CSD436: Blockchain Project Report

A Decentralized Alumni-Student Mentorship and Resource Sharing Platform

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1 Research Area and Importance

The research area is **Education Technology and Blockchain Studies**. Two of the biggest problems in the field of educational technology now are accessibility and trust. Students need trustworthy study resources and guidance, but it can be difficult to know who to believe when online. Alumni who want to help should be recognized for their contributions. Most platforms today are centralized, creating bottlenecks, allowing for the spread of fraudulent information, and enabling fabricated alumni status, leading to mistrust between students and alumni.

Blockchain technology provides a fresh solution. Its core characteristics decentralization, immutability, and transparency allow creation of tamper-proof systems where students can confidently communicate with alumni whose identities are verified by smart contracts. Every interaction and contribution is broadcast on blockchain, restoring a verifiable truth at the network's core.

2 Our Objective

Our primary goal is to build a decentralized platform for alumni student resource sharing and mentorship using consensus, persistence, and liveness the three fundamental blockchain properties to ensure reliable resource exchange, genuine alumni verification, and transparent rewards.

How Our Project Uses Blockchain Principles

- **Liveness:** Students can access materials uploaded to the platform at any time as long as the blockchain is live. The platform guarantees that communication between students and alumni is always accessible.
- **Persistence:** Materials and records stored on blockchain are permanently available and immutable.
- **Consensus:** All updates and interactions are validated through decentralized consensus, ensuring fairness and trust.

3 Why Blockchain Instead of a Centralized System?

It is indeed possible to implement this project using a traditional centralized architecture. However, such an approach introduces several trust and security concerns that blockchain can address more effectively:

- **Identity Fraud:** In a centralized system, there is a risk that someone might impersonate a trusted alumnus in order to sell counterfeit study materials or notes. Since blockchain is decentralized and tamper-proof, such fraudulent activity becomes significantly harder to execute or conceal. All transactions and interactions are permanently recorded and auditable, fostering trust between students and alumni by reducing the risk of identity theft.

- **Multi-University Adoption:** If the platform is centralized or controlled by a single university, other institutions may be hesitant to adopt it due to concerns of bias fearing that the system would prioritize alumni and students of the host university. By contrast, a blockchain-based decentralized application provides a neutral and transparent environment, ensuring fairness across all participating universities and their communities.
- **Data Manipulation Risks:** In a centralized or university-controlled system, administrative authorities could potentially alter data for personal gain. For example, an insider might collude with a malicious alumnus to fabricate mentoring sessions or falsify resource-sharing records in order to obtain rewards. Blockchain prevents such tampering by making all records immutable and verifiable, thereby preserving the credibility of the platform.

In summary, while the core functionality of the platform could be realized using a centralized system, blockchain offers distinct advantages such as decentralization, immutability, and transparency. These properties eliminate single points of failure, minimize opportunities for manipulation, and create a secure and reliable environment that fosters long-term trust within the alumni-student ecosystem.

4 Summary of Relevant Research

To contextualize our contributions, we reviewed recent academic literature:

Paper 1: "Trustworthy Verification of Academic Credentials through Blockchain Technology" (Kabashi, Faton; Snopçe, Halil; Luma, Artan; Neziri, Vehbi, iJOE, 2024)

This study proposes a blockchain-powered system to improve the security and transparency of academic credential verification. Three levels make up the architecture: the data layer maintains records of students, instructors, and credentials; the blockchain layer uses smart contracts to verify and safeguard those records; and the application layer provides an intuitive user interface for communication. The framework offers tamper-resistant storage, trustworthy validation, and smooth communication between students, institutions, and employers by utilizing the fundamental blockchain principles of liveness, persistence, and consensus.

This work addresses long-standing issues in centralized systems and contributes to a more dependable educational ecosystem by demonstrating how blockchain can improve security, transparency, and efficiency in credential verification.

Paper 2: "A Zero-Knowledge Proof-Enabled Blockchain-Based Academic Record Verification System" (Juan Alamrio Berrios Moya, John Ayoade, Md Ashraf Uddin, MDPI, 2025)

This paper presents ZKBAR-V, a blockchain-based academic record verification system enabled by zero knowledge proof that guarantees immutability, security, and privacy in the administration of academic credentials. In order to balance efficiency and confidentiality, the framework combines zero-knowledge proofs with a dual blockchain architecture. Additionally, it integrates IPFS for safe decentralized storage, open source APIs for smooth interoperability, and decentralized identifiers (DIDs) for standardized identity management. These elements work together to produce an affordable and privacy-preserving substitute for conventional blockchain solutions.

The work's main contribution is the creation of a reliable and scalable verification framework that addresses privacy and efficiency issues by enabling credential validation without disclosing private information. ZKBAR-V offers institutions and students a reliable system that improves academic integrity and promotes international mobility by lowering costs, facilitating global interoperability, and decreasing reliance on centralized authorities.

Paper 3: "Blockchain-Based Applications in Education: A Systematic Review" (Ali Alammary, Samah Alhazmi, Marwah Almasri, Saira Gilani, 2019)

This study discusses blockchain applications in education in a systematic way, examining both their present applications and possible future developments. In addition to highlighting the advantages of blockchain, such as decentralization, improved security, reliability, and transparency, it lists current applications in fields like credential verification, learning management, and content sharing. However, the review also identifies drawbacks, including lack of unified standards, privacy concerns, technical complexity, and adoption resistance. The study also looks at new areas where blockchain technology could transform education.

This work's contribution consists of compiling a collection of information regarding blockchain's application in education and offering a fair assessment of both its advantages and disadvantages. The paper gives researchers and practitioners a better understanding of where blockchain works, where it encounters obstacles, and where future innovation in educational contexts could be focused by mapping current applications and highlighting gaps.

5 Comparative Analysis

Most existing research stops at verifying credentials, which is just the starting point. Our platform takes that verified identity and expands its value enabling resource sharing, mentoring, and a dynamic reputation system within a trusted, decentralized network.

Trends

- **Growing Use of Blockchain in Education:** We are part of a broader movement to use blockchain technology to address persistent issues in education, such as safeguarding intellectual property, stopping the spread of misinformation, and establishing clear reward systems
- **Fighting Misinformation:** We use our reputation system as a defence against misinformation and poor advice. The community itself acts as a filter when students can downvote offensive content and upvote good content. An obvious red flag is a low score.
- **User-Controlled Privacy:** People are fed up with platforms abusing their personal information. By giving alumni authority over who can access their private files and contact information, we restore their sense of security on our platform.
- **Peer-to-Peer Mentorship:** More students are seeking out firsthand advice from people who have been there before them. Our platform eliminates the clutter and puts them in direct contact with trustworthy mentors who have been verified.

Potential Weaknesses and Gaps

- **Adoption Failure Due to Technological Shift:** Users may hesitate to move from centralized to decentralized systems as blockchain in education is still new.
- **Collusion Risk:** Groups could artificially upvote each other to manipulate reputation.
- **Malicious Downvoting:** Someone could unfairly harm a useful alumnus's reputation.
- **Identity Spoofing:** Even with face recognition, advanced fakes can pose a risk.

6 Conclusion

Where the Field Stands Today

Current research clearly shows that blockchain is an effective solution for securely verifying information and managing data. However, most educational programs are either simple mechanisms for awarding degrees or simply thoughts on paper. The true potential, which was to establish an active community based on trust, was lost. Most student-alumni platforms are stuck in the outdated, centralized world. Our approach bridges this gap by establishing a decentralized network for knowledge exchange and mentoring where trust has been built rather than only considered as an afterthought.

Future Possibilities and Next Steps

- **Adoption:** Promoting blockchain adoption to address the adoption gap.
- **Getting Incentives Right:** Refining incentive structures to motivate positive contributions.
- **AI Content Moderation:** Utilizing AI to ensure shared information is accurate and reliable.
- **University Partnerships:** Collaborating with universities for initial alumni verification while keeping the platform decentralized.

7 Project Proposal

We are building a decentralized platform to fix the broken trust between students and alumni. Today's platforms are filled with fake profiles and bad information, making it impossible for students to find reliable help. Our network changes that by creating a secure, transparent, and community-run space for mentorship and resource sharing.

Core Ideas Implemented via Smart Contracts

- **Verifiable Identity:** Trust starts with knowing who you're talking to. Our system uses a multi step process, starting with facial recognition against a university ID and reinforced by a community validation model where trusted members can vouch for others.
- **Incentivized Contribution:** Good advice is valuable, and we believe in rewarding it. Alumni earn tokens for holding mentorship sessions, sharing notes, and being helpful. Smart contracts handle these payments automatically and transparently.
- **Community-Governed Reputation:** Reputation is everything. On our platform, it's earned, not just claimed. Every interaction can be rated by students, and this feedback directly shapes an alumnus's reputation score. It's a living measure of their trustworthiness, decided by the community itself.
- **User-Controlled Privacy:** Some information of contributors such as there contacts info and some notes they wish to be shared privately are in control of user. Note: Not all information status is in hand of contributors such as Name, Major, University, Picture this is so community can themselves be the judge weather contributors are legit or not.

Blockchain is essential here: it establishes rules everyone must follow, stores every important action forever, and makes the system tamper-proof.

8 Technical Specifications

- **Smart Contracts:** Solidity

- **Smart Contract Development:** Hardhat
- **Backend (Face Recognition):** Python
- **Backend (Concurrency):** Go
- **Frontend:** Next.js + React

9 Project Timeline

- Face Recognition Backend: Completed near end of August.
  Description: Developed the facial recognition based user verification using Python. This module enables alumni identity verification as the first step in the platform's trust process.
  Time taken: 5 hours

- Smart Contracts: Completed near end of August.
  Description: Built core smart contracts to manage the main platform logic. Developed contracts for user registration (UserRegistry), content storage and sharing (ContentRegistry), content access control (ContentAccess), reputation scoring (Reputation), and mentorship management (Mentorship).
  Time taken: 5 days

- Concurrency Backend: In progress as of September, completion planned before mid-semester exams.
  Description: The plan is to integrate concurrency with smart contracts, enabling the platform to handle multiple user requests smoothly and efficiently. This backend, developed in Go.

- Frontend Development: Planned for October 11th–18th; target completion before end of October.
  Work: The plan is to develop the frontend using Next.js to create a modern, attractive, and responsive UI that provides a seamless user experience for the platform.

References

1. Kabashi, F., Snopçe, H., Luma, A., Neziri, V. (2024). *Trustworthy Verification of Academic Credentials through Blockchain Technology.* iJOE. [Access Link]

2. Moya, J. A. B., Ayoade, J., Uddin, M. A. (2025). *A Zero-Knowledge Proof-Enabled Blockchain-Based Academic Record Verification System.* MDPI. [Access Link]

3. Alammary, A., Alhazmi, S., Almasri, M., Gilani, S. (2019). *Blockchain-Based Applications in Education: A Systematic Review.* MDPI. [Access Link]

4. Stack Overflow, ChatGPT, Claude AI, Solidity Docs, YouTube tutorials (Video 1, Video 2) used for debugging and understanding code concepts.

5. Research papers were found via Google Scholar.