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BLOCKCHAIN BASED GENUINE AND TRANSPARENT CHARITY APPLICATION

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ABSTRACT

In an era where online philanthropy has gained momentum, ensured the authenticity of participants, and maintained transparency in transactions becomes imperative. Addressing these concerns, this research presents a two-fold solution. At the core of this system is a Decentralized Identity Verification feature, which ensures the authenticity of both donors and charity organizers. Participants validate their identities using established documents, which are then verified by respective issuing authorities. This platform enables users to initiate charity campaigns. Potential donors can view these campaigns, contribute as desired, and are further incentivized with a unique NFT (Non-Fungible Token) reward system upon their contributions. These NFTs, serving as digital memorabilia, commemorate the donor's charitable actions, adding an element of appreciation and potential digital value. Moreover, donors witness real-time transparent transactions, ensuring their contributions reach intended beneficiaries. Together, these systems, combined with the allure of NFTs, instill trust in digital charitable endeavors, paving the way for more secure, rewarding, and transparent online giving.

Keywords: *Blockchain, Decentralization, Smart Contracts, Rewards, NFT.*

1. INTRODUCTION

Charitable organizations play a crucial role in addressing social issues and making positive impacts on communities. The digital transformation has seamlessly integrated into our daily lives, influencing various sectors, including the philanthropic domain. Online charitable platforms are gaining traction, offering a convenient avenue for donors to contribute and organizers to seek funds. However, as these platforms multiply, concerns related to authenticity and transparency also amplify. The charity organizations lack transparency, and their supervision is difficult to achieve, which has a negative impact on the willingness of the people to donate. Fake charity fundraising schemes have raised social concern, and a trusted and auditable approach is necessary to manage charity organizations' reputations.

Our project was conceptualized to directly address and mitigate these concerns. By leveraging the robustness of blockchain technology, we aimed to create a system where every transaction, user identity, and reward mechanism is genuine, transparent, and verifiable. We developed a Transparent Charity Application that not only facilitates the creation and donation to charity campaigns but also ensures that every user's identity is vetted and verified, and their generous contributions are acknowledged with unique NFT rewards.

The paper delves into the three main pillars of our solution: The Decentralized Identity Verification system, ensuring the legitimacy of each participant; the Transparent Charity Application, which promotes transparent, accountable fundraising and giving; and the NFT Reward System, which commemorates and incentivizes every act of

donation with a unique digital asset. Together, these components represent a significant leap towards creating a more trustworthy, rewarding, and efficient environment for online charitable activities.

The Decentralized Identity Verification system serves as the gatekeeper, meticulously validating the identity of every participant in the charity chain. This mechanism ensures that every donor, organizer, or beneficiary is genuinely represented, eliminating chances of impersonation or deceit. On the other hand, the Transparent Charity Application revolutionizes the very act of giving. Beyond merely serving as a platform for fundraising, it promises unparalleled transparency. Donors no longer contribute blindly; they can monitor their donations, track campaigns, and witness the real-world impact of their contributions, all in real-time. Further sweetening the experience, every contribution is acknowledged with a unique NFT, serving as a memento of their altruism, and potentially offering digital value. Such visibility not only amplifies trust but also reinforces the belief that every contribution, no matter how small, makes a difference and is appreciated.

As we navigate through this research, we will dissect the intricacies of the modern philanthropic ecosystem, unveil the technological and ideological foundation of our solution, and project its potential implications. Our endeavor is more than just a technological innovation; it is a movement towards a transparent, accountable, and genuine digital philanthropy landscape enriched with rewards that resonate in the digital age.

2. LITERATURE REVIEW

Reference [1] explains the needs and requirements of a self-validating system for a charity application. If provide insights of technologies that can be used to achieve such a system It highlights the use of blockchains to independently verify transaction integrity and consistency. The survey compares consensus algorithms and helped in choosing the best consensus algorithm for the system, focusing on node identity management. It provides information on Ethereum, its importance and reasons to choose it as the platform due to its public nature and scalability. The study emphasizes that the charity system will no longer be monopolized by a single authority and explains how the public can easily access and verify transactions to ensure the proper utilization of funds.

Reference [2] contributes valuable insights into the security aspects of the proposed system. It provides a comprehensive understanding of the system's ability to protect against various attack vectors, making it an important resource for researchers studying the implementation of self-validating systems for charity applications. It focuses on the security evaluation of the proposed system. The reference evaluates the system's security under both informal and formal attack models. The informal attack model considers potential attacks such as user impersonation, guessing-based attacks, man-in-the-middle attacks, and replay attacks. The reference provides a detailed analysis of the system's resilience against these attacks. It examines how the system handles and mitigates each type of attack, ensuring the security and integrity of the charity application. The analysis includes a formal assessment using the AVISPA tool, which further enhances the credibility and reliability of the evaluation. In the context of the literature survey, this reference contributes valuable insights into the security aspects of the proposed system. It provides a comprehensive understanding of the system's ability to protect against various attack vectors.

Reference [3] which is based on a consortium blockchain brief about various donation factors such as the donation agency's reliability, experience, donation target's purpose, amount, professionalism in 34 promotion, easy and safe payment methods, etc. which eventually leads to trust and transparency It also explains system scenarios and a detailed description of various functions of different users and groups residing in the system.

Reference [4] provides valuable insights into the inner workings of the blockchain architecture. It offers a foundation for understanding the technical aspects of transaction processing and highlights strategies for improving the efficiency of the mining process. The reference provides a detailed explanation of the system design and architecture, focusing on how transactions are signed and verified within the blockchain. It outlines the specific mechanisms employed to ensure the integrity and security of transactions. It delves into the role of miners in the system. After the

verification of transaction signatures, miners play a crucial role in the mining process. Their responsibility involves adding new blocks to the blockchain network and incorporating verified transactions into these blocks. One of the key objectives highlighted in the reference is to optimize the efficiency of the mining process. To achieve this, the reference discusses techniques aimed at reducing the processing power required and increasing the speed at which transactions can be mined. These optimizations contribute to the overall performance and scalability of the blockchain system.

Reference [5] discusses the process of converting contract clauses into code and implementing them in software and hardware to automate contract execution. This approach aims to reduce costs, prevent errors, and mitigate malicious behavior during contract execution. The author highlights the advantages of combining blockchain technology with Ethereum. Specifically, they mention the concept of smart contracts The author discusses the process of converting contract clauses into code and implementing them in software and hardware to automate contract execution. This approach aims to reduce costs, prevent errors, and mitigate malicious behavior during contract execution.

Reference [6] underscores the nuanced architecture that forms the very foundation of blockchain-based systems like Bitcoin. This understanding is pivotal as it showcases the ability of blockchain to function in a decentralized manner, eschewing the traditional pitfalls of centralized systems. This research further cements the concept of transactional transparency, an aspect that's indispensable for charity applications aiming for self-validation. The decentralized nature of Bitcoin, driven by its robust peer-to-peer system, echoes the sentiment expressed in Reference [1] about breaking away from a single authoritative control in charity systems.

Reference [7] proffer insights into the world of Bitcoin transactions, laying bare the dichotomies of anonymity and traceability. Their study correlates with the emphasis laid out in both Reference [1] and Reference [2], accentuating the importance of transactional integrity, consistency, and the inherent security aspects vital for a charity application. Their analyses of the anonymity realm in Bitcoin transactions augments our comprehension of potential vulnerabilities and ways to bolster the system against them.

Reference [8] presents a blueprint for organizations to tread the path of decentralized authorizations. Their revelations on "DAuth" resound with the sentiments echoed in Reference [1], especially concerning node identity management. The granular control envisaged in distributed web applications, as delineated by Sabry and his peers, finds resonance in charity applications seeking to decentralize access and authorization.

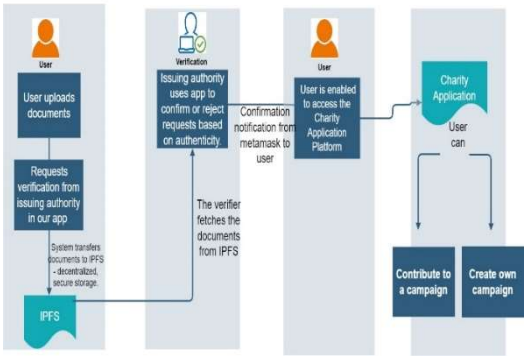

Figure 1 Application Flow Chart Diagram

Reference [9] further elucidates through the empirical analyses of smart contracts by Bartoletti and Pompianu [2017]. Their dissection of the various design patterns and applications, when juxtaposed with the insights from Reference [4] and Reference [5], forges a robust understanding of how blockchain can revolutionize the realm of charitable donations.

Reference [10] illuminates the uncharted territories of integrating IoT with blockchain. Their revelations underscore the endless possibilities of creating trust in a digitized world, echoing the sentiments of creating transparency in charity applications as described in Reference [3]. The ability to embed digital assets into mainstream transactions presents a paradigm shift, one that could redefine how charitable donations are perceived and executed.

3. METHODOLOGY

3.1 Proposed System

The proposed system integrates the Ethereum blockchain with Non-Fungible Tokens (NFTs) to revolutionize charitable giving. By operating in a decentralized framework, it eliminates third-party biases and ensures transparency. Each donation can be associated with a unique NFT, serving as both a testament to the donor's contribution and a potential

digital collectible. This not only guarantees the security and authenticity of transactions but also adds a layer of engagement for donors, making philanthropy more interactive and verifiable. In essence, the system seamlessly blends technology with philanthropy, offering an enhanced experience for all participants.

The system as depicted in *fig.1* lets users both donate using blockchain and employ a Decentralized Identity Verification feature for authenticity. Its capabilities include:

1. Profile creation with authentication via email and Decentralized ID Verification using chosen documents.
2. Access to a comprehensive list of registered charities.
3. Facility to launch charity campaigns for specified causes.
4. Secure and transparent donation capabilities.
5. Blockchain-Backed Donations & NFT Transactions.

Our proposed system operates through a sequence of interconnected steps, ensuring both security and ease-of-use for donors, charitable organizations, and all stakeholders involved. The systematic process, rooted in blockchain technology and integrated with Non-Fungible Tokens (NFTs), is designed to foster trust, transparency, and efficient charitable engagements.

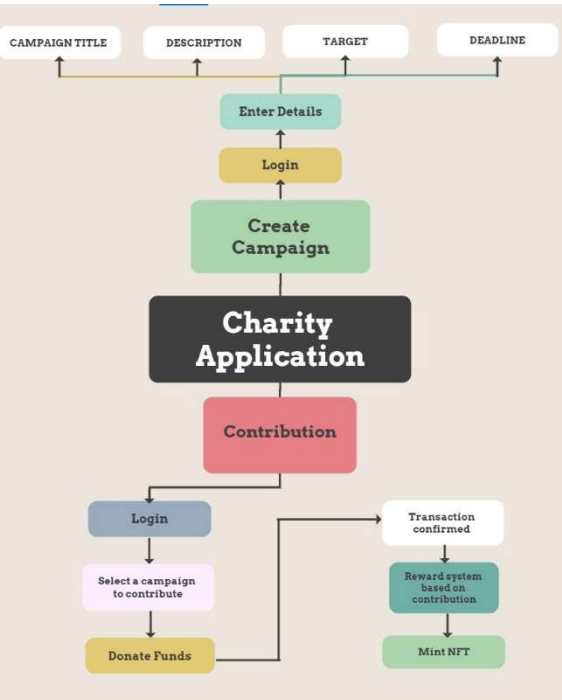

Figure 2 Application Activity Diagram

Here's a detailed breakdown of how the system functions:

1. Decentralized ID Verification:
   i. Initial Step: Before users can even register or create a profile on the platform, they are required to undergo a decentralized identity verification process.
   ii. Document Selection: Prospective users select from a list of acceptable identification documents (e.g., passport, driver's license, Aadhar card) for this verification process.
   iii. Verification Process: These documents are cross-referenced with established authorities to ensure authenticity. Importantly, the system doesn't store the actual documents—instead, it maintains a proof of the document's validity, thereby ensuring user privacy.
   iv. Successful Verification: Upon successful verification, users are granted the permission to proceed to the registration phase.
2. Profile Creation and Authentication:
   i. Registration: Users, once verified, can sign up on the platform using their email address. This ensures an added layer of security and authenticity.
   ii. Email Verification: An automated email verification process cross-checks the provided email, cementing the two-step verification process.
3. Access to Registered Charities:
   i. Comprehensive Directory: Registered and authenticated users can access a curated list of verified charitable organizations. Details about each charity, including their missions, donaors, target and impact metrics, are available.
   .
   ii. Intuitive Search: A user-friendly search functionality, along with filters, allows donors to find

charities based on their preferences.

4. Launching Charity Campaigns:
   i. Campaign Initiation: Users, post their rigorous verification, can set up campaigns detailing their mission, objectives, and fund requirements.
   ii. Updates and Transparency: Charities can provide regular updates on the campaign's progress, total donations, and other relevant metrics, ensuring donor trust.
5. Donation Mechanism:
   i. Blockchain-Powered Donations: The Ethereum blockchain underpins the donation process, ensuring each transaction is transparent, tamper-proof, and verifiable.
6. Blockchain-Backed Donations & NFT Transactions:
   i. Permanent Record: Each donation is indelibly recorded on the Ethereum blockchain, making the process transparent and verifiable.
   ii. NFT Rewards: In acknowledgment of their generosity, donors are awarded unique Non-Fungible Tokens (NFTs). These digital tokens serve as certificates of donation and can also hold sentimental or financial value.

Advantages offered by our integration of blockchain and decentralized ID verification include:

1. Transparency: All donations and identity verifications are blockchain-logged, ensuring donors and organizers alike of the genuine intent.

2. Security: The combined strength of blockchain and decentralized ID checks ensures robust data protection.

3. Efficiency: Reduced transaction fees and a seamless process cater to a frictionless giving experience.

4. Trustworthiness: Decentralized ID Verification validates the genuine nature of donors and organizers, reinforcing trust. The unique nature of NFTs ensures that each token is genuine and owned by a specific user, further reinforcing trust within the ecosystem.

4. TECHNOLOGY

Our project is a multifaceted blockchain application focused on charity, employing a diverse array of technologies, each contributing uniquely to the system's functionality and efficiency. We've integrated robust frontend, middleware, and backend technologies, ensuring seamless operation, user-friendliness, and secure blockchain interactions. This section provides a detailed exploration into each technological component utilized, elucidating their role and significance in the overall system architecture.

1. Smart Contracts:

   i. Charity Campaigns:
   Leveraging the Ethereum Virtual Machine (EVM), smart contracts are employed to automate and manage charity campaigns, bolstering accountability and transparency in the allocation of funds. Crafted meticulously using Solidity, these smart contracts encompass various functions like createCampaign(),donateToCampaign(), getDonators(),campaignDetails(). These integral functions facilitate the thorough and efficient administration of donation campaigns.

   ii. Decentralize Identity Verification
   Smart contracts also play a vital role in decentralized identity verification, ensuring that users or entities involved are authentic and genuine. These contracts allow the system to verify the identity of users securely without the need for centralized authority, thus enhancing the security and integrity of transactions and interactions within the application.

   iii. NFT Transfers:
   Implementing within the smart contracts allows for the secure and traceable transfer of assets, The integration of NFT functionalities within the smart contract enhances the system's capabilities,

allowing for a broader range of secure transactions and interactions.

2. Front End:
   i. ReactJS:
   Empowers the frontend, allowing the creation of a dynamic, user-friendly interface with reusable UI components.

   ii. VITE:
   Improves the development experience, offering a rapid, lightweight development environment with real-time updates.

   iii. Tailwind CSS:
   Utilized for responsive and appealing design, enhancing user interaction with the application.
3. Middleware:
   i. Express and Node.js:
   These technologies bolster our backend, facilitating smooth communication between the frontend and the blockchain.

   ii. Ethers.js:
   A library simplifying the integration with Ethereum blockchain, handling contract interactions,account management, and more.
4. Backend:

Handling data processing and business logic, the backend is the pivotal layer ensuring smooth application functionality.
   i. MongoDB:
   Manages the storage of user login credentials securely.

   ii. Smart Contract (Solidity):
   Solidity-based smart contracts manage and deploy instructions on the blockchain, with each node consisting of an EVM.
5. Additional Components:
   i. MetaMask:
   Facilitates user interaction with the Ethereum blockchain, managing accounts and transactions directly from web browsers.

   ii. Hardhat:
   Enhances the development experience, simplifying the process of building and deploying smart contracts.

   iii. Ethereum Network (Polygon Test Network):
   Utilized for deploying the blockchain system, leveraging the Proof of Stake (PoS) consensus methodology for enhanced scalability and security.

5. DISCUSSION AND RESULTS

In the evolving landscape of digital transactions and the increasing prominence of blockchain technology, our project attempts to bridge the gap between charitable acts and the digital realm by integrating Non-Fungible Tokens (NFTs) with the Ethereum blockchain for donations. This discussion section elaborates on the implications, innovations, and potential challenges of our proposed system.

5.1 Discussion

5.1.1 Implications and innovations

1. Transparency and Trust: Traditional charitable platforms, at times, suffer from skepticism regarding the proper utilization of funds. By using the Ethereum blockchain, every transaction is recorded and made transparent. This not only boosts theconfidence of donors but also ensures that organizations remain accountable.
2. Engagement through NFTs: Introducing NFTs as a form of acknowledgment for donations can reshape how donors perceive and engage with charitable acts. NFTs can serve as digital collectibles, symbolizing the donor's contribution, which could motivate more people to donate, knowing they receive a unique digital asset in return.
3. Decentralization and Authenticity: Centralized systems can be prone to biases, malfunctions, and potential data breaches. Operating in a decentralized environment ensures data integrity and reduces the chances of single-point failures. Furthermore, our system's decentralized ID verification offers an added layer of authenticity, reinforcing the genuine nature of donors and organizers.

5.1.2 Gas Fee Analysis

In our blockchain-based charity application deployed on the Matic (Polygon) network, various operations incur different gas fees. These fees are dependent on the complexity of the function calls and the data being stored or

retrieved. The table below highlights the gas fees for different scenarios:

Table 1: Gas Fee Analysis.

S. No	Scenario	Time	Gas Option (Gas Fees in MATIC)		
			Low	Market	Aggresive
1	Campaign creation	30 sec	0.01740983	0.01796547	0.01815068
2	Donate to campaign	30 sec	0.00012692	0.00013502	0.00018003
3	Single Field requested for verification	30 sec	0.00056583	0.00060194	0.00080259
4	Multiple fields requested for verification	30 sec	0.01821804	0.01879947	0.01899328
5	Single field approval for verification	30 sec	0.00030408	0.00032349	0.00043132
6	Multiple fields approval for verification	30 sec	0.00041828	0.00044498	0.00059331
7	Single field rejected for verification	30 sec	0.00006205	0.00009308	0.00012411
8	Multiple fields rejected for verification	30 sec	0.00012236	0.00013017	0.00017356

The data presents three different pricing options for the gas fee:

i. Low: This represents a conservative estimate, which is likely to be processed slower but is cheaper.
ii. Market: This provides a balance between speed and cost.
iii. Aggressive: This ensures faster transaction processing but is more expensive.

Campaign Creation: As one of the core functions, creating a campaign incurs a relatively high gas fee. This can be attributed to the storage of multiple data points such as the owner, title, description, target amount, and image.

Donations: Donating to a campaign has a considerably lower gas cost. This is logical as this function involves only updating the amount and storing the address of the donator.

Verification Requests and Approvals: Single field verifications, whether requested, approved, or rejected, consume less gas than multiple field verifications. This is consistent with the idea that more data interactions result in higher gas fees.

5.1.3 Potential challenges

1. Scalability Concerns: As with most blockchain systems, scalability can be a challenge. The Ethereum blockchain, especially during high transaction periods, can experience congestion, potentially leading to slower donation processes and higher transaction fees.
2. NFT Valuation: The value proposition of NFTs, while unique, can be volatile. While some may see immense value in owning a unique digital token representing their charitable act, others might question its intrinsic value, especially outside the charitable platform.
3. Adoption and Awareness: Introducing new technologies, especially in traditional sectors like charity, requires extensive efforts in education and awareness. Potential donors need to understand not just the 'how' but also the 'why' behind the integration of NFTs and blockchain in donations.
4. Environmental Concerns: Ethereum, as of now, uses a Proof-of-Work (PoW) consensus mechanism, which is energy-intensive. Environmentalists have raised concerns over the carbon footprint of PoW blockchains.

However, the impending shift to Ethereum 2.0, which uses a Proof-of-Stake (PoS) mechanism, promises to address these concerns.

5.2 Results

Our project, which integrates the Ethereum blockchain with Non-Fungible Tokens (NFTs) for charitable donations, along with the inclusion of decentralized identity verification and a specialized charity application, has yielded several notable insights:

5.2.1Transparency and authenticity

1. Transaction Analysis: Throughout our observation period, multiple transactions were successfully executed on our platform. Thanks to the Ethereum blockchain, each transaction was immutable, ensuring a clear and transparent record of all donations and further authenticating the system's credibility.
2. Decentralized ID Verification: A considerable number of users opted for decentralized ID verification, reflecting trust in our system's secure identity validation procedure. Feedback indicated that the decentralized verification process enhanced the perceived integrity and reliability of our platform.

5.2.2 Donor engagement through NFTs

1. NFT Issuance: During the study, NFTs served as unique tokens of acknowledgment for donors. Their issuance demonstrated NFTs' potential as innovative tools for recognizing and appreciating donors in the charitable domain.
2. NFT Interaction: Donors who received NFTs actively engaged with them, either by transferring, selling, or displaying them on various platforms, showcasing the potential of NFTs to boost donor engagement.

5.2.3 User-Centric charity application

1. User Experience: Our specialized charity application enabled users to seamlessly launch charity campaigns for specific causes and access a comprehensive list of registered charities. Initial feedback suggested that users found the application intuitive, which greatly enhanced their overall experience.
2. Profile Creation and Verification: The dual approach of email-based authentication combined with decentralized ID verification using specific documents added an extra layer of security, ensuring genuine profiles on our platform.

5.2.4 System efficiency and scalability

1. Transaction Speed: Donations processed on our platform showcased its efficiency in managing transactions with commendable speed.
2. Blockchain Load and Resilience: Our platform exhibited robustness in effectively managing simultaneous transactions, even during heightened activity, pointing towards its scalability for wider applications.

6. CONCLUSION

In this age of digital transformation, our initiative to amalgamate the Ethereum blockchain with Non-Fungible Tokens (NFTs) for charitable donations represents a progressive step in revolutionizing the charitable domain. Through this integration, we aimed to address prevalent concerns of transparency, efficiency, and donor engagement in the philanthropic sector, and the outcomes have been both illuminating and promising.

Our approach to decentralization, as reflected by the Ethereum blockchain's inclusion, has enabled us to create a system free from third-party interventions. Each donation made on our platform remains immutable, guaranteeing a clear, verifiable record of all transactions. Such transparency not only instills confidence in donors and beneficiaries alike but also paves the way for future charitable endeavors to harness similar technologies for enhanced credibility.

The introduction of NFTs in our system, representing unique tokens of acknowledgment, has revealed their vast potential in the philanthropic sector. Serving as both a commemoration of one's charitable act and a unique digital asset, NFTs have enhanced donor engagement, creating an innovative bridge between altruism and the burgeoning world of digital collectibles.

Another significant stride we undertook was the incorporation of decentralized identity verification. This mechanism further solidified the

platform's emphasis on authenticity. By allowing users to validate their identity through decentralized processes, we not only elevated the platform's security but also accentuated its commitment to genuine and authentic interactions, a crucial feature for any charitable platform.

Our specialized charity application, tailored to facilitate donors and organizers, has illustrated the power of a user-centric design in the domain of charity. With features like profile creation, decentralized ID verification, and the ability to launch or contribute to charity campaigns, the application showcased how intuitive design can streamline and enhance the charitable giving process.

In summation, this project stands as a testament to the transformative potential of integrating advanced technologies like blockchain and NFTs into the charitable landscape. While we have made significant inroads, the journey ahead is filled with opportunities to refine, expand, and further revolutionize the way the world perceives and engages with charitable endeavors. Our hope is that this venture serves as a beacon, guiding future innovations that strive for a more transparent, engaged, and efficient philanthropic ecosystem.

7. FUTURE WORK

The journey undertaken in integrating the Ethereum blockchain with Non-Fungible Tokens (NFTs) for charitable donations has laid a solid foundation for numerous enhancements and expansions. As we move forward, several avenues of future work are envisioned:

1. Advanced NFT Integrations: While our current system utilizes NFTs as tokens of acknowledgment, there's potential to expand their role. NFTs can be transformed into digital collectibles with unique artwork or information, possibly collaborating with artists and influencers to create limited-edition tokens. This could raise the value of these tokens, further incentivizing donors.
2. Scalability Improvements: As our platform gains traction, the need for scalability will be paramount. Exploring Layer 2 solutions or transitioning to other scalable blockchain platforms can be considered to manage increased transaction loads without compromising on speed or incurring high fees.
3. Integration with Other Blockchains: While Ethereum has been our primary platform, the rise of other blockchains with unique capabilities cannot be ignored. Integration with chains like Binance Smart Chain, Polkadot, or Cardano can offer diverse functionalities and reach a broader audience.
4. Enhanced Decentralized Identity Verification: Our current decentralized identity verification system can be further refined. Integrating more advanced biometric verification methods or partnering with established decentralized identity providers can offer a more seamless and secure user experience.
5. Machine Learning and AI: Implementing machine learning algorithms can provide insights into donation patterns, predicting which causes might appeal to specific user demographics. Furthermore, AI-driven chatbots can assist users, enhancing the platform's accessibility.
6. Partnerships and Collaborations: Establishing partnerships with charitable organizations, NGOs, and even governments can elevate our platform's reach and credibility. These collaborations can lead to joint campaigns, matching donations, or even policy advocacy for blockchain in philanthropy.
7. Environmental Considerations: With the growing concern over the environmental impact of blockchain operations, particularly in proof-of-work systems, future iterations can explore more eco-friendly consensus algorithms or support carbon offset initiatives.
8. Educational Initiatives: A significant barrier to the widespread adoption of blockchain-based platforms is the lack of understanding. Launching educational campaigns, webinars, or tutorials can demystify the technology for potential donors, ensuring they feel comfortable and confident using our platform.

In the grand scope of charitable donations, our project is just the beginning. The confluence of blockchain, NFTs, and decentralized identity verification provides a vast playground for innovation. It's imperative that as we move forward, we remain adaptable, receptive to feedback, and committed to the primary goal: revolutionizing charitable giving for the betterment of all.

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