating over the Internet in this new system that educational institutions were forced to implement, and block chain technology is a qualitative revolution in information technology. It is a technology that aims to store and verify the validity of digital transactions on the Internet with a high degree of security. This research paper explains how to take advantage of the block chain technology in the educational process and secure its data so that it is not exposed to hacking, theft or modification, by developing a visualization How to use block chain technology and benefit from it in securing and protecting data in online education, which achieves security and confidentiality and not to modify it, such as securing academic degrees for students and to ensure the attendance of students and to ensure that they are not tampered with.

Keywords: Block Chain ,UMS, Online Education.

1. INTRODUCTION

There is a lot of talk in our time about digital technologies that have entered all aspects of life, as educational institutions have begun to introduce digital technologies into the educational system, which has contributed to the quality of the educational system.

Block chain technology has emerged that can be used in many areas and take advantage of its advantages, the most important of which is the high data security process.

Block chain is considered a qualitative revolution in information technology, and it is a technology that aims to store and verify the validity of digital transactions on the Internet with a high degree of security.

A block chain is a distributed database that has the ability to manage a list of records called blocks. Each block contains a timestamp and a link to the previous block. The block chain is designed so that it can preserve stored data and ensure that it is not modified (that is, when information is stored in a chain The block cannot later modify this information).

And one of the most important areas that moved towards block chain technology are some economic fields that depended on Bit coin and other digital currencies. Block chain technology allows a secure exchange of money, shares, or even confidential data without the need for a middleman or a central registry system to follow the exchange movement where all parties dealing directly with each other.

Block chain technology can make a big shift in the educational process, especially with regard to students and faculty members, such as issuing academic certificates, storing study data, managing grants for students, sending periodic reports on student performance, notes to universities and paying tuition fees in an inexpensive way through Bit coin.

This research paper explains how to take advantage of the block chain technology in the educational process and secure the data of students and faculty members by developing a vision for how to use the block chain technology and benefit from it in securing and protecting data in online education, which achieves safety, confidentiality and non-existence. Modify them, such as securing students' grades, securing students' attendance, and ensuring that they are not tampered with.

2. RELATED WORK

This study proposed creating a block chain-based learning environment characterized by the investigation and security of students' educational records. These records can be exchanged in a decentralized manner with others by means of encryption data, unlike records kept by the college, school, or administration. Through the block chain, official certificates can be issued that are evidence of students' accomplishments and the identification of suitable jobs after college(Han & etal, 2018). This study aimed to achieve privacy and security through block chain encryption algorithms. The data is divided into blocks connected with each other. This study was used in managing higher education institutions and securing student data and certificates transactions. The study recommended interest in future studies and the possibility of employing them and making use of the block chain in educational institutions(Al Harthy & etal ,2019). This study presented a proposal in education and professional development in companies through block chain technology. Individualized professional learning records are designed for people. This data and records are stored in ledgers and cannot be tampered with or modified. The block chain records transactions in a secure, reliable, and verifiable manner. The fingerprints of certificates and various educational elements are stored, certificates are issued and protected from fraud (Gräther & etal,2018). This paper proposes block chain technology to improve the educational process and the quality of its output. Learning outcomes are applied and are based on the university's graduation requirements index. An automatic assessment program is used as a tool and learning outcomes are based on grades, course name, graduation requirements. Student achievement is evaluated based on results related to the evaluation of competency after the end of the job, thus achieving continuous improvement of the curriculum (Sun & etal, 2018). The purpose of this

study is to use Block chain technology and a decentralized peer-to-peer architecture that relies on transparency and the ability to revolutionize online education. You can access training services, educational content via the Internet, registration and payment methods. Achieving quality and credibility, shifting from formal education to non-formal education, and using decentralized learning to achieve its educational goals with credibility and transparency (Duan&etal,2017). This paper discusses the challenges and applications of block chain technology in education. It consists in digitizing educational certificates and decentralization and identifying challenges. It aims to improve the performance of educational institutions and student learning and to identify barriers to block chain application in education. It reached the advantages of block chain such as trust and transparency in transactions, and recommended its application in certification, identity management and stimulating lifelong learning (Mikroyannidis & etal. ,2019). The purpose of the study is to use crypto currencies, such as Bit coin. As part of the industrial revolution and information technology. The current paper focused on its educational applications and how block chain technology can be used to solve some of the education problems (Steiu, 2020). This paper presented the advantages of block chain technology and some of the current block chain applications for education. It suggested some applications for using block chain technology in the field of education and discussed the benefits and challenges of using block chain technology in the education process(Chen, &etal,2018). This study provided an online student test, achieved transparency, verified student answers, and suggested a blueprint based on Double-layer Consortium Block chain is proposed and adding the prime-chain's index to the sub-chains(Shen, & Xiao ,2018).

This study aimed to establish privacy controls and restrictions for the learning management system by identifying security issues such as data encryption, licensing and authentication using block chain technology to provide security in learning management systems (Mahmood ,2019).

This paper used hierarchical encryption in the private block chain in light of the Corona pandemic to manage the learning system and solve the problem of illegal access to information and issue a secret key to decrypt and store record information in the block chain to ensure review and prevent modification. The study recommended activating it in the administration of the Ministry of Education to ensure stability (Chun & Noh ,2020).

The study presented the development of a block chain-based educational system, a decentralized learning system that uses e-books and virtual currency to pay and solve the copyright problem (Hori &etal,2018).

3. BLOCKCHAIN

3.1 Definition

Block chain "block chain" is data that is stored and preserved through a decentralized network of computers(Kolvenbach & etal ,2018).The block chain is an encrypted information system that is based on a decentralized information base, that is, distributed to all devices in the network, to record all transaction data and its modifications, in a way that ensures the consent of all relevant parties to the validity of the data(Hacioglu,2020).Block chain is a distributed database that is characterized by its ability to manage an ever-growing list of records called blocks. When information is stored in the block chain, it is not possible to modify this information later. The block chain is safe by design(Ziling,2018).

Block chains act as logbooks distributed with specific time stamps of operations that are stored through decentralized networks of computers, also called "nodes," with each computer storing the entire block chain (Harris, A. ,2018). Block chain is a database or a new method for organizing data and the way it is dealt with is different. Block chain technology, previously known as a transaction log, helps Bit coin, and allows for a secure exchange such as money, stocks, or data access rights. There is no need for an intermediary or a central registration system to follow the exchange movement, but all parties deal directly with each other (Nofer&etal,2017). Block chain can store all kinds of data, such as: crypto currency transaction details, land registry contents, insurance records, health history, auto accident history, title deeds changes, and others. It can also act as a platform for other applications (Underwood,2016).

3.2 Features of block chain

- Block chain helps to discover any imbalance in transactions, which is an essential aspect of crypto currencies such as Bit coin (Swan,2015).
- The strength of the system is in the degree of encryption and decentralization. The highest levels of security and encryption are achieved on the databases in all devices related to one operation, and make it impossible to penetrate them.
- Giving confidence in the most lacking times in the rest of the transactional community.
- Block chain has the advantage of not needing the presence of a third party in the transaction.
- Easy access to financial transactions and their dates at any time.
- Easy access to the account books of each user separately, Each user has their own identity.
- You do not need an intermediary to complete transactions through it and ease of use by the user.

3.3 Advantages of block chain

Block chain technology has a set of advantages, which are illustrated in the following points(Bashir,2017),(Drescher,2017):

1-Technology belongs to everyone

Block chain technology is open source technology, so it belongs to humanity, and everyone can copy, reuse and apply it in many fields.

2-Decentralization:

Decentralization is the storage of data and information for each person in a place separately and not in one entity.

3-Safety and protection

Data in block chain systems is static and immutable after the block is created and appended to the chain. All linked blocks can be read and tracked historically, thus weakening the possibility of a change in the general transaction log present in all network devices. Although the traditional financial systems owned by banks and governments are systems of any level of security and protection, they are systems in one way or another that are

vulnerable to penetration. In the decentralized system of block chain technology, the idea of penetrating the system is almost impossible. In order to hack a block chain technology system, you must change the data of thousands of devices distributed around the world.

4-Transparency:

Changes to public block chains are publicly viewable This provides greater transparency, and all transactions are immutable.

5-Reducing costs

Block chain systems contribute to reducing costs by not requiring an intermediary party to complete transactions. Any of the parties can enter and settle transactions, which means an increase in the speed of completing transactions, and eliminating the expenses paid to the intermediary parties that work to complete the transactions.

6-Privacy

The privacy of its users is represented in that each person has his own address. No one can see it except his owner, and this is through his own address. In systems that are based on block chain technology, such as digital currencies, users have encrypted codes in the system, and no user can know any personal data about another user. Of course, because it is a decentralized technology, no agency or organization can know user data .

3.4 Ethereum and Bit coin

Ethereum is a global application, a distributed public network and an open-source block chain platform. It enables developers to build and deploy decentralized applications. The idea of Ethereum's business is based on the advantage of smart contracts. Through it, one can write code and create applications that can be accessed anywhere in the world. Ethereum's idea is to run the programming code for any decentralized application that is not controlled by any individual or central entity. Ethereum is used to build decentralized organizations. Ethereum has a digital currency that can be traded and the currency managed by the Ethereum platform has the symbol ETH which is a minable coin with an unlimited coin limit. Ethereum is the second largest currency after Bit coin, and Ethereum can be purchased from many platforms around the world, but the process varies slightly from one platform to another. Ethereum can be purchased directly for Bit coin or any other supported currency(Antonopoulos,2017). .Bit coin A network that provides an electronic cash system for electronic payment via the Internet. It is used to track digital currency and allow electronic payments over the Internet. Bit coin is a decentralized peer-to-peer payment network that is fully managed by its users without any central authority or intermediaries. Bit coin is controlled by all Bit coin users from all over the world. Bit coin can only work well when there is consensus and integration among all users. Bit coin is a program that provides a personal Bit coin wallet and allows the user to send and receive Bit coins using it(De Filippi,2018).

4.BLOCKCHAIN AND SECURITY

Using Block chain technology to secure system, it represents a strong security element, which led to use this technology in the largest systems of money, real estate, and governance in the world.

Using Block chain technology makes information decentralized peer –to- peer figure Using Block chain technology to secure , it a strong security element, So to use this technology in the largest systems of money, real estate, in the world. Using Block chain technology makes information decentralized peer –to- peer figure.

Each block contains a timestamp and a link to the previous block, also storing files on the Internet, distribution data across the network all of these makes a highly protect from hacking, changing or loss.

Current digital economy is based on the reliance on a certain trusted authority. Our all online transactions rely on trusting someone to tell us the truth—it can be an email service provider telling us that our email has been delivered; it can be a certification authority telling us that a certain digital certificate is trustworthy; or it can be a social network such as Facebook telling us that our posts regarding our life events have been shared only with our friends or it can be a bank telling us that our money has been delivered reliably to our dear ones in a remote country. The fact is that we live our life precariously in the digital world by relying on a third entity for the security and privacy of our digital assets. The fact remains that these third party sources can be hacked, manipulated or compromised (Xu & etal ,2019). Block chain technology is characterized by security, as it uses the encryption feature, and records are linked to each other, and these records are not lost because they are stored in multiple places, which is difficult to lose(Sharples& Domingue,2016).

5. APPLICATIONS BLOCKCHAIN IN ONLINE EDUCATION

- **Diplomas and certificates**

The application can be done by providing the student with academic information, titles, experiences and observations. And it is protected to a high degree and it is not possible to amend or change the certificates obtained by each student.

- **Secure archived data:**

Documents are subject to theft or impersonation and change of information. Block chain technology eliminates these attempts and gives the data a large degree of safety and non-change in it(Zhu Liehuang &etal,2017).

- **Documenting transactions:**

Block chain plays a major role in maintaining transactions. It contributes to controlling economic transactions of all kinds with e-learning institutions. And verify the credibility of the educational institution and avoid falling into fraud.

- **Smart contracts:**

Smart contracts can be used in office work in many sectors of education, such as University managed by block chain, where distributed ledger technology is used to implement smart contracts.

- **Pay fees and charges:**

Block chain has provided a great role in paying fees and paying tuition fees in an effective and fast way using Bit coin.

- **Full record of learning trajectory**

The block chain operates in a distributed database and records the blocks in chronological order using cryptographic algorithms to prevent data modification(Sun & etal ,2018).

6.RESEARCH OBJECTIVES

The research can be useful in finding:

- Improving the results of securing the data of the university management system through a proposed system based on the block chain to secure data in online education.
- Increasing the contribution in the field of data security in the online education system.

7. RESEARCH IMPORTANCE

The importance of the research is as follows:

- Producing a system to secure data in the online education system.
- Helping teachers and faculty members to secure their data in the online education system.
- Providing accuracy in securing data in the online education system compared to other insurance methods.

8. RESEARCH PROBLEM AND QUESTIONS

The research problem is summarized in answering the following main question:

Q: What is the impact of a proposed system for using the block chain to secure the university management system in online education?

Several sub-questions are derived from the main question, as follows:

- 1- What are the steps for developing a system for using the block chain to secure the university management system in online education?
- 2- How accurate is the proposed system for the use of the block chain in securing the university management system in online education, as opposed to other insurance methods?

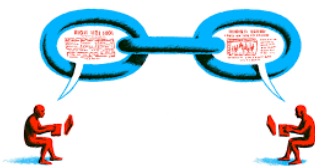


Fig1 Block chain, peer to peer

9. THE PROPOSED SYSTEM

In the university there are different departments and classrooms. Each department has a name, and each person which can be a professor, an employee, (the system admin), or a student at the university has a unique ID.

Context Diagram for university Admission system

This stage represents the main purpose of the systems' creation which is converting the management system in the university between the students and the staff (both of professors and employees) to a computerized system by using block chain technology, where each transaction between them would be online, decentralized, cryptic, and reports are sent to the manager.

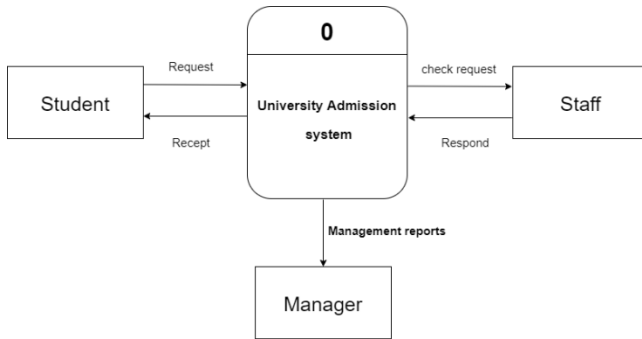


Figure 2: Context Diagram

The proposed system work

When transferring information between professor and the student using Block chain, the data flows as following:-

- Professor send data by network that using block chain.
- Data converts by encryption and algorithm into hash code in blocks form, these sites included in network. Blocks encode data is formed of symbols, numbers and letters, it has a specific sequence contains time and date too as it .
- Blocks delivered to the server and all network partners'.
- Data storing in its own sequence and linking it with the previous block.
- Blocks are coded and have a unique sequence.
- Data files cannot be deleted or modified.
- When there is a request to change data, a file with a new sequence number is created.
- Inter Planetary File System (IPFS) is a protocol decentralized, used to speed up file transfer.

First level for university Admission system

This stage illustrates how the university Admission system flows.

The student applies for the university by using an online form, this form is saved in an online file (students' file requests), the form is processed by sending it to a service provider and a service specialized file to save it, the service provider checks the form then gives a decision (agree or deny), this result is recorded and delivered to the service special file then students' file to reply for the request, then a report is sent to the manager.

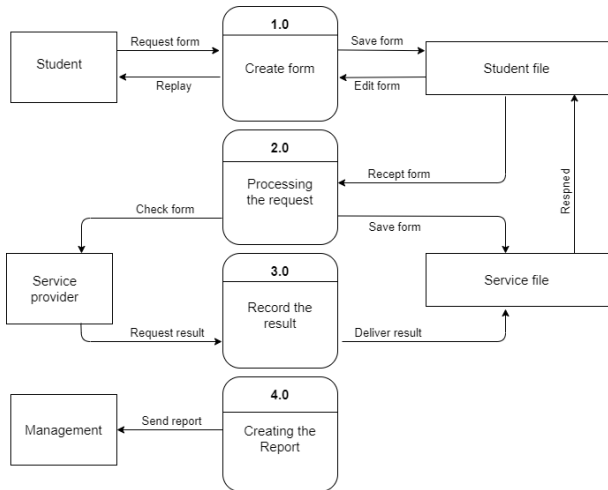


Figure 3: First level

Use case Diagram for University Management System

A UMS use case diagram is the primary form of system/software requirements for a new software program underdeveloped. Use cases specify the expected behavior.

Student Use Case Diagram shows interface and services available on student application.

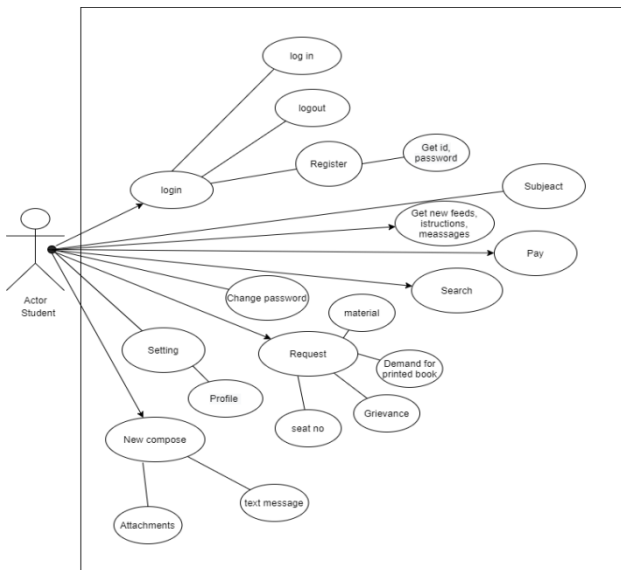


Figure 4: Student Use Case Diagram

Professor use case diagram shows services available on the professors' application.

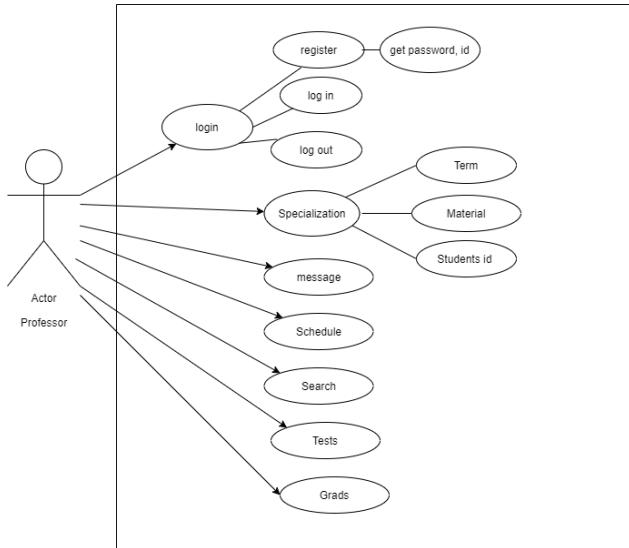


Figure 5: Professor use case diagram

System admin use Case diagram shows services available on the System admin application.

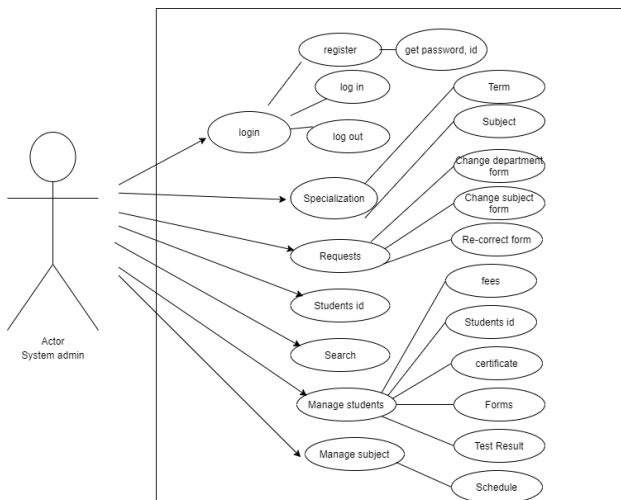


Figure 6: System admin use case diagram

Sequence Diagram for University Management System

Sequence diagram shows the interaction according to actions happens without time considering.

The following shows how transactions flows sequentially between (student – Professor).

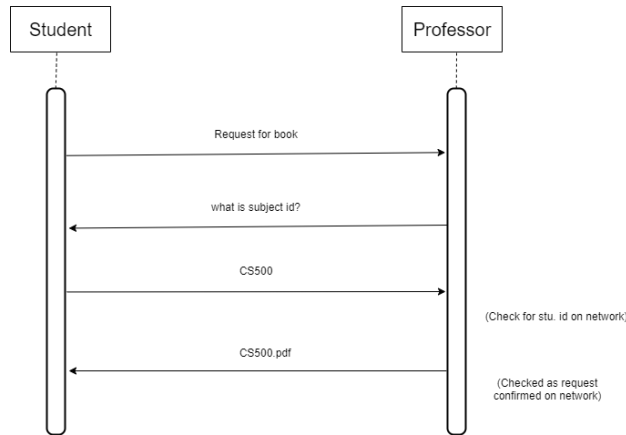


Figure 7: sequence diagram for student – Professor

The following figure shows how transactions flows sequentially between (student – System admin).

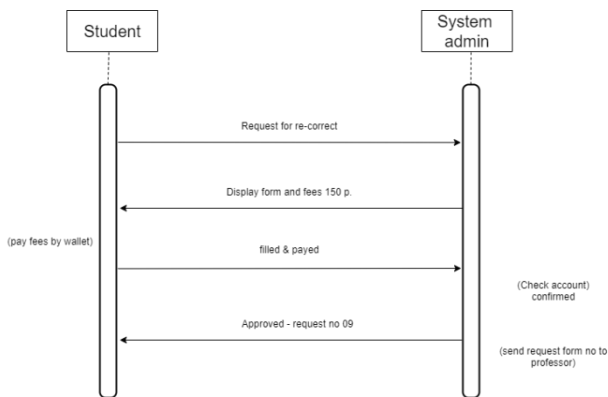


Figure 8: sequence diagram for student – System admin

Using block chain to transfer and secure data for the university management especially for exam.

The following is a sequence diagram between student and professor shows how data flow between users in case of exam by using block chain technology: -

The figure shows how data flows in serial blocks form between the users in the network. Every block stored in the specific place by a unique serial include the date and time plus the data in encryptions way by hashing it. Only user who has the permission can see it.

Block chain has a high secure that denied to modify, delete or hack it.

When there is a need to re-correct an exam score it will be recorded on the database and a notification will send to user who manage the system or all users' who had the permission to discover that changes in report. that report contains details like time and date modified, the professor id who apply modifying, the student id and the score before and after

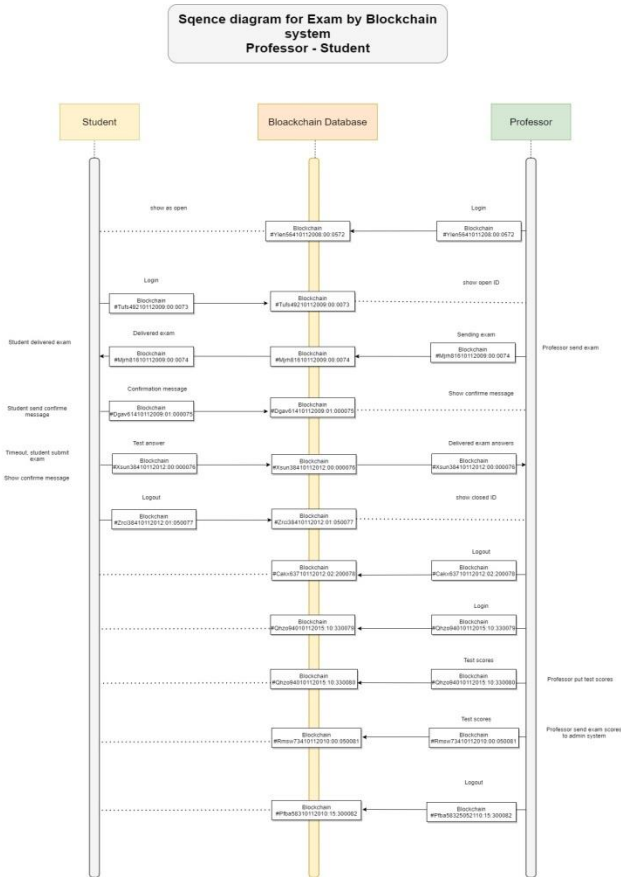


Figure 9: sequence diagram for exam by block chain system

Sequence diagram for attending lecture by Blockchain database Professor – Student.

The following is a sequence diagram between student and professor shows how data flow between users during the lecture focus on attendance how it takes in block chain database environment:

The figure shows how data flows in serial blocks, the figure shows how data flows in serial blocks form between the users in the network.

Every block stored in a serial way by specific and unique data, include the date and time which student logged in/out to the lecture.

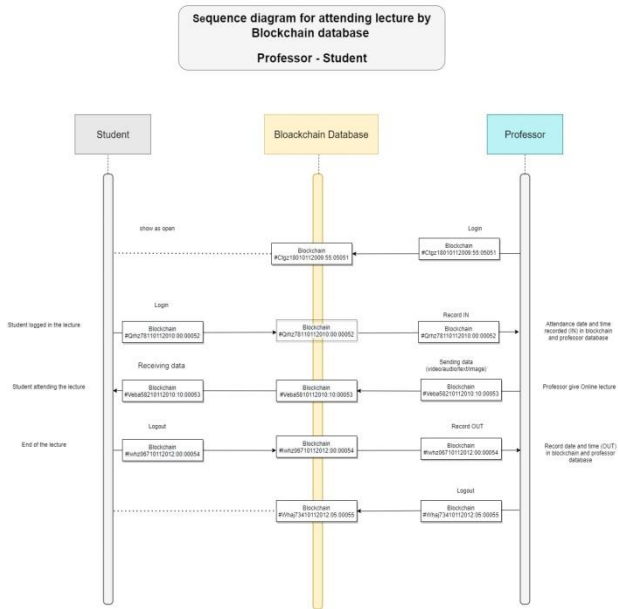


Figure 10: Sequence diagram for attending lecture by Block chain database Professor – Student.

Lecture attendance date and time are filling automatically in a schedule shows the lecture No., the students ids, and the time attendance sort ascending according to time attend. Only professor has the permission to see it.

The following table is an example for system outputs to computer science subject lecture attendance.

(Lec .No) column is the subject code plus lecture number.

Table 1:: Output system of lectures attending by block chain technology

Lectures attending						
S	ID	Lec. No.	IN		OUT	
			Dat e	Tim e	Dat e	Tim e
1	Mohamed saeed	CS50 0L05	10-	10:0	10-	11:3
			11-20	0:00	11-20	0:05
2	Doaa mohamed	CS50 0L05	10-	10:0	10-	11:4
			11-20	1:05	11-20	0:00
3	Abeer saad	CS50 0L05	10-	10:0	10-	11:4
			11-20	3:10	11-20	2:06
4	Safaa mahmoud	CS50 0L05	10-	10:0	10-	11:4
			11-20	4:08	11-20	3:09

5	Mahmoud yasser	CS50 OL05	10-11-20	10:04:30	10-11-20	11:50:15
6	Amira saeed	CS50 OL05	10-11-20	10:05:00	10-11-20	11:55:00
7	Asmaa shata	CS50 OL05	10-11-20	10:10:00	10-11-20	11:56:08
8	Gana yasser	CS50 OL05	10-11-20	10:11:02	10-11-20	11:56:30
9	Arwa saeed	CS50 OL05	10-11-20	10:12:18	10-11-20	11:58:00
10	Omar abdo	CS50 OL05	10-11-20	11:05:03	10-11-20	12:00:00

Differences Between Database and Block chain

We can clearly see that the design is what makes a traditional database and block chain different. Let's summarize some of those features. As Block chain technology represent a highly reliability, trust, security and efficiency.

Table 2: Differences Between Database and Block chain

DATABASE	BLOCKCHAIN
Centralized	Decentralized
Permissioned	Permission less
Requires administrator	No administrator
Low context security	High context security
Low peer to peer	High peer to peer
Low immutability	High immutability

10. CONCLUSION

In this research paper, it was explained how to take advantage of block chain technology in the educational process and secure its data so that it is not exposed to hacking, theft or modification, by visualizing how to use the block chain technology and benefiting from it in securing and protecting data in education through The Internet, which achieves security and confidentiality and not to modify it, such as securing students' grades, securing students' attendance and ensuring that it is not tampered with through the use of block chain technology in transmitting data, as it represents a strong security element, which led to the use of this technology in the largest money and real estate trading systems And governance in the world, as storing files on the Internet in a decentralized manner leads to the distribution of data across the network and to the protection and immunization of files from penetration or loss.

When transferring information between the staff and the student using the block chain, the data flows as follows:

- Create blocks that encode data in the form of symbols, numbers, and letters, and have a specific sequence.
- Send it to the server and all devices on the network, and then it is stored in its own sequence and linked to the previous files.
- Each data block is encrypted and has a unique sequence.
- It is not possible to delete or modify the data file, and upon requesting an amendment, a file with a new sequence number is created.

Therefore, the block chain technology is an innovative way to pass information from one person to another in an automated and completely secure manner that depends on the decentralization of information, as it is not possible to control the data transfer process from any party, as it is server devices and networks that are not owned by anyone.

The opinion of learning experts was surveyed on the proposed scenario for the use of block chain in the university management system in online education The results were as follows:

Table 3: It shows the frequencies, percentages and the value of chi square about the opinions of learning experts towards the proposed model for using Block chain to Secure the university Management System in Online Education

N	phrases	agree		Not agree		Chi square	significance level
		k	%	k	%		
1	The proposed system corresponds to the proposed objectives	25	100	0	0	25	function at 0.05
2	The proposed system is consistent with modern trends in education	24	96	1	4	21.16	function at 0.05
3	The system increases administrative efficiency	21	84	4	16	11.56	function at 0.05
4	The system achieves transparency over the follow-up of transactions on documents	22	88	3	12	14.44	function at 0.05
5	The system achieves security through stability of operations	23	92	2	8	17.64	function at 0.05
6	The system provides a secure way to administer tests remotely	25	100	0	0	25	function at 0.05

7	The system provides a safe way to track the attendance and absence of students	25	100	0	0	25	function at 0.05
8	The system provides a secure way to manage educational content remotely	25	96	1	4	21.16	function at 0.05
9	The system provides the security feature in verifying the data of students and faculty members	23	92	2	8	17.64	function at 0.05
10	The system provides the property of protecting files and immunizing them from hacking and loss	22	88	3	12	14.44	function at 0.05
11	The system provides storage of student records digitally in a secure manner	21	84	4	16	11.56	function at 0.05

12	The system helps eliminate administrative corruption	22	88	3	12	14.44	function at 0.05
13	The system has the property of transparency in transactions	24	96	1	4	21.16	function at 0.05
14	The system provides the feature of no intermediary to complete transactions and make the data visible	20	80	5	20	9	function at 0.05
15	No need for administrative effort to keep records related to documents	23	92	2	8	17.64	function at 0.05
16	The digital block chain provides review of facility transactions	20	80	5	20	9	function at 0.05
17	The system provides accuracy and speed in performing tests	24	96	1	4	12.16	function at 0.05
18	The system provides fast data provision and exchange	23	92	2	8	17.64	function at 0.05

It is clear from the previous table that the calculated chi square values are greater than the tabular chi square values, which amounted to (3.84) at the significance level (0.05), which indicates the existence of a statistical significance for the difference between the frequency of acceptance and rejection of the statements in favor of the proposed model.

This is evidence that the learning experts agreed with the proposed model and that it can be used to a large extent in education.

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