Decentralized Charity Portal: Empowering Transparent Philanthropy through Blockchain Technology

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Abstract. Ensuring transparency and efficiency in charitable contributions is critical in philanthropy. This paper proposes a decentralized charity platform to address the need for a transparent and streamlined system connecting donors with diverse charity organizations. The platform's architecture supports comprehensive user registration for donors, volunteers, beneficiaries, NGOs, and service providers, incorporating robust verification mechanisms to ensure legitimacy. It facilitates two campaign types: Direct Beneficiary Support Campaigns, directing funds to verified individuals, and Community Relief Campaigns, allocating resources to service providers. Advanced tracking mechanisms allow donors to monitor the real-time progress of contributions, enhancing transparency and accountability. Volunteers are integrated via NGO-coordinated opportunities, and transparent reporting mechanisms provide donors with detailed records of funds raised and expenditures, fostering trust. Beneficiaries can convert cryptocurrency into local currency, with direct deposits to bank accounts, improving financial accessibility. This platform addresses challenges in traditional donation methods and fragmented volunteer coordination, maximizing the impact of charitable contributions on societal needs.

Keywords: Decentralized charity platform, Verification processes, Blockchain, Smart contracts, Cryptocurrency

INTRODUCTION

To address the growing necessity of transparent and effective philanthropy, this paper proposes a decentralized charity platform utilizing Blockchain Technology. Through Blockchain's immutable ledger, the integrity of transactions is maintained, enhancing security and trust among users. The primary goal is to streamline charitable

contributions with a seamless interface for registration, donation, campaign hosting, and volunteer participation while ensuring the legitimacy of involved entities.

The platform supports two types of campaigns: Direct Beneficiary Support Campaigns and Community Relief Campaigns. Donors can monitor the progress of their donations in real time, fostering confidence and accountability. The platform also features beneficiary payout conversion, ensuring timely fund transfers and financial accessibility. Smart contracts automate predefined actions, eliminating intermediaries and reducing exploitation risks.

By incorporating Blockchain technology, the Decentralized Charity Portal enhances security and transparency while streamlining processes. This initiative represents not only a technological innovation but also a step towards more accountable and impactful philanthropy. Every donation is transparent, every volunteer effort efficiently coordinated, and every beneficiary receives timely support, promising to redefine charitable interventions.

In conclusion, the Decentralized Charity Portal aims to foster a globally connected community committed to humanitarian efforts. By promoting transparency, trust, and technology, the platform seeks to enhance donor confidence and facilitate more effective charitable contributions. This initiative aligns with the broader goal of promoting accountable and impactful philanthropy, setting a new standard for charitable giving in the digital age..

RELATED WORKS

In [1], SmartCon is presented as a blockchain-based smart contract management framework specifically designed for scalability. SmartCon incorporates two separate blockchains for contract and transaction storage, allowing for better resource utilization and potentially faster transaction speeds. Real-world testing scenarios include smart contracts within a decentralized autonomous organization (DAO) and software activation key sales. SmartCon is compared to NEM, NEO, Ethereum, and Hyperledger Burrow, offering benefits such as process automation, security, and reduced reliance on intermediaries while striving to improve scalability and transaction speeds.

In [2], a Decentralized Donation Tracking System on the Ethereum Blockchain is proposed to ensure transparent fund distribution. Operating without centralized entities, users interact through unique account addresses and private keys. The system leverages smart contracts, the Ethereum Virtual Machine (EVM), and transactions for fund distribution. Users engage in transparent transactions based on their roles, with government oversight and permission granting, fostering trust and efficient fund distribution through the Ethereum blockchain.

In [3], a technical overview of smart contracts in blockchain technologies is provided. Smart contracts are executable programs stored on the blockchain, offering trust, traceability, and irreversibility without intermediaries. Users interact with smart contracts, with transactions stored in a pool awaiting validation by nodes. Smart contracts provide reliability and decentralization, eliminating the need for trusted third parties and enabling secure interactions on the blockchain.

In [4], The paper introduces a decentralized carpooling system that addresses shortcomings in centralized ride-sharing services through smart contracts. By enabling users to act as drivers or passengers, the system facilitates seamless ride publication and booking. Smart contracts execute user requests triggered by specific events, ensuring secure and efficient transactions. Fare calculation based on route distance, fuel prices, and vehicle mileage reduces costs, with fares debited from passengers and credited to drivers upon ride completion. The system aims to enhance carpooling convenience while upholding user security, offering insights for the development of decentralized solutions in various domains.

In [5], trust issues in the cryptocurrency ecosystem are addressed, with proposed solutions for immediate, short-term, and long-term resolutions. Building a trustworthy cryptocurrency ecosystem requires collaboration among stakeholders, prioritizing security, privacy, and trust in underlying systems. Resolving trust issues is crucial for the next generation of cryptocurrency systems to support financial institutions and the mainstream economy, necessitating stakeholder understanding of technical and non-technical implications.

In [6], a blockchain-based platform for tracking charitable donations is explored, focusing on distributed ledger technology, cryptocurrencies, and smart contracts. The platform aims to enhance transparency, efficiency, and accountability within the charitable sector by leveraging blockchain's attributes to provide an immutable and auditable record, streamline reporting processes, and foster donor trust.

PROPOSED SYSTEM

SYSTEM ARCHITECTURE

The Decentralized Charity Portal system architecture is intended to create an open, efficient, and safe atmosphere to promote charitable donations and manage volunteers by employing up-to-date technological platforms such as modern web frameworks, database systems, and blockchain. This particular framework, therefore, comes with different layers including front-end interfaces (the GUI), at the back-ends(engine room), on the blockchains(ledger) and distributed database elements that are pivotal in enabling smooth running of operations..

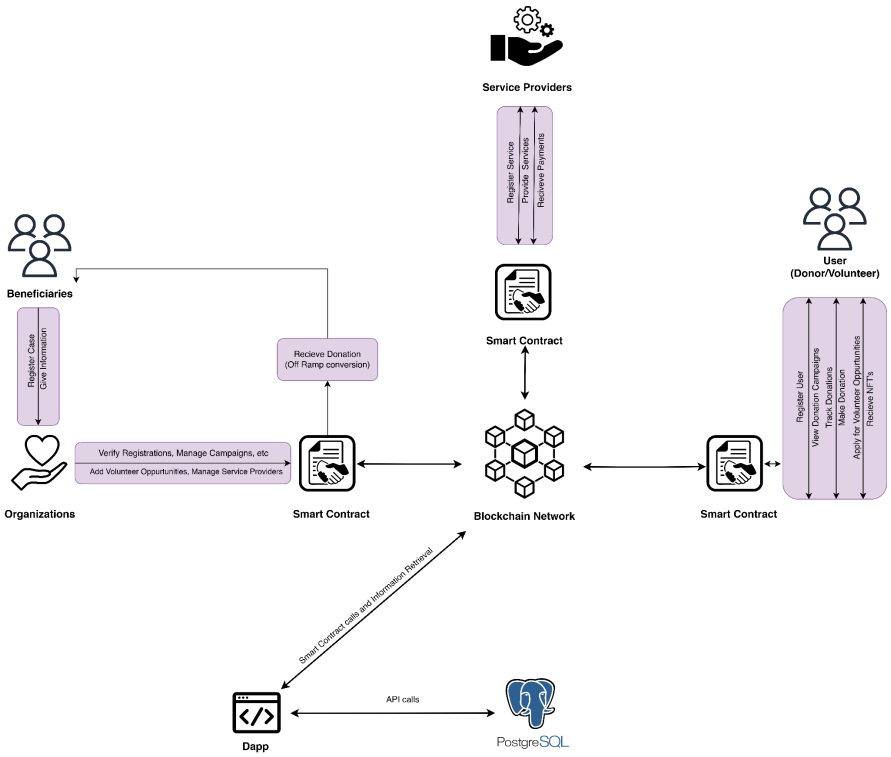


FIGURE 1. System Architecture

The decentralized charity platform is designed to combine simplicity and effectiveness smoothly across its backend, frontend and blockchain elements. Next.js powers the backend, managing user authentication, campaign cycles and interactions with the Ethereum blockchain network, for operations and real time transaction monitoring. Smart contracts on the Ethereum network oversee functions to ensure transparency in campaign information, fund usage and secure transaction records. PostgreSQL acts as the repository for blockchain data management to streamline data retrieval processes and enhance communication between frontend and backend systems. The frontend, also utilizing Next.js provides a user interface integrated seamlessly with the backend through API routes. The platform's connection to the Ethereum blockchain network via Metamask wallet ensures security and trustworthiness while a feature allows cryptocurrency conversion into beneficiaries local currency through Transak API for deposit into their bank accounts. This comprehensive structure showcases the platform's cutting edge technology, in leveraging blockchain for contributions.

WORKFLOW OF THE PROPOSED ARCHITECTURE

The application flow of the decentralized charity portal begins with user registration, comprising four distinct categories: Donor Registration, where individuals provide personal information and set up their digital wallets; Volunteer Registration, involving submission of personal details, skills, and availability; Charity Organization Registration, requiring detailed information and legal documents for verification; and Beneficiary Registration, facilitated through NGO sponsorship, with submission of necessary identification details for verification. Following registration, organizations can initiate and host campaigns, categorized into Direct Beneficiary Support Campaigns for specific financial assistance to verified beneficiaries, and Community Relief Campaigns encompassing broader initiatives like disaster relief or medical assistance.

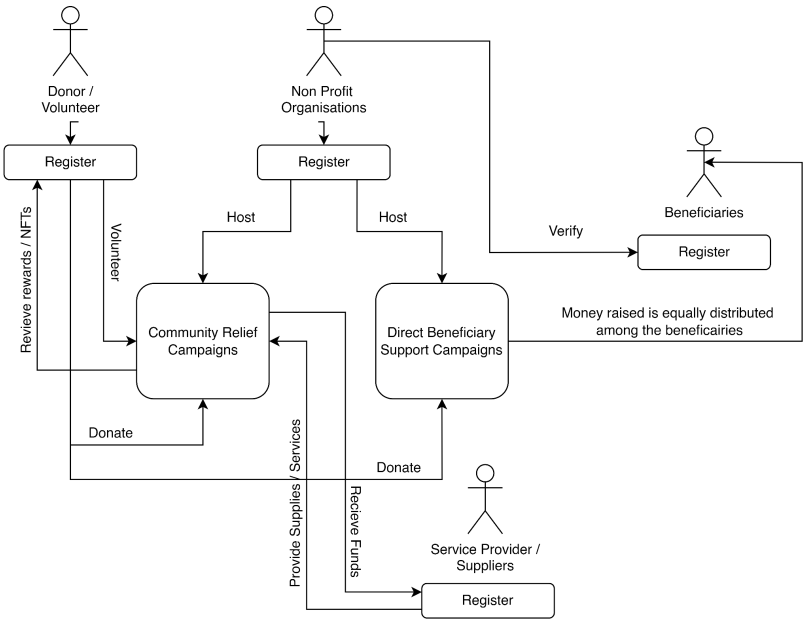


FIGURE 2. Workflow Diagram

All campaigns undergo scrutiny and approval by the platform to prevent fraud and ensure alignment with mission standards. The donation process instills trust and encourages generosity among donors, where they select campaigns based on type, location, or theme, make donations through digital wallets via blockchain transactions, track their contributions until confirmed received by beneficiaries, and then, the platform emphasizes the accessibility of currency conversion for beneficiaries to convert cryptocurrency into their local currency, with assurance of direct deposit of converted funds into beneficiaries' bank accounts. Additionally, donors receive updates on how their contributions are utilized by service providers. Volunteers are matched with opportunities aligned with their skills and availability, facilitated through searching for opportunities posted by NGOs, submitting applications directly through the platform, and undergoing review and selection by NGOs. Transparency measures include real-time updates on financial transactions and fund usage visible to donors, feedback mechanisms from volunteers and beneficiaries, continuous engagement facilitated through user surveys, feedback collection, and performance analytics monitoring engagement and campaign success rates.

FUNCTIONAL SCENARIOS

The use case diagram for the decentralized charity portal outlines the key actors and their interactions within the system. In the decentralized charity portal, several key actors play essential roles in the ecosystem. Donors, representing individuals passionate about contributing to charitable causes, engage with the platform by making financial donations or volunteering their time and expertise. Beneficiaries, on the other hand, are the recipients of charitable aid who utilize the platform to receive donations and manage their profiles. Service providers, including entities or individuals offering various services related to charity work such as logistics, healthcare, or education, interact with NGOs and beneficiaries to provide necessary support.

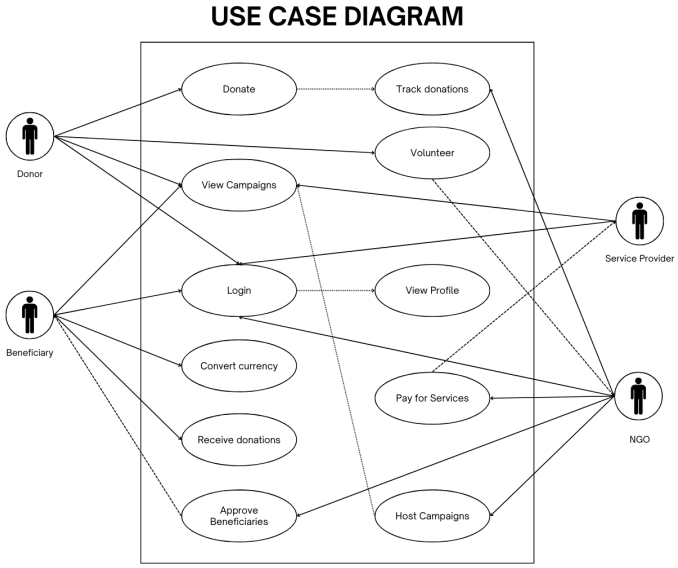


FIGURE 3. Use Case Diagram

Non-Governmental Organizations (NGOs) are pivotal in managing and hosting campaigns on the platform, coordinating fundraising efforts, and distributing aid to beneficiaries. Each actor interacts with the platform through a set of defined use cases tailored to their specific roles. Donors can contribute funds to specific campaigns leveraging blockchain technology, explore ongoing charity campaigns, monitor donation history, and participate in volunteer activities supporting charitable initiatives. Beneficiaries have the capability to log in securely, convert received donations to local currency, receive financial aid directly into digital wallets, and grant approval to other beneficiaries. Service providers manage profiles showcasing their expertise and services offered, as well as receive payments for services rendered to NGOs.

NGOs, being the campaign managers, create and manage charity campaigns, setting fundraising goals and making payments to service providers for their contributions. The interactions between actors and their respective use cases are visually represented in the diagram, illustrating the flow of actions within the decentralized charity portal. This visualization helps stakeholders understand how different entities interact with the platform and perform various tasks to support charitable causes effectively.

IMPLEMENTATION

A) User Registration

User registration within the Decentralized Charity Portal is a pivotal process aimed at onboarding and verifying users, thereby ensuring the integrity and legitimacy of the platform. Each user role, including

donors, volunteers, charity organizations, and beneficiaries, undergoes specific registration procedures tailored to their respective requirements and responsibilities.

During the registration process, donors provide essential personal information such as their name, email address, and contact details. Additionally, they set up their digital wallets using MetaMask integration, facilitating seamless transactions on the blockchain. This registration triggers the execution of the createCampaign function within the "SolidGivr" smart contract, enabling donors to initiate campaign creation by specifying campaign details and target amounts.

Similarly, volunteers also undergo registration by providing personal information and specifying their skills and availability. This information is crucial for matching volunteers with suitable opportunities posted by NGOs on the platform. The volunteer registration process sets the stage for the application process, allowing volunteers to express interest in specific opportunities through the platform's interface.

Charity organizations undergo a stringent registration process, wherein they submit comprehensive details about their mission, goals, and legal documents. The platform verifies these documents using smart contract functionalities to ensure the legitimacy and operational status of the organization. Upon successful verification, charity organizations gain access to campaign creation functionalities, enabling them to host fundraising campaigns for their causes. Beneficiaries, on the other hand, register through NGO sponsorship, providing necessary identification details and reasons for aid. Their registration undergoes verification and approval by partnering NGOs to ensure the authenticity of beneficiary profiles. Upon approval, beneficiaries gain access to financial assistance campaigns initiated by donors through the platform.

B) Campaign Hosting

User registration within the Decentralized Charity Portal is a pivotal process aimed at onboarding and verifying users, thereby ensuring the integrity and legitimacy of the platform. Each user role, including donors, volunteers, charity organizations, and beneficiaries, undergoes specific registration procedures tailored to their respective requirements and responsibilities.

Algorithm 1 Create Campaign Function

Input : targetAmount, targetAddress, title, description
Output: New Campaign created
if *targetAmount <= 0* **then**
| **revert** AmountLessThanZero()
end
if *targetAddress == address(0)* **then**
| **revert** AddressNotValid()
end
Create new fund **Campaign** newCampaign =
{campaignCounter, msg.sender, block timestamp, 0, targetAmount,
targetAddress, title, description, false }
listCamapigns.push(newCampaign)
emit CampaignCreated(campaignCounter)
campaignCounter ++

Within the Decentralized Charity Portal, two primary types of campaigns are hosted: Direct Beneficiary Support Campaigns and Community Relief Campaigns.

Direct Beneficiary Support Campaigns, initiated by donors, provide financial assistance directly to verified beneficiaries. Leveraging the createCampaign function within the "SolidGivr" smart contract, donors specify campaign details such as target amounts, descriptions, and beneficiary addresses. Funds raised through these campaigns are transferred directly into the beneficiary's web3 wallet, ensuring transparency and direct impact.

On the other hand, Community Relief Campaigns address broader objectives such as disaster relief, education programs, or medical assistance. These campaigns are created by NGOs and charity organizations, specifying campaign details and target amounts. Funds raised are utilized to procure goods and services through verified service providers, contributing to community welfare and development.

Before campaigns are launched, they undergo scrutiny and approval by the platform to ensure compliance with regulatory and ethical standards. Smart contract functionalities validate campaign details and verify the authenticity of participating entities, preventing fraudulent activities and maintaining the platform's integrity.

C) Donation Process

The donation process on the Decentralized Charity Portal is transparent and efficient, utilizing blockchain technology to track contributions and ensure accountability. Donors first browse through a list of active campaigns, filtering them based on criteria such as type, location, or theme. The platform's interface fetches campaign data from the blockchain, providing donors with real-time updates on available opportunities.

Algorithm 2 Donate function

Input : campaignld, msg.value
Output: New donation made
Declare uint256 amount = msg.value
if *amount <= 0* **then**
| **revert** AmountlessThanZero()
end
if *campaignld >= campaignCounter* **then**
| **revert** CampaignDoesNotExist()
end
if *listCampaigns[campaignld].completed == true* **then**
| **revert** CampaignAlreadyCompleted()
end
// *Update amount of contribution for author*
contributionAuthors[msg.sender] += amount
// *Update amount of campaign*
listCampaigns[campaignld].amount += amount
if *listCampaigns[campaignld].amount >= listCampaigns[campaignld].targetAmount* **then**
| sendFund(campaignld)
end
// *Create new donation*
Donation memory donation = Donation(amount,msg.sender)
contributionFunds[campaignld].push(donation)
emit DonationCreated(amount, msg.sender)

Once a campaign is selected, donors proceed to make their contributions using digital wallets connected during registration. Blockchain transactions are employed for transparency and security throughout the donation process. The donate function in the "SolidGivr" smart contract facilitates donation transactions. This function validates the donation amount and the existence of the chosen fund. If the fund is completed or does not exist, the transaction is reverted to maintain system integrity. Upon successful validation, the contribution amount is updated for the donor, and the fund amount is incremented accordingly. If the accumulated amount meets or exceeds the target amount for the fund, the sendFund function is invoked internally to complete the fund and distribute the raised funds to the specified target address. A new donation record is created, and an event is emitted to notify stakeholders of the successful donation.

Algorithm 3 SendFund Internal Function

Input : campaignid
Output: Funds sent if completed
if *campaignld >= campaignCounter* **then**
| **revert** CampaignDoesNotExist()
end
if *listCampaigns[campaignld].completed == true* **then**
| **revert** CampaignAlreadyCompleted()
end
// Send amount of fund to the target address
(bool result,) =payable(listCampaigns[campaignld].targetAddress).callvalue:
listCampaigns[campaignld].amount ("")
if *result == false* **then**
| **revert** SendAmountFailed()
end
// Set completed the campaign
listCampaigns[campaignld] completed = true
emit CampaignCompleted(campaignld)

D) Tracking Contributions

Donors can track their contributions and monitor the utilization of funds through the functionalities provided by the Decentralized Charity Portal.

a) Listing Campaigns: The platform enables donors to view a list of active campaigns, including both direct beneficiary support campaigns and community relief campaigns. By calling the getCampaigns() function, donors can retrieve information about ongoing campaigns, such as campaign details, target amounts, and current campaign status.

b) Viewing Donations: Donors can access detailed information about their contributions to specific campaigns by utilizing the getDonations() function. This function provides donors with a list of all donations made to a particular campaign, allowing them to track their individual contributions and verify the accuracy of recorded transactions.

c) Checking Contribution Totals: To gain insights into their overall impact, donors can utilize the getContributions() function to retrieve the total amount of contributions they have made across all campaigns. This functionality allows donors to assess their level of engagement and track their cumulative impact on charitable initiatives.

By leveraging these tracking functionalities, donors can ensure transparency and accountability in the allocation and utilization of their contributions within the Decentralized Charity Portal.

Algorithm 4 Get Campaigns function

Output: List of Campaigns
function getCampaigns() **public view returns** (Campaign[] memory)
{ **return** listCampaigns }

Algorithm 5 Get Donations function

Input : campaignid
Output: List of donations for the specified campaign
if *campaignld* >= campaignCounter **then**
| **revert** CampaignDoesNotExist()
end
return contributionFunds[campaignld]

Algorithm 6 Get Contributions function

Input : author
Output: Total amount of contributions made by the specified author
return contributionAuthors[author]

E) Volunteering

The Decentralized Charity Portal streamlines the volunteering process, connecting volunteers with relevant opportunities and facilitating efficient collaboration between volunteers and NGOs.

a) Finding and Applying for Opportunities: Volunteers explore and apply for opportunities directly through the platform, filtering them based on criteria such as skills required and time commitment. The platform fetches opportunity data from the blockchain, providing real-time updates on available roles. Volunteers submit their qualifications and additional information for consideration, streamlining the application process and enhancing transparency.

b) Approval Process: NGOs review volunteer applications and select candidates based on their qualifications and suitability for specific roles. Smart contract functionalities validate volunteer credentials and facilitate communication between NGOs and volunteers, ensuring an efficient and transparent approval process. Through these mechanisms, the Decentralized Charity Portal optimizes resource allocation and maximizes the impact of volunteer efforts

F) Transparency Measures

Transparency is a core principle of the Decentralized Charity Portal, supported by blockchain technology and smart contract functionalities to provide stakeholders with real-time insights and accountability.

G) Offramp Conversion

Our Portal integrates the Transak API to seamlessly convert cryptocurrency, particularly Ether, into beneficiaries' local currencies, enabling direct fund disbursement into their bank accounts. This integration involves registering for API keys, configuring parameters, and setting up webhook endpoints as per Transak's documentation. Upon achieving the funding goal, the platform triggers the conversion process, transferring Ether to Transak for currency conversion based on beneficiary bank details.However this feature can be used only when the contract is deployed in the main network.

H) Real-time Updates

All financial transactions and fund usage are recorded on the blockchain, providing donors with real-time updates on campaign progress and fund allocation. Smart contract events and logs facilitate transparent reporting, enabling stakeholders to track contributions and monitor campaign performance.

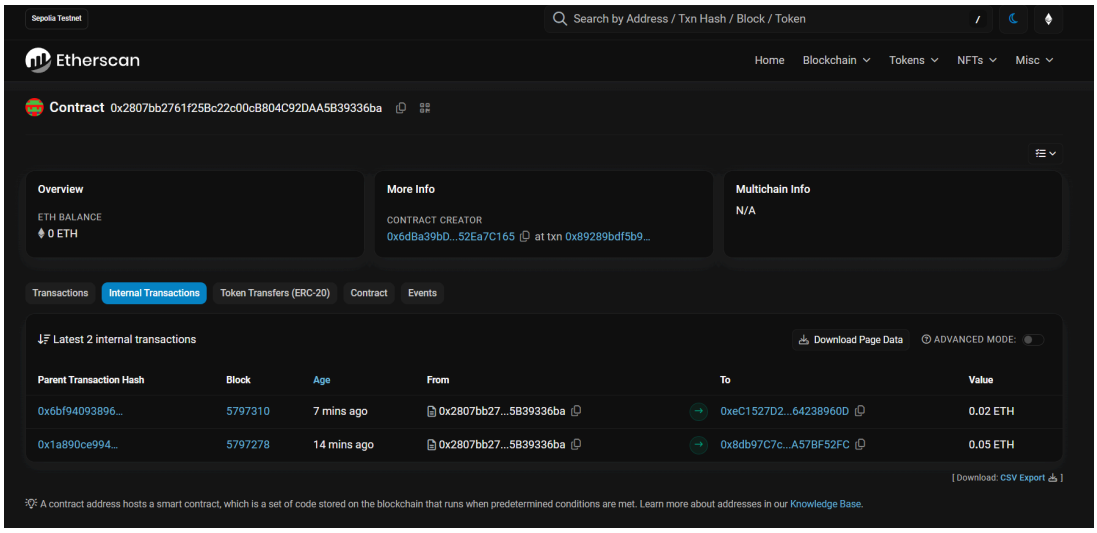


FIGURE 4. Internal Transactions (SendFund) In The Sepolia Test Network

I) User Surveys and Feedback

Regular surveys and feedback mechanisms gather user experiences and suggestions for platform improvement. Smart contract functionalities record user feedback on the blockchain, enabling data-driven decision-making and iterative development

J) Performance Analytics

The platform utilizes analytics to monitor user engagement, campaign success rates, and overall platform performance. Smart contract events and logs capture performance metrics on the blockchain, providing insights for optimization and enhancement..

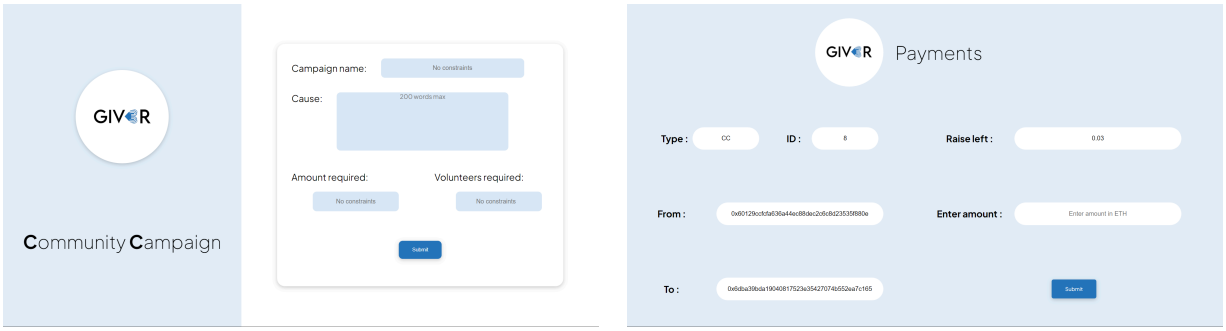
RESULT

The implementation of the Decentralized Charity Portal is poised to bring forth a myriad of positive outcomes across various stakeholders. Donors will benefit from heightened confidence due to transparent fund tracking, fostering increased trust and a willingness to contribute more. Additionally, the utilization of blockchain technology is expected to streamline fundraising efforts, resulting in swift and successful campaign completions, ultimately meeting funding goals efficiently. Moreover, volunteers are anticipated to engage more actively with the platform, attracted by centralized opportunities, transparent operations, and rewarding incentives such as NFTs and recognition certificates. This active participation is set to catalyze more dynamic and effective volunteer work, fostering a sense of community among users and strengthening bonds within the charity ecosystem.

Furthermore, the platform's rigorous verification processes for charity organizations will boost overall credibility, attracting genuine and impactful campaigns. Robust security measures and compliance standards will instill user confidence, minimizing security incidents and ensuring a safe environment for all users. As user registrations continue to grow, driven by the platform's popularity, continuous feedback-driven iterations will lead to enhanced user satisfaction and functionality. Comprehensive documentation will aid users in navigating the platform effectively, further contributing to improved user experience and operational efficiency.

CONCLUSION

In conclusion, the Decentralized Charity Portal represents a significant leap forward in the philanthropic sector, leveraging cutting-edge technology to address long-standing challenges such as transparency, efficiency, and donor engagement. By utilizing blockchain and smart contracts, the platform ensures that every donation is traceable and that the utilization of funds is transparent, instilling confidence among donors and fostering a culture of accountability within charitable organizations.



(a) (b)

FIGURE 5. Screenshots from The WebApp, (a) Creating A Campaign, (b) Donating To A Campaign

The implementation of a user-friendly interface combined with the direct engagement of donors and volunteers further enhances the effectiveness of charitable campaigns. This not only improves the overall donor experience but also maximizes the impact of contributions by streamlining the process and reducing administrative overheads. The portal's ability to connect volunteers with opportunities and offer rewards in the form of digital assets underscores a modern approach to volunteerism that is both engaging and rewarding.

Moreover, the architecture of the system built on robust technologies and designed for scalability and security ensures that the platform can handle growing volumes of users and transactions without compromising performance or user data.

Overall, the Decentralized Charity Portal stands as a model of innovation in digital philanthropy, setting new standards for transparency and efficiency while actively fostering a sense of community among its users. Its continued evolution, driven by user feedback and technological advancements, will likely influence the broader landscape of charitable giving, making it more accessible, accountable, and impactful. Through this platform, the future of philanthropy looks not only more transparent but also more participative and aligned with the digital age.

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