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Decentralized Charity Portal: Empowering Transparent Philanthropy through Blockchain Technology

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Abstract. Transparency and efficiency of the process of charitable contributions are of utmost importance to the sector of philanthropy. This paper suggests a decentralized charity platform capable of solving the pressing problem of a transparent and easy-to-use system that connects donors and beneficiaries with a broad range of charity organizations. The platform's architecture enables registration of users, such as donors, volunteers, beneficiaries, NGOs, and service providers, and implies verification mechanisms to exclude non-legitimate actors. There are two campaign types: Direct Beneficiary Support Campaigns, aiming to collect money for a particular recipient, professional service providers, and NGOs, and Community Relief Campaigns, aiming to gather money for services and allocate funds between service providers. Donors can track the way the funds have been utilized during their contribution, while volunteers work similarly to donors but choose among the opportunities provided by NGOs. Donors receive reports with the list of funds spent and raised during various campaigns, which enables accountability and builds trust. Beneficiaries might turn cryptocurrency received during the campaign into their local currency, transferred to native bank accounts, ensuring financial accessibility. The platform is tailored to navigate through the pitfalls of traditional donation methods and scattered volunteer work, maximizing the charitable effect on societal needs

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

INTRODUCTION

In response to the growing need for transparent and efficient philanthropy, this paper presents a decentralized charity platform leveraging Blockchain Technology. By harnessing Blockchain's immutable ledger, the platform ensures the integrity of transactions, bolstering security and trust among users. The primary goal is to streamline charitable contributions by providing a seamless interface for registration, donation, campaign hosting, and volunteer engagement, all while verifying the legitimacy of participating entities.

The platform supports two campaign types: Direct Beneficiary Support Campaigns and Community Relief Campaigns. Donors can track the progress of their contributions in real time, fostering trust and accountability. Additionally, innovative features such as beneficiary payout conversion enable seamless fund transfer and financial accessibility. Through smart contracts, the platform automates predefined actions, eliminating intermediaries and reducing exploitation risks.

By incorporating Blockchain technology, the Decentralized Charity Portal enhances security and transparency, while also streamlining processes. This initiative not only represents a technological innovation but also a step towards more accountable and impactful philanthropy. With every donation transparent, every volunteer effort efficiently coordinated, and every beneficiary receiving timely support, the platform promises 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 our 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 introduced as a blockchain-based smart contract management framework aimed at scalability. It employs two distinct blockchains for contract and transaction storage, enhancing resource utilization and potentially increasing transaction speeds. Real-world testing scenarios involve 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 like process automation, security, and decreased reliance on intermediaries while striving to improve scalability and transaction speeds.

In [2], a Decentralized Donation Tracking System on the Ethereum Blockchain is proposed for transparent fund distribution. Operating without centralized entities, users interact with 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 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 in the blockchain, providing trust, traceability, and irreversibility without intermediaries. Users interact with smart contracts, with transactions stored in a pool awaiting validation by nodes. Smart contracts offer reliability and decentralization, eliminating the need for trusted third parties and enabling secure interactions on the blockchain.

In [4], trust issues in the cryptocurrency ecosystem are addressed, proposing solutions for immediate, short-term, and long-term resolutions. Establishing 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 drive financial institutions and the mainstream economy, necessitating comprehension of technical and non-technical implications among stakeholders.

In [5], 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 system architecture of the Decentralized Charity Portal is designed to foster a transparent, efficient, and secure environment for charitable contributions and volunteer management through the integration of cutting-edge technologies such as blockchain, modern web frameworks, and database systems. This architecture encapsulates various layers including the frontend, backend, blockchain, and database components, each playing a pivotal role in ensuring the seamless operation of the platform. Below, each component is detailed for clarity and comprehension.

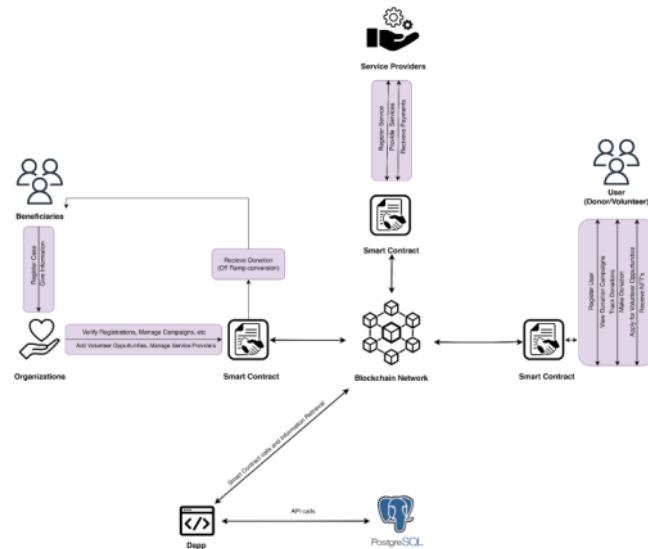


FIGURE 1. System Architecture

The decentralized charity platform is architected to seamlessly integrate simplicity with effectiveness across its backend, frontend, and blockchain components. At the backend, powered by Next.js, the core engine orchestrates user authentication, campaign life cycles, and interactions with the Ethereum blockchain network, ensuring fluid operations and real-time transaction tracking. Critical functionalities are governed by smart contracts deployed on the Ethereum network, ensuring transparency in campaign details, fund utilization, and immutable transaction recording. Meanwhile, PostgreSQL serves as the repository for non-blockchain data management, optimizing data retrieval processes and facilitating smooth communication between frontend and backend. The frontend, also leveraging Next.js, offers an intuitive and responsive user interface, seamlessly integrated with the backend through API routes. Notably, the integration with the Ethereum blockchain network, facilitated by Metamask wallet, ensures security, transparency, and trust, while an off-ramp conversion feature enables direct conversion of cryptocurrency into beneficiaries' native currency, deposited into their bank accounts via Transak API. This holistic architecture positions the platform at the forefront of technological innovation, showcasing the transformative potential of blockchain in revolutionizing charitable 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.

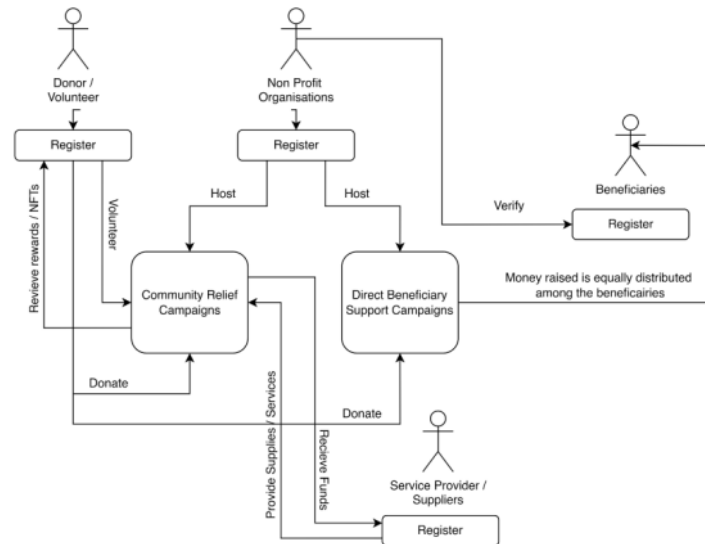


FIGURE 2. Workflow Diagram

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.

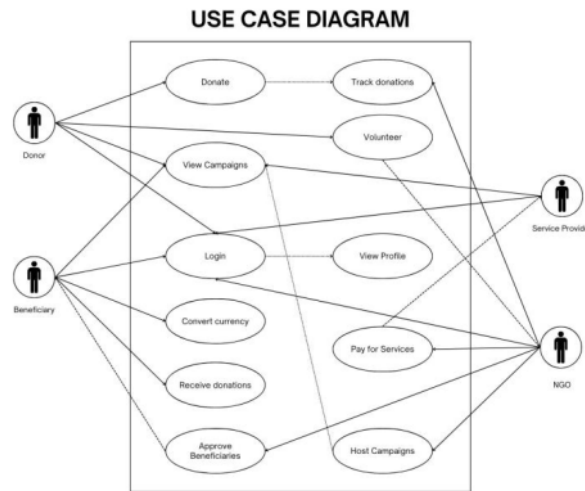


FIGURE 3. Use Case Diagram

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 ⁴personal 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 : campaignId, msg.value
Output: New donation made
Declare uint256 amount = msg.value
if amount <= 0 then
| revert AmountlessThanZero()
end
if campaignId >= campaignCounter then
| revert CampaignDoesNotExist()
end
if listCampaigns[campaignId].completed == true then
| revert CampaignAlreadyCompleted()
end
// Update amount of contribution for author
contributionAuthors[msg.sender] += amount
// Update amount of campaign
listCampaigns[campaignId].amount += amount
if listCampaigns[campaignId].amount >= listCampaigns[campaignId].targetAmount then
| sendFund(campaignId)
end
// Create new donation
Donation memory donation = Donation(amount,msg.sender)
contributionFunds[campaignId].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 campaignId >= campaignCounter then
| revert CampaignDoesNotExist()
end
if listCampaigns[campaignId].completed == true then
| revert CampaignAlreadyCompleted()
end
// Send amount of fund to the target address
(bool result, ) = payable(listCampaigns[campaignId].targetAddress).callvalue:
listCampaigns[campaignId].amount ("")
if result == false then
| revert SendAmountFailed()
end
// Set completed the campaign
listCampaigns[campaignId].completed = true
emit CampaignCompleted(campaignId)
```

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 campaignId >= campaignCounter **then**
| **revert** CampaignDoesNotExist()
end
return contributionFunds[campaignId]

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.

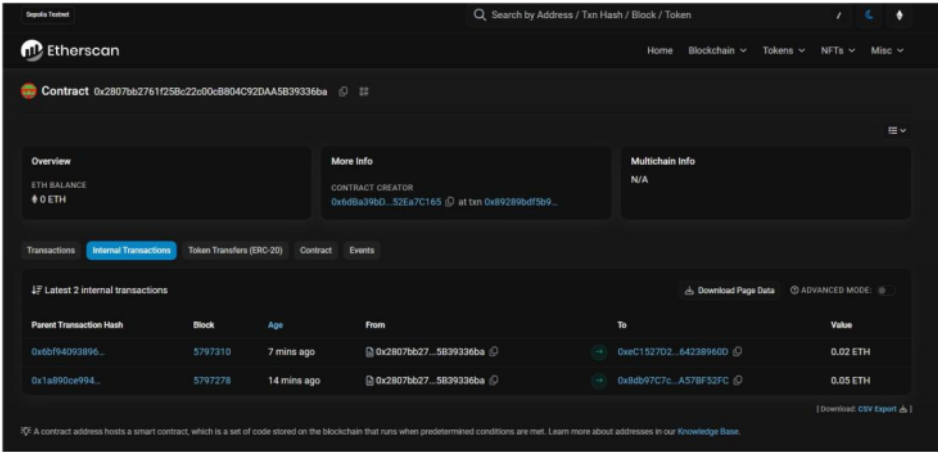


FIGURE 4. Internal Transactions (SendFund) In The Sepolia Test Network

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

2 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.

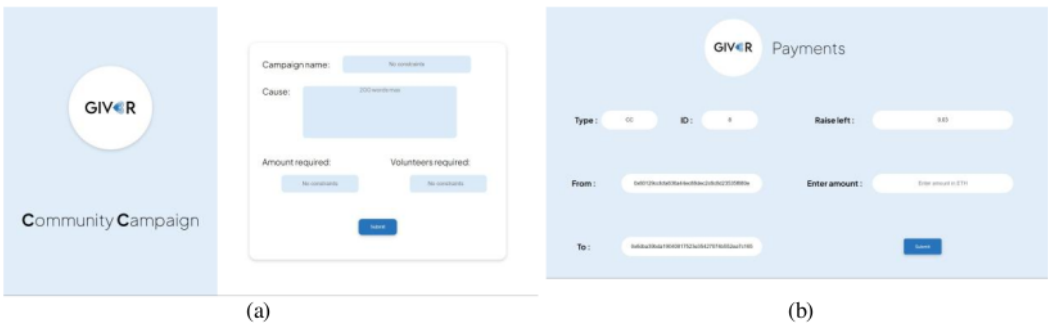


FIGURE 5. Screenshots from The WebApp, (a) Creating A Campaign, (b) Donating To A Campaign

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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