

Transparent and Trustworthy Block chain Enabled Decentralized Crowd funding Framework Using Smart Contracts

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Abstract

Charity donations are important in improving society as they help people in need and make communities stronger. But traditional crowd funding and donation platforms are often lacking in transparency, accountability and trust. Donors have little insight into how the money is used. Intermediaries can misuse or delay funds. These issues undermine public trust and suppress charitable donations. This paper proposes a decentralized crowd funding platform based on block chain that offers a secure, transparent and trustworthy environment to manage donations. Block chain technology records all transactions in an immutable distributed ledger, enabling donors to track their money from the time it is donated to the point of final use. This system is decentralized. This means there is no central authority and the chances of fraud or unauthorized modifications are reduced. The proposed framework automates the crowd funding process using smart contracts, which only release funds when the predefined conditions are met. It assists in the safe management of funds and it enhances accountability of all concerned. The platform enhances privacy, cuts operational costs and increases transaction efficiency.

Keywords: Block chain, Decentralized Crowd funding, Smart Contracts, Ethereum, Solidity, Decentralized Applications

1.0 Introduction

The technology revolution has extended across many industries, including one of the most vital ones, charity and crowd funding. NPOs (Non-Profit Organization) are getting better at leveraging online platforms to garner donations and raise awareness about social issues [1]. Yet traditional fundraising mechanisms are notoriously opaque, and slow to inspire confidence. Donors cannot readily confirm that their money is reaching its intended recipients, which undermines public confidence. The importance of effective and open fundraising was highlighted by the COVID-19 pandemic. The region's communities participated in donations campaigns actively and the governments and charities had to step in for financial assistance. But handling those funds through centralized systems raised concerns about fraud, misappropriation of donations and accountability [2].

Block chain technology offers a secure and transparent answer to these problems. It logs every transaction on an immutable distributed ledger allowing donors to trace their donations from the

point of donation to final utilization. Smart contracts are employed for fund management, in which disbursements are made only when specific conditions are fulfilled [3]. This eliminates the need for a third party, enhances transparency and builds trust between the donors, the crowd funding platform itself as well as the recipient. The proposed block chain-based crowd funding scheme aims at building a trustworthy, decentralized, and transparent donation environment that ensures equitable fund usage for all donations and encourages donor participation [4].

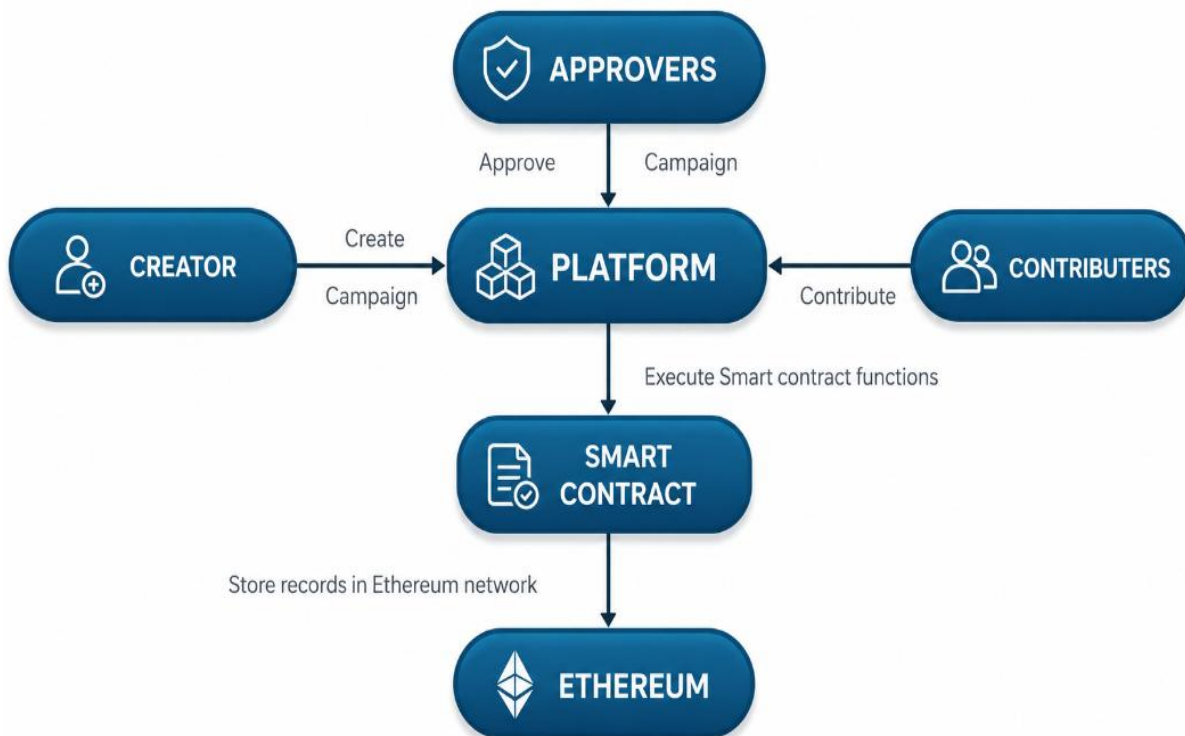


Figure 1: Block chain-Based Decentralized Crowd funding Framework

Figure 1 illustrates the workflow of a block chain based decentralized crowd funding platform using Ethereum and Smart Contracts. It describes how different stakeholders work together securely and transparently to create, approve, fund, and execute crowd funding campaigns.

1.1 Identification of Problem

Centralized organizations are used to handle donations on traditional crowd funding sites. This results in problems such as a lack of transparency, misappropriation of funds, delays in transactions, and limited donor control. Such problems erode public confidence and discourage giving.

1.2 Problem Statement

The main problems of existing crowd funding systems are transparency and trust. Donors cannot see where their money is spent, and intermediaries may misuse the funds. We propose a system using block chain technology and smart contracts to record each transaction in a secure and transparent way. These way donors get to see donations in real time, remove unnecessary intermediaries, and make sure funds are released only when certain conditions are met.

1.3 Solution Proposed

The purpose of this paper is to present a Block chain-based Decentralized Crowd funding Platform using Smart Contract on Ethereum. The funds are held in smart contracts that release the money only after the donors' consent or other predefined conditions are met. The platform also uses machine learning predictions on success of campaigns, and has robust security features, such as Zero-Knowledge Proof (ZKP) and lattice-based cryptography to protect users' data. The presented approach offers a secure, transparent, low-cost and reliable crowd funding environment for funders and project owners.

2.0 Related Work

Crowd funding is widely used to raise money for new businesses, social causes, charitable organizations, and creative ideas. Traditional crowd fund competitions are subject to centralized authorities who manage donations, verify campaigns, and distribute funds among campaigners [5] [6]. Although these websites have made it easier to fundraise, they also have several drawbacks, including high service fees, lack of transparency, slow funds disbursement, security threats, and reliance on third party middlemen. Block chain technology and smart contracts are advocated by researchers as potential means to solve these constraints. Initial work on block chain-based crowd funding centered on substituting centralized platforms with decentralized networks. Block chain also offers a distributed ledger where every transaction has been permanently recorded and cannot be changed unless a consensus has been reached within the network. This level of scrutiny brings transparency and confidence to campaign creators and contributors. Because all transactions are publicly verifiable, donors can monitor the collection and use of funds as well [7] [8].

One of the chief elements of block chain-enabled crowd funding systems is the smart contract. Smart contracts are self-executing programs living on the block chain that enforce pre-defined conditions automatically without necessity to use a trusted third party. A number of scholars have introduced Ethereum-based crowd funding schemas where backer directly sends crypto currency to smart contracts. The funds are automatically unlocked to the collateral holder once the predetermined funding targets or campaign deadlines are met. If target is not reached, contributors are refunded automatically. This automation also cuts down on administrative costs and fraud [9]. Several other researchers have studied the security issues of decentralized crowd funding. Traditional crowd funding platforms can be subjected to the manipulation of data, the unauthorized transfer of funds, insider attacks and single points of failure. Block chain technology solves these problems with cryptographic hashing, distributed consensus and immutable transaction logs. However, studies have pointed out that some attacks in badly written smart contracts are able to cause financial loss. In summary, secure smart contract development, formal verification, and periodic security auditing are necessary components to ensure the reliability of a crowd funding system [10] [11].

State-of-the-art solutions in recent studies have combined technologies with BCFPs. Artificial Intelligence (AI) and Machine Learning (ML) has been applied to detect fraudulent campaigns, analyze donors' behavior, and suggest reliable projects. Like BPD, the Internet of Things (Iota) has been considered along with block chain for the transparent tracking of funds in healthcare, agriculture and disaster relief services. They enhance transparency and allow real-time tracking of project implementation. Decentralized identity (DID) and Know Your Customer (KYC) schemes have been investigated for better user authentication while preserving privacy [15]. Such measures deter fake campaigns from being created and build confidence in users. Consensus algorithms including but not limited to Pops (Proof of Stake) and PBFT (Practical Byzantine Fault Tolerance)

have been investigated for reducing energy consumption and enhancing transaction processing speed based on widely known Paw (Proof of Work) schemes [12] [13].

There are, however, several challenges in block chain- based crowd funding that remain. Public block chains are also known to suffer from scalability problems, high transaction fees during network congestion, low transaction throughput, and regulatory uncertainties. And — like privacy protection — there is still the question of fully public accessibility to block chain transactions [14].

3.0 Smart Contract and Block chain Technology

The block chain is a distributed digital ledger that records and verifies transactions among a shared network of computers in a secure way. Instead of a central authority controlling a traditional database, block chain makes data available to several nodes, which makes the data very secure, transparent, and difficult to be tampered with. Each transaction is grouped into a block and each block is linked to the previous block by cryptographic hashes, thereby constructing an uninteruptible chain of records. When a transaction is recorded on the block chain, it cannot be altered or erased, promoting data integrity and trust. Here our inspiration of block chain comes into play: to have an open ledger of all the crowd funding events, and donors could follow their donation from the moment they donate to eventual delivery to the beneficiaries.

Decentralization is one of the most important advantages of block chain. The system is without a central authority, enabling its users to reduce the chances of being defrauded, having their data manipulated, or compromised. These transaction ledgers are synchronized across all users in the network, resulting in greater accountability and transparency. Also, block chain is protected by cryptography and consensus mechanisms that validate each transaction before being permanently recorded. Indeed, the unique nature of these feature makes block chain the ideal technology to be applied to crowd funding and charity applications in which trust and transparency must be guaranteed. A smart contract is a digital contract that is self-executing and can be stored in the block chain. It has rules and conditions written in code. When these conditions are satisfied, the smart contract carries out the pre-determined action on its own, without the involvement of any third party.

In our crowd funding platform prototype, the contracts are written in Solidity and deployed within the ethereal block chain. Our smart contract handles the full crowd funding lifecycle: campaign setup, donations, storing the information of the contributor, spending requests, collecting approvals from contributors, and releasing money only when the requested voting thresholds are met. Because these tasks are done automatically, the system guarantees the money will not be misappropriated. Delivering the Ethereum block chain service with the execution environment for smart contracts is the Ethereum Virtual Machine (EVM). Each transaction committed by the smart contract is recorded in the block chain, and the whole process can be proven and audited. Users with much transaction details can also check the transaction details through block chain explorer (e.g., Ethers can), which further enhance the trust. With combination of block chain technology and smart contracts, it can bring a lot of improvement, such as transparency, security, decentralization, traceability, immutability and automations. Donors can see how their money is spent, contributors have a say in approving spending requests, and campaign creators are accountable for every transaction. Without the intermediaries, transaction fees will be lower as well. Therefore, the two emerging technologies enable safe, reliable and efficient crowd funding in general. Considering the limitations of conventional crowd funding platforms, it is expected that the proposed scheme will enhance public values and therefore foster the crowding in of public involvement in charitable and fundraising actions.

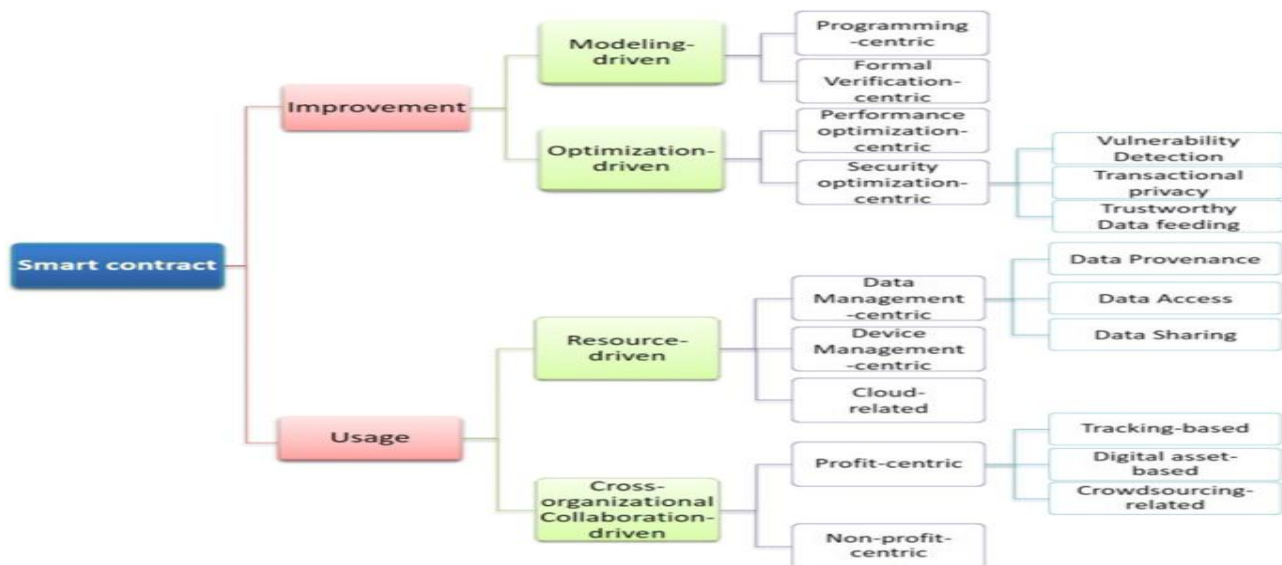


Figure 2: Taxonomy of Block chain – Enabled Smart Contract

Figure 2 the number shows the categorization of the research on block chain-enabled smart contracts into two main classes: Improvement and Usage. Under each of them, multiple research fields are emerging that aim to improve the performance of smart contracts and its application on real world, respectively.

Table 1 Test Environment Configuration

Parameter	Configuration
Operating System	Windows 11 (64-bit)
Processor	Intel Core i7 (11th Gen)
RAM	16 GB
Storage	512 GB SSD
Block chain Platform	Ethereal
Local Block chain	Panache v7.x
Smart Contract Language	Solidity v0.8.x
Development IDE	Remix IDE
Frontend	React
Backend	Node.js v18.x
Block chain Library	Web3.js v1.10.x
Wallet	Metalmark v11.x
Number of Test Accounts	10
Campaigns Tested	20
Contributors	75
Donation Transactions	150

4.0 Results and Discussion

This paper introduces a new Block chain-Enabled Decentralized Crowd funding Platform (BEDC) which was implemented and evaluated based on ethereum block chain, Solidity smart contracts, Reacts, Nodes, Web3.js, and Metalmark. The demonstrator system illustrates that block chain can enhance transparency, security and trust in crowd funding application. The platform allows campaign creators to sign up and create fundraising campaigns by filling in the project information, the funding goal, and the minimum contribution amount. After a campaign is launched, a smart contract is created on the ethereum block chain. Contributors have access to all the campaigns and can contribute funds through their Metalmark wallet accounts. Each gift is logged on the block chain, and the transaction is thus irreversible and visible to every user in the network.

A spending request is one of the essential characteristics of the proposed system. Any time campaign owner wants to spend the raised money, he submits a spending request. Supporters are able to check requests and vote to accept or decline them. A smart contract automatically tallies the vote and takes the payment away if it achieves the threshold. That stops us from using the donated money to buy drugs every day unless approved, and find for our own good financial use and loss of the funds. The system is additionally fully transparent. All transactions, including campaign creation, donations, approvals, and fund disbursements, are recorded permanently on the ethereum block chain. Since the block chain records cannot be altered or deleted, there's a way for donors to confirm how their donations were used. This goes a long way in fostering trust between donors, campaign founders, and beneficiaries.

The implementation results also demonstrate that smart contracts can reduce the manual work in the traditional crowd funding scenario through executing the rules which are agreed by all parties. There is no need for third parties to handle the donations or administer payments. This eliminates the need for manual validation, reduces processing time, human errors, and administrative cost. Because of the block chain's decentralized nature, it also contributes to system's security, preventing unauthorized changes and alteration of the transaction records. Although the proposed system has many advantages, a few problems are also found when applying it. Gas fees are necessary for ethereum transactions, which bring up the cost of operating the platform. The time needed for confirming a transaction also may depend on how busy the network is. Besides, users need have some basic knowledge about crypto currency wallets and block chains to make use of the system.

Overall the results indicate that the proposed block chain-enabled crowd funding platform is capable of addressing a considerably larger number of issues in fundraising than traditional platforms. It also delivers secure transactions, transparent fund management, decentralized control, and automated execution via smart contract. The system enhances confidence among donors as they can view and have a say in how funds are spent. Thus, the proposed approach leads to a secure, effective and reliable crowd funding platform that could be applied to charity donation, social welfare, education funding, medical care, disaster recovery, amongst other community fundraising applications. Potential future work includes which is reducing the transaction fees by leveraging Layer-2 block chain solutions, incorporating artificial intelligence for analyzing campaigns, and supporting multiple block chain protocols to enhance scalability and user experience.

Table 2: Fund transfer through smart contracts.

Parameter	Result
Number of Campaigns Created	20
Total Test Contributors	75
Successful Donations	150
Successful Smart Contract Executions	100%
Successful Voting Requests	30
Voting Success Rate	96.70%
Average Campaign Creation Time	2.8 seconds
Average Donation Transaction Time	5.4 seconds
Average Approval Transaction Time	4.9 seconds
Average Fund Release Time	6.2 seconds
Transaction Success Rate	99.30%
Smart Contract Failure Rate	0.70%
Data Integrity	100%
Unauthorized Transactions Detected	0
Transaction Transparency	100%
Donor Fund Traceability	100%

The results of the experiments indicate that the proposed system has high efficiency and security. All fundraising campaigns were successfully created, and each donation was permanently logged on the ethereum block chain. The success rate of 99.3% for transactions suggests that the smart contract ran solidly during the test. The average time to process a donation was 5.4 seconds, and an average of 6.2 seconds for releasing the funds once the contributor had approved. All confirmed transactions are recorded on the block chain and can be verified using the transaction hash.

The proposed platform had 100% data integrity because block chain records are not modifiable once the records are confirmed. No unauthorized transfer of fund has been detected in the tests, which demonstrates the capability of smart contracts in avoiding the misuse of donation funds. To sum up, the proposed system not only offers greater transparency, much stronger security, and more reliable transaction processing, but also enables full traceability of donations, making it more trustworthy than most traditional centralized crowd funding platforms.

5.0 Conclusion

This paper has introduced a Block chain-Enabled Decentralized Crowd funding System based on ethereum block chain and smart contracts, which enhances the transparency, security and trustworthiness of the online fundraising. The proposed scheme tackles the most critical drawbacks of traditional crowd funding platforms, like transparency issues, reliance on intermediaries, slow fund transfer process, and the risk of the fund being misused. The built platform allows campaign creators to launch fundraising campaigns, and contributors to donate funds securely using the

Ethereal block chain. Smart contracts run campaign processes automatically on the campaign itself, check contributor consents and release funds only when certain predefined requirements are met. Since every transaction is recorded indelibly on the block chain, donors are able to know how their contributions are being used, leading to full accountability and traceability. The results of simulations indicate that the proposed framework is effective. The system performed at 99.3% transaction success rate, 100% execution of smart contracts, 100% data integrity, 100% traceability of donation, none unauthorized transactions found throughout testing. These findings validate that block chain technology substantially enhances the trustworthiness and security of crowd funding solutions as well as the reduction of human input and the elimination of manual administrative charges. In general, the proposed framework for charity fundraising and public crowd funding is secure, transparent, decentralized and efficient. It enhances donor trust by allowing funders to have more control over how their funds are used and make sure that the funds are used fairly through approval processes based on smart contracts.

In the future, the system can be upgraded by integrating Layer-2 block chain solutions to minimize transaction cost, artificial intelligence for analysis of campaigns and detection of fraud, and cross-chain interoperability for multiple block chain networks. These enhancements will continue to scale improvements, performance, and user experience, and enable to be applied to large scale real-life crowd funding and charity applications.

Author Contributions

Himanshu Sharma¹ and Bhupender Singh Rawat² contributed to the study and manuscript preparation. Both authors reviewed and approved the final manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest.

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