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Blockchain-Based Transparent Charitable System: A New Era of Ethical Giving

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***Abstract*—**Charity, a universal moral duty involving substantial monetary donations for philanthropic causes, often grapples with issues of transparency and accountability within charitable organizations, causing donor concerns about the impact of their contributions. A solution lies in leveraging blockchain technology, which provides a decentralized and secure donation management system. It records each transaction on an immutable ledger, guaranteeing that funds reach their intended recipients and employs smart contracts to automate and streamline the process, reducing administrative costs and ensuring more of the funds directly benefit beneficiaries. This approach not only ensures transparency and accountability but also serves as a strong barrier against fraud, potentially revolutionizing the charity sector by reestablishing donor trust and facilitating more effective, accountable, and sustainable charitable initiatives.

Keywords— Charity, Transparency, Accountability, Blockchain technology, Smart contracts

I. INTRODUCTION

Throughout the course of human civilization, charity has stood as a foundational moral duty, aiming to alleviate the suffering of those in need and contribute to the betterment of our world. This commitment to charitable giving has seen a significant jump in recent times, with millions of individuals and organizations worldwide generously donating funds to various causes each year. Nonetheless, the charitable sector faces a profound challenge - the lack of transparency and darkness in the collection and utilization of these donations. The resultant erosion of donor trust, ascribed to the charity sector's struggles with transparency and accountability, has led to a significant decline in contributions, marking a troubling loss of faith in the very essence of charity.

The emergence of blockchain technology offers a potential solution for this widespread issue. Operating as a decentralized and secured platform, blockchain ensures an extraordinary level of transparency and accountability in financial transactions. Recent years have witnessed a growing interest in using blockchain's capabilities for social impact, particularly in the context of charitable donations. This paper embarks on a journey to explore the latent potential of a charitable system underpinned by blockchain, revealing the various advantages it holds for the current struggling charity sector.

Charitable organizations are the foundation of societal support structures, dedicated to offering aid to those in need. Their operations are intrinsically reliant on financial contributions, yet the charity sector finds itself ensnared in the quagmire of non-transparency. Numerous organizations remain opaque concerning their financial activities and inner workings, with harmful consequences on the trust and confidence vested by donors. This unfortunate lack of transparency poses a powerful hurdle, obstructing donors from confirming the destination of their contributions, their effective deployment, and the tangible impact created.

Regrettably, the absence of transparency has also opened the door to instances of misleading and the misappropriation of donations. In some disheartening cases, charitable entities have diverted funds toward unrelated expenses, reneged on their commitments, or altogether misused the contributions entrusted to them. Such episodes have further corroded public faith in the charity sector, making it increasingly challenging for genuinely benevolent organizations to attract and retain the support they need.

II. LITERATURE SURVEY

In 2022, Y. Jia, Y. Yang, X. Luo, Y. Song, and J. Zhang proposed a blockchain-based platform to facilitate donations for charitable organizations. Their system seeks to enhance the transparency and accountability of donations by utilizing blockchain technology. The platform boasts several key features, such as smart contracts, which automatically carry out donation agreements, consensus mechanisms, guaranteeing that all transactions are verified and agreed upon by a network of participants, and an auditing system, enabling continuous monitoring of transactions. This combination of features guarantees that donations are managed effectively, and donors can have confidence that their contributions are being handled responsibly[1]. In 2021, J. Liu, Z. Gao, Y. Yang, J. Liu, and C. Zhang a system was developed to facilitate a blockchain-based system to facilitate charitable donations. Their innovation lies in the process of tokenizing donations, which motivates donors by providing them with tokens that symbolize their contributions. These tokens can be utilized to motivate individuals to engage in activities or to offer incentives for their efforts. The platform prioritizes transparency, ensuring that the donation process is visible and verifiable to all participants involved. The system underwent testing with a prototype, showcasing positive outcomes like higher donor involvement and a substantial decrease in fraudulent activities, thereby validating the potential of tokenization to encourage more individuals to contribute while guaranteeing the secure and transparent management of funds[2].In 2020, A. Rahman, M. S. Hossain, S. Saha, and M. A. Hossain proposed a blockchain-based charity donation system that employed smart contracts to guarantee the integrity of the donation process. Their platform prioritizes transparency and accountability, aiming to provide donors with peace of mind by streamlining the transaction process. The prototype was put to the test, and the results demonstrated that it could enhance donor confidence and minimize the risk of fraudulent activities. By leveraging blockchain's decentralized structure, the solution guarantees that once a donation is made, the funds cannot be misappropriated or diverted[3]. In 2020, S. Shams, M. A. Hossain, M. A. Hasan, and S. R. Chowdhury, a real-time tracking system for charity donations using blockchain was proposed. Their platform includes a tokenized system to track and verify donations as they are made, allowing donors to view their contributions in real-time. Additionally, the system features a decentralized application (DApp) where donors can monitor the progress and impact of their donations, making the donation process more interactive and transparent. This real-time tracking capability boosts donor confidence and ensures accountability at every stage[4]. In 2020,Q. Ma, Y. Wang, and Y. Zhang proposed a blockchain-based platform focused on tracking donations and ensuring transparency in how funds are distributed. Their platform also uses smart contracts to automate the donation and distribution processes and includes an auditing system to provide transparency. The addition of auditing ensures that every donation is correctly accounted for, fostering greater trust between charitable organizations and their donors[5]. In 2020, A. Khan, A. Ali, A. R. Khan, and R. U. Khan proposed a tokenized platform for transparent charity donations. Their system not only tracks donations in real-time but also includes features such as smart contracts, consensus mechanisms, and an auditing system. These features collectively ensure that every donation is tracked and verified, making it impossible for funds to be misused. The consensus mechanism adds an additional layer of security by verifying all transactions across the network before they are executed, ensuring that the entire donation process is both transparent and trustworthy[6]. In 2019, H. Cheng, Y. Zhang, X. Hu, Y. Wang, and L. Zhang developed a real-time blockchain-based donation platform that allows for the real-time tracking of donations. This system provides transparency and a more efficient way to distribute charitable funds. By allowing donors to see exactly where their money is going, the platform builds trust and eliminates concerns about misuse of funds. Real-time tracking also ensures that funds reach their intended beneficiaries promptly and without intermediaries[7]. In 2019, J. Lee, Y. K. Kim, and H. Kim proposed a blockchain-based platform that utilizes a tokenized system to incentivize donors. Similar to later proposals, this platform focuses on increasing donor participation by offering tokens as rewards for contributions, while ensuring transparency in the distribution process. This system was also tested using a prototype and showed promising results in reducing fraud and increasing engagement by offering incentives to donors[8].

III. PROPOSED FRAMEWORK

1.Methodologies and Terminologies

In the context of creating a transparent charity system, it's crucial to understand the fundamental methodologies and terminologies that underpin the proposed solution. This understanding provides the foundation for the implementation of an efficient and accountable donation management system.

a)Blockchain: Blockchain technology is a revolutionary decentralized ledger system designed to facilitate the monitoring of assets and the recording of transactions across a network of participants. It offers immediate, shared, and transparent data on an immutable ledger accessible exclusively to network members with permission. An election algorithm plays a crucial role in determining which node within the network will append the next block of transactions to the blockchain. This approach ensures the decentralized and trustless maintenance of the blockchain, eliminating the need for reliance on any single node or entity to have absolute control over the network.

b)Ethereum: Ethereum is a decentralized blockchain platform that empowers participants to engage in various business activities without the need for central authority or intermediaries. Transactions on Ethereum are

executed through user-created accounts, and senders are required to sign transactions and allocate Ether as needed. Ethereum has fostered a vibrant digital economy, ushering in novel online income opportunities for content creators, developers, and entrepreneurs.

c)Smart Contract: Smart contracts are self-executing agreements established between two or more parties, designed to execute predefined business logic on a blockchain that can be transparently monitored. These contracts represent value streams that are subject to specific terms and conditions, constituting pre-programmed code inscribed on the blockchain. They possess the ability to autonomously perform computations, store data, and facilitate the automatic movement of assets, streamlining complex processes with enhanced transparency.

d) Digital Wallets (Metamask): Digital wallets are integral components of blockchain-based systems, enabling users to securely store, manage, and transact digital assets, including cryptocurrencies like Ether in the case of Ethereum-based platforms. Metamask, in particular, is a popular digital wallet and browser extension specifically designed for Ethereum and Ethereum-based tokens. It allows users to access decentralized applications (DApps) on the Ethereum network, facilitating seamless interactions with smart contracts and blockchain-based services while ensuring robust security measures to protect users' private keys and assets. Metamask has gained significant recognition within the blockchain and decentralized finance (DeFi) communities, providing a user-friendly gateway to the world of blockchain and decentralized applications.

1. 2. System Architecture

2. Prior research efforts have prepared the way for the development of comprehensive systems designed to interlink three crucial modules within the realm of charitable donations. These modules are adeptly structured to streamline the intricate processes of collection, tracing, and distribution of donations, consequently reinforcing the trust of donors and securing the efficient transfer of contributions to their designated beneficiaries. This approach operates through a careful organization of three pivotal domains: the beneficiary, non-governmental organizations (NGOs), and the donors themselves. By establishing a well-defined, transparent, and accountable framework that seamlessly connects these entities, these systems aim to mitigate the issues of transparency, accountability, and efficiency that often plague the charity sector. This not only safeguards the intent and impact of donations but also cultivates a stronger sense of trust and reliability among donors, facilitating the realization of charitable initiatives with greater efficacy and integrity.

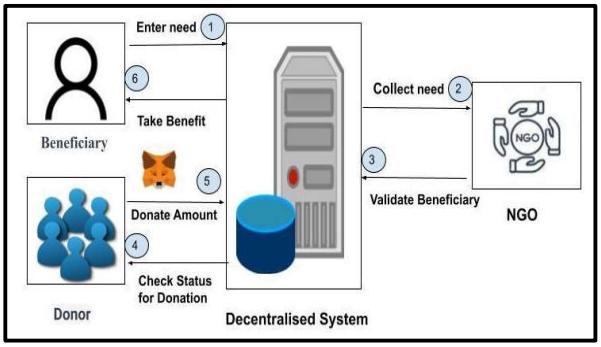

Fig. 1 System Architecture

In an implemented system, a network of modules collaborates seamlessly to oversee the multifaceted aspects of donation management. The donation management module assumes a pivotal role by meticulously handling the collection, processing, and equitable distribution of donations, assuring that these contributions efficiently reach their intended destinations. Concurrently, the beneficiary management module operates diligently to verify and authenticate beneficiaries, ensuring that those in need receive the support they require. On the donor front, the donor management module plays a crucial part by maintaining comprehensive donor records and actively fostering donor relationships. This well-integrated approach not only guarantees transparency, accountability, and efficiency in the donation process but also actively contributes to bolstering the trust and confidence of donors in the charitable ecosystem. By harmonizing these modules, the system creates a robust foundation for charitable endeavors, allowing for greater impact and integrity in the allocation of resources to those who need them most.

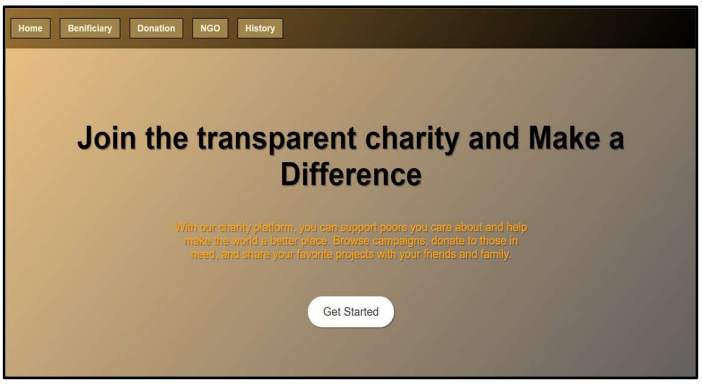

Fig. 2 Home Page

A) Beneficiary : The first and most crucial module of the system is the beneficiary module. This module allows anyone who has a valid demand and proof of demand to request funds from the system. The inclusivity and accessibility of this module is essential, as the system's primary objective is to ensure that financial assistance is readily available to anyone genuinely in need. It plays a pivotal role in expediting the distribution of charitable donations to those who require it most, prioritizing ease of access and user-friendliness. By fostering a system that places the beneficiary module at the forefront of its design, the platform actively seeks to bridge the gap between donors and those seeking assistance, ultimately promoting a more equitable and efficient approach to charitable endeavors.

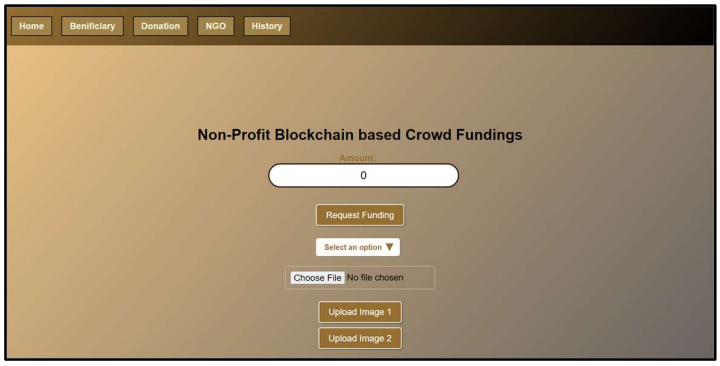

Fig. 3 Beneficiary Page

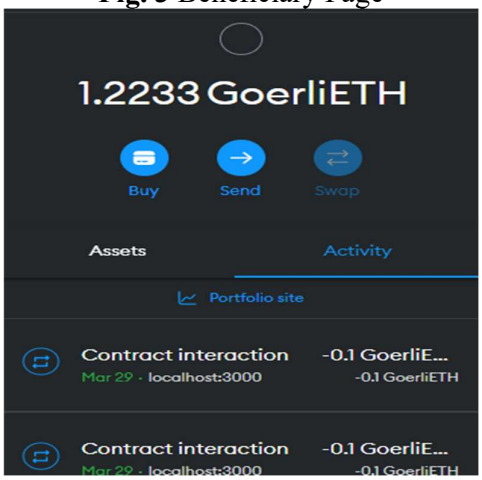

Fig. 4 Metamask Wallet

B) NGO's **:** The NGO module assumes a critical role in the system by taking on the responsibility of verifying the legitimacy of beneficiaries who have looked for financial assistance through the platform. This verification process is systematically conducted by accredited Non-Governmental Organizations (NGOs), who diligently examine the documentation and information submitted by the beneficiary during the fund request procedure. The overarching objective of this module is to ensure the utmost transparency and integrity in the allocation of resources, safeguarding against potential misuse or fraudulent claims. Through this rigorous validation

conducted by trusted NGOs, the system establishes a robust layer of scrutiny that bolsters the credibility and trustworthiness of the charitable distribution process, ultimately ensuring that donations reach those who genuinely require them and merit such assistance.

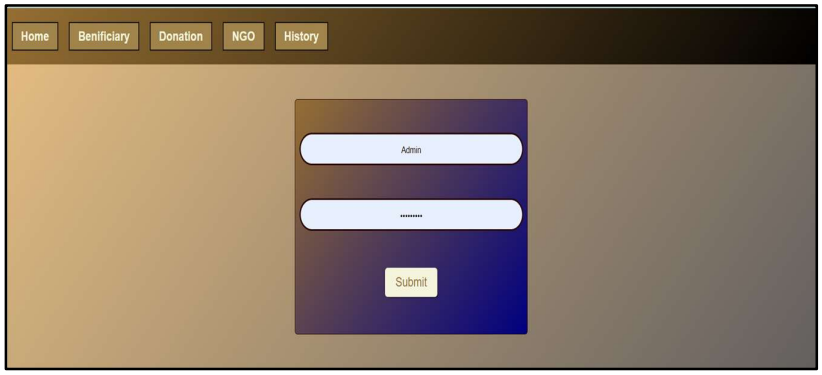

Fig. 5 NGOs Login Page

Within the system, access to the NGO module is carefully regulated, with only NGOs possessing valid government permits granted a unique ID and password. This rigorous access control mechanism is instrumental in safeguarding the system's integrity. The NGO module meticulously scrutinizes the demands put forth by beneficiaries, verifying their authenticity and faithfulness to the eligibility criteria established by the system. This dedicated verification process serves as a robust defense against fraudulent activities, ensuring that donated funds are channeled exclusively to their intended recipients. By conferring access solely to accredited and verified NGOs, the system not only fortifies the verification process but also guarantees its efficiency and effectiveness. This stringent access control mechanism is pivotal in upholding the system's commitment to transparency and accountability, thus nurturing donor trust and the overall integrity of the charitable distribution process.

Fig. 6 NGO Page

C) Donor **:** The donor module is designed to be accessible to anyone possessing a Metamask or any digital wallet account, offering a user-friendly gateway for individuals to contribute funds to validated beneficiaries whose legitimacy has been confirmed by accredited NGOs. This module is crafted with a dual focus on donor privacy and the effective channeling of charitable donations. Donors can seamlessly make contributions via their Metamask account, ensuring a streamlined process that neither compromises their own privacy nor violates the confidentiality of beneficiaries. This careful balance is helpful in generating trust within the system. It assures donors that their personal information remains confidential while enabling them to actively participate in philanthropic efforts. By leveraging the accessibility and convenience of a Metamask account, the donor module serves as a secure, straightforward, and efficient channel for donors to contribute to the system's charitable causes, thereby facilitating the seamless flow of donations to those who require them most.

Fig. 7 Donation Page

D) Transaction History **:** A history module has been developed for the platform that displays all the transactions made, ensuring transparency and accountability. The module uses Etherscan to facilitate this process.

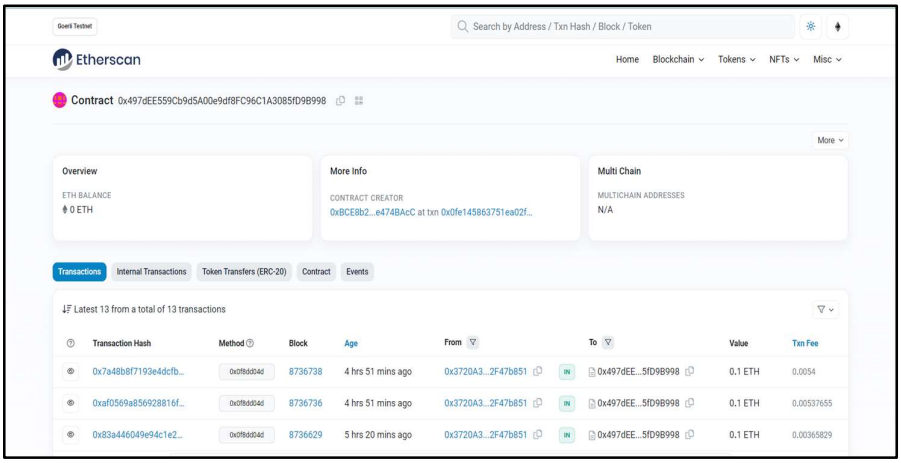

Fig. 8 Transaction History Page

This system facilitates the donation process by integrating donors, beneficiaries, NGOs, and other parties. It aims to increase transparency and accountability by verifying beneficiaries through NGOs. This ensures that only valid and deserving beneficiaries receive donations, which in turn gains the trust of donors. Overall, the system enhances the efficiency of the donation process while ensuring that donations are distributed to those who truly need them.

3. Flow of Proposed System

The proposed system uses blockchain technology to trace charity donations and ensure that all conditions are met during the donation process. It consists of a public-permissioned ethereum chain and smart contracts written in solidity. The system integrates several components to provide the necessary functionalities and verify that the required conditions are met. The architecture flow is designed to track the donation flow, record donation details, and ensure transparency and accountability in the donation process. Overall, the system aims to increase trust and transparency in charity donations using blockchain technology. Fig. presents the flow of the system, which is principally designed to trace charity donations and verify that the necessary conditions have been satisfied during the donation process.

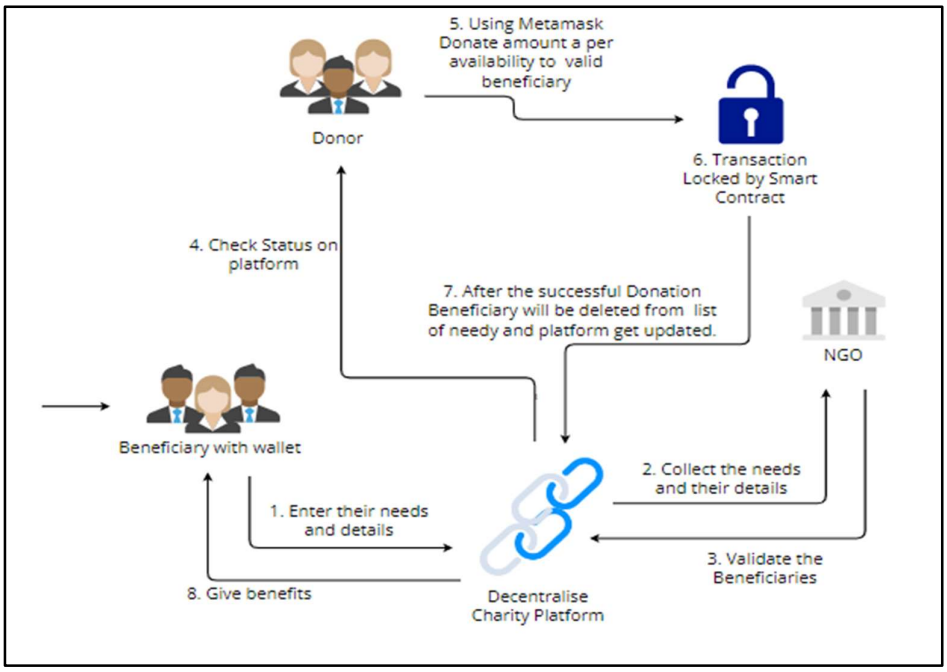

Fig. 9 Proposed Framework

Process:

1. The user accesses the platform and selects their role as either a beneficiary, donor, or NGO.
2. If the user selects the beneficiary module, they will be prompted to select the type of fund required, such as primary needs, education, or medical etc.
3. The beneficiary will then need to request a certain amount of funds by uploading necessary documents to support their request.
4. After the beneficiary submits their request, the NGO verifies the documents and their purposes to ensure the request is valid.
5. If the NGO approves the request, it is then passed to the donor page. If the NGO does not approve the request, it is deleted.
6. Approved requests are visible on the donor page, where donors can log in and check the status of the beneficiary amount on the platform.
7. Donors can then check their account balance from their Metamask Wallet and donate the amount they wish to donate.
8. Once a donation is made, the beneficiary request is deleted from the list of beneficiaries as well as the donor page.
9. A history module is created to show all the transactions made on the platform, providing transparency and accountability with the help of Etherscanner.

1.Login Process:

NGO Module:
FUNCTION handleSubmit NGO(e): *PREVENT default behavior of event e;* *IF (username equals "Admin Name" AND password equals "Password"):* *SET isLoggedIn to true;* *ELSE:* *DISPLAY alert message "Wrong ID or Password";* *ENDIF* *ENDFUNCTION*

The user enters a username u and password p, which are then compared to the correct admin username $Uadmin$ and password $Padmin$. If both the entered username and password match the correct credentials, the boolean variable `$isLoggedIn'$ is set to `true`, indicating a

successful login. If they do not match, an alert is displayed with the message "Wrong ID or Password," and the login attempt is considered unsuccessful (`$isLoggedIn = false$'). This logic prevents further actions unless the correct credentials are provided.

$$f(u,p) = \begin{cases} \text{isLoggedIn} = \text{True}, & \text{if } u = U_{\text{admin}} \text{ and } p = P_{\text{admin}}, \\ \text{isLoggedIn} = \text{False and Alert} = \text{"}WrongIDorPassword\text{"}, & \text{otherwise.} \end{cases}$$

3. 2. Finding Request for transaction mining can define as follows:

Requesting Funding:
ASYNC FUNCTION requestFunding(address, amount, userAddress): *TRY:* *CALL web3.eth.getBalance(address) and store the result in balance variable* *DISPLAY "Balance is ->" message followed by web3.utils.toWei(balance, "ether")* *DISPLAY "Amount is ->" message followed by web3.utils.toWei(amount, "ether")* *CALL web3.eth.getAccounts() and store the result in accounts variable* *CALL fundingContract.methods.requestMoney(address, web3.utils.toWei(amount, "ether")).send() with options object { from: userAddress, value: web3.utils.toWei(amount, "ether"), gas: 2562600 } and store the result in receipt variable* *DISPLAY "Transaction successful! Receipt:" message followed by receipt* *RETURN resolved Promise with receipt* *CATCH error:* *DISPLAY "An error occurred while trying to request funding: " message followed by error* *RETURN rejected Promise with error* *ENDTRY* *ENDFUNCTION*

4. $F(a,x)$ represents a funding contract request where a is the target address, and x is the requested amount in Ether.$Wei(x)$ converts Ether to Wei.

$$\text{FundingRequest}(a,x,u) = \begin{cases} r = F(a, x_{\text{wei}}), & \text{if transaction is successful,} \\ E, & \text{if an error occurs.} \end{cases}$$

The **requestFunding** function takes three parameters, **address, amount,** and **userAddress.** It first retrieves the balance of the address provided using web3.eth.**getBalance.** It then logs the balance and amount in ether using **web3.utils.toWei.**

It then retrieves the list of available accounts using **web3.eth.getAccounts(),** and uses **fundingContract.methods.requestMoney** to initiate a transaction to request funding with the specified amount, address, and userAddress. The transaction is sent with an options object that includes the amount of gas and the value of the transaction. If the transaction is successful, it logs the receipt and returns a resolved Promise with the receipt.

If an error occurs, it logs the error and returns a rejected Promise with the error.

3. Balance checking process can be defined as follows:

A: Set of all Ethereum addresses.

B(a)B(a)B(a): Balance function for an address a∈Aa Win Aa∈A, which returns the balance of that address.

MMM: Address of the manager (retrieved by calling the manager function).

CCC: Funding contract with methods available for interactions.

Wei(x)\text{Wei}(x)Wei(x): Conversion function from Wei to Ether.

$$\text{CheckBalance}(u) = \begin{cases} \text{Display: "Caller is not the manager"}, & \text{if } u \neq m, \\ ans = \text{Wei}^{-1}(C.\text{checkBalance}()(u)), & \text{if } u = m. \end{cases}$$

If an error occurs during any step:

$$E = \text{Error}(\text{message}).$$

The **checkBalance** function takes one parameter, **setBalance,** which is a callback function used to set the balance state in the component.
The function first retrieves the first account in the list using **web3.eth.getAccounts()** and stores it in the userAccount variable. It then retrieves the **manager** address from the smart contract using **fundingContract.methods.manager().call()** and compares it with the **userAccount.** If the **userAccount** is not the manager, it logs a message and calls the **setBalance** function with the argument "Only manager can access this".

Checking Balance:

```
ASYNC FUNCTION checkBalance(setBalance):
  TRY:
    CALL web3.eth.getAccounts() and retrieve the first account in the list, and store it in userAccount variable
    CALL fundingContract.methods.manager().call() and store the result in manager variable
    IF userAccount is not equal to manager:
      DISPLAY "Caller is not the manager" message
      CALL setBalance function with "Only manager can access this" argument
      RETURN
    ENDIF
    CALL fundingContract.methods.checkBalance().call({ from: userAccount }) and store the result in balance variable
    CONVERT balance from wei to ether and store the result in ans variable
    CALL setBalance function with ans as argument
    DISPLAY "The balance of the account in wei is: " message followed by balance
  CATCH error:
    DISPLAY "An error occurred while trying to check the balance: " message followed by error
  ENDTRY
ENDFUNCTION
```

If the userAccount is the manager, the function calls **fundingContract.methods.checkBalance().call({ from: userAccount })** to retrieve the balance of the smart contract. It converts the balance from wei to ether using **web3.utils.fromWei,** and calls the **setBalance** function with the converted balance as the argument. Finally, it logs the balance of the account in wei.
Using the Template

IV. Result

This blockchain-based transparency model for charitable operations underwent testing across three distinct scenarios: addressing primary needs, facilitating educational initiatives, and catering to medical requirements. During these tests, a variety of individuals submitted requests to accredited NGOs, with multiple requests from different accounts being accepted. In cases where a user submitted the same request multiple times, the NGO efficiently combined them, allowing no further submissions until the initial request received approval. The model's success lay in showcasing how blockchain technology can significantly enhance transparency and accountability within the charity sector. Notably, the system prominently displayed all approved requests on the donor page, providing a clear avenue for contributions. This feature not only ensured that funds were utilized as intended but also empowered donors to monitor the precise allocation of their contributions.

Furthermore, the model harnessed smart contracts to automate the distribution of funds, follows predetermined criteria. This automation served as an effective prevention against fraudulent activities and corruption, fostering the efficient and equitable distribution of resources to those in genuine need. The overarching conclusion from this model's results is that blockchain technology possesses considerable potential for reshaping the charity sector, imbuing it with transparency and operational efficiency. Nevertheless, it's crucial to acknowledge that while blockchain offers significant benefits, it's not a panacea for all the challenges faced by the charity sector. Its effectiveness is most pronounced when used in conjunction with complementary transparency measures and

well-defined regulatory frameworks, thereby ensuring ethical and efficient charitable operations.

V. CONCLUSION

The adoption of blockchain technology using this system in the charity sector has the potential to revolutionize the way donations are made and tracked. By increasing transparency and accountability, donors can feel more confident that their contributions are being used for their intended purposes. The use of this system can also help prevent fraud and corruption by providing a tamper-proof and decentralized system for tracking donations. Additionally, implementing appropriate safeguards and controls can ensure that the personal data of beneficiaries and donors is protected. The charity sector can benefit from the increased efficiency and effectiveness of blockchain technology, allowing for better and faster delivery of aid to those in need. Overall, the integration of blockchain technology into the charity sector can significantly improve trust and confidence in the sector and ultimately lead to more effective and impactful assistance for those who need it most

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