

Revolutionizing Fundraising: The Power of Blockchain Crowdfunding

Omkar Jagtap^{1,*}, Sonali Jadhav², Ankita Jagtap³, Sangharsh Indalkar⁴

Abstract

Crowdfunding is a powerful fundraising method that leverages the financial contributions of many individuals to support various projects and ventures, typically facilitated through online platforms. It encompasses different models tailored to specific goals. In reward-based crowdfunding, contributors get non-monetary incentives, which aids in creating community involvement. Conversely, equity-based crowdfunding grants investors a share in the company, promoting a collective feeling of ownership. Blockchain technology is revolutionizing crowdfunding by offering a decentralized and distributed ledger that improves transparency, security, and transaction efficiency. A crowdfunding platform utilizing blockchain can greatly improve transparency and accountability during the fundraising process. Traditional crowdfunding methods frequently leave contributors unsure about the allocation of their funds, which can erode trust. By leveraging blockchain, the proposed application addresses these concerns. In this blockchain-based model, all transactions, including donations and fund usage, are securely recorded on the blockchain, making them immutable and transparent. This allows donors to monitor their contributions in real time and see how fundraisers are using the money. The blockchain's decentralized structure also removes the need for intermediaries, simplifying the donation process and cutting costs. The platform will offer an intuitive interface, making it easy for donors to access comprehensive details about their donations. By fostering greater trust and transparency, this blockchain-based crowdfunding platform aims to create a more accountable and efficient fundraising environment, ultimately benefiting both donors and fundraisers.

Keywords: Blockchain, Ethereum, cryptocurrency, solidity, crowdfunding, Hardhat, Polygon, MetaMask

INTRODUCTION

Crowdfunding has emerged as a dynamic fundraising approach that leverages the collective financial support of numerous individuals to support a wide array of projects, initiatives, or ventures. Through online platforms, project creators present their ideas, and backers contribute funds, with various models offering different incentives, such as rewards, equity, loans, or donations. This democratized model has revolutionized fundraising by engaging a broad audience, accommodating diverse projects and investor preferences, and fostering innovation and community involvement.

The evolution of crowdfunding has transitioned from traditional localized methods to a globally accessible phenomenon facilitated by the internet and social media. Online platforms have connected creators with a vast pool of backers worldwide, increasing accessibility, expanding the types of funded projects, and enabling direct engagement between creators and supporters. Furthermore, the

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integration of blockchain technology has introduced transformative elements by ensuring transparency, security, and efficiency in transactions, mitigating risks associated with fraud or manipulation through its decentralized and tamper-resistant ledger, and the implementation of smart contracts.

Blockchain-based crowdfunding offers a revolutionary approach to obtaining support for various initiatives or ideas and addressing common issues encountered in traditional crowdfunding. This ensures clarity and transparency by maintaining an immutable record of financial activities on a tamper-resistant computer system, allowing contributors to verify the proper use of funds. Safety and trust are bolstered through encryption and smart contracts, instilling confidence in the system's integrity and ensuring that agreements are upheld reliably. Moreover, this system enables global participation without complications regarding currency types or geographical locations, fostering inclusivity and excitement among the participants. By eliminating intermediaries such as banks, it streamlines the process, establishing a direct connection between creators and supporters, while offering additional benefits such as digital tokens as rewards, enhancing engagement, and incentivizing involvement.

The exploration of crowdfunding has revealed its diverse forms, including reward-based, equity-based, debt-based, and donation-based models, marking its transformative evolution from localized to global online platforms. The integration of blockchain technology has emerged as pivotal, offering solutions to traditional crowdfunding challenges such as transparency, security, and global accessibility. Blockchain's tamper-resistant ledgers, cryptographic features, smart contracts, and tokenization incentivize backers, ensuring transparency, and accountability, and mitigating the risks of scams and fund misuse. Additionally, blockchain presents a potential remedy for corruption issues in government projects, offering transparency and accountability, akin to its benefits in crowdfunding.

LITERATURE SURVEY

Crowdfunding has emerged as a pivotal mechanism in entrepreneurial finance, leveraging the power of social capital and online platforms to fund projects. Mollick's (2014) study on crowdfunding dynamics using Kickstarter data underscores the significance of social capital, project preparedness, and geographical factors in determining project success [1]. Hartmann et al. (2019) extend this understanding by differentiating between the success factors of conventional crowdfunding and blockchain-based platforms. Their research emphasizes blockchain's potential to revolutionize crowdfunding through enhanced security and transparency via tokens and profit-sharing mechanisms [2]. Addressing a broader governance concern, Vipin and Sharma (2011) delved into the pervasive issue of corruption and scams in India. Their qualitative analysis highlights systemic issues stemming from weak governance, political patronage, and a lack of accountability, requiring multi-stakeholder efforts and legal reforms to counteract [3]. Similarly, the World Bank Integrity Vice Presidency (2011) investigates corruption in the road sector, underscoring the need for transparency, oversight, and ethical practices to counter fraud and collusion. This report outlines measures for governments and organizations to combat corruption in World Bank-funded projects [4]. The recent literature has further explored the fusion of crowdfunding and blockchain technology. Swamiraj et al. (2022) emphasized the integration of blockchain to enhance privacy, transparency, and security in crowdfunding platforms, primarily through smart contracts. These studies propose blockchain-based decentralized applications and emphasize the immutability of smart contracts as a safeguard against tampering [5]. Similarly, Jhanji et al. (2023) aim to rectify crowdfunding inefficiencies by combining smart contracts and smart properties in a decentralized Ethereum application. This emphasizes the secure storage of funds using smart contracts [6]. Kulkarni et al. (2023) compared traditional and blockchain-based crowdfunding approaches, emphasizing the latter's advantages in transparency and information symmetry, albeit at a slightly slower transaction speed [7]. Proposals for specific platforms have emerged, such as Kumbhar et al.'s (2023) fundraising platform for startups, and Subash 8 (2023) charity-focused blockchain crowdfunding platforms. Both suggest utilizing smart contracts for transparency and accountability, ensuring donors can track fund utilization which will help monitor fund uses and reduce scams and corruption [8, 9]. Further, Pawar et al. (2023) explored the effectiveness of Ethereum smart contracts in crowdfunding, emphasizing security and global access.

It envisions integration with decentralized finance [10]. Expanding beyond business financing, Rashid et al. (2019) introduced TEduChain, a blockchain-driven platform that facilitates tertiary education funding. The platform ensures transparency and security in student funding mechanisms and proposes a decentralized architecture for managing funds and scholarships [11]. Crowdfunding, bolstered by blockchain technology, has emerged as a transformative force for financing and securing transactions across diverse domains. Hassija et al. (2020) introduced BitFund, a blockchain-based crowdfunding platform that seamlessly connects investors and developers. This study underscores the attributes of blockchain, including transparency and decentralization, facilitating a secure and equitable crowdfunding system while eliminating intermediary intervention. Additionally, an iterative auction algorithm was proposed to optimize the project assignment within the platform [12]. Another facet of blockchain's application lies in the financial supply chain (SCF) frameworks that adhere to Islamic Sharia principles, as highlighted by Sanjaya and Akhyar (2022). Their study focused on enhancing financial efficiency and diversifying funding sources for companies through a Sharia crowdfunding platform. The integration of blockchain and smart contracts ensures transparency, fraud prevention, and effective fund tracking throughout the supply chain network, aligned with Sharia principles [13]. Saadat et al. (2019) delved into the amalgamation of crowdfunding and blockchain technology, emphasizing the pivotal role of social media and the internet in facilitating capital accumulation. Their analysis underscores the potential of blockchain integration in crowdfunding platforms, augmenting donor privacy and project credibility. This comprehensive study outlines both benefits and challenges, serving as a foundational resource for comprehending crowdfunding financing strategies for businesses [14]. To explore the feasibility of blockchain in donation-based crowdfunding for ethical projects, Khan and Ouaich (2019) proposed a decentralized app within the Ethereum blockchain, targeting Zakaah donation optimization. Their research delves into functional architecture, stress testing, and comparison between Ethereum and hyperledger environments. The insights shed light on blockchain's potential, along with challenges and scalability considerations in the context of donation-based crowdfunding for ethical endeavors [15]. Furthermore, Vakilinia et al. (2018) introduced a framework that leverages blockchain to ensure cyber products [16].

The outlined stages include registration, crowdfunding, and indemnity, all of which collectively guarantee transparency and build trust in the insurance process. The framework's design incentivizes insurer participation and promotes cyber-product security by extracting indemnity from crowdfunding funds in case of vulnerability [16].

In this chapter have seen the different types of IEEE papers that are connected with a system called “Blockchain-Based Crowdfunding Application” IEEE papers are on the different types of systems that are nothing but implemented in the different fields connected with medical, education, industrial, and many other application lots of paper are concern with the blockchain-based crowdfunding application and its advantages over traditional way of crowdfunding, how scams and frauds which are happening in traditional systems can be prevented using blockchain [17]. Some of these topics are deeply studied, observed, and understood, and some of these papers have their software or have just proposed an application.

BLOCK DIAGRAM AND DESCRIPTION

The fusion of blockchain technology and crowdfunding has opened new avenues for interaction and engagement. At the heart of this dynamic landscape is a pivotal technology that is transforming the way we can participate in crowdfunding.

This design and drawing project delve into blockchain technology, investigating its capabilities, applications, and promising opportunities. By harnessing the power of blockchain technology, this system aims to reshape the crowdfunding landscape and how we interact with it. As given in Figure 1, the application process begins with a needy person who initiates the story on the crowdfunding platform. This request was managed using a user interface. The foundation of the crowdfunding process relies on the smart contracts deployed on the Ethereum blockchain. These contracts enforce campaign rules, such

as the funding goal and criteria for distributing funds. By operating on the Ethereum blockchain, smart contracts take advantage of their decentralized and secure characteristics [18]. As potential donors interact with the platform through the user interface, they initiate transactions to contribute to funds. These transactions are safely logged into the Ethereum blockchain, guaranteeing transparency and permanence. A blockchain network governed by its chosen consensus mechanism validates and confirms these transactions. The details of the crowdfunding campaign, including progress toward the target amount, were stored in a decentralized crowdfunding database. This ledger provides a clear and tamper-resistant record of all the transactions and project details.

The crowdfunding process begins with a needy person sharing stories on the platform interface. Smart contracts on Ethereum enforce campaign rules and manage fund allocation [19]. Donors interact through the interface and initiate secure transactions recorded on Ethereum for transparency. Blockchain validation ensures transaction integrity. Campaign details stored in a decentralized database maintain transparency. The funds are securely distributed, thus closing the crowdfunding cycle.

IMPLEMENTATION

As suggested in Figure 2, this blockchain-based crowdfunding project leverages the Ethereum blockchain, Solidity smart contracts, and user-friendly technologies, such as Thirdweb and MetaMask, to create a decentralized crowdfunding platform. It allows project creators to create campaigns, receive contributions in cryptocurrencies, and transparently manage funds, whereas contributors can participate with ease using their MetaMask wallets. The project aims to harness the benefits of blockchain technology, such as security and transparency, to foster trust and reliability in crowdfunding.

Blockchain-based crowdfunding applications leverage a combination of cutting-edge technologies to revolutionize the crowdfunding landscape. The core of the application lies in the utilization of ThirdWeb, a leading Web3 development platform, which provides a comprehensive suite of tools and services crucial for deploying decentralized applications (dApps). ThirdWeb streamlines the integration of blockchain functionalities into a crowdfunding platform, offering robust SDKs for seamless development [20]. By utilizing ThirdWeb, developers can focus on building innovative features while ensuring the security and reliability of an application.

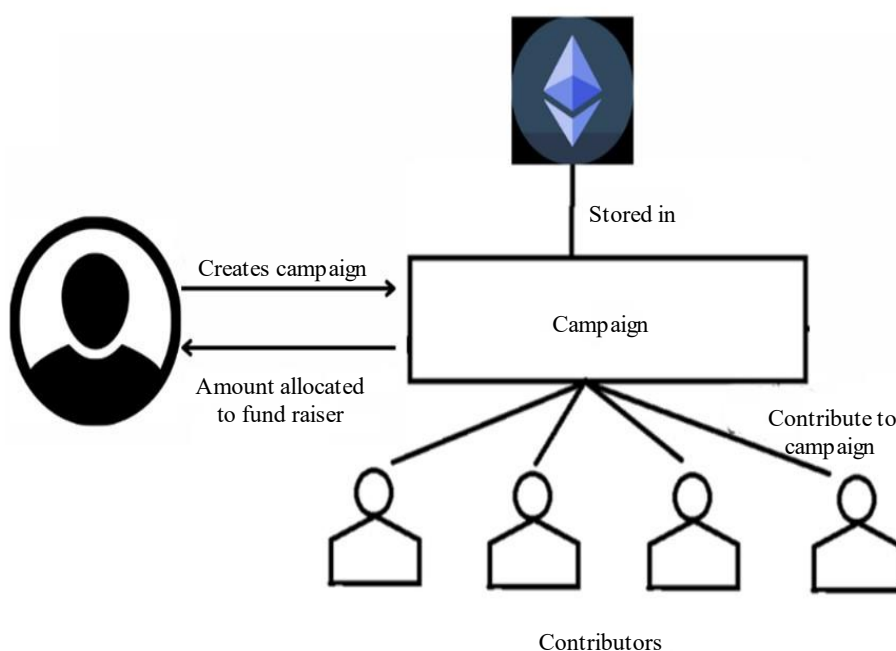


Figure 1. Block diagram of blockchain-based crowdfunding application.

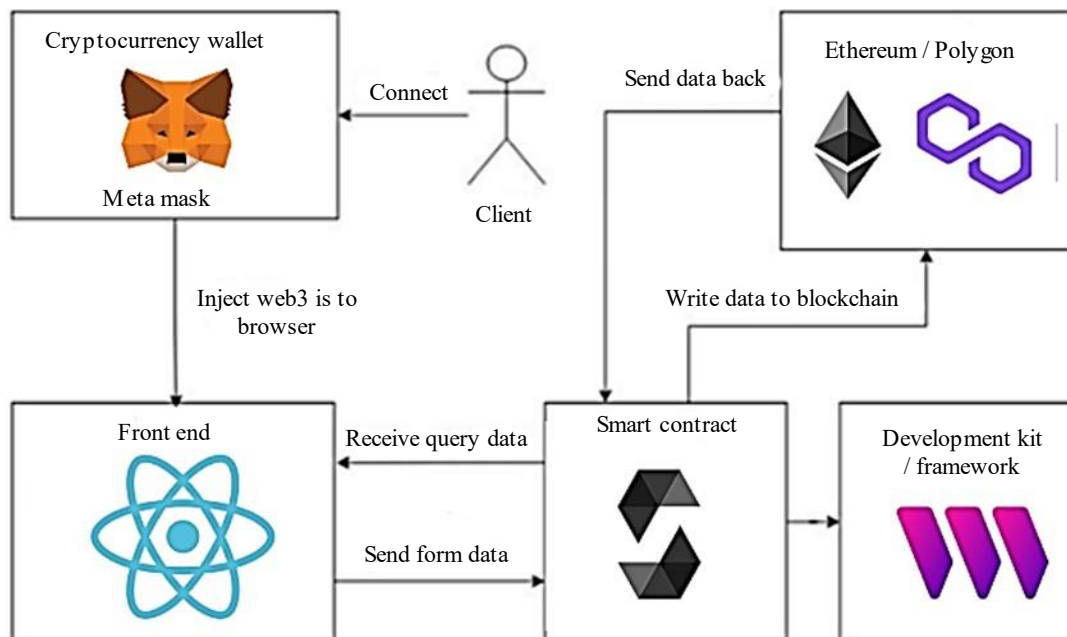


Figure 2. Flow diagram of blockchain-based crowdfunding application.

We employ a stack of powerful technologies to bring crowdfunding applications to life. Tools such as VS Code and Hardhat facilitate the development and testing of smart contracts written in the Solidity programming language. These smart contracts govern the core functionalities of crowdfunding platforms, including the management of funds and the execution of transactions. Moreover, ReactJS, Node.js, and Web3.js play crucial roles in developing an intuitive and user-friendly front-end interface. This combination of technologies allows for smoother user experience while interacting with the crowdfunding platform, whether browsing campaigns or contributing to projects [21].

Furthermore, the application harnesses the scalability and efficiency of the Polygon network to address the challenges associated with transaction costs and throughput in the Ethereum blockchain. By leveraging Polygon's layer 2 scaling solution, users can enjoy fast and low-cost transactions, making crowdfunding more accessible to a broader audience. Integration with MetaMask and Alchemy ensures seamless connectivity to the blockchain, enabling users to manage their digital assets securely and interact with the crowdfunding platform directly from their web browser [22]. Overall, the synergy between ThirdWeb and a robust technology stack comprising the VS Code, Hardhat, Solidity, ReactJS, Node.js, Web3.js, Polygon, MetaMask, and Alchemy forms the foundation of a groundbreaking blockchain-based crowdfunding application poised to disrupt the traditional fundraising model.

Technologies

1. *Solidity*: Solidity is the programming language used to create smart contracts that run on an Ethereum Virtual Machine (EVM). In this application, Solidity is used to define the rules and behaviors of crowdfunding smart contracts.
2. *React.js*: React.js, a JavaScript library designed for constructing user interfaces, will be central to future developments. This will allow users to create an interactive and user-friendly interface for engaging with their crowdfunding platform.
3. *Node.js*: Node.js is the runtime for executing the server-side JavaScript code that will be integrated into the application backend. It can solve problems such as processing requests and interacting with the blockchain.
4. *Polygon*: Layer 2 scaling for Ethereum will solve problems related to high transaction costs and scalability. It offers a cost-effective and efficient fundraising environment. It seeks to address certain scalability problems and to reduce the high transaction fees commonly associated with Ethereum.

5. *Hardhat*: Hardhat, the development environment for Ethereum, helps design, deploy, and test smart contracts during development. We can deploy your contracts, run tests, and debug the Solidity code without directly interacting with the environment. The Hardhat Network is a local Ethereum environment tailored for development purposes.
6. *Web3.js*: Web3.js, a JavaScript library, enables front-end interaction with the Ethereum blockchain. It offers a unified interface for working with Ethereum and simplifies data retrieval without causing delays.
7. *MetaMask*: MetaMask is a browser extension that is the main component for users to manage Ethereum-based assets and interact with crowdfunding programs through their browsers. *MetaMask* available as both a browser extension and mobile app, offers comprehensive tools for managing digital assets, including key management, secure login, wallet, and token exchange.
8. *ThirdWeb*: ThirdWeb is a platform offering a suite of tools for developers, artists, and entrepreneurs to effortlessly create, launch, and manage Web3 projects. It enables users to incorporate features such as NFTs, marketplaces, and social tokens into Web3 projects without the need to write any code.

The application integrates various cutting-edge technologies to revolutionize crowdfunding. ThirdWeb serves as a pivotal Web3 development platform, providing essential tools and services for deploying decentralized applications (dApps) and streamlining blockchain functionality integration. Development and testing of smart contracts are facilitated by tools such as VS Code and Hardhat, which are written in the Solidity programming language. React.js, Node.js, and Web3.js were employed to create an intuitive front-end interface, ensuring a smooth user experience. In addition, scalability and efficiency are enhanced through integration with the Polygon network, addressing transaction costs and throughput challenges on the Ethereum blockchain. MetaMask and Alchemy ensure seamless blockchain connectivity, enabling secure management of digital assets directly from the web browser.

EXPERIMENTATION

Campaigns Overview Page

- *Purpose*: To present a comprehensive list of all campaigns created on the platform, providing an overview of active, completed, or ongoing campaigns.
- *Functionality*: This enables users to browse through various campaigns and view their details, status, and progress.

Create Campaign Page

- *Purpose*: Facilitate users in initiating new crowdfunding campaigns by providing the necessary fields and options for campaign setup.
- *Functionality*: Offers form fields for campaign details, funding goals, duration, and other pertinent information. Enables users to design and initiate new campaigns.

Dashboard Page

- *Purpose*: It serves as a personalized space for users to manage and track campaigns initiated by them.
- *Functionality*: Displays a summary or list of campaigns created by a logged user. It provides insights into campaign performance, contributions, and status updates.

Campaign Details Page

- *Purpose*: Offers detailed information about a specific campaign and provides insights into its objectives, progress, and contributors.
- *Functionality*: Displays comprehensive details of the selected campaign, including description, funding progress, contributors, milestones, and updates or changes.

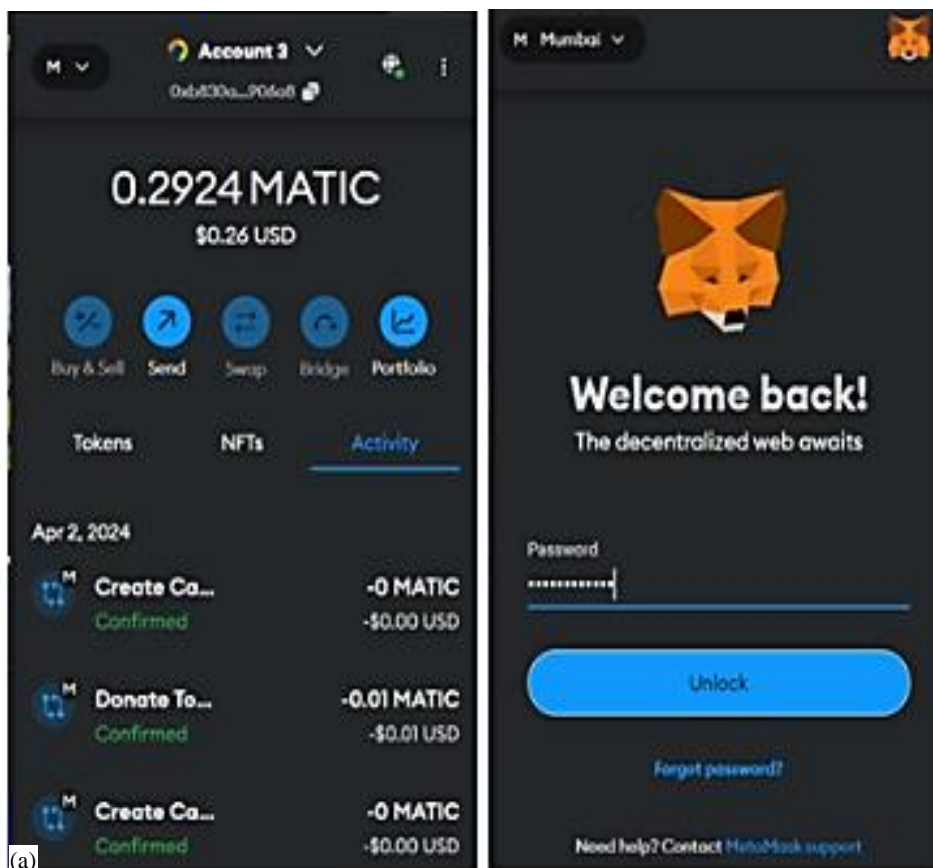
RESULTS

As shown in Figure 3(a), for any transactions to occur, whether creating a campaign or contributing to one, users must initially link their Ethereum wallet to the site. This link is created via a browser extension known as MetaMask, which is designed to authorize cryptocurrency transactions. Once a user's wallet is linked, they can contribute to campaigns on the platform. The process is straightforward: a user selects a campaign, enters the desired contribution amount, and authorizes the transaction using the MetaMask extension. This streamlined process highlights the platform's user-friendly nature.

Blockchain technology transforms information exchange and money transfer by providing straightforward, secure, and efficient methods. Integrating blockchain into crowdfunding contracts addresses prevalent issues, such as abuse, trust, and privacy. This integration provides a much-needed solution to the challenges faced by traditional crowdfunding mechanisms. By leveraging the transparency and security of the blockchain, users can engage in crowdfunding activities with enhanced confidence and trust.

Figure 3(b) represents creating a campaign page that facilitates users in initiating new crowdfunding campaigns by providing necessary fields and options for campaign setup such as name, campaign title, campaign story, required amount, and deadline of the campaign which helps donors to revise their decision. Figure 3(c) exhibits a dashboard page that serves as a personalized space for users to manage and track campaigns initiated by them. Where only the campaigns created by him are displayed so that he can keep track of all the campaigns that he has initialized.

Figure 3(d) represents all campaign pages which display a comprehensive list of all campaigns created on the platform, providing an overview of active, completed, or ongoing campaigns. Here all the campaigns are displayed sorted in order of their creation by clicking on them, we can navigate to a campaign detail page.



(a)

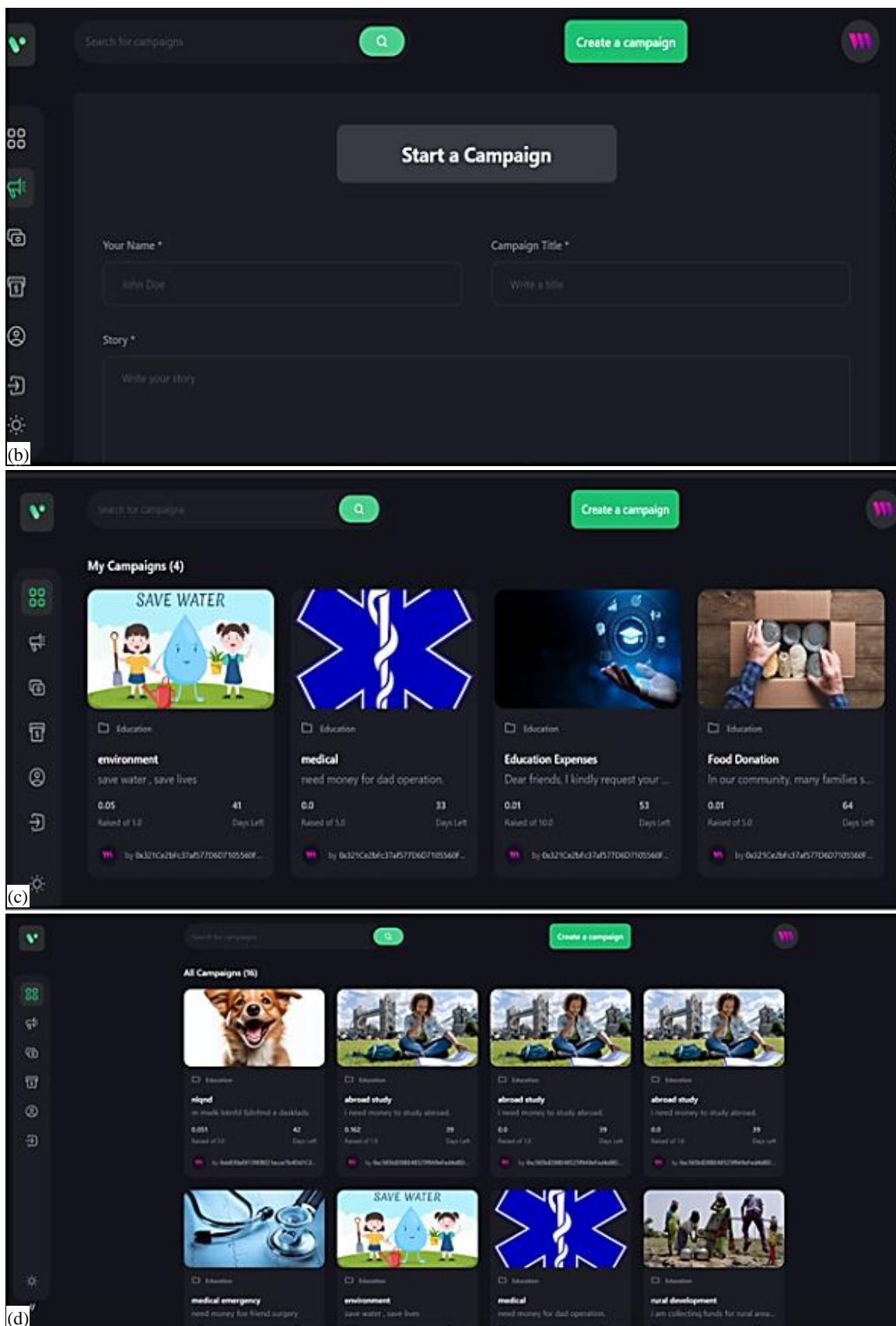


Figure 3. (a) to (d) Front-end pages. (a) Connecting wallet to website; (b) Create campaign page; (c) Campaigns page; (d) All campaigns page.

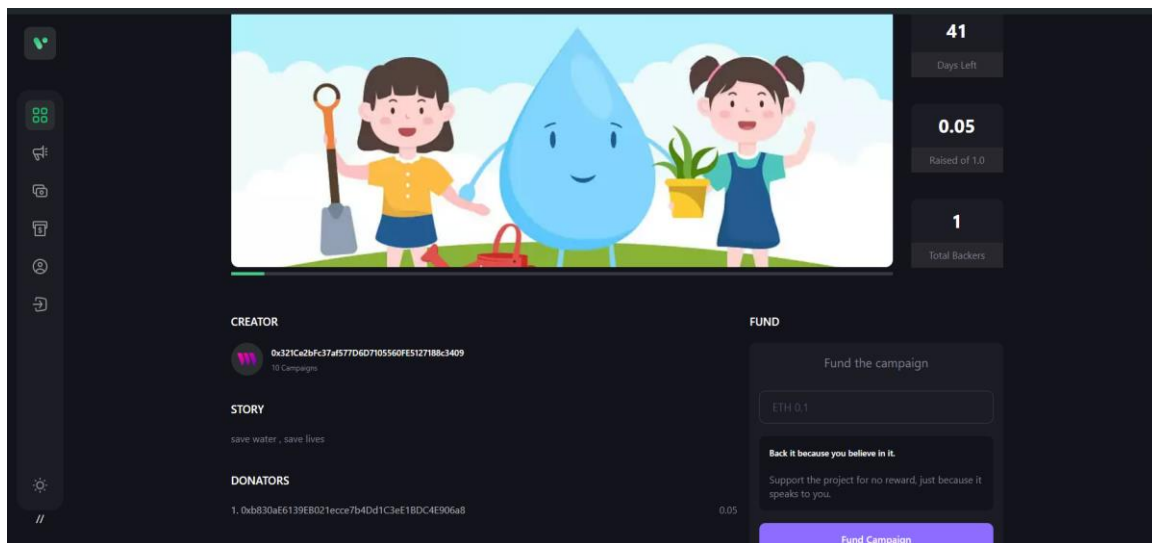


Figure 4. Campaign detail page.

Figure 4 displays a detailed campaign page that offers detailed information about a specific campaign, providing insights into its objectives, progress, and contributors. This page provides information about the number of donors' account numbers/addresses, their donated amounts, how many days remain to end the campaign, raised amounts, total required amounts, and addresses of fund creators. On the same page, we also provided a feature for donating to the campaign.

CONCLUSION

In conclusion, the creation of crowdfunding software is an important step in solving the problem of fraud common in crowdfunding and traditional philanthropy. Using the irreversible and transparent features of blockchain technology, this program offers a secure way to guarantee accountability and trust in the collection process. Donors and investors can contribute with confidence using smart contracts as they ensure that their transactions are securely documented and immutable. Additionally, because blockchain technology is decentralized, there is no need for intermediaries, which reduces transaction costs and increases productivity. This leading platform not only protects against scams but also encourages openness and inclusiveness, allowing people from all over the world to participate in worthwhile projects. We continue to use blockchain technology to our advantage.

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