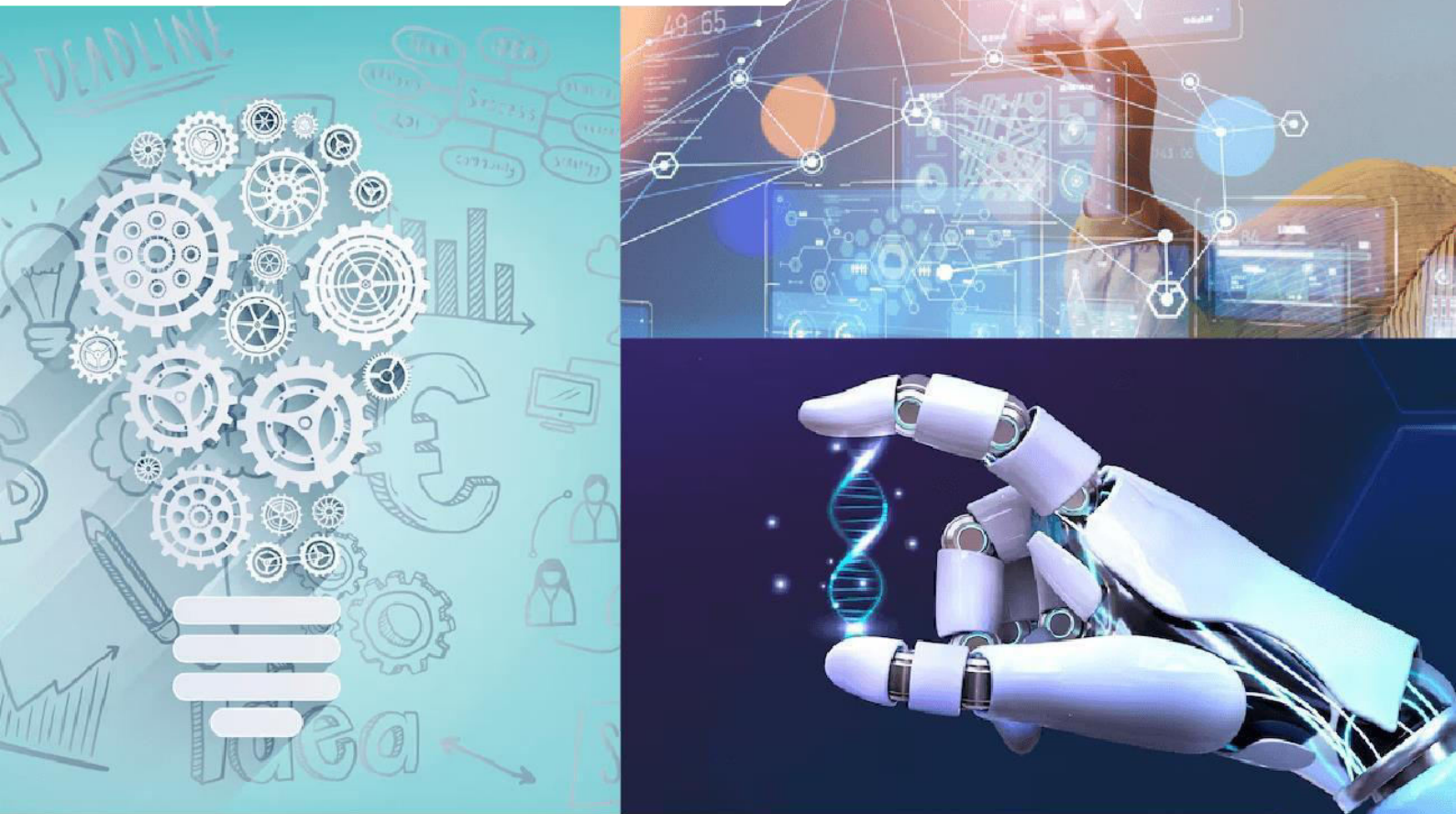




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A Framework for Sharing Student-Owned Educational Data on Public Blockchain Network

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ABSTRACT: Today, educational data is centrally controlled by institutions and administrative units, making it vulnerable to risks such as natural disasters, political instability, and wars. Additionally, accessing this data for educational activities, including exchange programs and lifelong learning, presents significant challenges. To address this issue, this study proposes shifting data control to students—the rightful owners of their educational records—rather than keeping it solely under institutional control. In line with the vision of a decentralized internet, public blockchain networks are identified as the most suitable infrastructure for this purpose. To meet this need, a framework named PublicEduChain has been developed.

PublicEduChain enables students to store their educational data in smart contracts on the public Ethereum network, allowing them to share this information securely with educational institutions and administrative units. Educational institutions can access student data through Learning Management System (LMS) applications, which interact with smart contracts on the Ethereum network. Institutions can also add new data to these contracts while ensuring student ownership and control. Furthermore, PublicEduChain incorporates a daily updated course system, where newly assigned courses are automatically recorded in the blockchain via smart contracts. This ensures transparency, security, and immutability of course enrollments and progress tracking.

KEY WORDS: Educational Data, Blockchain, Decentralization, Ethereum, Smart Contract

I. INTRODUCTION

Education has been profoundly impacted by globalization, digital transformation, Industry 4.0, and the pandemic. These factors have accelerated the transition to online learning and raised the demand for lifelong learning and digital skills. Students are now receiving education from a variety of sources thanks to international initiatives like Erasmus+ and DAAD, which have increased academic mobility. Nonetheless, it is still difficult to manage academic records across multiple systems, particularly for undocumented refugee students like Ukrainian students in Poland. A promising solution is provided by blockchain technology, which is decentralized, transparent, and secure. Blockchain was initially created for digital currencies, but it now helps a number of industries, including education. It makes it possible for academic records, credits, and certifications to be safely stored and verified between institutions.

II. LITERATURE SURVEY

Title: A proposed model for improving the reliability of online exam results using blockchain

Year: 2024

Author: M. Abdelsalam, M. Shokry, and A. M. Idrees.

Description: Recently, Learning Management Systems (LMS) have become increasingly popular, especially because of the COVID-19 pandemic, providing enhanced effectiveness and efficiency. Within LMS, online assessments have become an essential method for evaluating students' performance and comprehension of course content, significantly influencing their advancement. It is essential to guarantee the reliability and transparency of online exam outcomes. Any security flaw, like hacking, can negatively affect students' grades. Traditional online examination systems typically save data centrally in databases such as MySQL, rendering them vulnerable to unauthorized access and alteration. This article introduces a blockchain-driven system to facilitate secure peer-to-peer administration and assessment of academic examinations. The system utilizes hashing methods to guarantee data integrity and incorporates proof of stake mechanisms to boost security. The decentralized data storage of blockchain, along with cryptographic hashing for each block, effectively protects data integrity. The article shows how blockchain can be utilized to create

online examinations, with each question and answer recorded directly on the blockchain. To accomplish this, we developed a module that works with the Moodle learning management system. By conducting a comparative analysis with the default centralized storage of Moodle, our module alters the storage of exam results, guaranteeing secure and tamper-resistant data storage on the blockchain. Utilizing blockchain technology, exam information is securely stored, preserving its integrity and preventing tampering. Our findings indicate that the data recorded on the blockchain is completely precise, without any inconsistencies when compared to Moodle's conventional method. The blockchain network offers a dependable and unchangeable platform, stopping unauthorized modifications to student information. To sum up, our blockchain-driven framework provides a strong answer for improving the security and dependability of online exam outcomes.

Title: Addressing challenges with Ukrainian refugees through sustainable integration: Response of the educational community in Poland **Year:** 2023

Author: M. Rataj and I. Berezovska.

Description: The impact of the war on higher education and research in Ukraine is devastating. A great many teachers, researchers and students had to flee ruined universities and research centres. Numerous universities worldwide have demonstrated solidarity with Ukrainian refugees. In an effort to develop effective support strategies, this study identifies specifics of migration from Ukraine caused by the war. The questionnaire was developed to conduct a survey among 26 Ukrainian faculties recently employed at the University of Information Technology and Management in Rzeszow (Poland). Respondents reported great satisfaction with integration strategies based on perfect intra-university collaboration and comprehensive individual approach. Four groups of challenges that can be influenced by an intervention at nation-wide, local and institutional levels were identified and then addressed in terms of empirical considerations, firsthand experience and survey findings.

Title: Ethereum-based information system for digital higher education registry and verification of student achievement documents. **Year:** 00202023

Author: .Y.Kistaubayev, G. Mutanov, M. Mansurova, Z. Saxenbayeva, and Y. Shakan.

Description: Blockchain is an innovative and contemporary technology that is slowly being adopted across different sectors because of its capability to decentralize and manage secure, dependable data sharing and storage. A growing area of related research is education, particularly emphasizing the digitization and automation of management processes in education and the capacity to store and verify digital records of student progress. The primary objective of this research is to build a platform that establishes a cohesive digital record of students' educational successes, addressing one of the most urgent challenges in education, utilizing the Ethereum blockchain framework. Blockchain can be costly; hence, it's essential to take performance factors into account when assessing any decisions related to the technology, particularly the key elements like forecasting traffic patterns, evaluating transaction expenses, and offering the required metrics for system quality and performance. Nevertheless, much of the research overlooks assessing performance metrics like throughput, transaction speed, and the volume of data held in the Ethereum blockchain database, which are key evaluation factors. This study seeks to bridge this gap by assessing the performance of the created platform and by analyzing the experimental results obtained. Consequently, the primary outcomes of this study involve the creation and implementation of a blockchain platform along with an examination of its transaction expenses. We find that the suggested blockchain solution is suitable as a system for accounting and verifying loans and students' academic accomplishments.

Title: The future of continuous learning-digital badge and micro credential system using blockchain. **Year:** 2021

Author: V. Chukowry, G. Nanuck, and R. K. Sungkur.

Description: Ongoing Learning is regarded as essential for maintaining competitiveness and efficiency in the workplace. Often, this happens beyond the confines of a classroom as well. Currently, Digital Badges and micro credentials serve as means to identify and validate a learner's accomplishments and particular skills. This study reviews various methods employed in current blockchain-based educational platforms and ultimately suggests an innovative web-based digital badge and micro credential system that assists learners in gaining the necessary skills. Ethereum has been utilized for the Blockchain, while ReactJS has been employed for the front end development. A system for digital badging and micro-credentials featuring quizzes and digital badges was developed utilizing the Ethereum blockchain, along with IPFS for badge image storage and Firebase for exam management, registration, and course storage. The suggested system demonstrated significant advantages and tackled the fundamental limitations of conventional learning content management systems (LCMS). This study by Chukowry, Nanuck, and Sungkur (2021) explores the evolving role of digital badges and micro-credentials in promoting continuous learning and skills recognition, especially in professional and non-formal learning contexts. The authors highlight the increasing importance of lifelong learning for maintaining workforce competitiveness and adapting to rapidly changing industries. Traditional classroom-based

models are often insufficient to meet these evolving educational needs, and there is growing interest in decentralized, verifiable methods for recognizing learner achievements outside formal education. In response to this need, the study presents the design and development of a blockchain-based digital badging and micro-credential system. The proposed platform leverages Ethereum for blockchain integration, ReactJS for the front-end user interface, IPFS (InterPlanetary File System) for decentralized image storage of badges, and Firebase for handling backend operations such as course registration, exam management, and data storage.

Title: What is Web 2.0: Design patterns and business models for the next generation of software.

Year: 2023

Author: T. O'Reilly.

Description: This study was the initial effort to define Web2.0 and comprehend its effects on the forthcoming generation of software, examining design patterns and business models. Web 2.0 is the internet as a platform, encompassing all linked devices; Web 2.0 applications are designed to fully leverage the inherent benefits of that platform: offering software as a constantly-updated service that improves with increased usage, utilizing and combining data from various sources, including personal users, while also supplying their own data and services in a manner that permits others to remix, generating network effects via an "architecture of participation," and evolving past the page concept of Web 1.0 to provide rich user experiences.

Title: Challenges of using blockchain in the education sector: A literature review.

Year: 2022

Author: A. Mohammad and S. Vargas.

Description: Blockchain stands out as a recent innovation that is progressively capturing the interest of various parties across multiple industries, including education. This is mainly because of its appealing characteristics, including decentralization, transparency, traceability, security, and dependability. Although it has benefits, blockchain encounters numerous obstacles, and the rate of adoption for this technology remains limited. Consequently, the aim of this research was to perform a review of published papers that have addressed the obstacles of implementing blockchain in the education sector. The review included scientific articles released between 2017 and 2022, and a total of 32 papers were examined in their complete text from the filtered records. This review identified and categorized 14 challenges according to the technology-organization environment (TOE) framework. Moreover, this review indicated that organizational and environmental obstacles were not sufficiently addressed in the literature, in contrast to technological barriers. This literature review by Mohammad and Vargas (2022) investigates the various challenges that hinder the adoption of blockchain technology in the education sector. While blockchain has gained increasing attention due to its notable attributes—such as decentralization, immutability, transparency, traceability, enhanced data security, and reliability—its integration into educational systems has been slow and uneven. To understand the underlying reasons for this slow adoption, the authors systematically reviewed 32 peer-reviewed scientific papers published between 2017 and 2022. This review provides valuable insights for researchers, policymakers, and educational institutions seeking to harness blockchain's potential, and it underscores the importance of addressing both technical and non-technical factors to achieve successful adoption.

III. EXISTING SYSTEM:

- In the present educational data management environment, data is mainly governed by educational organizations and administrative departments. This centralized method exposes data to risks from natural disasters, political turmoil, and conflicts. Furthermore, it may hinder access for students participating in exchange programs or lifelong learning initiatives.
- Current systems frequently face challenges regarding data portability and security, leaving students with restricted control over their personal educational information. Natural disasters, political unrest, and wars in nations can lead to the irreversible destruction of education systems and data
- For instance, many Ukrainian refugee university students in Poland lacked documents verifying their educational history, prompting Polish universities to carry out interviews and specific exams to evaluate their knowledge level

EXISTING SYSTEM DISADVANTAGES

- Centralized systems are susceptible to data loss or corruption due to external threats such as natural disasters or political unrest.
- Limited Data Accessibility
- Inflexibility.

IV. PROPOSED SYSTEM

- The suggested PublicEduChain framework seeks to tackle these issues by decentralizing the management of educational data using blockchain technology. PublicEduChain enables students to manage their educational data in smart contracts through public Ethereum networks, ensuring they have ownership and control over their information. This decentralized method reduces the dangers linked to centralized data storage while improving data security and accessibility.
- Educational institutions can engage with student data via Learning Management System (LMS) applications, which have the capability to read from and write to these smart contracts. This system enables effortless data sharing, minimizes the chance of data loss, and promotes more adaptable and secure educational exchanges and lifelong learning possibilities.

PROPOSED SYSTEM ADVANTAGES

- Students retain control over their educational data by storing it in smart contracts, allowing them to manage and share their information independently.
- Improved Accessibility.
- Flexibility and Adaptability.

V. SYSTEM ARCHITECTURE

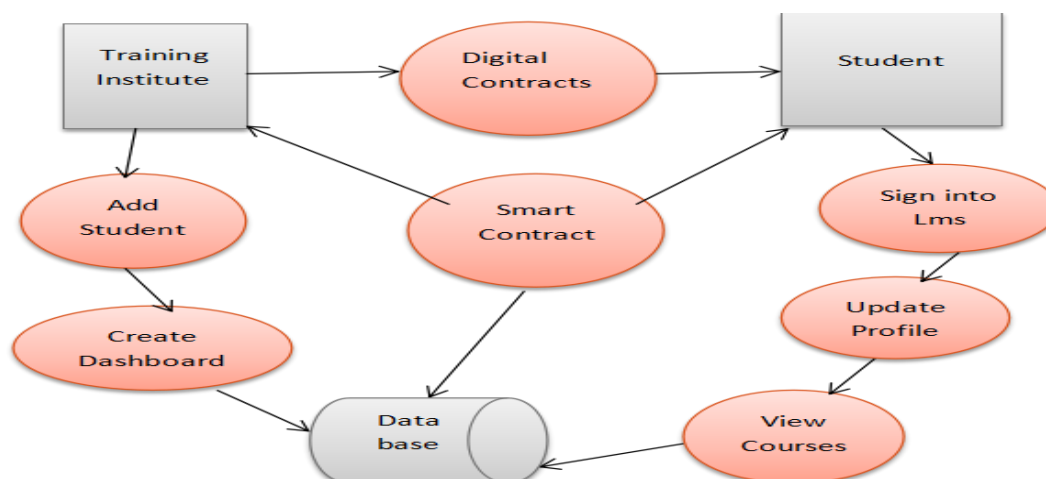


Fig 1: System Architecture

In the PublicEduChain framework students gain complete control over their data by creating smart contracts through their accounts on the public Ethereum network. Educational institutions can enable students to log in with their Through LMSs, educational institutions can facilitate student access by allowing them to log in with their Ethereum accounts and retrieve educational data stored in their smart contracts. Moreover, educational institutions can establish corporate Ethereum accounts, utilizing them to store data like certificates and grades within individual student smart contracts. In this way, a student can store his educational data in his own smart contract, log in to LMSs with only his Ethereum ID without the need for any other registration process, and these LMSs can read data from the student's contract and write data to the contract. With the PublicEduChain framework, students can store their educational information without the need for any educational institution or third party and participate in educational activities more freely.

VI. METHODOLOGIES

Modules Name:

- User Interface Design
- Smart Contract
- Admin

- Educational Institutions
- Student
- Upload course

1) User Interface Design:

To connect with server user must give their username and password then only they can able to connect the server. If the user already exists directly can login into the server else user must register their details such as username, password, Email id, City and Country into the server. Database will create the account for the entire user to maintain upload and download rate. Name will be set as user id. Logging in is usually used to enter a specific page. It will search the query and display the query.

2) Smart Contracts

Smart contracts are typically used to automate the execution of an agreement so that all participants can be immediately certain of the outcome, without any intermediary's involvement or time loss. They can also automate a workflow, triggering the next action when predetermined conditions are met

3) Admin

This is the third module in our project is Admin. Here admin will login with his password and Id who has created by the training educations. After admin login directly will navigate into admin home page. The purpose of admin is to add or create institutions and control institution's data.

4) Educational Institutions

This is the fourth module in our project is educational institutions. Here institutions will login with hospital id and password. After login it will directly navigate home page there we can add students for course training and when they accept student immediately smart contract will be created and course data will be started.

5) Student

This is the Fifth module in our project is Student. The student logging into the LMS application with their Ethereum account can update the address of the smart contract along with their profile information. The LMS application should have the capability to read the educational data stored in this smart contract and write data to this contract when necessary.

6) Upload

This is the Sixth module is Upload. The process of writing the course data to the smart contract with the address "0xA537CD933Ef5B2Ff097447bC30656149844ff 22f", which the student updated in his profile from the address "0xC6e723eF3f13C1cF0C5Df6F0869676d8e5349 E79".

VII. ALGORITHM USED

PublicEduChain framework :

The PublicEduChain framework is designed to integrate blockchain technology into the public education system to enhance transparency, security, and efficiency. By leveraging blockchain's immutable ledger and decentralized nature, PublicEduChain aims to create a more transparent and accountable educational environment. This framework allows for secure storage and verification of academic records, certifications, and student achievements, reducing the risk of fraud and ensuring the integrity of educational credentials. Additionally, it facilitates better tracking of funding and resource allocation, enabling more effective management of public education budgets. Through smart contracts, PublicEduChain can automate administrative processes and streamline interactions between educational institutions, students, and regulatory bodies. Overall, this framework seeks to modernize and improve public education by harnessing the benefits of blockchain technology to build a more reliable and equitable system.

SmartContract :

Smart contract is a self-executing program that automates the actions required in a blockchain transaction. Once completed, the transactions are trackable and irreversible. The best way to envision a smart contract is to think of a vending machine—when you insert the correct amount of money and push an item's button, the program (the smart contract) activates the machine to dispense your chosen item.

VIII. EXPERIMENTAL RESULTS:-

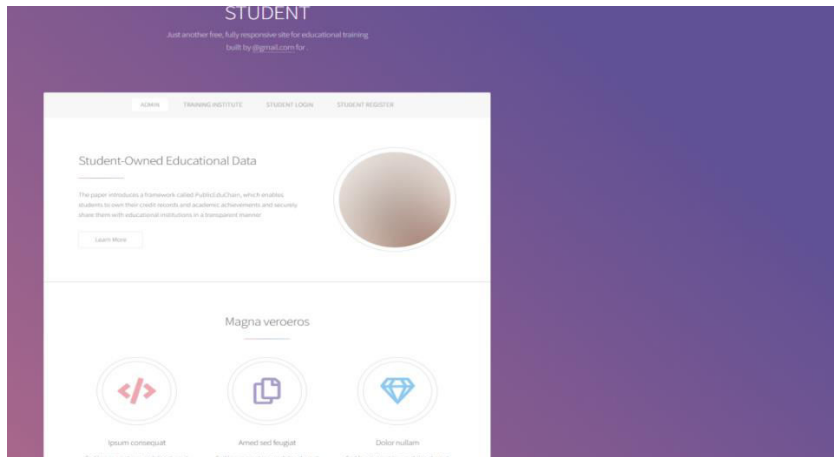


Fig 2: Home page

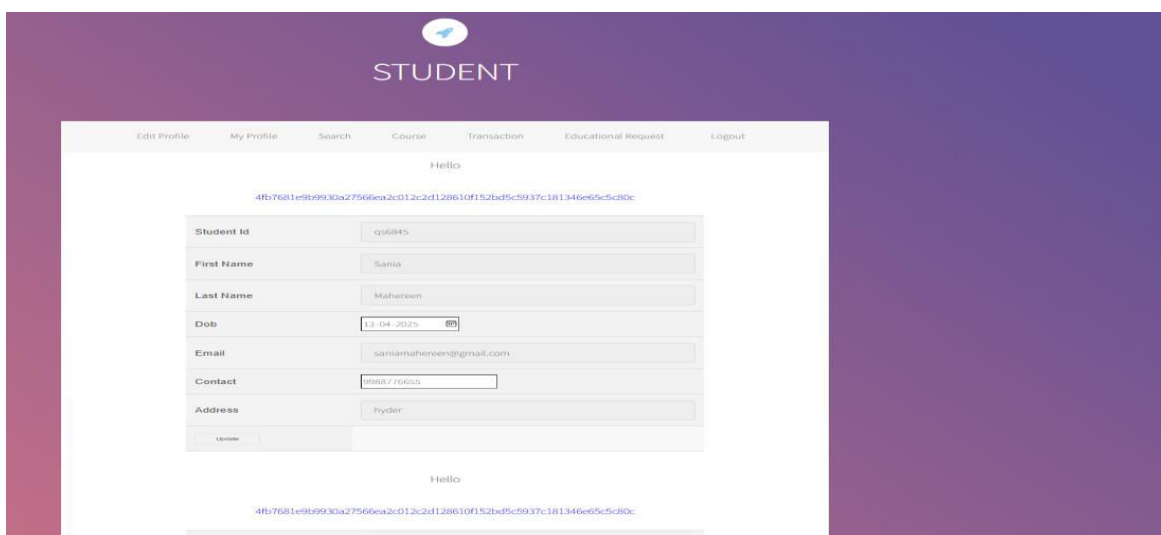


Fig 3: Profile page

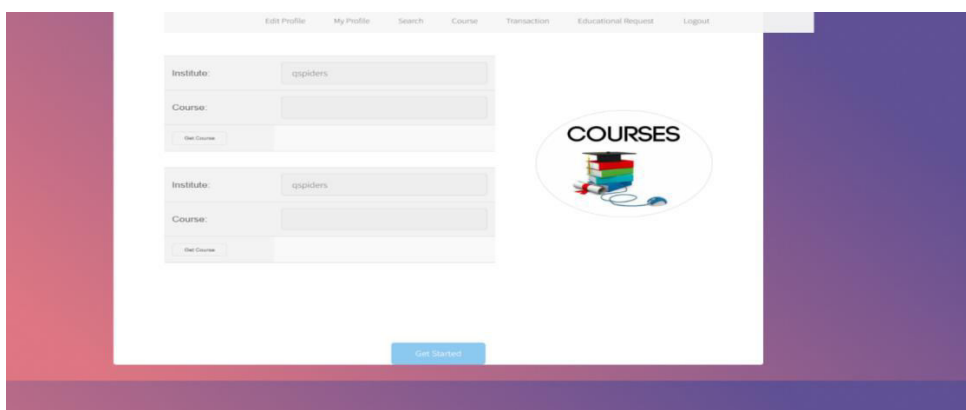


Fig 4: Courses page

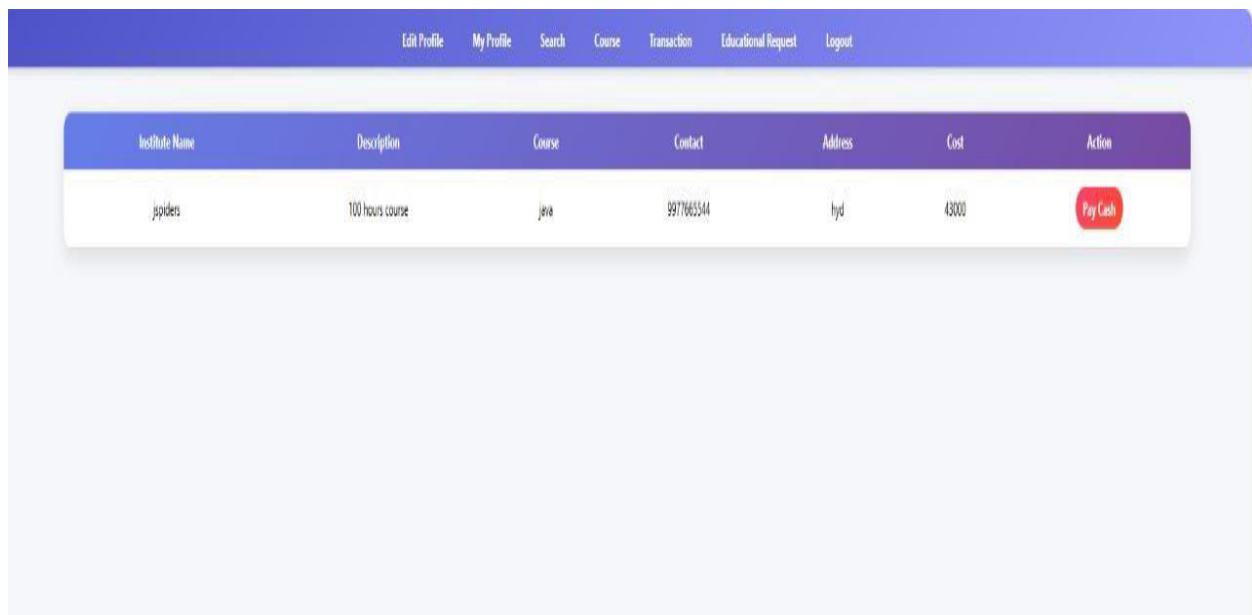


Fig 5: Cash payment page

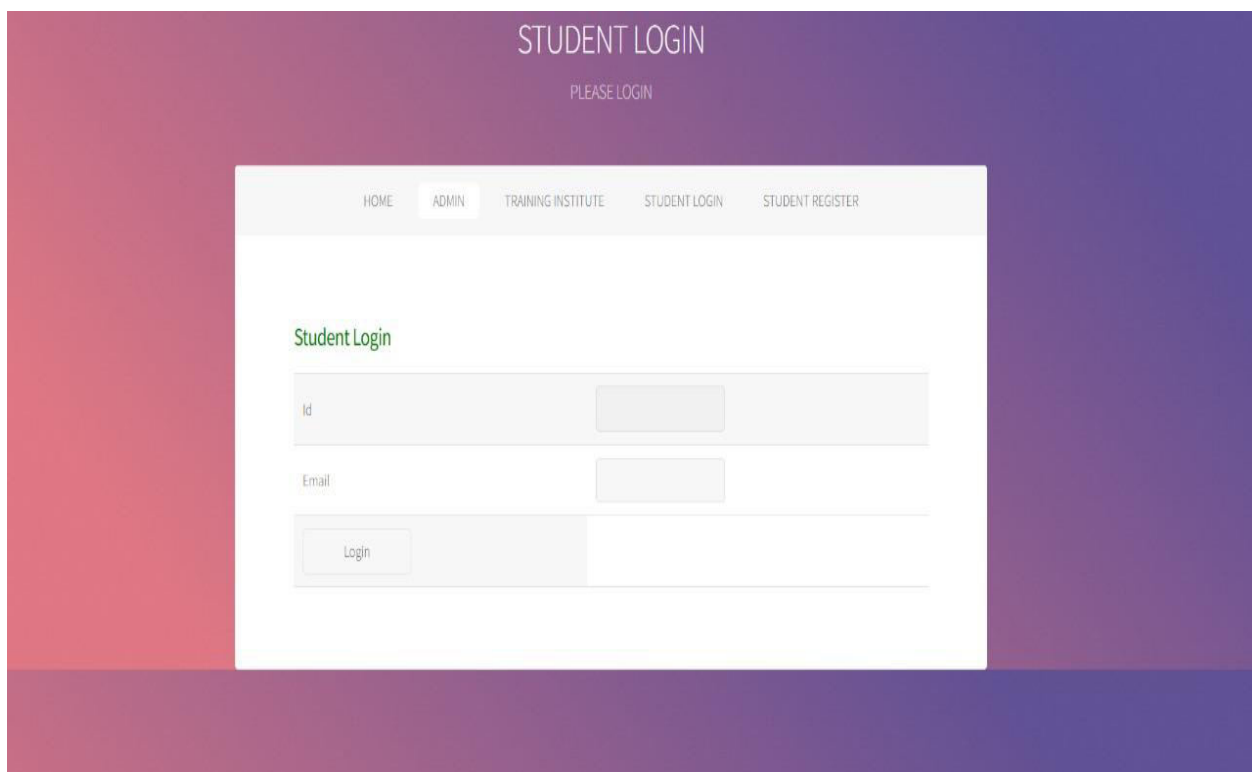


Fig 6: Student login page

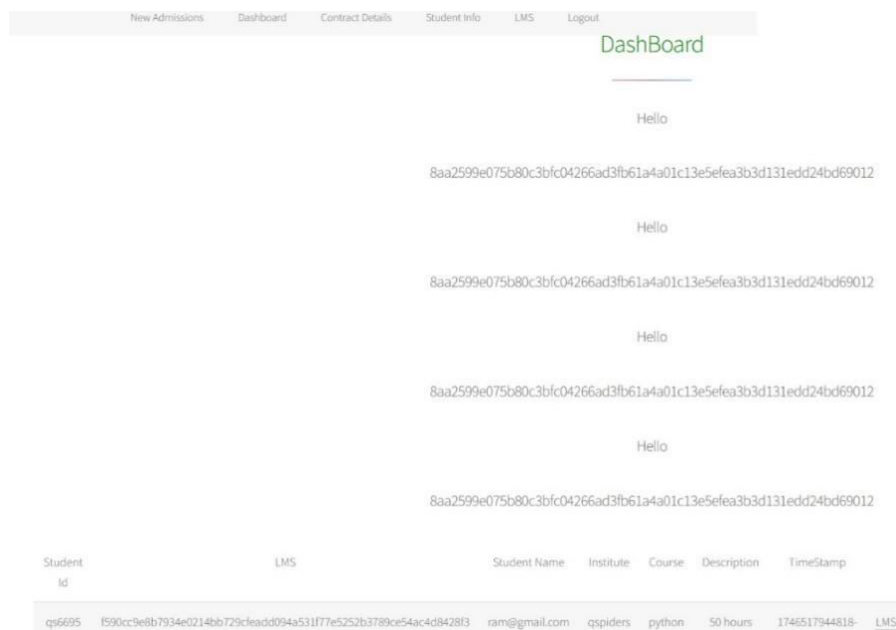


Fig 7: Welcome page

IX. CONCLUSION

The PublicEduChain framework offers a transformative approach to managing educational data by shifting control from centralized institutions to the students themselves. By leveraging public blockchain networks like Ethereum, PublicEduChain enables students to store and manage their educational data securely and transparently through smart contracts. This decentralized approach not only mitigates risks associated with natural disasters, political instability, and other threats to centralized systems but also facilitates easier access and sharing of educational records across institutions. With the ability for educational institutions to interact directly with student data stored on the blockchain, PublicEduChain enhances both the integrity and accessibility of educational information. This innovative framework thus represents a significant step towards a more secure and student-centric model for managing educational records.

X. FUTURE ENHANCEMENT

The future of the PublicEduChain framework holds significant promise for further enhancement and widespread adoption. As information and communication technologies, including blockchain and decentralized applications, continue to evolve, PublicEduChain can be expected to integrate more advanced features and tools to streamline its implementation. Future enhancements may include the development of user-friendly interfaces and automated tools that simplify the creation and management of student smart contracts, making the system more accessible to a broader audience. Additionally, improved integration with Learning Management Systems (LMS) will enhance interoperability and ease of use, ensuring seamless data exchange between educational institutions and students. As blockchain technology matures, there may also be innovations that reduce transaction fees and improve the scalability of public networks, further reducing the costs and barriers associated with decentralized data management. Furthermore, advancements in security protocols and encryption techniques will bolster the robustness of the system, addressing any potential vulnerabilities.

REFERENCES

- [1] Y. Kistaubayev, G. Mutanov, M. Mansurova, Z. Saxenbayeva, and Y. Shakan, "Ethereum-based information system for digital higher education registry and verification of student achievement documents," *Future Internet*, vol. 15, no. 1, p. 3, Dec. 2022, doi: 10.3390/fi15010003.
- [2] Erasmus+. Accessed: Sep. 5, 2023.
- [3] Germany—DAAD. Accessed: Sep. 5, 2023.

- [4] M. Rataj and I. Berezovska, "Addressing challenges with Ukrainian refugees through sustainable integration: Response of the educational community in Poland," *J. Further Higher Educ.*, vol. 47, no. 9, pp. 1221–1227, Oct. 2023, doi: 10.1080/0309877x.2023.2241386.
- [5] M. Choi, S. R. Kiran, S.-C. Oh, and O.-Y. Kwon, "Blockchain-based badge award with existence proof," *Appl. Sci.*, vol. 9, no. 12, p. 2473, Jun. 2019, doi: 10.3390/app9122473.
- [6] S. Nakamoto. Bitcoin: A peer-to-peer Electronic Cash System. Accessed: Nov. 8, 2018.
- [7] X. Li, Z. Zheng, and H.-N. Dai, "When services computing meets blockchain: Challenges and opportunities," *J. Parallel Distrib. Comput.*, vol. 150, pp. 1–14, Apr. 2021, doi: 10.1016/j.jpdc.2020.12.003.
- [8] K. Kumutha and S. Jayalakshmi, "Blockchain technology and academic certificate authenticity—A review," in *Proc. Expert Clouds Appl.*, in *Lecture Notes in Networks and Systems*, vol. 209, 2022, pp. 321–334, doi: 10.1007/978-981-16-2126-0_28.
- [9] V. Chukowry, G. Nanuck, and R. K. Sungkur, "The future of continuous learning-digital badge and microcredential system using blockchain," *Global Transitions Proc.*, vol. 2, no. 2, pp. 355–361, Nov. 2021, doi: 10.1016/j.gltp.2021.08.026.
- [10] A. Alammary, S. Alhazmi, M. Almasri, and S. Gillani, "Blockchain-based applications in education: A systematic review," *Appl. Sci.*, vol. 9, no. 12, p. 2400, Jun. 2019, doi: 10.3390/app9122400.
- [11] H. Byström, "Blockchains, real-time accounting, and the future of credit risk modeling," *Ledger*, vol. 4, pp. 40–47, Apr. 2018.
- [11] F. Loukil, M. Abed, and K. Boukadi, "Blockchain adoption in education: A systematic literature review," *Educ. Inf. Technol.*, vol. 26, no. 5, pp. 5779–5797, Sep. 2021, doi: 10.1007/s10639-021-10481-8.
- [12] P. Bhaskar, C. K. Tiwari, and A. Joshi, "Blockchain in education management: Present and future applications," *Interact. Technol. Smart Educ.*, vol. 18, no. 1, pp. 1–17, 2020, doi: 10.1108/ITSE-07-2020-01
- [13] A. F. Camilleri, A. I. dos Santos, and A. Grech, "Blockchain in education," *Eur. Commission Joint Res. Centre*, Seville, Spain, 2017, doi: 10.2760/60649.
- [14] C. Delgado-von-Eitzen, L. Anido-Rifón, and M. J. Fernández-Iglesias, "Blockchain applications in education: A systematic literature review," *Appl. Sci.*, vol. 11, no. 24, p. 11811, Dec. 2021, doi: 10.3390/app112411811.
- [15] J. Park, "Promises and challenges of blockchain in education," *Smart Learn. Environ.*, vol. 8, no. 1, pp. 1–13, Dec. 2021, doi: 10.1186/s40561-021-00179-2.
- [16] R. Raimundo and A. Rosário, "Blockchain system in the higher education," *Eur. J. Invest. Health, Psychol. Educ.*, vol. 11, no. 1, pp. 276–293, Mar. 2021, doi: 10.3390/ejihpe11010021.
- [17] S. Saberi, M. Kouhizadeh, J. Sarkis, and L. Shen, "Blockchain technology and its relationships to sustainable supply chain management," *Int. J. Prod. Res.*, vol. 57, no. 7, pp. 2117–2135, Apr. 2019, doi: 10.1080/00207543.2018.1533261.
- [18] A. Ayub Khan, A. A. Laghari, A. A. Shaikh, S. Bourouis, A. M. Mamlouk, and H. Alshazly, "Educational blockchain: A secure degree attestation and verification traceability architecture for higher education commission," *Appl. Sci.*, vol. 11, no. 22, p. 10917, Nov. 2021, doi: 10.3390/app112210917.
- [19] A. Mohammad and S. Vargas, "Challenges of using blockchain in the education sector: A literature review," *Appl. Sci.*, vol. 12, no. 13, p. 6380, Jun. 2022, doi: 10.3390/app12136380.
- [20] N. Upadhyay, "Demystifying blockchain: A critical analysis of challenges, applications and opportunities," *Int. J. Inf. Manage.*, vol. 54, Oct. 2020, Art. no. 102120, doi: 10.1016/j.ijinfomgt.2020.102120

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