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Transforming Education and Management Using Blockchain Applications

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Abstract: The integration of blockchain technology has brought about revolutionary advancements in various domains, including education and information management. This research paper explores the diverse applications of blockchain in enhancing the efficiency, security, and transparency of library record management, academic records management, online attendance systems, and online exams portals.

I. INTRODUCTION

In today's educational and organisational landscape, the process of tracking attendance remains a critical yet often cumbersome task. Various methods have been employed, ranging from manual call-outs and data recording to the implementation of advanced biometric systems such as fingerprint recognition, RFID card readers, and iris scans. Despite the adoption of these methods, challenges persist. Manual attendance-taking remains highly inefficient and prone to inaccuracies, while systems like RFID cards can be susceptible to misuse, with one individual potentially marking attendance on behalf of multiple others. Other biometric solutions, such as fingerprint and voice recognition, have their own limitations and do not consistently deliver optimal performance.

One major worry among many educational institutions is the fake alteration of graduation certificates, a challenge that can be addressed by using blockchain technology. In this context, blockchain technology emerges as a promising avenue for securely storing attendance records on a decentralized, publicly accessible ledger. The immutability inherent to blockchain ensures the authenticity of records, effectively preventing unauthorized access and tampering.

In the context of library record management, blockchain's decentralized ledger ensures the integrity of records, eliminates data tampering, and simplifies interlibrary resource sharing. The transparency and immutability of blockchain technology guarantee the authenticity of academic records, enabling institutions to efficiently verify and share credentials, reducing the prevalence of fraudulent degrees and certifications.

Blockchain's role in the online attendance system enhances its reliability by creating a tamper-proof ledger of student attendance records. This results in more accurate attendance tracking, mitigating issues of proxy attendance and fraudulent records. Furthermore, this paper discusses how blockchain facilitates secure and efficient online exams, ensuring the integrity of question papers, answer sheets, and results while reducing the risk of cheating. This paper discusses the most efficient proposed solutions that leverage the power of machine learning for face detection and blockchain technology as a distributed database to effectively manage attendance logs. The workflow may begin with data capture through IoT devices like camera sensors. Machine learning algorithms then analyse this data, accurately identifying and locating faces. Facial recognition and analysis may follow, ensuring that attendance records are linked to the correct individuals. The attendance data, along with timestamps, is securely stored on a blockchain network.

II. RELATED WORK

A. Academic Record Management

The paper's [1] primary aim is to establish a certificate generation [2] and validation system that cannot be altered. It explores the application of smart contracts to streamline the verification procedures, which would lessen administrative workloads and minimise the likelihood of errors. [3] Through decentralised access, student gain more autonomy over their records, enabling them to securely share information with those who require it. The system's unchangeable and tamper resistant characteristics offer robust protection against unauthorised changes. Moreover, this system encourages efficiency, scalability, and convenient access to documents, thereby promoting smoother operations and reducing dependence on centralised authorities. The three main focuses of the review paper [4] are as follows. It begins by exploring the various fields in which blockchain is used. These include smart campus infrastructure, educational organisations, student performance assessment, money management, student information and academic record maintaining systems [5], and data exchange and management.

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They also include the digitization, validation, and management of user-focused documents. Second, it looks at blockchain's benefits for stakeholders in higher education institutions [6] [7] (HEIs), including increased privacy and security, decentralisation, data integrity and traceability. Finally, it examines the difficulties involved in implementing blockchain technology, including organisational issues (such as stakeholder engagement, organisational size, financial constraints, and a lack of skills or expertise), technological issues. This study [8] explores a cutting-edge form of instruction that combines computer technology and specialist approaches. It starts off by looking at traditional, information-assimilation-based learning paradigms. The article goes on to elaborate on how smart use of digital data resources might improve learning results. The importance of modern technology in this educational framework is emphasised throughout this study. It explains the complexities of these systems and the persuasive case for adopting them. Additionally, it outlines the many elements of the technology infrastructure and how they work together to enhance learning.

B. Attendance Monitoring

In paper [9], authors used OpenCV and the haar cascade algorithm to construct a facial detection model which then compares the images to images stored in a database to mark attendance and secure the data by employing it on a blockchain server. Smart contracts define the attendance records for a particular class by initialising the series of transactions to be performed between all the entities. In paper [10], authors use IoT devices like a camera sensor to capture an image of an employee and send it to a distributed server like multichain where all the data gets stored. Further, machine learning models like cascaded classifier for real-time identification of image and Local binary pattern histogram for detection of the employee. Neural network is used for training the dataset. In paper [11], authors have created a database using student's images and details which is used to train a CNN model for detection and recognition. A notification is generated at entry and exit along with a log that is maintained in a blockchain network. Authors have deployed a web application that lets the mentor login and check the attendance log.

C. Library Record Management

To solve the problem of lack of tracking and missing and disappearance of textbooks, a blockchain-based intra-campus book-sharing system BookChain is proposed, which securely records all of the book's interacting entities on blockchain [12]. This model is very verifiable and effective because every consumer could retrace the book's renting activity effectively lowering the risk of a book being misplaced. This system promotes the use of smart contracts to streamline the distribution of books with very less human interference, which maximizes productivity [13]. The efficiency and affordability of the suggested system are quite good even with a large number of concurrent participants. The blockchain stores the progress status of books as well as other important details. By tracing books' development throughout this approach, the issue of the confidence crisis can be solved. Smart contracts are used for all shareable book-related transactions, making it easier to circulate books and address the issue of ineffective administration [14].

Figure. 1 depicts the three components that make up BookChain's conceptual framework: Top, Middle, Lower-level Layers. A group of programs created for end customers to easily control the system make up the applications level. Users are given access to the essential Bookcrossing features through the Trust Service Level (i.e., borrowing books).

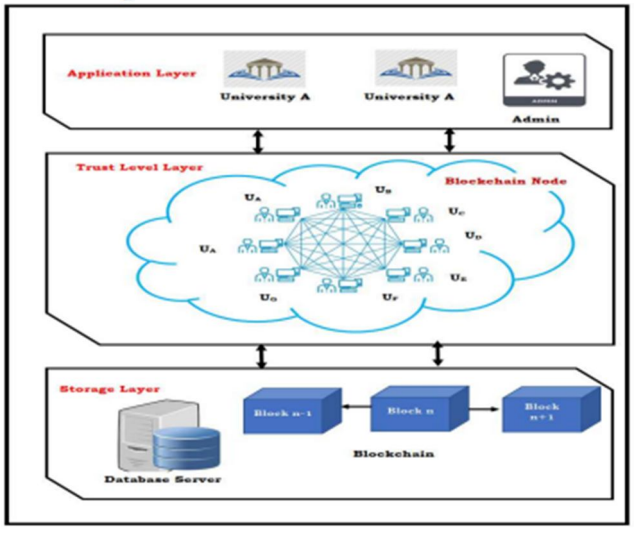


Figure 1. The Architecture of the Proposed Method[12]

D. Online Exam Portal

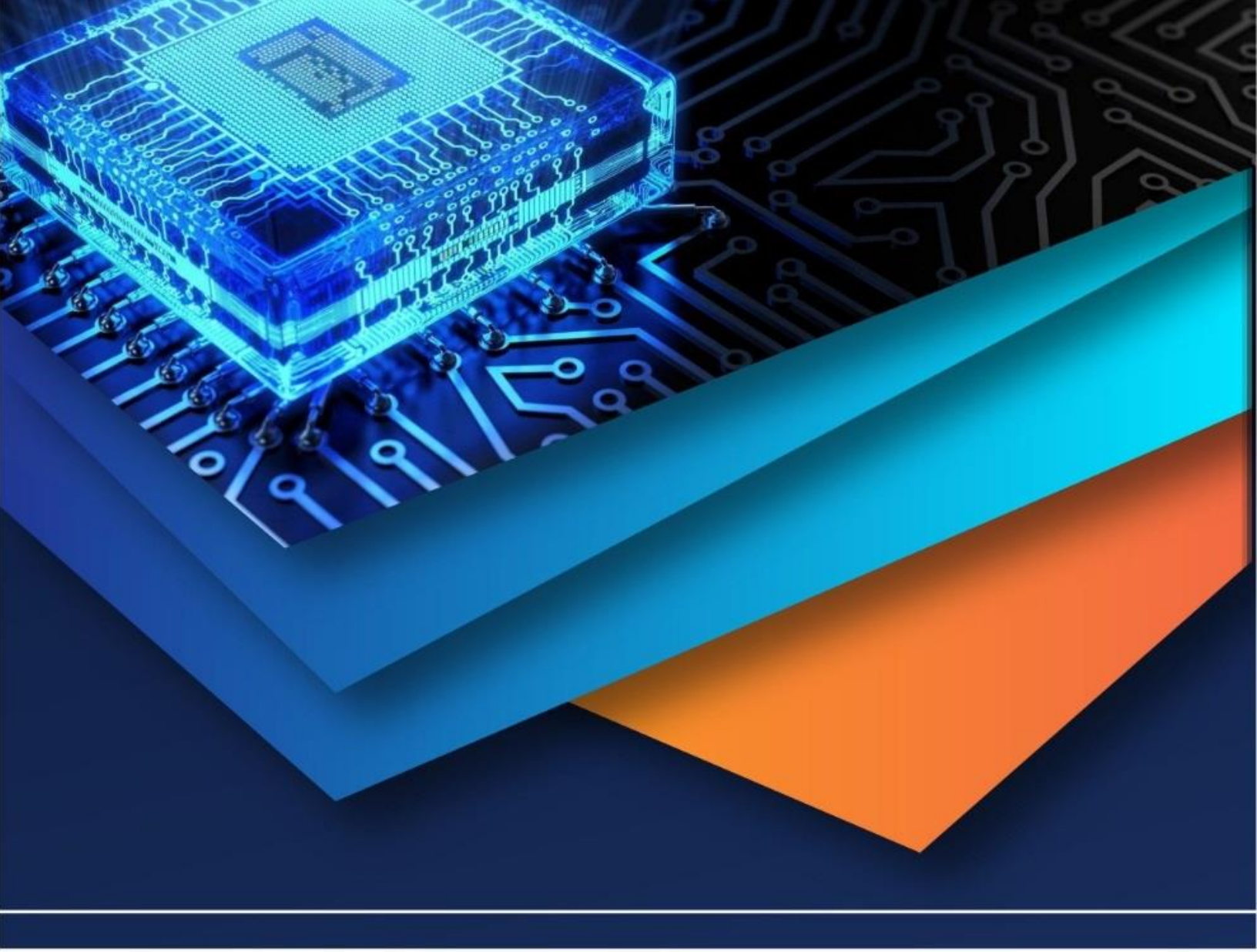
This paper proposes an innovative model that uses blockchain technology to transform the examination system into a web application. Using blockchain networks within the portal, this concept enables students to log in, take tests, and submit their answers directly to the portal, resulting in the immediate storage of their answers onto the network [15]. The model enhances security and reliability by storing exam data in a tamper-proof manner that cannot be easily manipulated or removed. The portal system which was used during the pandemic has been improved to a great extent with the integration of blockchain technology [16]. This address concerns related to cheating, hacking, and unauthorised alteration of exam content. The model also makes use of the popular LMS (Learning Management System) Moodle, which offers a number of features like online lectures, assignments, and exam authoring. One of the top learning management systems, Moodle, can be used to implement the aforementioned recommended approach. By integrating the above proposed model with Moodle, one of the best Learning Management Systems, it allows for seamless administration and management of exams within a familiar and supportive environment. The model also introduces an auto-grading system that automatically corrects exams and sends the grades to students. This streamlines the grading process and provides timely feedback to students. Overall, by leveraging blockchain's immutability and transparency, the proposed model aims to address the challenges associated with centralised exam systems and provide a secure and reliable solution for conducting online exams.

III. CONCLUSION

The literature reviewed here demonstrates the versatility of blockchain technology in revolutionising library record management, academic records management, online attendance systems, and online exams portals. The adoption of blockchain offers numerous benefits, including data integrity, transparency, and enhanced security, while also addressing common challenges such as fraud and cheating. However, the successful implementation of blockchain in these contexts requires overcoming scalability issues, addressing regulatory concerns, and ensuring user-friendly interfaces. Future research should focus on practical implementations and the development of standardised frameworks to maximise the potential of blockchain technology in education and information management.

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