2024, Vol. 1
https://fupress.org/journal

Blockchain-assisted Multi-modal Literature Teaching Based on Computer Network

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ARTICLE INFO

Received: 10 Feb 2024
Accepted: 27 Apr 2024

ABSTRACT

Multi-modal is the integration of two or more modalities to produce meaning. Multi-modal literacy may be taught through the selection of relevant model texts by the teacher for each assignment or lesson. To communicate successfully, the teacher provides a clear infrastructure for the integration of language with paper, live, and digital multimedia platforms. There is a need to improve the teaching of Multi-modal literature to ensure data privacy and openness in the system. Various scholars have suggested various multi-modal literary education methods however they all fail in managing decentralized governance, transparency, trust, and communication. Decentralized solutions to real-time challenges are now possible because of the development of blockchain (BC) technology. In this paper, we propose a blockchain-based computer network framework for Multi-modal literature teaching. Initially, we leverage (BC) technology to bind participants when sharing resources and recognize other instructors when their instructional materials are obtained. To encrypt the literature teaching data by using a novel secure adaptive content-based RSA algorithm (SAC-RSA) is used and also to boost encryption performance, ant colony optimization is performed. Proof-of-work (PoW) consensus algorithm is applied to verify the block data inside the blockchain. Finally, the performance of the proposed approach is examined and that is related to certain existing approaches to accomplish the proposed approach with the maximum effectiveness in this study. Using the OriginPro application, the study's outcomes are represented graphically.

Keywords: Blockchain, Security, Communication, Multi-modal Literacy, SAC-RSA, PoW.

INTRODUCTION

Education ecology is the starting point for teachers in this situation. They need to change their teaching concepts, analyze the root causes of problems and deficiencies, and study the complement and improvement for deficiencies. They also need to adjust their teaching curriculum arrangement and actively promote teaching mode reforms. Because of its particular qualities and benefits in the lengthy history development process, multi-modal literature (ML) may be used as a reference to help us construct our country. Despite its differences from conventional literature, ML has a huge potential (Agarwal, Sheikh, & Obaid, 2021). Online education, which incorporates the Internet, intelligence, and technology and transcends the limitations of time and geography, has evolved into the new norm for university instruction with the advent of digitization, networks, and a global learning environment. However, with the epidemic's expansion of online learning, there are severe issues including the loss of privacy and a lack of confidence in students' learning, as well as sophisticated and difficult-to-supervise online learning content. Traditional approaches for designing and evaluating online training cannot capture students' interest or gain the respect of education stakeholders, which severely limits the legitimacy and acceptance of online instruction (Min & Bin, 2022).

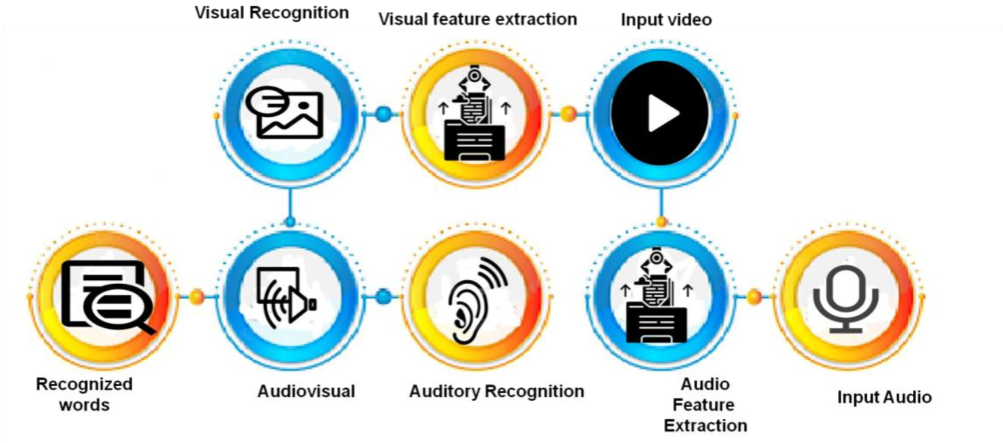

Figure 1. Traditional Multimedia-assisted Teaching Model

Figure 1 depicts the traditional multimedia assisted teaching model. BC technology may greatly improve learning performance, considering the importance of BC in educational institutions. Additionally, BC has an effect on academic achievement from the perspective of students (our future generation—a crucial part of a long-term economic future). Blockchain technology may alter teaching-learning. Traditional classrooms are teacher-centered. Modern classrooms have changed. Technology makes the process two-way. It has renovated the learning area (physically and online) and introduced new teaching-learning approaches and student interactions (Qassim, 2020; Mody & Bhoosreddy, 1995). Based on the learner's model, an adaptive learning system is a learning system that has been constructed and designed utilizing artificial intelligence techniques. In terms of theoretical study and technological capabilities, it is a learning environment that satisfies the specific demands of learners. It prioritizes the personal growth of the learners, in contrast to earlier e-learning platforms. In terms of digital learning research and development, this is unquestionably a trend. The system's ability to offer learners a customised learning mode and dynamically present learning materials and content is the key reason it is regarded as intelligent and advanced. It can also employ adaptive navigation technology to carry out learning diagnosis and learning strategies in accordance with the traits of learners (J. Li, 2022). Strong cybersecurity capabilities are built into the blockchain technology architecture, which have been applied in a number of industries. Blockchain technology is only now beginning to be used in education. Additionally, the blockchain is a technology utilized in educational contexts for certificate issuance, validation, and distribution. As the keepers of their official school records, people can readily share their credentials with all parties with an interest through the use of technology in an educational setting that creates a digitalized, decentralized, open record of all cryptographic data exchanges. Though some educational institutions are utilizing blockchain technology for e-transcripts, digital degrees, and certification, the development is quite sluggish and might be leveraged to bring about a revolution in the education industry. Expanding the blockchain technology's potential offerings can greatly benefit the education industry (Bhaskar, Tiwari, & Joshi, 2021; Garg, 2020). Blockchain technology can increase the reproducibility of clinical studies, provide secure data exchange for researcher communities, and provide patient groups with tools that ensure their privacy. In recent years, a large number of professionals and institutions have recognized blockchain technology as an emerging solution to guarantee secure data translation among many stakeholders via a distributed ledger. To reach consensus with several unreliable stakeholders, a consensus-driven strategy is required (Hang, B. Kim, & D. Kim, 2022). The blockchain maintains an exhaustive, current history of all trial-related data, including the clinical protocol, visit history, subject information, etc., which would monitor the enrolled subject during the clinical trial research. The data lake functions as an independent data repository, also referred to as off-chain storage. The distributed ledger's consistency is maintained by the blockchain network's trusted validating peers, each of whom keeps a copy of the ledger for the network to maintain. The trial-related data are accessible to the clinical director through any network peer where their information is kept safe. This is made possible by defining the access control policy in the smart contract, which is implemented over the entire blockchain network to guarantee data security and privacy. To guarantee the security of the system, all contact between end users and the blockchain is encrypted and signed digitally (Hang, Chen, Zhang, & Yang, 2022) **Figure 2** depicts the Multi-modal teaching builds multiliteracies.

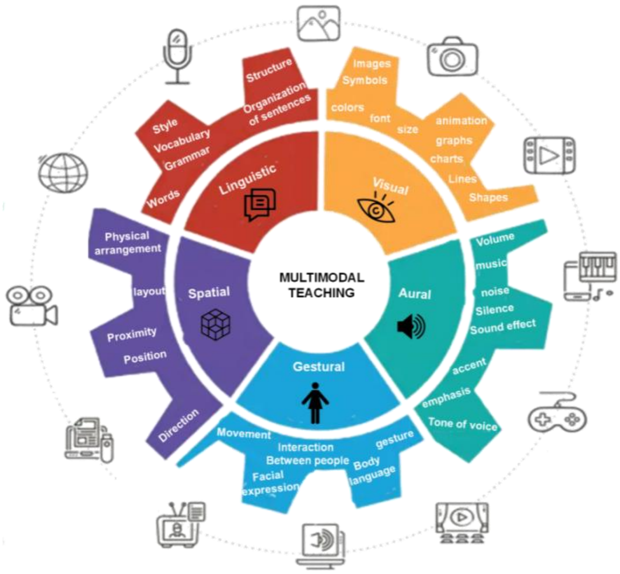

Figure 2. Multi-modal Teaching Builds Multiliteracies

Figure 2 depicts the Multi-modal teaching builds multiliteracies. A multi-modal teaching strategy combines learning material with verbal, visual, auditory, spatial, and gestural meaning and interaction, requiring students to engage in multiple sensory modalities (listening, speaking, watching, gesturing, touching, etc.) to grasp the information. Teachers choose learning materials from several sources (videos, blog posts, new articles, video games, short films, etc.). Students should be able to demonstrate their learning by combining semiotic modes and presenting them in different modalities. Although ML teaching offers a wide range of potential uses, it also has numerous drawbacks and difficulties. Multi-modal Teaching and learning are becoming more popular as a means of expanding knowledge. With the aid of BC Technology, we provide a technique to get around the aforementioned restrictions and difficulties. The suggested system places a strong emphasis on the quality and traceability of the courses offered by many teachers throughout the world. In contrast to current multi-modal teaching platforms, the proposed approach is decentralized to provide complete user transparency. Hence, we provided a novel approach to educating literature across several mediums by proposing a secure adaptive content-based RSA for a blockchain-based computer system.

As a result, it is widely anticipated that blockchain will have a significant impact on a variety of industries, including finance and real estate, administration of government, energy, and transportation. However, in order for blockchain to be useful, it must be able to process transactions at rates comparable to those offered by conventional database management systems and offer some of the same transactional guarantees. One of the major issues with using blockchain technologies to replace current centralized servers is performance. Due to poor transaction processing capacity and a lack of standards, limited scalability, throughput bottleneck, transaction latency, and storage constraints may prevent blockchain adoption (Hang, B. Kim, & D. Kim, 2021).

Contributions of this Paper

1.A secure adaptive content-based RSA algorithm (SAC-RSA) is used for converting plaintext data to cipher text.

2.Ant colony algorithm is used for optimizing the process.

3.Data can be validated through the smart contract.

This article's sections: Section II provides a literature review and a problem statement. Shown in Part III are the proposed techniques. Section IV contains the results and comments. Section V includes the proposed work's conclusion.

LITERATURE REVIEW

English reading teaching covers multi-modal. Multi-modal English reading instruction improves reading scores. This approach can enhance student reading and instruction. Most students like multi-modal English reading instruction. Multi-modal teaching combines sounds, sights, videos, actions, teaching aids, equipment, instructor arrangement, etc. to increase teacher-student connection and teaching efficacy. Multi-modal English reading teaching broadens the research viewpoint of English reading teaching and offers a reference for front-line teachers' teaching practice and research (Serafini, 2012). According to Pan and Zhang (2020)Applying a multi-modal approach to teaching EFL reading in high school may increase student involvement and reading competence. It also seeks students' opinions on multi-modal learning. China's high school students read. Multi-modal instruction may boost students' English reading proficiency and reading engagement. Most students like multi-modal teaching. Multi-modality, in Zhu (2007), Shahbaz and Afzal (2021) refers to the employment of a multitude of communication modalities, such as language, color, taste, and picture. Multi-modality is defined as the use of two or more senses in the course of an encounter. Using a variety of visual, acoustic, verbal, and spatial cues to convey ideas is referred to as multi-modality; it includes both spoken and written communication. Single-mode is interaction with just one sense organ, whereas multi-mode is simultaneous engagement with more than one. Architecture students learn English online using a multi-modal method. Student groups were experimental and controlled. The control group used conventional instruction, whereas the experimental group used online multi-modal English learning. Statistics suggest that the experimental group had some job benefits, reducing pressure. Multi-mode learning is effective in scientific and engineering English education, thus the multi-modal online teaching system design may be adapted to online English teaching (Wei, 2016; Z. Li (2022). Multimedia technologies and the widespread use of the Internet have already made College English education extremely multi-modal. Since the fast growth of computers and the Internet, communication has changed dramatically and the network has become the primary platform for communication, which, in turn, has influenced the education business. Many issues have arisen as more and more network teaching has appeared in the market. Modal teaching theory has evolved swiftly as a result of this setting, and the significance of this theory in the education business has grown steadily. Chen (2021), Miao (2014), Salihu and Zayyanu Iyya (2022) illustrate that formulaic sequences in textbooks commonly used for English teaching in China are the focus of this article. The frequency of formulaic sequences in the listening-speaking textbook is substantially greater than that in the reading-writing textbook, according to research data. Both the categories and the functions of formulaic sequences change across the two modal textbooks. The problem is that most Chinese English learners are not aware of these subtle variances. Learning formulaic sequences from textbooks is affected by a plateau effect since there is no substantial variation in competence levels. In college English teaching and learning, stressing the contrasts between reading-writing and listening-speaking is critical to shedding light on the input and output aspects. M. Chen (2022), Benson and Chick (2010) explain that in innovating and promoting the digital and three-dimensional growth of English education, multi-modal teaching is a key component. Graduate students' ability to conduct academic research and communicate their work clearly and concisely depends heavily on their ability to write in academic English. Traditional methods of teaching graduate students academic English writing lack interaction and focus on a particular topic, making it difficult to see progress in students' ability to write better academic English. To ensure the desired quality and fairness of teaching and assessment, this article introduces a novel online teaching and assessment [NOTA] system that utilizes BC technology. For students and instructors alike, NOTA provide a sense of purpose and encouragement via the Blockchain reward mechanisms (Cheriguene et al., 2022). Blockchain technology can increase the reproducibility of clinical studies, provide secure data exchange for researcher communities, and provide patient groups with tools that ensure their privacy. In recent years, a large number of professionals and institutions have recognized blockchain technology as an emerging solution to guarantee secure data translation among many stakeholders via a distributed ledger. To reach consensus with several unreliable stakeholders, a consensus-driven strategy is required. The blockchain maintains an exhaustive, current history of all trial-related data, including the clinical protocol, visit history, subject information, etc., which would monitor the enrolled subject during the clinical trial research. The data lake functions as an independent data repository, also referred to as off-chain storage. The distributed ledger's consistency is maintained by the blockchain network's trusted validating peers, each of whom keeps a copy of the ledger for the network to maintain. The trial-related data are accessible to the clinical director through any network peer where their information is kept safe. This is made possible by defining the access control policy in the smart contract, which is implemented over the entire blockchain network to guarantee data security and privacy. To guarantee the security of the system, all contact between end users and the blockchain is encrypted and signed digitally. As a result, it is widely anticipated that blockchain will have a significant impact on a variety of industries, including finance and real estate, administration of government, energy, and transportation. However, in order for blockchain to be useful, it must be able to process transactions at rates comparable to those offered by conventional database management systems and offer some of the same transactional guarantees. One of the major issues with using blockchain technologies to replace current centralized servers is performance. Due to poor transaction processing capacity and a lack of standards, limited scalability, throughput bottleneck, transaction latency, and storage constraints may prevent blockchain adoption.

Issues, capacities, and challenges of multi-modal teaching literature with blockchain integration have been the subject of a great deal of analysis. However, the existing research has only covered certain topics, such as public and private data, with economics at the front of the most recent data. Therefore, the purpose of this research is to identify the benefits and drawbacks of combining these three technologies with the most improvements to help design and enhance the accessibility and specificity of providing a variety of services. The complexity of blockchain assessments and the risk of data loss are both exacerbated by the abundance of available e-learning material. Therefore, the data analysis has developed a blockchain system with a new encryption method for evaluating student progress in an online course. Among the most significant advances in this analysis was also blockchain implementation inside the online education system. With the hope that more individuals will trust the educational software network provided more data is encrypted. To use smart contracts to implement a trustworthy automated grading system for blockchain platform student performance evaluations.

METHODOLOGY

This section presents a BC-based computer network framework for teaching ML. The four layers that constitute this framework are as follows: teacher domain, Literature teaching material encoding domain, BC infrastructure, and student domain. **Figure 3** depicts the overall methodology used. In the teacher domain, the teacher's dataset is gathered. In the Literature teaching material encoding domain, data are encrypted and an optimization process takes place. In BC infrastructure, data can be validated and stored in BC. In the student's domain, students' request is accepted to decrypt the data for ML teaching.

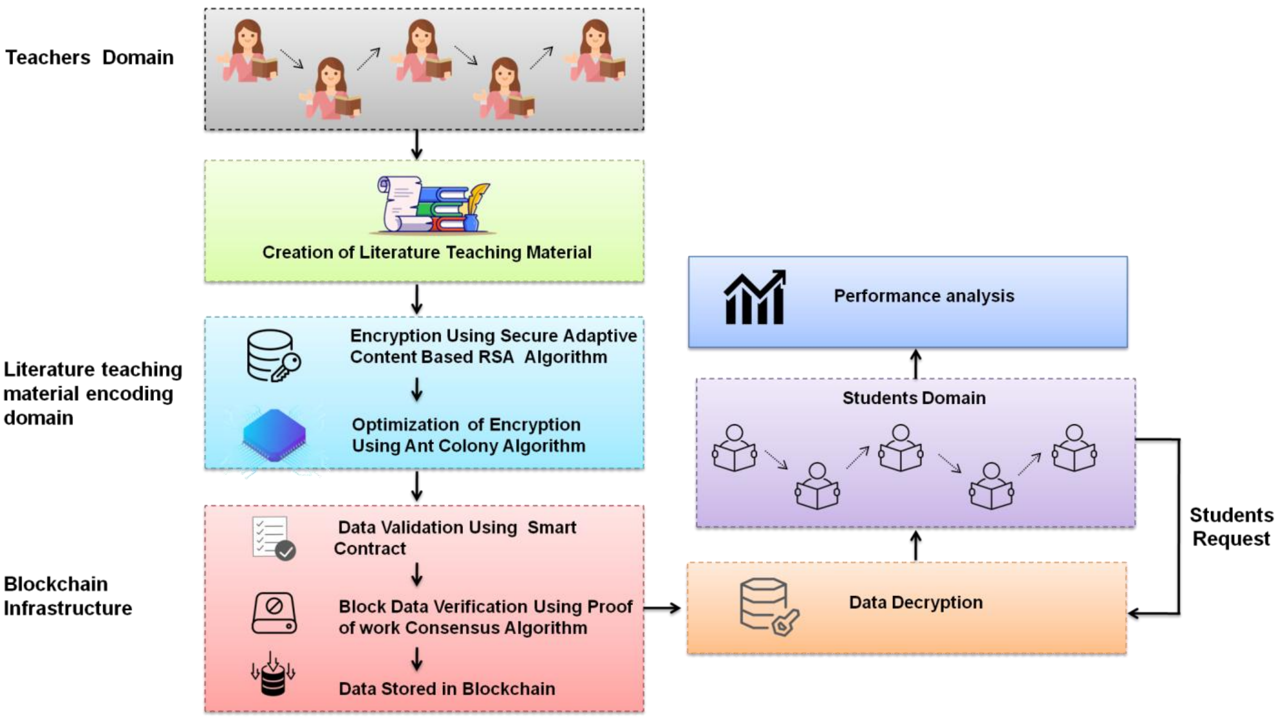

Figure 3. Overall Methodology Used

Teacher's Domain

The crucial participants in the educational system make up this sphere: students and educators. Books, handouts, and online docs are all examples of supplementary materials that supplement an online course. In addition, much like in the traditional model, students here can interact with one another and the course material via means of a variety of communication and social media platforms.

This domain is composed of a teacher's dataset. The English Language Center at the focal institution served as the recruitment site for the study's teacher participants. The Center employed 60 teachers as of the time of this research, with around half of them hailing from outside of China. All 60 instructors received an online survey, which 35 of them completed and returned. Additionally, teachers may develop their multi-modal literary materials based on concepts using visual, aural, reading, writing, and kinaesthetic techniques. It aims to improve teaching standards by aligning information transmission with the student's preferred learning style (Liang, 2021).

Table 1 indicates the teacher's dataset.

Table 1. Dataset Description

Categories	%	Frequency
Gender		
Female	56.1	21
Male	43.9	14
Age		
46 or older	24.7	8
36 to 45	13.3	4
26 to 35	55.3	18
25 or younger	5.6	1
Degree		
PhD	8.5	2
Master	85.6	31
Bachelor	5.8	1
English teaching experience(in years)		
16 or more	14.4	6
11–15	14.2	4
6–10	20.1	6
1–5	51.3	17
Training in technology integration (Participants)		
No	2.8	2
Yes	97.2	33

Literature Teaching Material Encoding Domain

It is possible that the many teaching materials developed for the course could aid students in exploring their responses to the domain of encoding literature. Students can get an appreciation for 'diversity,' tolerance, and compassion through reading literature about cultures and experiences different from their own. However, the literary teaching material encoding domain can tackle taboo subjects like love, war, and loss that aren't often addressed in the online textbook world. This domain includes encryption using a secure adaptive content-based RSA algorithm and optimization of encryption using the Ant colony algorithm.

Encryption using a Secure Adaptive Content-based RSA (SAC-RSA) Algorithm

A lot of people utilize SAC-RSA (Secure Adaptive Content-based Rivest-Shamir-Adleman) because it's a public-key encryption method. In 1977, Ron Rivest, Adi Shamir, and Len Adleman announced a new method of public-key cryptography that they called RSA. To ensure that only authorized parties have access to the data, we have advocated utilizing the RSA technique to encrypt it. Keeping the information safe prevents anyone from having a peek at it without permission. A public key and a private key are used in the RSA public key encryption algorithm. Generally speaking, everyone is capable of understanding data encrypted with global public keys.

To secure data while it is being communicated over a network, a new idea is discussed. It claims that data security is the most important part of sending information via a potentially unsafe network. The administrator of a network is in charge of deciding who is allowed to access what data within the network. The term "network security" refers to the protection of data transmitted across a network, which can be both public and private data utilized in a wide range of situations, including the transfer of value, sensitive documents, and other sensitive information. There are two main types of networks: those that are limited to a specific group of users (such as those within an organization) and those that are accessible to the whole public data.

Several encryption methods are commonly utilized in information security. Asymmetric (public) and symmetric (private) encryption are two types. Symmetric keys encryption or secret key encryption encrypts and decrypts data using a single key. Asymmetric keys make use of two types of keys: a private key and a public access key. Encryption relies on the public key, whereas decryption relies on the private key. Symmetric algorithms are very simple and fast, but if the key is intercepted by other parties, they can decrypt the communications. Asymmetric encryption is used to address this shortcoming. Anyone can see an encrypted communication that has been sent using cryptography, but it is extremely difficult to understand, particularly if it has been encrypted using a powerful cryptographic technique like the SAC-RSA algorithm. It is an algorithm for asymmetric cryptography. A computer method called SAC-RSA, which stands for secure Adaptive Content-based “Ron Rivest, Adi Shamir, and Leonard Adleman”, is used to encrypt and decode communications. This is also known as public-key cryptography, since one of the keys may be shared with anybody at any time. Both the public and the private keys may be used to encrypt a communication; the opposite key from the one used to encrypt a message is used to decode it. The other key must be kept secret. This feature is one of the reasons RSA has grown to be the most used asymmetric algorithm, it offers a way to ensure the privacy, integrity, authenticity, and reliability of electronic communications and data storage. The public key of an RSA user is generated by multiplying two big prime integers along with an auxiliary value. The most crucial facts must be kept secret. Anyone can encrypt a message using the public key. A three-step process is required to complete the RSA algorithm Key generation, Encryption, and Decryption.

In a key generation, a public key and a private key are required for RSA encryption to work properly. Everyone has access to the public key, which is used to encrypt communications. The private key is used to decode a communication that was encrypted using the public key. RSA algorithm keys are produced in the following manner:

Select two separate numbers Q and r, the integer's q and r should be selected at random.

The modulus for both the public and private keys is n, which is calculated as n = qr. The key length is the size of the string, which is often given in bits.

Calculate where "Euler's totient function" is . Select an integer f such that 1<f< and gcd =1 that is f and φ(n) are co-prime, and f is used as the exponent of the public key. The multiplicative inverse of , e is defined as . Solve for e assuming that is preserved as the private key exponent. is constructed as .

The public key is composed of modulus n and public exponent f (or encryption exponent).

The private key consists of modulus n and the private (or decryption) exponent e, which must be kept secret q, r and must also be kept secret because they can be used to calculate e.

The private key consists of modulus n and the decryption exponent e, which must be kept secret. To determine e, the values of q, r, and must all be kept secret

Figure 4 depicts the SAC-RSA encryption process. In this process, literature teaching content is encrypted using the public key to generate a secret code that hides the information's true meaning. The encryption method adopted in this platform is SAC-RSA (Rivest-Shamir-Adleman). A method is used to extract data from the system and encrypt them. When it came to encrypting data, we often made use of the public key.

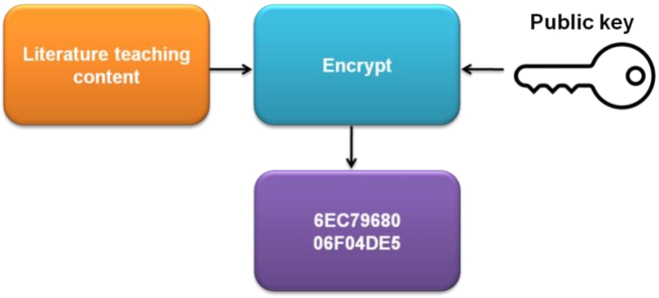

Figure 4. SAC-RSA Encryption Process

Common encryption methods include the RSA algorithm. As of right present, no other algorithm exists to generate public and private keys or encrypt data. That's because it uses a lightning-fast encryption method. In this paper, we analyze the RSA algorithm, which requires two very big prime numbers as input. To set up the encryption mode, the primes are utilized as a preamble. Two huge prime numbers stand in for the public key and the secret key that is used for decryption and encryption respectively. The original data has been encrypted using the RSA method and public key data. That's because it's an asymmetric method, and it's utilized for sending information to the server safely. The steps of the RSA algorithm are as follows: algorithm 1 is shown by pseudo code for encryption using the RSA algorithm.

Algorithm 1: Pseudocode for Encryption using RSA algorithm

Input data n

Get the prime numbers q & r

Calculate n=q*r and euler totient (n)=(q-1)(r-1)

Compute multiplicative inverse f= e (mod (n))

Perform encryption as follows

Get data, split into RGB

re←modular power (public key, n)

qe←modular power (public key, n)

Qe←modular power (public key, n)

rqQ←(re[fn] << 16) | (qe[fn] << 8) | Qe[fn]

set the RGB to get encrypted data

Optimization of Encryption Using Ant Colony Algorithm

Ant Colony Optimization (ACO) is a probabilistic optimization algorithm that can be used in networks to find the best solution to a computational issue or the most efficient way to traverse a network. Initial ACO algorithms were developed by Marco Dorigo and his team in the early 1990s. These algorithms were developed with the use of ideas gleaned from studying ant colonies. Ants, unlike most insects, are highly sociable creatures. They're symbiotic, meaning that their survival depends on the survival of the colony as a whole rather than any one member of the colony. Ants' foraging activity, and more specifically their ability to locate the shortest paths between food sources and their nest, served as inspiration for ACO. By synthesizing the pheromone information, ACO seeks to continuously locate the optimization algorithm to the target problem via a guided search (i.e., the movements of several ants) over the solution space. The two main phases of an ACO algorithm are the forward and backward phases. During forward mode, a colony of ants uses preexisting pheromone trails to build solutions in a probabilistic manner. In reverse mode, the quality of the solution built is used to alter the pheromone trails left behind. The ants will eventually reach a near-optimal or optimal solution after several repetitions. Ant colony optimization (ACO) is an optimization method that applies the probabilistic approach and is used to solve computational problems and identify the best solution. ACOA is of historical significance. ACOA already matches the preceding subsection's framework, with the parts listed below:

$$u^t_{n\psi} = \begin{cases} \frac{\delta^{\beta}_{n\psi}+\eta^{\gamma}_{n\psi}}{\sum_{(n\zeta)\notin tbcv_t}\left(\delta^{\beta}_{n\zeta}+\eta^{\gamma}_{n\zeta}\right)} & if (n\psi)\notin ubcv_t \\ 0 & otherwise \end{cases} \tag{1}$$

An ant t ubcv list is used in formula (1) to indicate the effect of trail and attraction on$ubcv_t$.

Formula (1) is used to update the trails after each iteration of the algorithm, i.e. after all ants have finished a solution.

$$\delta_{n\psi}(\delta) = \rho\delta_{n\psi}(\delta - 1) + \Delta\delta_{n\psi} \tag{2}$$

For each step that an ant makes, (nψ) it contributes an equal amount of trial contributions, based on how well it solves its problem. This means that a better solution means a bigger contribution.

Using the TSP as an example, movements correspond to graph arcs, thus a route ending at node y may correspond to the state n, while the state would correspond to the same path but with the arc (yz) added at the end (yz). Formula (1) becomes $\delta_{yz}(q) = \rho\delta_{yz}(q-1) + \Delta\delta_{yz}$, if the length NT of the tour discovered by the ant is used to measure the quality of the ant's answer to t.

$$\Delta\delta_{yz} = \sum_{t=1}^{g}\Delta\delta^t_{yz} \tag{3}$$

$$\Delta\delta^t_{yz} = \begin{cases} \frac{X}{N_T} \text{ if ant t uses are (yz) in its tour} \\ 0 \quad otherwise \end{cases} \tag{4}$$

X is a constant parameter in this example.

Ants build solutions in parallel and then update the trail levels in the main loop of the ant system. Various parameters must be tuned correctly for the algorithm's performance to be at its best $\delta_{yz}(0)$. These parameters include: the number of insects used to define the quality of the solution, and X (which is used to define the relative relevance of ρ, trail, and attraction). Algorithm.2 depicts the Ant Colony Optimization Algorithm (ACOA). The algorithm is the following.

Algorithm 2: ACOA

{Initialization}

Initialize $\delta_{n\psi}$and $\eta_{n\psi}$, $\forall(n\psi)$

{Structure}

For every ant, t (currently in state n)do

repeat

select the state to proceed with the probability

add the selected move to the t-the ant's array $ubcv_t$

till ant t has resolved the issue.

end for

{Trail upgrade}

For every ant stir (nψ) do

calculate $\Delta\delta_{n\psi}$

revise the irregular matrix.

end for

{Terminate state}

If not (end test) go to step

Blockchain Infrastructure

Blockchain is a decentralized and peer-to-peer distributed ledger system that enables users to safely store, process, and share data among themselves. The name originates from the fact that blockchain records transactions in blocks that are sequentially linked to one another. A block records the time of a transaction, the order in which the transactions occurred, and a pointer to the prior block. The use of a hash to link transaction blocks guarantees that no data in any given block can be changed, and it also prevents malicious actors from inserting blocks between two existing organizations. The independence of a public blockchain is its main feature. Users are not dependent on or need to place trust in a central authority because of the equality of access granted to all users and the inaccessibility of any third party to the data being kept. Public blockchains, on the other hand, are impossibly big and thirsty for resources since they are accessible to anybody. Private Blockchains, on the other hand, are more intimate and adaptable since they allow for a more restricted number of participants and can be tailored to the needs of individual participants based on their rights and access requirements.

In this section, this is the domain at the end of the Smart contracts blockchain infrastructure. Successfully solving the difficult Proof-of-Work (PoW) puzzle is the primary criterion for election as a miner in this field; this achievement will also be rewarded. For the platform, we categorize blockchains into three different types: OCER, SR, and AR. Registration for Online Courses and Exams (only instructors can contribute transactions to this blockchain), Registration for Students' Responses (only students can add transactions to this blockchain), and Registration for Assessments (only teachers can add transactions to this blockchain) (only teachers are allowed to add transactions to this blockchain). The Miners initially verify the data based on the consensus procedure once it has arrived at them from the communication domain and the student/teacher. The data can be added to the Blockchain once the miner has solved the PoW challenge. The data can be validated using a smart contract and the block data is verified by using the Proof of Work Consensus Algorithm and the data can be stored in BC

Data Validation Using Smart Contract (SC)

BC is a type of chained data model that joins data blocks in the temporal order that uses encryption to ensure a non-tampering or non-forgery BC network. A layer, internet layer, agreement layer, reward surface, SC layer, and application server make up the BC system. Its data layer contains the core blocks of data, as well as associated encryption keys and representation of the data, as well as other essential data and algorithms. A multiple supply mechanism, a data transmission process, and a data verification method are all part of the network level. All forms of network node agreement mechanisms are included in the consensus mechanism. The motivation developed and developing economic factors with BC's technology system, specifically the distribution mechanism and financial motive distributing system, to form the incentive barrier. The SC substrate contains all kinds, including scripts, methods, and SCs, and maybe the cornerstone of BC programmability. The framework includes all of BC's application scenarios and cases. As illustrated in **Figure 5**, all BC-based SCs, comprising event archiving and state processing, is performed on the BC. The transaction primarily comprises the data that must be delivered, with time serving as the data's descriptor. When transactional or event data is given to the SC, the contract resource set's resource status is modified, which prompts the SC to perform state machine judgment. The contractual action is immediately and accurately performed by an automaton according to the patient's predetermined data if the event activity meets the trigger requirement.

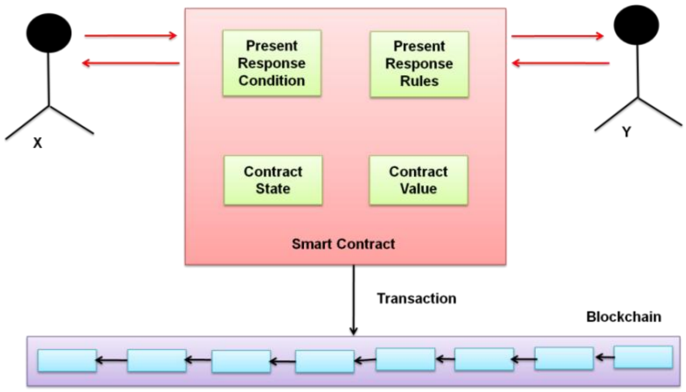

Figure 5. SC Execution Model

Block Data Verification

The proof of work consensus technique was used to verify the data in the block. Scan for hashes beginning with several zero bits in values to use this approach. To do this, a nonce (work) is added to the original value until it contains the required amount of zero bits. Changing the block now will need repeating the work for all subsequent blocks as well as finding this nonce and gaining agreement on proof of work.

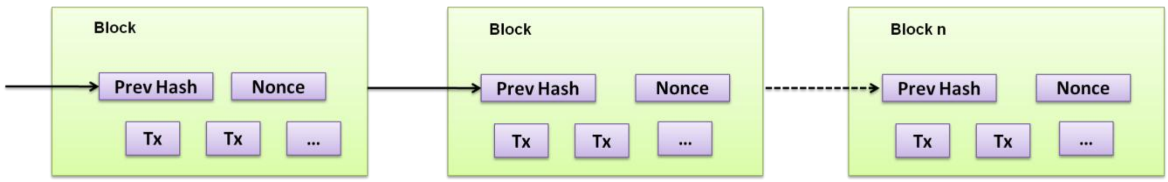

Figure 6. Visualization of Two Blocks within a POW BC

As seen in **Figure 6**, all blocks, except the very first block generated by the system (the "genesis block"), have a hash that is composed of the preceding block's hash and the nonce needed to generate the required zero bits for the next block to be constructed. In this case, the genesis block is an exception since it has no preceding block to refer to, and hence its hash is completely comprised of zeroes. When the input is to be established and the yield is recognized, use the hash function. Hash continues to be the name of the mathematical formula or PoW problem solution. Before the legitimate POW has been formed by the miners, there must be many trials and errors because creating a POW is a random operation with a low chance.

Student's Domain

Once the learning domain has been organized and integrated using a network of relations between declarative and procedural information knowledge, we can think about the student domain and the likelihood that the necessary learning has occurred for any given task to be completed successfully. For teaching ML in this domain, students' gave requests to decrypt the data.

Decryption refers to the process of recovering encrypted data and re-encoding it in its original format. As a result, it's the opposite of encryption. A secret key or password is required to decrypt the encrypted data, so it can only be decrypted by an authorized user. **Figure 7** depicts the decryption process in SAC- RSA algorithm. The decryption method used throughout this system is SAC-RSA (Rivest-Shamir-Adleman). A method is used to extract data from the system and encrypt data. For decryption purposes exclusively, we employ the private key.

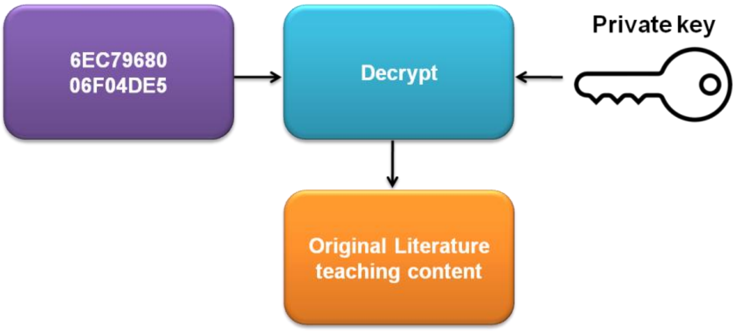

Figure 7. SAC-RSA Decryption Process

The encrypted code is decoded using the private key in SAC-RSA decryption for restoring access to encrypted data in its original literature teaching content format. And the decrypted data returns to the student domain.

RESULTS

In this paper, we investigate a novel blockchain-assisted based on multi-modal literature teaching using a computer network. The performance evaluation simulation is performed in "NetSim (Network Simulator and Emulator)" and indicated in **Table 2**.

Table 2. Hardware and Software Configuration

Components	Value
Processor	Intel I7 2.3 GHz
Packet size	1510 bytes
Packet arrival rate	1950-19950 ms
Memory	12 GB
Area of sensor deployment	100 x 100m
Operating System	Windows 10
Total number of nodes	50

A BC-enabled education system may meet the goal criteria since all information is kept on the BC, which ensures privacy, dependability, and data immutability. To evaluate the performance of the computer network framework for Multi-modal literature teaching based on BC. The parameter is teaching capability ratio (%), latency (s), Memory usage (kb), Packet loss in bytes, throughput (bps), energy consumption (J), and Security level (%). The existing methods are the Blowfish encryption algorithm (Ghanmi et al., 2022), the Improved identity-based encryption algorithm (IIBE (Cao et al., 2021)), the Hybrid encryption algorithm (HEA (Sajay, Babu, & Vijayalakshmi, 2019)), Text to image encryption algorithm (TTIE (Abusukhon, Anwar, Mohammad, & Alghannam, 2019)), Blockchain+Census algorithm (BC+CA (Ruan, 2022)), Power of work (POW Tracker (Iyer, Mehmood, Babu, & Reddy, 2022)).

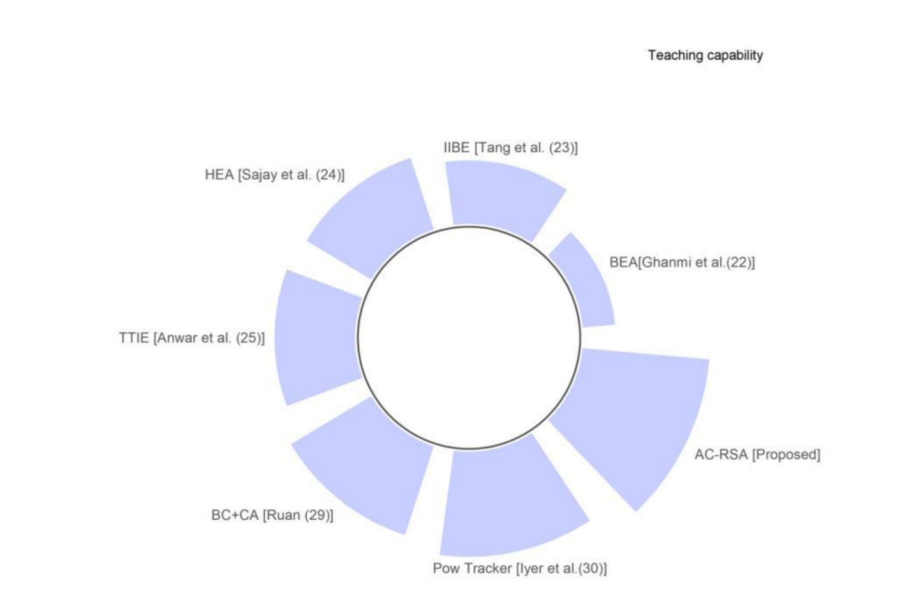

Figure 8. Teaching Capability Ratio

Figure 8 depicts the teaching capability ratio. Teachers take personal responsibility for their professional growth and development to better serve their students' academic goals. ML teaching may be greatly enhanced by the use of BC.

The amount of time that elapses between the moment that a user submits a request and the time that the server returns a response is known as latency. It is measured in seconds. **Figure 9** depicts the latency. The mixed encryption algorithm, improved identity-based encryption algorithm, Hybrid encryption algorithm, and Text to image encryption algorithm were all evaluated using the latency of 90 seconds, 85 seconds, 73 seconds, and 65 seconds respectively. The proposed secure adaptive content-based RSA algorithm was evaluated with a latency of 58 seconds. SAC- RSA proposed latency was implemented in less time than existing methods such as BEA, IIBE, HEA, and TTIE.

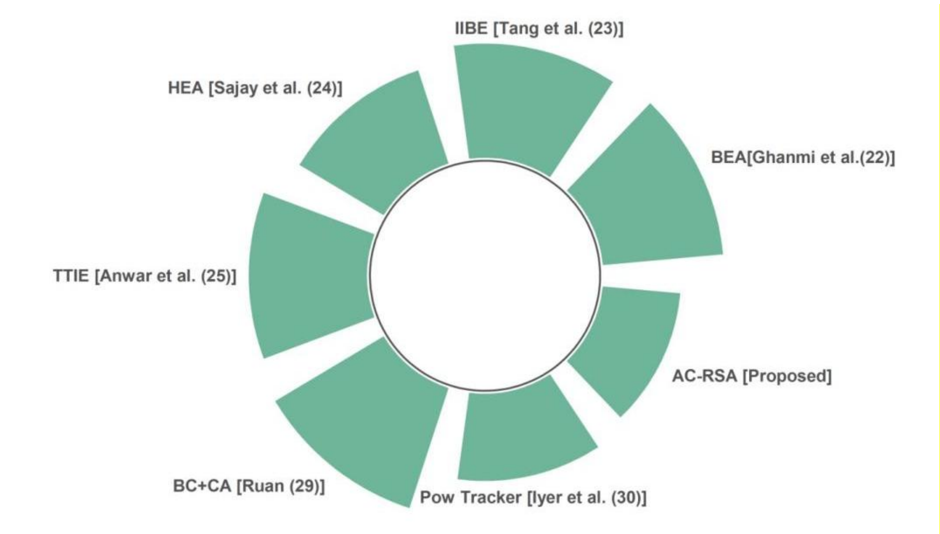

Figure 9. Comparative Analysis of Latency in Suggested and Traditional Methods

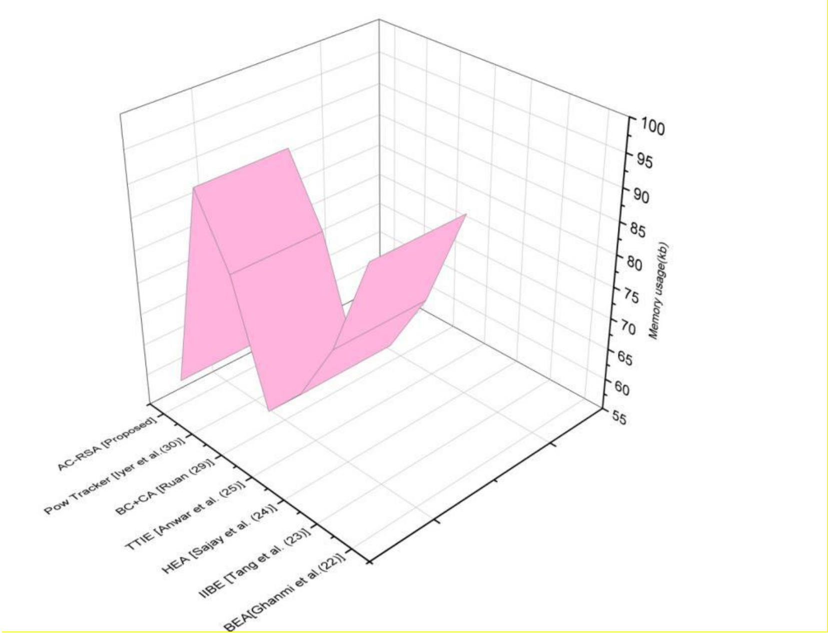

Figure 10. Comparative Analysis of Memory Usage in Suggested and Traditional Methods

The amount of RAM needed to hold a key and its value is shown by the MEMORY USAGE command. The entire amount of RAM allotted for data and administrative requirements that a key and its value need is the reported consumption. It is measured in kb. **Figure 10** depicts memory usage. The memory usage in existing algorithms such as mixed encryption algorithm, improved identity-based encryption algorithm, Hybrid encryption algorithm, and Text to image encryption algorithm of 95 kb, 80 kb, 70 kb, and 64 kb respectively. The memory usage in the proposed secure adaptive content-based RSA algorithm is 59 kb. As performance results show that the memory usage of SAC-RSA is also lower than the memory usage of BEA, IIBE, HEA, and TTIE. To conclude, the performance of the SAC-RSA algorithm in the context of memory usage is much better than the BEA, IIBE, HEA, and TTIE.

When one or more communicated data packets are lost in the packet, they are unable to reach their targeted destination. It is measured in bytes. **Figure 11** depicts a Comparative analysis of packet loss in Suggested and Traditional Methods.

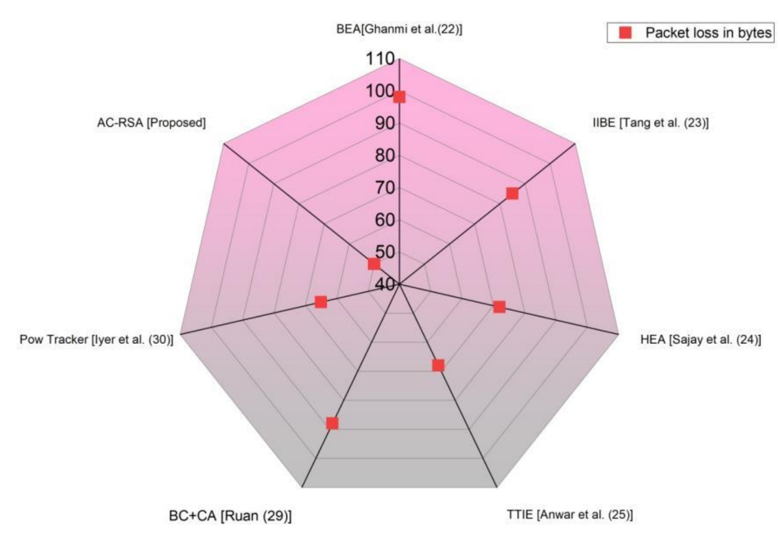

Figure 11. Comparative Analysis of Packet Loss in Suggested and Traditional Methods

The mixed encryption algorithm, improved identity-based encryption algorithm, Hybrid encryption algorithm, and Text to image encryption algorithm were all evaluated using packet loss of 98 bytes, 85 bytes, 72 bytes, and 68 bytes respectively. The proposed secure adaptive content-based RSA algorithm was evaluated with a packet loss of 61 bytes. SAC- RSA packet loss was implemented in less time than existing methods such as BEA, IIBE, HEA, and TTIE.

The quantity of information a system can process or transmit in a given length of time is known as Throughput. The quantity of data that the users get from the server at any given second is measured in bytes per second (bps). **Figure 12** depicts a Comparative analysis of throughput in Suggested and Traditional Methods.

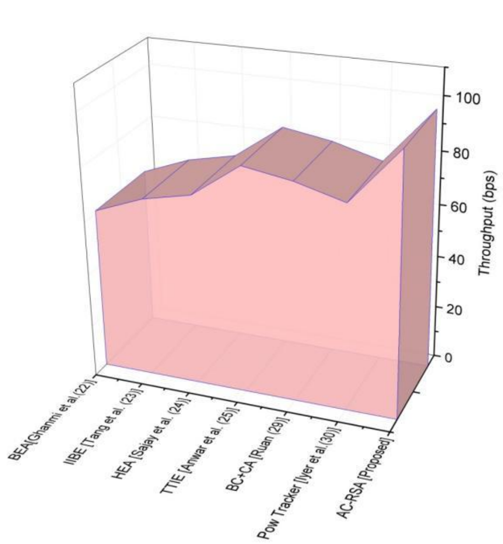

Figure 12. Comparative Analysis of Throughput in Suggested and Traditional Methods

The mixed encryption algorithm, improved identity-based encryption algorithm, Hybrid encryption algorithm, and Text to image encryption algorithm were all evaluated using throughput of 61 bps, 68 bps, 72 bps, and 85 bps respectively. The proposed secure adaptive content-based RSA algorithm was evaluated with a throughput of 98 bps. To transmit or process information using the proposed method SAC- RSA has high efficiency than existing methods such as BEA, IIBE, HEA, and TTIE.

The quantity of power or energy needed to encrypt data is referred to as energy consumption. It is measured in joule (J). **Figure 13** depicts a Comparative analysis of energy consumption in Suggested and Traditional Methods.

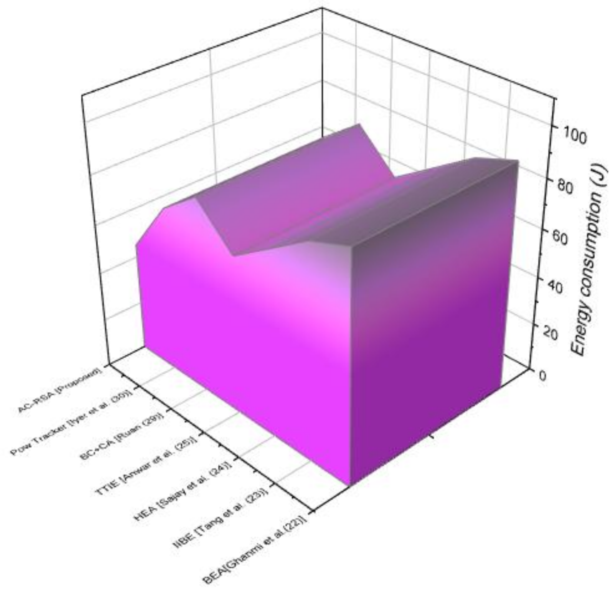

Figure 13. Comparative Analysis of Energy Consumption in Suggested and Traditional Methods

The energy consumed in the mixed encryption algorithm, improved identity-based encryption algorithm, Hybrid encryption algorithm, and Text to image encryption algorithm are 93 J, 87 J, 76 J, and 65 J respectively. The energy consumed in the proposed secure adaptive content-based RSA algorithm is 54 J. As performance results show that the memory usage of SAC-RSA is also lower than the energy consumption of BEA, IIBE, HEA, and TTIE. In conclusion, the SAC-RSA method outperforms the BEA, IIBE, HEA, and TTIE in terms of energy consumption.

The calculation of the risk that a security event will be attempted or occur is known as the security level. **Figure 14** depicts a Comparative analysis of security levels in Suggested and Traditional Methods.

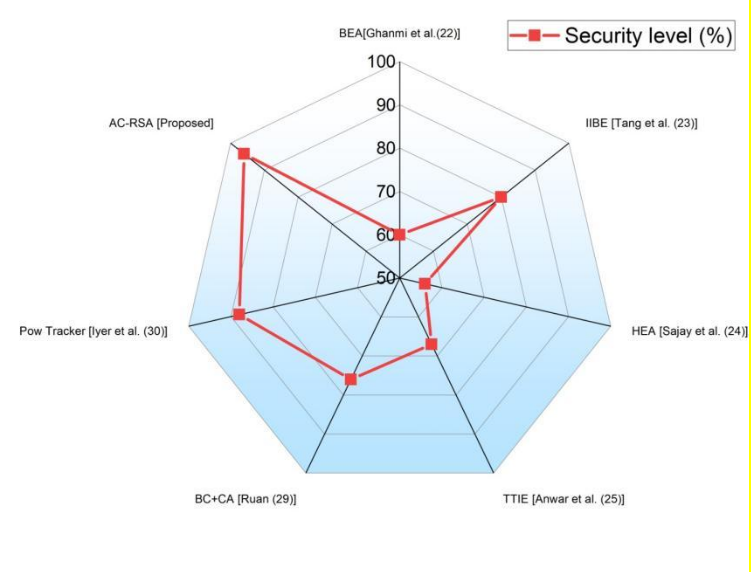

Figure 14. Comparative Analysis of Security Level in Suggested and Traditional Methods

Mixed encryption algorithm, improved identity-based encryption algorithm, Hybrid encryption algorithm, and Text to image encryption algorithm were all evaluated using security levels of 56 percent, 67 percent, 76 percent, and 88 percent respectively. The proposed secure adaptive content-based RSA algorithm was evaluated with a security level of 93 percent. The results show that the proposed method SAC- RSA has high efficiency than existing methods such as BEA, IIBE, HEA, and TTIE. **Table 3** represents a overall performance of existing and proposed methods.

Table 3. Overall Performance of Existing and Proposed Methodology

Existing and Proposed Methods	Teaching Capability Ratio (%)	Latency (%)	Memory Usage (%)	Packet Loss (%)	Throughput (%)	Energy Consumption(J)	Security Level (%)
Blowfish encryption algorithm	8	90	95	98	61	93	56
Improved identity-based encryption algorithm	25	85	80	85	68	87	67
Hybrid encryption algorithm	49	73	70	72	72	76	76
Text to the	62	65	64	68	85	65	88

Existing and Proposed Methods	Teaching Capability Ratio (%)	Latency (%)	Memory Usage (%)	Packet Loss (%)	Throughput (%)	Energy Consumption(J)	Security Level (%)
image encryption algorithm							
secure adaptive content-based RSA algorithm	83	58	59	61	98	54	93

DISCUSSION

The multimodal literature teacher uses a variety of auditory, visual, and other symbolic representations. Literature, such as an educational document, can be multimodal content. Digital texts are often multimodal materials. Multimodal texts can play to their strengths in preparing students for a multimodal society where people engage by utilizing audio, gestural, visual, spatial, and print resources as well as various combinations of these modalities. With computer network-based multimodal teaching, each existing method is interdependent and mutually supports the use of computer network technology, as opposed to the content of previous teaching materials. To appeal to the various sensory modalities of the students, multiple modalities are utilized (visual, auditory and tactile, etc). With blockchain; students can keep their records and determine their academic persona. Encrypting student data with blockchain technology ensures it is inaccessible to anyone who shouldn't have it, which is a huge improvement to student safety in an era when data breaches are all too frequent. Blowfish encrypts and decrypts data using the same encryption key. The metrics demonstrate that the proposed method works more effectively than the existing method, which has several serious flaws. These are a few of the weaknesses of the existing approach. The drawbacks of the Blowfish method include the need that the key to be obtained outside of the band and not through an insecure transmission channel. Key management gets more difficult as the number of users increases. For the protection of the Domain Name System (DNS), new identity-based encryption and a digital signature scheme called the "IIBES" has been implemented. Improved Identity-based encryption (IIBE) is an enhanced approach for generating keys that reduce network traffic while increasing security. One of IIBE's biggest flaws is its inability to handle huge networks of complex tasks efficiently. Hybrid encryption combines the benefits of public-key (asymmetric) encryption with the effectiveness of symmetric encryption. Only those who possess the private key may decode the information. A brand-new symmetric key is produced to encrypt the plaintext data for communication. A hybrid implementation might pose an even greater threat than a quantum computer since security breaches are more often caused by flawed implementations than by fundamentally weak cryptosystems. Text to-image encryption technique (TTIE) creates a matrix by converting each character in a text file into the RGB of a single pixel in an image. Cooperation requirements and the creation of a false sense of security are two drawbacks of TTIE. Our research showed that the proposed method is preferable to the existing system because it overcomes problems with the existing used techniques.

CONCLUSION

BC-enabled computer network-based multi-modal literature teaching was the subject of this study. The Multi-modal literature teaching has to be elevated to safeguard data privacy and transparency in the system, so that a BC-based computer network framework may be introduced for the Multi-modal literature teaching. The data from the ML teaching is encrypted, stored, decrypted, and transferred to protect teaching material privacy. Performance measures like latency, memory usage, packet loss, throughput, energy consumption, and security level. The suggested model's performance was calculated and compared to that of current techniques including BEA, IIBE, HEA, and TTIE. The effectiveness of our suggested strategy yields superior results. Experimental courses tend to focus more on developing the framework and adopting new methodologies, rather than on how to better integrate the teaching method and teaching material into a cohesive whole. Scholars of the future give attention to distinct fields of study for different computer network technology-based multi-modal literary teaching and assessment methodologies. This suggests that lecturers should be aware of the circumstances of the students, understand what worked, what did not, and why, to provide the best education, and that understanding students' experiences during remote learning would provide invaluable information and lay the groundwork for future online learning projects. According to the study's findings, as they are less familiar with the instructional tools, students in lower-level courses shouldn't be exposed to too many technologies without supervision and support. The interview survey's primary focus was on the shift in students' motivation for multimodal listening instruction and on instructional recommendations for the discipline's future.

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