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Reimagining Crowdfunding with Web3: A Blockchain-Based Framework for Transparency and Efficiency

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Abstract: *Startups often face challenges in attracting financial support for their original and disruptive ideas. While decentralized finance (DeFi) has created new avenues for investment, it still carries issues such as accessibility gaps, trust concerns, and regulatory uncertainty. Existing solutions fall short in addressing these barriers effectively, particularly for newcomers to the space. Our proposed framework introduces a decentralized funding ecosystem specifically tailored to support startups, aiming to enhance transparency, reliability, and inclusivity. By combining blockchain-based trust mechanisms with user-centric design, we envision a more fair and resilient model that empowers innovators and lowers the entry threshold for participation in startup funding.*

Keywords: Tokenized Crowdfunding, Peer-to-Peer Funding, Blockchain Crowdfunding Campaign, Transparency, Anti-Fraud, Immutable Records

I. INTRODUCTION

Entrepreneurs, especially those in early stages, often struggle to secure necessary funding due to rigid requirements of traditional financial systems such as bank loans and venture capital. These limitations have created a gap between innovative ideas and the capital needed to bring them to life. Crowdfunding has emerged as a decentralized solution, allowing individuals to raise funds from a wide audience through digital platforms, bypassing conventional gatekeepers [6].

Despite its benefits, conventional crowdfunding platforms face issues related to high service fees, lack of transparency, and the risk of fraudulent activities, which can undermine investor trust [2]. To address these concerns, blockchain technology has been introduced into crowdfunding systems, offering immutable record-keeping, transparency in transactions, and automated fund management through smart contracts [7][5]. These features reduce reliance on intermediaries and increase platform integrity.

The integration of blockchain enhances trust between entrepreneurs and backers by ensuring funds are released only upon achieving predefined milestones [8][1]. This paper explores how blockchain-enabled crowdfunding models improve security, efficiency, and transparency, ultimately contributing to a more reliable fundraising ecosystem for both startups and investors.

II. LITERATURE SURVEY

Sr No	Research Paper Name	Authors	Conclusion	Why We Use It
1	CROWD FUNDING FRAUD PREVENTION BLOCKCHAIN	Deerajkumar S, Subash I, ShanthaKumari A, Deepa R	Blockchain helps mitigate crowdfunding fraud through transparency and	Highlights fraud prevention mechanisms, a core benefit of blockchain in

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			immutability.	crowdfunding.
2	Blokchain-Based Crowdfunding: A trust Building Model	Sayyam Gada, Akash Dhuri, Denish Jain, Dhanashree Toradmalle, Smita Bansode	Trust can be enhanced in crowdfunding by implementing blockchain for security and verification.	Supports the trust-building aspect, crucial for our project's user assurance goals.
3	Global Journal Of Innovation and Emerging Technology	Gard N., Seth S., Rastogi N., Kumar R., Gupta V., Singh Rawat S.	Emphasizes emerging technologies transforming crowdfunding ecosystems.	Provides background on innovation trends applicable to our blockchain-based model.
4	Venturing Crowdfunding using Smart Contracts in Blockchain	S. Ahmad, A. Ahmad, M. Naeem, W. Ejaz, H. Kim	Smart contracts automate fund transfer and accountability in crowdfunding.	Showcases how smart contracts add automation and reduce middlemen.
5	Smart Contracts for NGOs and Startups using Blockchain	Mohil Sarvankar, Viraj Wasnik, Aditya Tarade, Payal Shah, Narendra Bhagat, Surendra Rathod	Blockchain helps ensure transparency for NGO/startup funding through smart contracts.	Relates directly to use cases similar to our platform – NGOs and startups.

Table. 1. Literature Survey

III. METHODOLOGY

• Literature Review

An extensive survey of current academic publications was carried out to highlight the shortcomings of conventional crowdfunding systems and to explore how blockchain technology could offer improvements [6].

• Comparative Analysis

A detailed comparison was made between conventional crowdfunding and blockchain-enabled models, particularly examining aspects such as susceptibility to fraud, fee transparency, and cost structures [2].

• Thematic Categorization

Core attributes of blockchain—like automation via smart contracts, mechanisms for building trust, and enhanced transparency—were sorted into thematic categories for further examination [4].

• Technology Mapping

Fundamental blockchain innovations, including cryptographic hashing (e.g., SHA-256) and consensus mechanisms like Proof of Stake, were aligned with their real-world applications, such as in platforms like FundCrypt [9].

• Use Case Analysis

To understand practical implementation, actual examples of blockchain-based systems used by NGOs and emerging ventures were studied, focusing on how they streamline operations and foster trust [5].

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IV. SYSTEM ARCHITECTURE

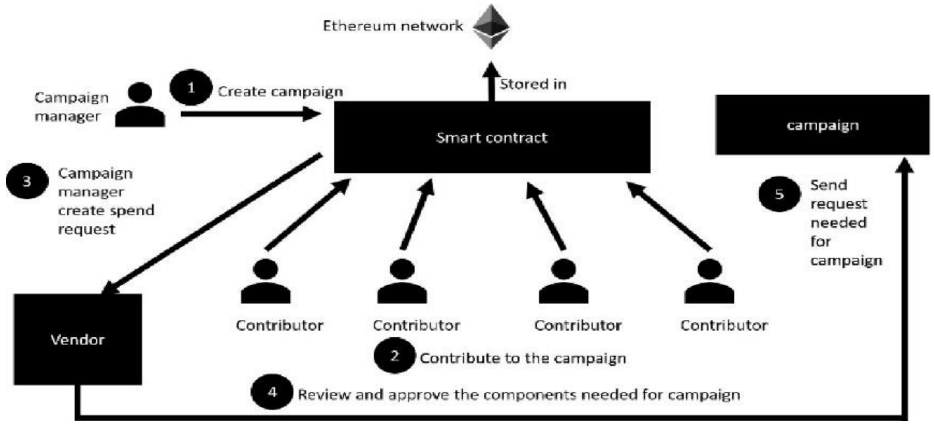

Fig. 1. SYSTEM ARCHITECTURE

The system architecture of the proposed blockchain-based crowdfunding platform is illustrated in Figure 1. It operates on the Ethereum blockchain, leveraging smart contracts to ensure automation, decentralization, and transparency.

1. Campaign Creation

The campaign manager initiates a new campaign, which is encoded into a smart contract and deployed on the Ethereum network. This contract outlines all conditions, including fund collection and disbursement mechanisms, and executes them automatically without intermediaries.

2. Contribution Mechanism

Contributors can invest in the campaign, with each contribution securely recorded on the blockchain. The funds remain locked in the smart contract until predefined goals or milestones are achieved, promoting transparency and traceability.

3. Spend Request Generation

The campaign manager can create spend requests during the course of the campaign. These requests are proposed to withdraw specific amounts from the contract for operational needs.

4. Approval via Voting

Contributors can review and vote on spend requests. A majority approval is required to release funds, ensuring that financial decisions are decentralized and collectively governed.

5. Vendor Interaction

Upon approval, the smart contract automatically transfers funds to the designated vendor. The vendor then provides the agreed-upon goods or services for the campaign.

6. Campaign Completion

Once all components are delivered and funds utilized as intended, the campaign concludes. All interactions are immutably recorded on the blockchain, enabling full auditability and trust.

V. UML DIAGRAM

This UML diagram illustrates the interaction between key entities in a blockchain-based crowdfunding platform: the Campaign Creator, the Investor, and the Blockchain, all coordinated via the Ethereum Network.

1. Campaign Creator

• Create Campaign: Initiates a new crowdfunding campaign on the platform.
• Create Request: Proposes a request to utilize the raised funds for specific purposes.
• Get Summary: Retrieves the campaign details such as total funds raised, number of investors, and current status.

2. Investor

• Approve Request: Reviews and approves or rejects fund usage requests made by the campaign creator.
• Contribute: Provides financial support to the campaign.
• Finalize Request: Completes a request after approval, triggering the actual fund transfer.

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• Vote: Participates in the decision-making process by voting on fund disbursement requests.

3. Ethereum Network

Acts as the intermediary that connects all participants, executing and validating transactions through smart contracts.

4. Blockchain

Stores all validated transactions immutably in sequential blocks, ensuring transparency and auditability of campaign activities.

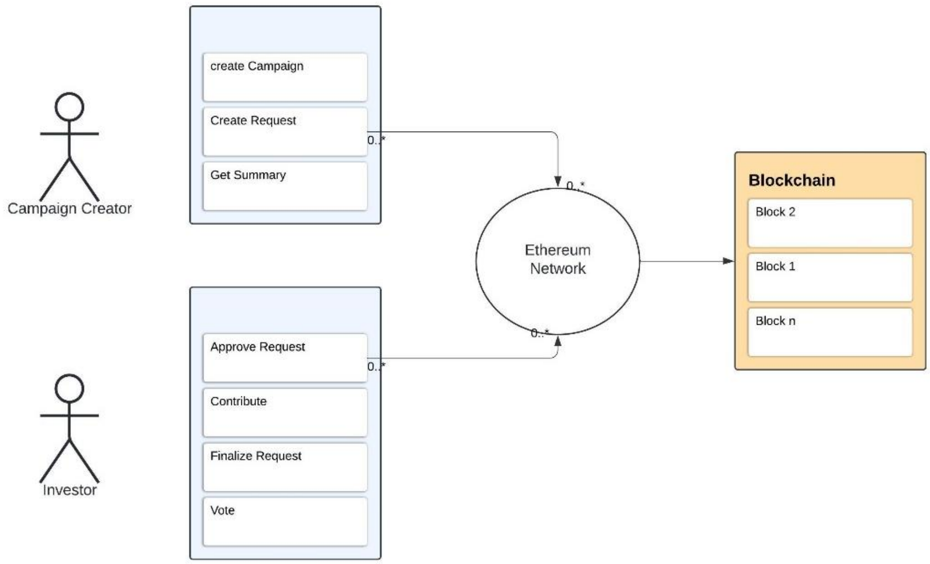

Fig. 2. UML DIAGRAM

VI. DATA FLOW DIAGRAM

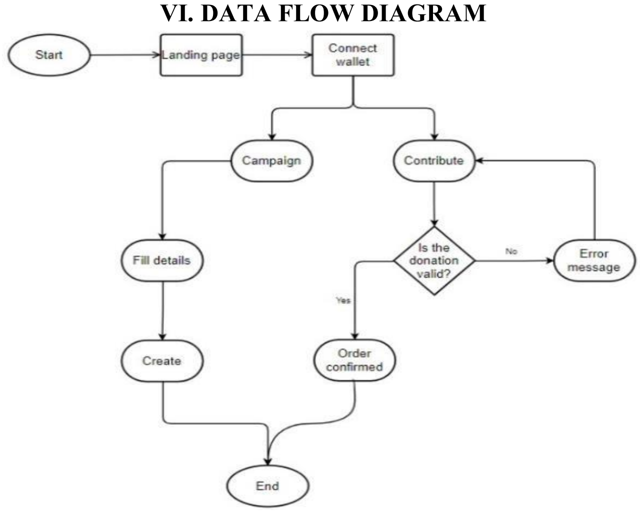

Fig. 3. DATA FLOW DIAGRAM

This flowchart outlines the process a user follows when interacting with a blockchain-based crowdfunding website, focusing on the two main actions: creating a campaign or contributing to an existing campaign. The process is as follows:

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1. Start
The user initiates the interaction with the platform.
2. Landing Page
The user is directed to the homepage displaying active campaigns and platform features.
3. Connect Wallet
The user connects their cryptocurrency wallet, enabling blockchain-based transactions.
4. Parallel Paths
After connecting the wallet, the process splits into two possible flows:
o Campaign Creation:
The user enters relevant details to launch a new fundraising campaign.
o Donate to Campaign:
The user selects an existing campaign and proceeds to make a contribution.
5. Validate Contribution
If the user chooses to donate, the system checks whether the contribution is valid:
o Yes:
The contribution meets all criteria (e.g., sufficient balance, valid input). A confirmation message is displayed: "Order Confirmed."
o No:
If any issue occurs (e.g., insufficient funds), an error message is shown to the user.
6. Termination
The process ends with either a successful contribution or the completion of a new campaign setup.

VII. CLASS DIAGRAM

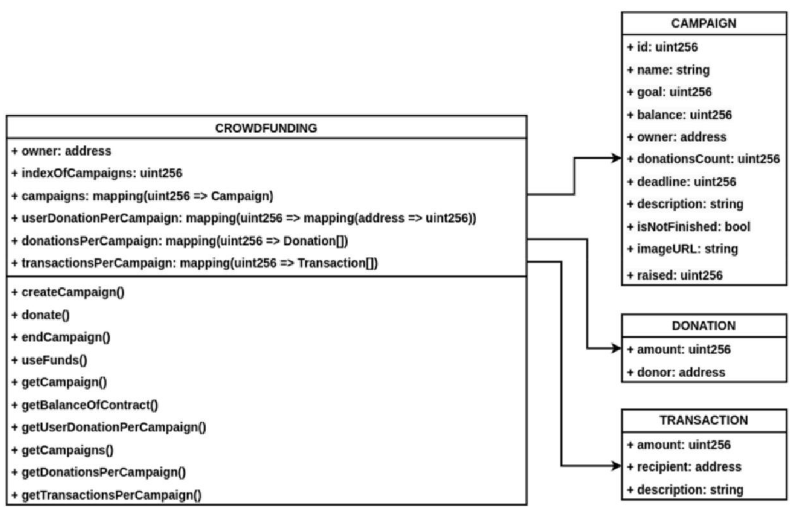

Fig. 4. CLASS DIAGRAM

1. Crowdfunding Smart Contract (System Core):
The smart contract serves as the decentralized core of the crowdfunding platform, encapsulating critical campaign and financial operations. It maintains:
• A dynamic registry of campaigns (campaigns)
• Donor-specific contributions per campaign (userDonationPerCampaign)
• Campaign-wise logs of donations (donationsPerCampaign)
• Comprehensive transaction records for fund disbursement (transactionsPerCampaign)

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The primary contract functions include:
• createCampaign(): Registers a new campaign on-chain
• donate(): Facilitates secure Ether-based contributions to active campaigns
• endCampaign(): Allows campaign owners to mark campaigns as completed
• useFunds(): Enables fund utilization with logged transaction metadata
• Accessor functions for querying campaign and donation data
The architectural design leverages Solidity's mapping structure to optimize storage and retrieval operations while maintaining immutability and transparency.

2. Campaign Struct (Data Model):

Each campaign is represented via a structured data model capturing:
• Identifiers and metadata: id, name, description, imageURL
• Financial parameters: goal, raised, balance, donationsCount
• Lifecycle markers: deadline, isNotFinished
• Ownership: Ethereum address of the campaign creator
This modular representation ensures separation of concerns and simplifies access control and state transitions during execution.

3. Donation Struct (Immutable Ledger Entry):

This data structure records individual donations, composed of:
• donor: Ethereum address of the contributor
• amount: Value contributed in Ether
Such records enable auditable, tamper-proof financial trails crucial for donor transparency and trust-building.

4. Transaction Struct (Fund Usage Record):

Transactions denote on-chain fund expenditures by campaign owners and include:
• amount: Disbursed amount
• recipient: Ethereum address receiving the funds
• description: Purpose of expenditure
Incorporating this structure allows for high-resolution accountability of post-campaign fund utilization, enhancing the integrity of the platform.

VIII. LIMITATIONS

1. High Gas Costs

The use of nested mappings and frequent state changes increases gas consumption, especially in high-traffic scenarios. This can deter micro-donors from participating and restrict real-time fund utilization [1].

2. No Native Refund Mechanism

The current implementation lacks an automated refund strategy if the campaign fails to meet its goal. This could reduce trust among donors and increase manual intervention risks [2].

3. Limited Campaign Lifecycle States

Campaigns are only tracked as "ongoing" or "ended," missing intermediate or terminal states like successful, failed, or under review. This restricts fine-grained analytics and campaign classification [3].

4. No KYC or Identity Verification

Campaign creators are identified solely by wallet addresses. Absence of Know-Your-Customer (KYC) or anti-fraud mechanisms can open the system to malicious actors and scam campaigns [4].

5. On-chain Storage Limitations

Smart contracts have constraints on how much structured data (e.g., long descriptions, receipts, multimedia) can be stored efficiently. This limits the contract's usability for media-rich campaigns [5].

6.Lack of Dispute Resolution

There is no built-in dispute resolution mechanism or arbitration support in case of fraudulent usage of funds. This is critical in real-world deployments where campaign owners may misuse donations [6]

IX. FUTURE SCOPE

1. Regulatory Advancements

There is potential to investigate how adaptive legal and regulatory structures can be seamlessly integrated into blockchain-based crowdfunding systems to promote international compliance and boost legitimacy.

2. Boosting User Engagement

Future research can aim at increasing trust and making onboarding more intuitive, particularly for individuals with limited technical knowledge and new investors.

2. Decentralized Identity Frameworks

Exploring the use of decentralized identity verification tools could further strengthen privacy, data security, and overall trust in the blockchain crowdfunding environment.

3. Environmental and Economic Sustainability

Evaluating the long-term ecological and financial impacts of blockchain-powered crowdfunding models is a key area for future development.

4. Interoperability via Cross-Chain Solutions

Next-generation platforms could be enhanced by supporting various blockchain ecosystems, enabling seamless participation through advanced cross-chain technology and multi-token compatibility.

5. Scalability Enhancements

As platforms like Ethereum face scalability limitations, the exploration of Layer-2 enhancements and alternative blockchain models may offer improved performance and greater transaction capacity.

6. AI-Driven Fraud Prevention

Incorporating AI technologies for proactive fraud monitoring and detection can significantly enhance the security of crowdfunding platforms by identifying threats in real time and ensuring system integrity.

X. CONCLUSION

The integration of blockchain technology into crowdfunding ecosystems presents a transformative opportunity to address several limitations inherent in traditional fundraising systems. Foremost among these advantages is transparency, achieved through the immutability and auditability of blockchain records. This ensures that fund flows can be traced in real time, enabling both entrepreneurs and investors to verify transactions independently. Additionally, the elimination of intermediaries such as banks and third-party payment processors significantly reduces transactional costs, thereby lowering the barriers for capital acquisition and investment.

Blockchain's decentralized architecture also facilitates frictionless cross-border transactions, granting entrepreneurs access to a global network of potential backers unconstrained by geographic or currency limitations. This democratization of funding channels can accelerate innovation, particularly in underrepresented or underserved regions where access to traditional financial institutions is limited.

Beyond cost-efficiency and transparency, blockchain-based crowdfunding offers a secure and trust-enhancing environment for both fundraisers and contributors. By ensuring tamper-proof transaction histories, it allows investors to make more informed decisions while enabling entrepreneurs to access funds more quickly. The enhanced trust mechanisms inherent in blockchain systems may reduce fraudulent activities and improve the overall user experience.

Nevertheless, the realization of these benefits requires further empirical research and practical validation. Critical areas such as scalability, regulatory compliance, and user adoption present ongoing challenges that must be addressed for widespread implementation. It is imperative that future investigations examine the integration of blockchain with existing financial and crowdfunding infrastructures in a way that minimizes disruption and supports interoperability. Additionally, comprehensive studies on legal frameworks, investor protections, and data privacy regulations are essential to determine whether blockchain-based crowdfunding platforms can evolve into a viable and secure alternative to traditional methods on a global scale.

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