

Design and Implementation of a Blockchain-Enabled Crowdfunding Platform for Secure Transactions

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Abstract

Crowdfunding is a modern technique that helps innovators, entrepreneurs, and organizations raise money for their ideas through online platforms. However, most existing crowdfunding platforms operate in a centralized way, making them prone to high fees, fraud, and lack of transparency. Blockchain technology provides a decentralized and secure way to conduct financial transactions without intermediaries. This paper presents a blockchain-enabled crowdfunding platform, named CoinRaise, that uses Ethereum smart contracts to create a transparent, automated, and low-cost fundraising process. CoinRaise integrates the Hardhat development environment for smart contract development, Chainlink Oracle for real-time data accuracy, and MetaMask for user wallet management. The system demonstrates how blockchain can improve trust, security, and efficiency in online fundraising.

Keywords— Blockchain, Crowdfunding, Ethereum, Smart Contracts, Decentralization, DAO, Chainlink.

I. INTRODUCTION

Crowdfunding has emerged as a powerful and democratic tool that connects people with creative ideas to individuals willing to fund them. Platforms such as Kickstarter and GoFundMe have enabled millions of projects globally, but these centralized systems still have significant limitations. They rely on intermediaries to manage funds, which increases operational costs, reduces user trust, and delays fund transfers. Additionally, users often face hidden charges and cannot verify where and how the funds are utilized.

Blockchain technology has the potential to solve these problems through its decentralized, transparent, and tamper-proof nature. Every transaction recorded on a blockchain ledger is immutable and can be verified by anyone, ensuring transparency. Smart contracts — self-executing programs stored on the blockchain — automate the process of fund collection and distribution, eliminating intermediaries and reducing costs.

This paper focuses on the development and evaluation of CoinRaise, a blockchain-enabled crowdfunding platform built using Ethereum smart contracts. It provides a secure and transparent system where campaign creators can raise funds directly from contributors. The use of Chainlink Oracle ensures real-time and accurate data integration, while Hardhat simplifies the testing and deployment of smart contracts.

II. LITERATURE REVIEW

Research on blockchain-based crowdfunding is expanding rapidly. Mulchandani et al. (2024) proposed a donation-based crowdfunding model using smart contracts to ensure transparency. Their system removed intermediaries and allowed direct interaction between donors and recipients. Saadat et al. (2019) explored blockchain-based crowdfunding systems that reduce fraud and provide traceable transactions. They highlighted Ethereum as the most suitable platform due to its support for smart contracts.

Guggenberger et al. (2023) studied blockchain-based equity tokens, suggesting their potential to enhance investor trust and secondary trading. Benila et al. (2020) proposed a decentralized platform that allows users to control donations directly through blockchain records. Other studies, including Kumbhar et al. (2022) and Varghese et al. (2023), demonstrated prototype systems integrating smart contracts with web applications for transparent fundraising.

Collectively, the literature establishes blockchain as a transformative tool in crowdfunding. Its immutability, automation, and global accessibility make it an ideal technology for secure and transparent fundraising.

III. PROBLEM DEFINITION AND OBJECTIVES

Traditional crowdfunding systems rely on third-party administrators who control fund storage and release. Such centralization introduces issues like fund mismanagement, fraud, and dependency on platform operators. Furthermore, users have limited visibility into how funds are used after collection. These issues reduce transparency and trust between creators and contributors.

To overcome these challenges, this research aims to design and implement a blockchain-based crowdfunding platform that ensures full transparency, automation, and security. The main objectives of the work are:

1. To design a decentralized crowdfunding system using Ethereum smart contracts.
2. To enhance transparency and security by recording all transactions on the blockchain.
3. To automate fund transfers and milestone approvals using smart contracts.
4. To integrate Chainlink Oracle for real-time and trustworthy data.
5. To ensure gas-efficient operations using optimized Solidity code.

IV. SYSTEM ARCHITECTURE

The CoinRaise architecture is designed around Ethereum's decentralized ecosystem. The system has four main layers: the user layer, the application layer, the smart contract layer, and the blockchain layer.

1. User Layer: Users interact with the system through a web interface. Campaign creators can start new projects, and contributors can fund them using cryptocurrency wallets such as MetaMask.
2. Application Layer: This layer includes the web server and user interface built with ReactJS and NodeJS. It connects users to the Ethereum blockchain using Infura API.
3. Smart Contract Layer: Smart contracts written in Solidity handle campaign creation, fund transfers, and milestone validation. Once a target is met, the smart contract automatically releases funds.
4. Blockchain Layer: Ethereum serves as the decentralized ledger, storing every transaction securely and transparently.

V. METHODOLOGY

The development process includes several phases: design, implementation, testing, and deployment. The platform's front end is developed using ReactJS for better user interaction. The back end is powered by NodeJS and connected to the Ethereum testnet via Infura. MetaMask is used to manage Ethereum wallets and to sign transactions securely.

Smart contracts are coded in Solidity and tested using the Hardhat framework. Each contract is verified for correct functionality through automated testing. The contracts manage fund collection, withdrawals, and refund processes based on predefined conditions. Chainlink Oracle integration provides external data feeds to validate real-world parameters, ensuring accuracy without central dependency.

To reduce gas costs, Solidity code is optimized by minimizing storage variables and using memory references efficiently. Testing shows that gas usage decreased by around 10% after optimization. The system was deployed on the Ethereum test network for evaluation and validation.

VI. RESULTS AND DISCUSSION

The CoinRaise prototype was successfully developed and tested on the Ethereum test network. Results show that the platform performs reliably with secure and verifiable transactions. All contributions and withdrawals are recorded on the

blockchain and can be tracked using EtherScan, promoting user trust.

A comparison between traditional crowdfunding and CoinRaise shows significant advantages in transparency, cost efficiency, and automation. In CoinRaise, transactions are executed automatically through smart contracts without third-party involvement. The optimized gas consumption resulted in a reduction of approximately 10% per transaction, which makes the system more economical.

Qualitative user feedback indicates that the system's interface is intuitive and easy to use. Users appreciated the transparency of seeing their contributions reflected in real time. Additionally, integration with Chainlink ensured accurate price conversions and data reliability.

VII. CHALLENGES

Despite the system's success, several challenges remain:

- Gas Fees: Ethereum's gas prices fluctuate, affecting transaction costs.
- Scalability: As the number of campaigns grows, blockchain throughput may become a limiting factor.
- Regulatory Compliance: Adhering to KYC and AML policies in decentralized systems is complex.
- User Adoption: New users may find blockchain wallets and transactions difficult to understand.

Addressing these issues requires education, improved UI design, and adoption of Layer-2 solutions.

VIII. FUTURE SCOPE

Future improvements include integrating Layer-2 scaling solutions like Polygon to reduce gas fees and improve transaction speed. Expanding the system into a multi-chain architecture would allow compatibility with Binance Smart Chain and Avalanche. The use of Decentralized Autonomous Organizations (DAOs) for decision-making could enhance community governance. Integration of Artificial Intelligence (AI) could help analyze user data and recommend campaigns to contributors.

IX. CONCLUSION

This research demonstrates that blockchain technology can make crowdfunding more secure, transparent, and efficient. By removing intermediaries and automating transactions through smart contracts, CoinRaise provides a more reliable platform for fundraising. The system ensures accountability, reduces costs, and builds trust among users. Although challenges such as regulatory compliance and scalability remain, the platform sets a strong foundation for the future of decentralized crowdfunding.

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