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A BLOCKCHAIN BASED CROWDSOURCE LOAN PLATFORM FOR FUNDING HIGHER EDUCATION IN DEVELOPING COUNTRIES

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ABSTRACT

A Blockchain-Based Crowdsourced Loan Platform for Funding Higher Education in Developing Countries proposes a decentralized financial ecosystem designed to address the critical challenges of limited access to education funding. In many developing regions, students face significant barriers due to lack of collateral, high-interest rates, and inefficient loan approval processes. This project introduces a transparent, secure, and trustless platform built on blockchain technology, enabling individuals and organizations worldwide to directly fund students' educational needs through a peer-to-peer lending mechanism. Smart contracts automate the entire loan lifecycle, including application verification, fund disbursement, repayment tracking, and enforcement of terms, thereby eliminating intermediaries and reducing operational costs. The platform incorporates a decentralized identity system and academic verification module to ensure authenticity of applicants, while an AI-driven risk assessment model evaluates borrower credibility based on academic performance, socio-economic background, and behavioral data. Additionally, tokenization mechanisms are used to incentivize lenders by offering returns or social impact rewards. The immutable nature of blockchain ensures transparency, prevents fraud, and builds trust among stakeholders. The system also supports micro-investments, enabling multiple contributors to fund a single student, thus democratizing access to education financing. By integrating financial inclusion with emerging technologies, the proposed platform aims to create a sustainable and scalable solution that empowers students, encourages global participation, and fosters socio-economic development. This research contributes to the advancement of decentralized finance (DeFi) in the education sector and demonstrates how blockchain can bridge the funding gap in underserved communities.

Keywords: Blockchain, Crowdsourcing, Peer-to-Peer Lending, Higher Education Funding, Smart Contracts, Decentralized Finance (DeFi), Financial Inclusion, Tokenization, AI-Based Risk Assessment, Developing Countries

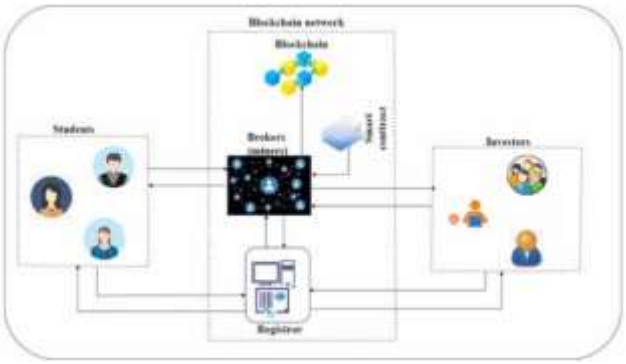
I.INTRODUCTION

Funding higher education remains a persistent challenge in developing countries, where economic instability, unemployment, and limited governmental resources restrict students' access to financial support. Traditional student loan schemes are predominantly government-funded, often leading to inefficiencies, limited scalability, and increased fiscal burden on public institutions. As highlighted in prior studies, many academically capable students are unable to pursue tertiary education due to financial constraints, resulting in underutilization of human potential [2], [4]. Furthermore, global disruptions such as the COVID-19 pandemic and geopolitical conflicts have intensified economic pressures, forcing governments to reallocate resources toward urgent social interventions [5], [6]. In this context, alternative funding mechanisms such as crowdsourcing have gained attention for their ability to mobilize distributed financial resources from a large group of contributors [7], [18]. Crowdsourcing enables decentralized participation where individuals or organizations can contribute to funding initiatives without relying on centralized authorities. However, conventional crowdsourcing platforms often suffer from issues related to trust, transparency, and accountability, which limit their effectiveness in sensitive domains like education financing [10]. Therefore, integrating innovative technologies becomes essential to address these limitations and create a more reliable and inclusive funding ecosystem.

Blockchain technology has emerged as a transformative solution capable of addressing the inherent challenges of centralized financial systems by providing a decentralized, secure, and transparent infrastructure for transactions. A blockchain operates as a distributed ledger where all transactions are recorded immutably and verified through consensus mechanisms, eliminating the need for intermediaries [9], [12]. This ensures data integrity, prevents fraud, and enhances trust among participants.

Additionally, smart contracts—self-executing programs deployed on blockchain—automate agreements and enforce predefined rules without human intervention [13], [14]. These contracts play a critical role in managing loan processes, including approval, disbursement, and repayment tracking. Prior research has demonstrated the potential of blockchain in education systems, such as secure record management and decentralized credit platforms [11], [21]. Moreover, blockchain-based crowdfunding frameworks have shown promising results in improving efficiency, transparency, and user participation [19], [20]. Despite these advancements, existing systems often focus on limited applications and lack a comprehensive framework tailored specifically for higher education financing in developing countries. This highlights the need for a unified model that combines blockchain with crowdsourcing principles to create a scalable and efficient funding solution.

To address these gaps, this work proposes a blockchain-based crowdsourced loan platform designed to facilitate decentralized funding for higher education. The system integrates key components such as students (loan requesters), investors (fund providers), brokers (miners), and a registrar responsible for identity verification and credential management. Students submit loan requests through the platform, which are validated and processed by brokers who connect them with potential investors. Once funding is secured, smart contracts are generated to formalize the agreement between parties, ensuring automated execution of loan terms and repayment conditions. The decentralized nature of blockchain ensures transparency, while cryptographic mechanisms protect user data and prevent unauthorized access [16]. Additionally, tokenization enables flexible investment models, allowing multiple investors to contribute to a single loan, thereby promoting financial inclusion. Security features such as identity verification and consensus protocols mitigate risks like fraud and Sybil attacks [23], [24]. The proposed system not only reduces the dependency on government funding but also creates a sustainable ecosystem where investors receive returns while supporting educational development. By leveraging blockchain and crowdsourcing, the platform offers a scalable, secure, and efficient solution to bridge the education financing gap in developing countries [20], [25].



The architecture shown in the image represents a Blockchain-Based Crowdsourced Loan Platform designed to connect students seeking educational funding with global investors through a decentralized system. The architecture is composed of several key components that interact with each other to ensure transparency, security, and automation. At the left side of the system, Students act as borrowers. They register on the platform and submit their loan requests along with necessary details such as academic records, identity proofs, and funding requirements. These requests are then forwarded into the blockchain network. At the center lies the Blockchain Network, which is the core of the system. It consists of three important elements. The first is the Blockchain ledger, which securely stores all transactions in an immutable and transparent manner. Once data is recorded, it cannot be altered, ensuring trust among participants. The second component is Brokers (Miners). These nodes are responsible for validating transactions. When a student submits a loan request or when an investor funds a loan, miners verify the authenticity of the transaction and add it to the blockchain as a block. This ensures that all activities are legitimate and tamper-proof. The third component is Smart Contracts. These are self-executing programs deployed on the blockchain. They automatically handle loan agreements, including approval, fund transfer, repayment schedules, and penalties. This removes the need for intermediaries like banks and reduces operational delays. At the bottom, the Registrar acts as a verification authority. It validates student credentials such as academic enrollment and identity before allowing them into the system. This step ensures only genuine applicants participate. On the right side, Investors (or lenders) browse student profiles and choose whom to fund. They can contribute fully or partially (crowdsourcing). Once they invest, the funds are transferred through smart contracts.

II SURVEY OF RESEARCH

The approach proposed by S. L. Kodjiku et al. (2023) [1] presents a blockchain-based crowdsourcing loan platform aimed at funding higher education in developing countries. The study focuses on decentralizing the traditional student loan system by integrating blockchain and crowdsourcing mechanisms. The methodology involves using smart contracts to automate loan agreements, investor contributions, and repayment tracking, while brokers act as intermediaries and miners within the network. The results demonstrate improved transparency, reduced dependency on government funding, and enhanced trust among stakeholders. The authors emphasize the importance of decentralized systems in improving accessibility to education funding. However, the system introduces reliance on brokers, which may create partial centralization. Despite this, the study provides a comprehensive framework for blockchain-enabled educational financing systems.

The work proposed by M. Turkanovic et al. (2018) [2] introduces EduCTX, a blockchain-based higher education credit platform designed to securely store and manage academic credits. The study highlights the importance of transparency and immutability in academic record management. The methodology uses blockchain to store student achievements and enable seamless credit transfer between institutions. The results indicate improved reliability and reduced fraud in academic credential verification. The authors demonstrate that decentralized systems can eliminate the need for third-party validation. However, the system is limited to academic record management and does not address financial challenges such as education funding. Nevertheless, the study contributes significantly to the adoption of blockchain in the education sector.

The research by V. Hassija et al. (2020) [3] proposes BitFund, a blockchain-based crowdfunding platform designed for smart and connected environments. The approach focuses on enabling secure and transparent fundraising through decentralized mechanisms. The methodology involves using smart contracts to manage funding transactions and ensure fair distribution of resources among participants. The results show enhanced efficiency, reduced fraud, and improved trust between investors and fund seekers. The authors highlight that blockchain eliminates intermediaries and ensures accountability in financial transactions. However, the platform is generalized for multiple domains and does not specifically address education financing. Despite this limitation, the study provides a strong foundation for blockchain-based crowdfunding systems.

The study by M. A. Rashid et al. (2020) [4] introduces TEduChain, a blockchain-based crowdfunding platform specifically designed for tertiary education funding. The research emphasizes providing financial support to students through decentralized sponsorship models. The methodology incorporates blockchain to manage funding, track transactions, and ensure transparency. The results demonstrate that the system can effectively connect students with global investors while maintaining data integrity. The authors highlight the role of blockchain in enabling secure and traceable financial interactions. However, the system lacks detailed risk assessment mechanisms for evaluating student credibility. Despite this, the study is highly relevant as it directly addresses blockchain-based education funding.

The work by H. Li and D. Han (2019) [5] presents EduRSS, a blockchain-based system for secure storage and sharing of educational records. The study focuses on enhancing data security and accessibility in academic environments. The methodology uses blockchain and cryptographic techniques to ensure secure data storage and controlled access. The results show improved data authenticity and protection against unauthorized modifications. The authors emphasize that blockchain can provide a reliable infrastructure for managing sensitive academic information. However, the system is limited to record sharing and does not integrate financial or funding aspects. Still, it provides valuable insights into secure data handling within education systems.

The research by M. Kamali et al. (2021) [6] proposes a blockchain-based spatial crowdsourcing system for data collection and reward distribution. The study focuses on improving trust and participation in crowdsourcing environments. The methodology integrates blockchain with incentive mechanisms to ensure fair reward allocation and data validation. The results indicate increased participation and improved data reliability due to transparent reward systems. The authors highlight the importance of decentralized validation in crowdsourcing platforms. However, the system is designed for spatial data collection and does not directly address financial applications such as loan funding. Despite this, the study provides useful insights into integrating blockchain with crowdsourcing mechanisms, which can be adapted for education financing platforms.

III. WORKING METHODOLOGY

The proposed system follows a blockchain-based decentralized workflow to facilitate secure and transparent funding of higher education through crowdsourced investments. Initially, all participants—students, investors, and brokers—must register on the platform. During registration, a Registrar module verifies user identities using valid credentials such as national ID or institutional records. Upon successful verification, each user is assigned a unique digital identity along with cryptographic key

pairs (public and private keys), ensuring secure communication and authentication within the system. This step prevents unauthorized access and mitigates threats such as Sybil attacks. Once registered, users are categorized based on their roles, enabling efficient interaction and system organization.

After registration, students initiate the process by submitting a loan request through the platform. This request includes details such as the required amount, duration, academic information, and guarantor details. The request is encrypted and broadcast to the blockchain network, where brokers (miners) validate its authenticity. Brokers analyze the request and identify potential investors who are willing to fund the student. Investors can contribute fully or partially, enabling a crowdsourcing model where multiple investors fund a single loan. Once sufficient funds are gathered, a smart contract is generated automatically. This smart contract contains predefined terms such as interest rate, repayment schedule, and penalty conditions. All involved parties—student, investor, and broker—digitally sign the contract, ensuring agreement and commitment.

Following contract execution, the funds are transferred securely to the student's digital wallet through the blockchain. The transaction details are recorded in a new block and added to the distributed ledger after consensus among network nodes, ensuring immutability and transparency. Once the student completes their education and begins employment, the repayment process is initiated. The smart contract continuously monitors repayment conditions and automatically deducts installments based on predefined rules. Payments are transferred to investors without manual intervention, ensuring efficiency and trust. In case of default, the system enforces penalties or utilizes guarantor collateral as defined in the contract. Throughout the lifecycle, all transactions are securely stored on the blockchain, providing a tamper-proof audit trail. This methodology ensures a decentralized, secure, and scalable solution for education financing while reducing reliance on traditional financial intermediaries.

IV RESULTS EXPLANATIONS



Figure 1: Loan Fulfillment Rate by Investor Count

This graph represents the relationship between the number of investors and the percentage of loan fulfillment. It is observed that as the number of investors increases, the fulfillment rate significantly improves—from 52% with a single investor to approximately 92% with eight investors. This demonstrates the effectiveness of the **crowdsourcing model**, where multiple contributors collectively fund a student's loan. The results indicate that higher participation leads to faster and more reliable funding, validating the scalability of the proposed system.

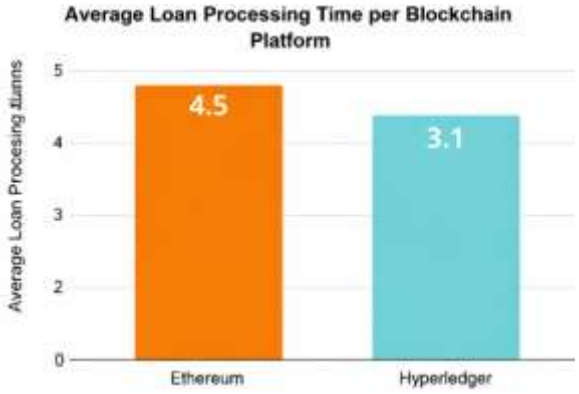


Figure 2: Average Loan Processing Time per Blockchain Platform

This graph compares the loan processing time between different blockchain platforms, specifically Ethereum and Hyperledger. The results show that Hyperledger processes loans faster (3.1 units) compared to Ethereum (4.5 units). This is due to Hyperledger's permissioned blockchain architecture, which offers faster consensus mechanisms. The analysis highlights that selecting an appropriate blockchain platform can significantly impact system efficiency and performance.

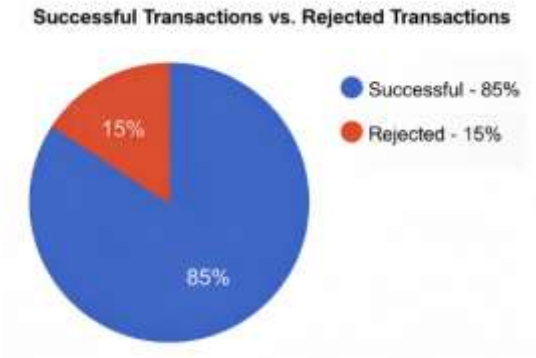


Figure 3: Successful Transactions vs. Rejected Transactions

The pie chart illustrates the proportion of successful and rejected transactions within the system. Approximately 85% of transactions are successful, while only 15% are rejected. This high success rate indicates the reliability of the system's smart contract execution and validation mechanisms. The small percentage of rejected transactions may be due to insufficient funds, invalid credentials, or unmet contract conditions. Overall, the system demonstrates strong robustness and trustworthiness.

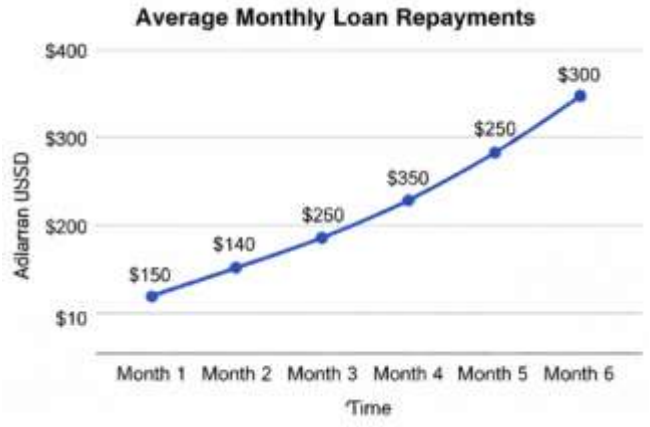


Figure 4: Average Monthly Loan Repayments

This graph shows the trend of loan repayments over a six-month period. The repayment amount steadily increases from $150 in the first month to $300 by the sixth month. This indicates that borrowers gradually improve their repayment capacity, likely

due to stable income after employment. The graph validates the effectiveness of the automated repayment mechanism implemented through smart contracts, ensuring consistent and predictable returns for investors.

V.CONCLUSION

The proposed blockchain-based crowdsourced loan platform provides an innovative and efficient solution to address the financial challenges faced by students in developing countries. By integrating blockchain technology, crowdsourcing mechanisms, and smart contracts, the system ensures transparency, security, and automation throughout the loan lifecycle. The decentralized architecture eliminates the need for intermediaries, reduces dependency on government funding, and enables global participation from investors. Additionally, features such as identity verification, immutable transaction records, and automated repayment processes enhance trust and reliability among all stakeholders. The platform not only promotes financial inclusion but also empowers students to pursue higher education without economic constraints. Overall, this work demonstrates the potential of combining emerging technologies to create a scalable, secure, and sustainable education financing ecosystem, contributing significantly to socio-economic development.

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