IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 6, June 2025

DOI: 10.17148/IARJSET.2025.12623

A Blockchain-Driven Framework for Securing NGO Crowdfunding Transactions

Soumya M Hedaoo[1], Rupesh K Chimankare[2], Satyam D Nikam[3], Prof. R. A. Vasmatkar[4]

Student, Department of Computer Engineering, Sinhgad College of Engineering, Pune[1]

Student, Department of Computer Engineering, Sinhgad College of Engineering, Pune[2]

Student, Department of Computer Engineering, Sinhgad College of Engineering, Pune[3]

Professor, Department of Computer Engineering, Sinhgad College of Engineering, Pune[4]

Abstract: Crowd funding has become a popular method for non-governmental organizations (NGOs) to raise funds for various causes. However, traditional crowdfunding platforms suffer from issues such as high fees, lack of transparency, and susceptibility to fraud. This paper presents a blockchain-driven framework designed to secure NGO crowdfunding transactions, leveraging the Ethereum blockchain with the Arbitrum Sepolia Layer 2 testnet for enhanced scalability and reduced costs. The framework includes a decentralized application (DApp) with user and admin modules, enabling users to create and view campaigns, donate to approved campaigns, and track fund utilization transparently. Smart contracts automate the approval and donation processes, ensuring that only verified campaigns receive funds and that all transactions are recorded immutably on the blockchain. By eliminating middlemen and providing a trustless environment, this framework significantly reduces the risk of fraud and increases donor confidence. The implementation demonstrates the potential of blockchain technology to revolutionize the crowdfunding sector, particularly for NGOs, by offering a secure, transparent, and efficient platform for fundraising..

Keywords: Blockchain, Crowdfunding, Smart Contracts, NGO, Transparency, Ethereum

I. INTRODUCTION

Crowdfunding is a crucial tool for NGOs to raise funds for social, environmental, and humanitarian projects. While platforms like Kickstarter and GoFundMe have enabled billions in fundraising, they face major issues— high fees, lack of transparency, and vulnerability to fraud. For example, Kickstarter charges a 5% fee plus payment processing costs, reducing the actual funds reaching campaigns. Donors also have limited visibility into how funds are used, leading to mistrust, and there's often no reliable way to audit transactions. To overcome these challenges, this paper proposes a blockchain-based framework for secure NGO crowdfunding using Ethereum and the Arbitrum Sepolia Layer 2 testnet for scalability and lower costs. The system features a decentralized application (DApp) with user and admin modules. Users can create and manage campaigns, while admins verify them. Once approved, donors can contribute via cryptocurrency, with all transactions immutably recorded on the blockchain. Smart contracts automate approvals and donations, ensuring only verified campaigns receive funds, while allowing donors to track fund usage. By eliminating intermediaries and increasing transparency, this framework offers a secure, cost-effective, and trust-enhancing platform for NGO fundraising..

II. LITERATURE REVIEW

The integration of blockchain technology into crowdfunding platforms has been a subject of increasing interest in recent years, driven by the potential to address the inherent challenges of traditional crowdfunding systems. This section reviews key studies and developments in blockchain-based crowdfunding, Ethereum Layer 2 solutions, and trust mechanisms in decentralized systems. Blockchain-Based Crowdfunding Platforms Several researchers have explored the application of blockchain technology to enhance the security, transparency, and efficiency of crowdfunding platforms. Building a Blockchain-Based Decentralized Crowdfunding Platform for Social and Educational Causes in the Context of Sustainable Development (2023) proposed a decentralized crowdfunding platform specifically for social and educational causes, utilizing the Polygon blockchain to ensure transparency and accountability in fund utilization. Their work demonstrates how blockchain can facilitate direct interactions between donors and recipients, eliminating intermediaries and reducing costs. Similarly, Blockchain Based Crowdfunding Systems," authored by N. A. Zainal and colleagues (2019) discussed the use of Ethereum smart contracts in crowdfunding to prevent fraud and ensure timely project delivery. By automating the execution of contracts, their system enforces the terms agreed upon by campaign creators and donors, thereby

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 6, June 2025

DOI: 10.17148/IARJSET.2025.12623

increasing trust in the platform. Crowdfunding Using Blockchain Technology (2022) provided an overview of crowdfunding and highlighted the benefits of using blockchain technology, such as enhanced security and reduced bureaucracy. Their study emphasizes the disruptive potential of blockchain in transforming traditional fundraising methods. Ethereum Layer 2 Solutions To address the scalability and cost issues associated with the Ethereum mainnet, Layer 2 solutions have been developed. Arbitrum, a prominent Layer 2 scaling solution, employs optimistic rollup technology to process transactions off-chain while maintaining the security guarantees of the Ethereum blockchain (Arbitrum Documentation, 2023). This approach significantly reduces transaction fees and increases throughput, making it ideal for applications like crowdfunding that require frequent and low-cost transactions. Other Layer 2 solutions, such as Optimism and zk-Rollups, also offer similar benefits, but Arbitrum's compatibility with existing Ethereum smart contracts and its growing adoption make it a suitable choice for our framework. Trust Mechanisms in Decentralized Systems Trust is a critical component in decentralized systems, where participants interact without relying on a central authority. Blockchain technology inherently provides trust through its consensus mechanisms and immutable ledger. However, additional mechanisms are often necessary to ensure the integrity of specific applications. In the context of crowdfunding, smart contracts can be designed to enforce rules and conditions, such as requiring admin approval for campaigns or releasing funds only when certain milestones are met. Furthermore, reputation systems and decentralized identity solutions can be integrated to verify the credibility of campaign creators and admins. Evaluation of Blockchain-Based Crowdfunding Campaign Success Factors Based on VASMAL Criteria Weighting Method (2023) analyzed success factors for blockchain-based crowdfunding campaigns and found that factors like industry, early investments, and retained equity significantly influence investors' decisions. Their study underscores the importance of designing platforms that cater to these factors to attract funding,

III. METHODOLOGY

3.1 System Architecture

The proposed framework is built as a decentralized application (DApp) on the Ethereum blockchain, specifically utilizing the Arbitrum Sepolia Layer 2 testnet for enhanced performance and reduced transaction costs. The system architecture comprises several key components:

1. User Module: This module allows users to create new crowdfunding campaigns by providing details such as the campaign title, funding goal, deadline, and description. Users can also view existing campaigns, donate to approved campaigns, and track the progress of their contributions.

2. Admin Module: Administrators are responsible for reviewing and approving or rejecting campaign proposals. This ensures that only legitimate and verified campaigns are made available for funding. Admins have access to a dashboard where they can manage campaign requests and monitor ongoing campaigns.

3. Smart Contracts: The core logic of the DApp is encoded in smart contracts written in Solidity. These contracts handle campaign creation, approval, donation collection, and fund distribution. They enforce the rules and conditions set by the platform, such as requiring admin approval before a campaign can receive donations.

4. Blockchain Layer: The Arbitrum Sepolia L2 testnet serves as the underlying blockchain infrastructure. It provides the necessary scalability and low transaction fees, making it feasible for users to interact with the DApp without incurring high costs.

5. Frontend Interface: A user-friendly web interface, developed using React or a similar framework, allows users and admins to interact with smart contracts seamlessly. The frontend communicates with the blockchain via ThirdWeb.js.

3.2 Process Flow:

The process flow of the crowdfunding framework is designed to ensure security, transparency, and efficiency. It consists of the following steps:

1. Campaign Creation: A user initiates the process by submitting a campaign proposal through the DApp's user interface. The proposal includes essential details such as the campaign's title, description, funding goal, and deadline.

2. Admin Approval: Upon submission, the campaign proposal is sent to the admin module for review. Administrators evaluate the proposal based on predefined criteria to verify its authenticity and alignment with the platform's objectives. If approved, the campaign is activated and made visible to potential donors. If rejected, the user is notified with reasons for rejection.

3. Donation Phase: Once a campaign is approved, donors can contribute to it by sending cryptocurrency (ETH) to the campaign's smart contract address. Each donation is recorded on the blockchain, ensuring transparency and immutability.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 6, June 2025

DOI: 10.17148/IARJSET.2025.12623

4. Campaign Tracking: Both campaign creators and donors can monitor the progress of the campaign through the "My Campaigns" page. This page displays real-time information about the total funds raised, the number of donors, and the remaining time until the deadline.

5. Fund Utilization: Depending on the campaign's design, funds may be released to the campaign creator upon reaching the funding goal or based on other conditions specified in the smart contract. For instance, some campaigns might implement milestone-based funding, where funds are released incrementally as project milestones are achieved.

Additionally, the smart contracts are designed to handle various scenarios, such as refunding donors if a campaign does not meet its funding goal by the deadline or allowing campaign creators to withdraw funds only after certain conditions are met. This ensures that donors' contributions are protected and that campaign creators are held accountable for delivering on their promises.

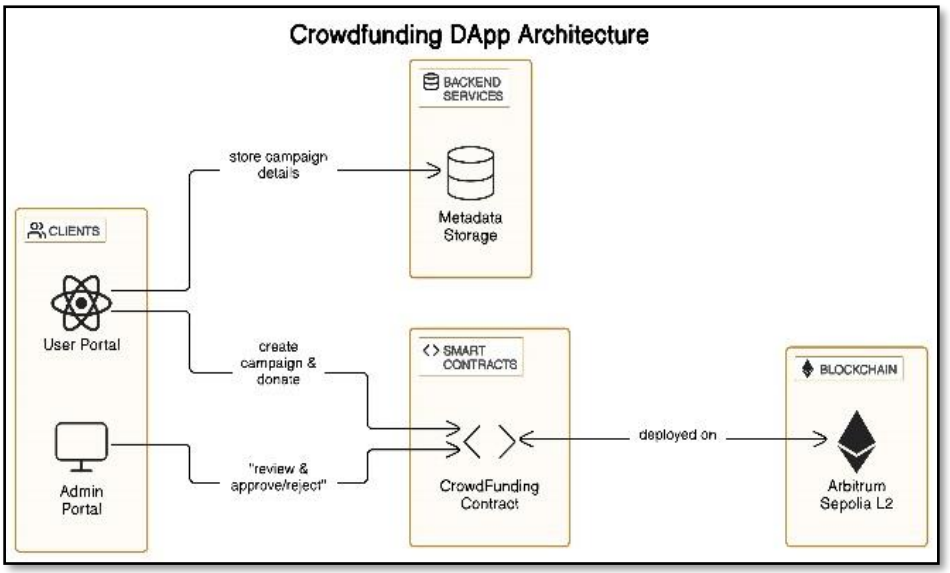

Figure 1: System Architecture

3.3 Implementation

The implementation of the framework involves several technical components and tools:

1.Smart Contracts: Developed using Solidity, the smart contracts define the logic for campaign management, including functions for creating campaigns, approving campaigns, donating to campaigns, and withdrawing funds. The contracts are deployed on the Arbitrum Sepolia testnet to take advantage of its Layer 2 scaling benefits.

2. Frontend Development: The user interface is built using React, a popular JavaScript library for creating interactive web applications. The frontend interacts with the smart contracts through the Web3.js library, which enables communication with the Ethereum blockchain.

3. Backend Services: While the core logic resides in smart contracts, certain off-chain services may be necessary, such as storing campaign metadata or handling user authentication. These services can be implemented using traditional web technologies, ensuring that sensitive data is not stored on the blockchain.

4. Integration with Arbitrum: To connect to the Arbitrum Sepolia testnet, the DApp uses the appropriate network configurations and RPC endpoints provided by Arbitrum. This allows the application to benefit from faster transaction times and lower gas fees compared to the Ethereum mainnet.

5. Testing and Deployment: Rigorous testing is conducted to ensure the correctness and security of the smart contracts. Hardhat is used for contract development, testing, and deployment. Additionally, the frontend is tested for usability and compatibility across different browsers and devices.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 6, June 2025

DOI: 10.17148/IARJSET.2025.12623

Specific libraries and frameworks used include:
- Solidity version 0.8.20 for smart contract development.
- React version 18.2 for frontend development.
-ThirdWebSDK version ^4.0.0 for blockchain interaction.

The implementation phase also involves setting up a development environment with necessary tools such as MetaMask for wallet integration, allowing users to manage their cryptocurrency and interact with the DApp seamlessly. Overall, the technical stack chosen for this framework ensures a robust, scalable, and userfriendly platform for NGO crowdfunding

IV. RESULTS AND DISCUSSION

The implementation of the blockchain-driven framework for NGO crowdfunding yields significant improvements in terms of transaction efficiency, cost reduction, and user trust.

Quantitative Results:

1. Transaction Speed: By utilizing the Arbitrum Sepolia Layer 2 testnet, the framework achieves faster transaction confirmation times compared to the Ethereum mainnet. While transactions on the mainnet can take several minutes to confirm, especially during periods of high congestion, Layer 2 solutions like Arbitrum offer near-instant transaction finality, typically within seconds.

2. Gas Fee Reduction: One of the most notable advantages of using Layer 2 is the substantial reduction in gas fees. On the Ethereum mainnet, gas fees can be prohibitively high, often exceeding several dollars per transaction. In contrast, Arbitrum's rollup technology aggregates multiple transactions into a single batch, significantly lowering the cost per transaction. For our framework, this means that users can create campaigns, approve them, and make donations at a fraction of the cost, making it more accessible to a wider audience.

Qualitative Results:

1. User Trust: The transparency provided by the blockchain ensures that all transactions are publicly verifiable, which enhances donor confidence. Users can track their donations and see exactly how funds are being utilized, reducing the risk of fraud and mismanagement. This increased trust is expected to encourage more participation in crowdfunding campaigns.

2. Admin Workflow Efficiency: The admin module streamlines the process of reviewing and approving campaigns. With a dedicated dashboard, administrators can efficiently manage campaign requests, access detailed information, and make informed decisions quickly. This improves the overall workflow and reduces the time between campaign submission and activation.

Additionally, the use of smart contracts automates many aspects of the crowdfunding process, such as fund collection and distribution, minimizing the need for manual intervention and reducing the potential for human error.

In summary, the framework not only addresses the technical challenges associated with traditional crowdfunding platforms but also fosters a more trustworthy and efficient ecosystem for NGO fundraising.

V. CONCLUSION

This paper presented a blockchain-driven framework aimed at securing NGO crowdfunding transactions through the use of decentralized technology. By leveraging the Ethereum blockchain with the Arbitrum Sepolia Layer 2 testnet, the framework offers a scalable, cost-effective, and transparent solution for fundraising.

Key achievements of this framework include:
- Enhanced Transparency: All transactions are recorded on the blockchain, providing an immutable and publicly accessible ledger that allows donors to verify the use of their contributions. - Reduced Fraud: The use of smart contracts ensures that funds are only released to approved campaigns and under predefined conditions, minimizing the risk of fraudulent activities.
- Lower Costs: By utilizing Layer 2 solutions, the framework significantly reduces transaction fees, making it more affordable for users to participate in crowdfunding.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 6, June 2025

DOI: 10.17148/IARJSET.2025.12623

- Improved Efficiency: Automation through smart contracts streamlines the campaign management process, from creation and approval to donation collection and fund distribution.

However, the framework also has some limitations. Currently, it is deployed on the Arbitrum Sepolia testnet, which is not intended for production use. Future work should focus on migrating to a mainnet environment to handle real-world transactions. Additionally, integrating with decentralized storage solutions like IPFS could enhance the platform by allowing for secure and transparent storage of campaign-related documents and media.

Other potential areas for future development include implementing advanced features such as milestone-based funding, where funds are released incrementally as project milestones are achieved, and incorporating reputation systems to further build trust among users.

In conclusion, the proposed framework demonstrates the transformative potential of blockchain technology in the crowdfunding sector, offering a secure, transparent, and efficient alternative to traditional platforms. With continued development and refinement, it has the potential to become a standard solution for NGO fundraising in the digital age.

ACKNOWLEDGMENT

We would like to express our heartfelt gratitude to **Prof. R. A. Vasmatkar**, our project guide and mentor, for his invaluable guidance, support, and encouragement throughout the development of this project. His expertise in blockchain technology and decentralized systems was instrumental in shaping our work.

We are deeply thankful to our **Head of Department, Dr. M. P. Wankhade**, for providing us with the academic support and infrastructure necessary to complete this project successfully.

We also wish to thank our project evaluation panel members, **Prof. S. P. Bholane** and **Prof. S. V. Patil**, for their valuable feedback, suggestions, and constructive criticism which helped us improve the quality and clarity of our work.

Lastly, we are grateful to the **Department of Computer Engineering, Sinhgad College of Engineering, Pune**, our peers, friends, and family for their continuous support, encouragement, and motivation during the course of this project.

REFERENCES

[1] Building a Blockchain-Based Decentralized Crowdfunding Platform for Social and Educational Causes in the Context of Sustainable Development, Bogdan Tiganoaia and George-Madalin Alexandru, Sustainability, 2023
[2] Evaluation of Blockchain-Based Crowdfunding Campaign Success Factors Based on VASMA-L Criteria Weighting Method, Santautė Venslavienė, Jelena Stankevičienė, and Ingrida Leščauskienė, Administrative Sciences, 2023
[3] Optimistic Rollups for Scaling Ethereum, Arbitrum Documentation, Documentation, 2023
[4] Crowdfunding Using Blockchain Technology, Saniya Zad, Zishan Khan, Tejas Warambhe, Rushikesh Jadhav, and Vinod Alone, SSRN, 2022
[5] Crowdfunding Fraud Prevention Using Smart Contracts, Deerajkumar S, Subash I, Shanthakumari A, and Deepa R, International Journal of Engineering Trends and Technology, 2022
[6] Secure and Transparent Crowdfunding Using Blockchain, Harsh Khatter, Ishan Trivedi, Hritik Chauban, and Jatin Agarwal, 2021 6th International Conference on Recent Trends on Electronics, Information, Communication & Technology (RTEICT), 2021
[7] Blockchain based crowdfunding systems, Md Nazmus Saadat, Syed Abdul Halim, Husna Osman, Rasheed Mohammad Nassr, and Megat F. Zuhairi, Indonesian Journal of Electrical Engineering and Computer Science, 2019
[8] Ethereum Whitepaper, Vitalik Buterin, Whitepaper, 2013
[9] Bitcoin: A Peer-to-Peer Electronic Cash System, Satoshi Nakamoto, Whitepaper, 2008

