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Blockchain-Driven Collective Funding Dapp

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Abstract: ***Blockchain technology has emerged as a disruptive force with the potential to revolutionize various industries, including crowdfunding. This study explores how blockchain can be applied to crowdfunding platforms to enhance transparency, security, and trust in the crowdfunding process. Through a thorough review of existing literature, analysis of current platforms, and the development of a prototype Decentralized Application (DApp) using React.js, Solidity, and other relevant technologies, this research demonstrates the promising prospects of blockchain in reshaping crowdfunding. The primary outcomes include mitigating fraud, enhancing accountability, and empowering both project creators and contributors. This paper offers a detailed examination of the research, laying the groundwork for a blockchain-driven collective funding DApp that utilizes React.js for frontend development, Solidity for smart contracts, and other contemporary technologies.***
Keywords: Blockchain technology, Decentralized, Crowdfunding, Transparency, Security.

I. INTRODUCTION

The "Blockchain-driven Collective Funding DApp" represents a pioneering initiative aimed at transforming the landscape of crowdfunding through the innovative application of blockchain technology. Leveraging Ethereum for smart contracts, Next.js for frontend development, and IPFS for multimedia file storage, this decentralized application (DApp) seeks to establish a transparent, secure, and inclusive platform for fundraising. By harnessing the power of blockchain, the project aims to address longstanding inefficiencies and limitations of traditional crowdfunding platforms, such as opacity, high fees, and restricted access to global markets.

At its core, the project aims to empower startups, small businesses, and innovative ventures by providing them with a streamlined avenue for financial backing. Through decentralization, transparent transactions, and the execution of smart contracts, the platform strives to instill trust and accountability within the crowdfunding ecosystem. Unlike traditional platforms, the "Blockchain-driven Collective Funding DApp" aims to democratize the fundraising process, offering a level playing field where individuals and organizations can easily initiate their own campaigns.

By eliminating intermediaries and introducing automation through smart contracts, the project endeavors to maximize the impact of fundraising efforts. This approach not only reduces associated fees but also ensures that a higher percentage of funds raised directly contribute to the intended projects. Furthermore, the platform's commitment to transparency and accountability is evident through features such as targeted contribution goals and deadline-driven expiry, which provide clear frameworks for project funding and safeguard contributors' interests.

However, the project also faces several challenges inherent to blockchain technology. Scalability remains a significant concern, as blockchain networks often struggle to support a large volume of transactions without compromising performance. Security is another critical aspect, with smart contracts susceptible to vulnerabilities that could jeopardize the safety of users' funds. Additionally, enhancing the user experience (UX) is paramount to attracting and retaining users, necessitating intuitive interfaces and streamlined processes to facilitate broader adoption of the platform. Despite these challenges, the "Blockchain-driven Collective Funding DApp" stands poised to unlock new opportunities for collective fundraising in the digital age, paving the way for a more decentralized and equitable financial future.

II. RELATED WORK

Several recent studies have delved into the integration of blockchain technology into crowdfunding platforms, each aiming to address various challenges and enhance the overall efficiency and security of the crowdfunding process. One such study, conducted in November 2022, proposed a novel crowdfunding solution leveraging blockchain technology to ensure secure and transparent fundraising. This platform streamlined campaign creation, donation management, and request approval, empowering both campaign initiators and contributors while allowing donors to monitor fund allocation effectively. Similarly, another study from the same period emphasized the potential of blockchain-based smart contracts in fostering mutual trust between investors and project stakeholders, ultimately attracting substantial contributions.

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In May 2023, a project focused on developing a blockchain-based crowdfunding platform using Ethereum aimed to tackle issues such as fraud and project execution delays by incorporating smart contracts for automation. Furthermore, a literature survey conducted in January 2023 highlighted the advantages of blockchain integration, including fraud prevention, removal of intermediaries, and enhanced transparency and security. This survey identified a notable absence of blockchain-based platforms tailored for creative individuals, proposing the incorporation of smart contracts and voting mechanisms to safeguard contributors' investments and provide a marketplace for funded creations. These studies collectively demonstrate the potential of blockchain technology in revolutionizing crowdfunding by mitigating risks, enhancing transparency, and fostering trust among stakeholders.

III. OBJECTIVES

1) To Develop a Secure and Transparent Crowdfunding Solution: The primary objective is to design and implement a crowdfunding platform that leverages blockchain technology to ensure the security and transparency of the fundraising process.
2) Streamlining Campaign Creation and Management: The project aims to create an interactive platform that simplifies the process of creating and managing crowdfunding campaigns, catering to the convenience of both campaign initiators and contributors.
3) Integration of Smart Contracts for Automation: Incorporating smart contracts into the platform will enable automation of key processes such as fund allocation and request approval, reducing the risk of fraud and improving operational efficiency.
4) Creating a Marketplace for Creative Individuals: In addition to crowdfunding, the platform aims to provide a marketplace for creative individuals to showcase and monetize their creations, thereby expanding the scope and impact of the project.

Collaborate closely with the deaf community, involving them in the development process to ensure that the technology aligns with their needs and preferences.

IV. METHODOLOGY

A. *Requirement Gathering and Analysis*

Conduct thorough interviews, surveys, and workshops with stakeholders to capture detailed requirements. Document user stories and acceptance criteria to ensure alignment with stakeholder expectations. Consider factors such as user demographics, target markets, and c ompetition analysis to inform feature prioritization. Identify any legal or regulatory constraints, such as Know Your Customer (KYC) requirements or securities regulations, and ensure compliance throughout the development process.

B. *UI/UX Design*

Conduct usability testing with prototypes to gather feedback and iterate on the design.

Create a style guide outlining typography, color schemes, iconography, and other design elements for consistency across the application. Design responsive layouts for various devices and screen sizes, considering accessibility standards and best practices. Implement microinteractions and animations to enhance user engagement and feedback. Collaborate closely with frontend developers to ensure seamless implementation of the design vision.

C. *Blockchain Integration and Metamask Pairing*

Provide detailed documentation and tutorials for users on how to install and set up Metamask or other Ethereum wallets. Implement error handling and recovery mechanisms for common wallet connection issues, such as incorrect network selection or insufficient funds. Consider implementing multi-factor authentication or biometric authentication for enhanced security. Test wallet integration across different browsers and platforms to ensure compatibility and usability.

D. *Smart Contract Development*

Follow established design patterns and best practices for writing secure and efficient smart contracts. Implement modular contract structures to facilitate upgradability and maintainability. Conduct formal verification and code audits to identify and mitigate potential vulnerabilities before deployment. Plan for contract upgradeability and migration strategies to accommodate future changes or enhancements.

E. *Frontend Development*

Optimize frontend performance by minimizing render-blocking resources, leveraging browser caching, and lazy-loading assets. Utilize state management libraries like Redux for managing complex application state. Implement client-side routing for a seamless navigation experience within the DApp. Leverage browser caching and CDNs for faster loading times and reduced server load.

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F. Ethereum Transactions and Blockchain Interaction

Provide users with clear and concise instructions on how to interact with Ethereum transactions, including gas fees and transaction confirmation times. Implement transaction batching and optimization techniques to minimize gas costs and improve transaction throughput. Utilize event-driven programming patterns to update UI elements in real-time based on blockchain events. Monitor blockchain network congestion and dynamically adjust gas fees or transaction priorities as needed. Implement strategies for handling transaction failures and providing users with meaningful error messages and support resources.

Stay up-to-date with the latest developments in blockchain technology and industry best practices, incorporating new features and improvements into the DApp through regular updates and enhancement

V. SYSTEM ARCHITECTURE

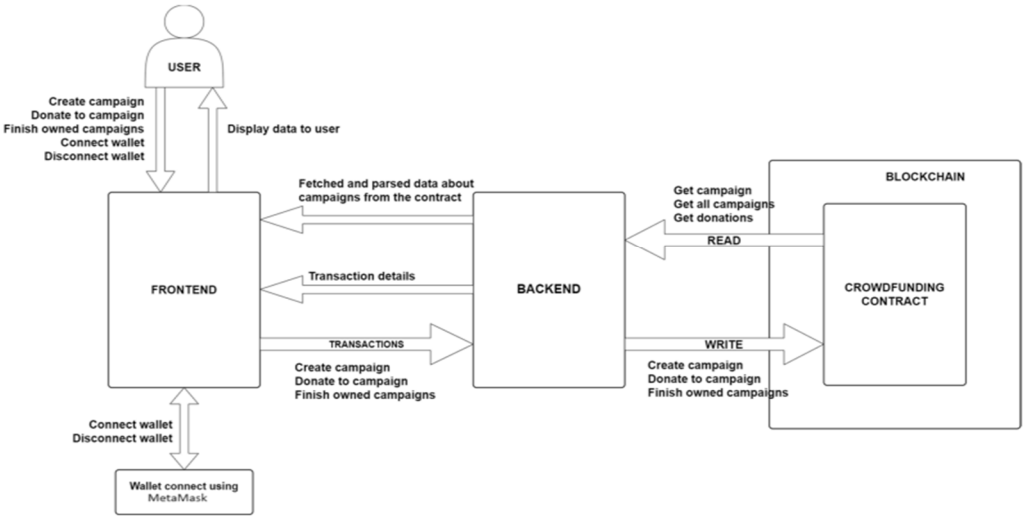


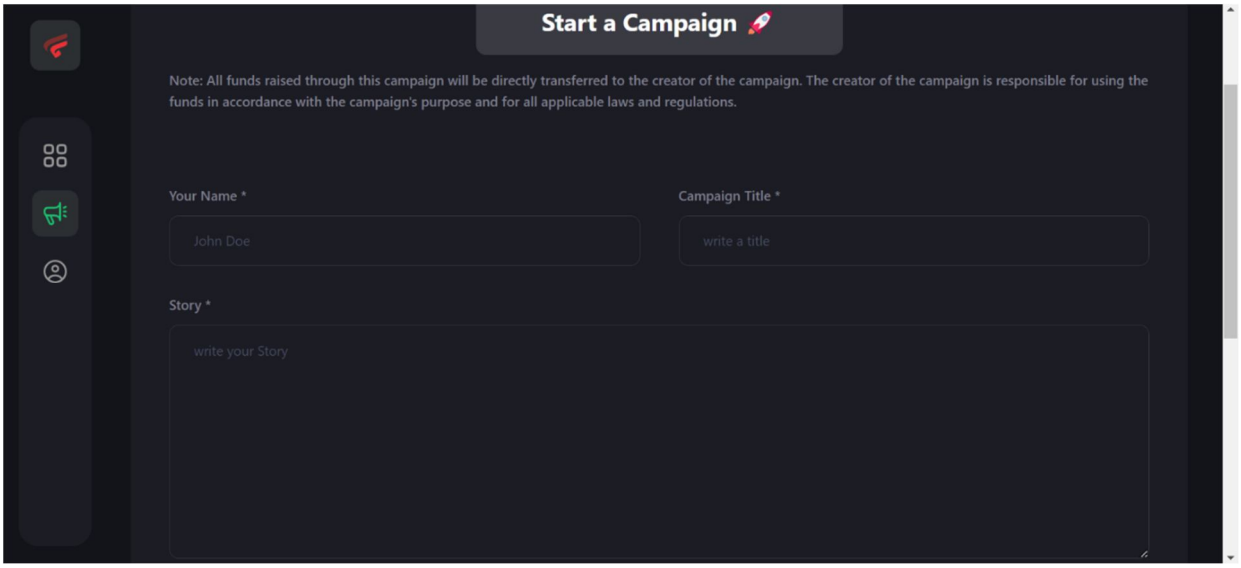
Figure1: System Architecture

The architecture of the blockchain-driven collective funding DApp consists of several components that work together to provide the desired functionalities while leveraging blockchain technology for transparency, security, and decentralization. Here's an overview of the key components:

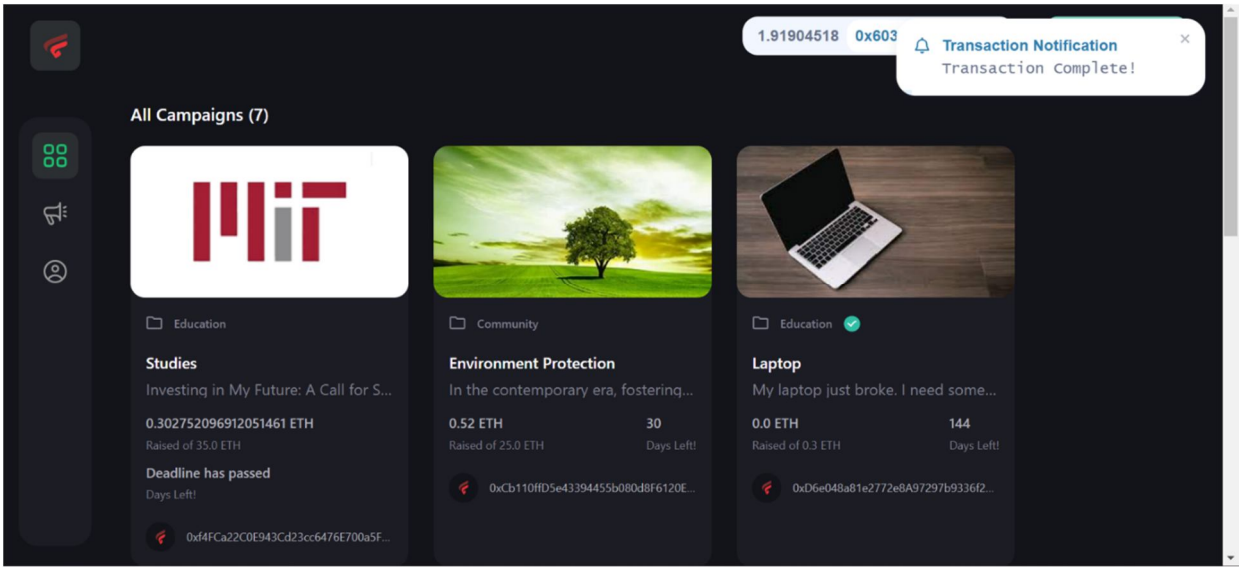
1) *Frontend Application:* The frontend application is responsible for presenting the user interface to users (fundraisers, backers, administrators) through web browsers or mobile devices. It communicates with the backend server and blockchain network to fetch and display data, submit transactions, and interact with smart contracts. Technologies: React.js for building dynamic UI components, HTML/CSS for styling, and JavaScript/TypeScript for client-side logic
2) *Backend Server:* The backend server handles business logic, user authentication, data processing, and communication with external services. It interfaces with the blockchain network to read data from smart contracts, monitor events, and execute transactions on behalf of users. Technologies: Solidity, Web3.js, chainlink etc.
3) *Blockchain Network:* The blockchain network serves as the underlying infrastructure for the DApp, providing decentralized consensus, immutability, and smart contract execution. It stores the state of smart contracts and records all transactions related to project funding, voting, and governance. Ethereum is a popular choice for blockchain networks due to its robustness, support for smart contracts, and large developer community.
4) *Smart Contracts:* Smart contracts are self-executing contracts deployed on the blockchain that govern the behavior of the collective funding DApp. They define the rules and logic for project creation, funding, voting, token issuance, and other operations. Solidity is commonly used to write smart contracts for Ethereum, while Chaincode is used for Hyperledger Fabric. Smart contracts are deployed and executed on the blockchain network and interacted with by the frontend application and backend server.

By integrating these components into a cohesive architecture, the blockchain-driven collective funding DApp provides a seamless and transparent platform for fundraisers and backers to collaborate on projects while leveraging the benefits of blockchain technology for trust and security.

VI. RESULTS



Result 1. Form for creating a new campaign.



Result 2: Display message after donation successfully completed.

VII. IMPLEMENTATION

The implementation of our blockchain-driven collective funding DApp encompasses a holistic approach, integrating a myriad of essential technologies and methodologies to ensure a seamless user experience and robust functionality. At its core, the DApp is designed to provide a secure, transparent, and decentralized platform for creating, managing, and participating in crowdfunding campaigns directly on the blockchain. Leveraging cutting-edge design principles and user-centric development practices, our team has meticulously crafted a visually stunning and intuitively navigable graphical user interface (GUI) that serves as the gateway to the world of decentralized finance (DeFi).

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The DApp's architecture is built upon the foundation of Web3.js, a powerful JavaScript library that facilitates communication with the Ethereum blockchain. By integrating Web3.js, users can effortlessly connect their Ethereum wallets, such as Metamask, to the DApp, enabling seamless interaction with smart contracts and blockchain transactions. Metamask integration ensures that users can securely manage their Ethereum assets and participate in crowdfunding campaigns with confidence and ease.

Central to the functionality of the DApp are smart contracts, written in Solidity, Ethereum's native programming language for smart contract development. These smart contracts govern the rules and logic of the crowdfunding platform, orchestrating key processes such as campaign creation, fund allocation, and transaction verification. Through the DApp, users can deploy smart contracts to create new crowdfunding campaigns, specifying essential parameters such as funding goals, campaign durations, and project descriptions. Once deployed, these smart contracts facilitate transparent and immutable transactions on the blockchain, ensuring accountability and trust between campaign creators and contributors.

Smart Contract

```
// SPDX-License-Identifier: UNLICENSED
pragma solidity ^0.8.9;

contract CrowdFunding {
   struct Campaign {
      address owner;
      string title;
      string description;
      uint256 target;
      uint256 deadline;
      uint256 amountCollected;
      string image;
      address[] donators;
      uint256[] donations;
   }
   mapping(uint256 => Campaign) public campaigns;
   uint256 public numberOfCampaigns = 0;
   function createCampaign(address _owner, string memory _title, string memory _description, uint256 _target, uint256 _deadline, string memory _image) public returns (uint256) {
      Campaign storage campaign = campaigns[numberOfCampaigns];
      require(campaign.deadline < block.timestamp, "The deadline should be a date in the future.");
      campaign.owner = _owner;
      campaign.title = _title;
      campaign.description = _description;
      campaign.target = _target;
      campaign.deadline = _deadline;
      campaign.amountCollected = 0;
      campaign.image = _image;
      numberOfCampaigns++;
      return numberOfCampaigns - 1;
   }
   function donateToCampaign(uint256 _id) public payable {
      uint256 amount = msg.value;

      Campaign storage campaign = campaigns[_id];
      campaign.donators.push(msg.sender);
      campaign.donations.push(amount);
      (bool sent,) = payable(campaign.owner).call{value: amount}("");
```

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```
        if(sent) {
            campaign.amountCollected = campaign.amountCollected + amount;
        }
    }

    function getDonators(uint256 _id) view public returns (address[] memory, uint256[] memory) {
        return (campaigns[_id].donators, campaigns[_id].donations);
    }

    function getCampaigns() public view returns (Campaign[] memory) {
        Campaign[] memory allCampaigns = new Campaign[](numberOfCampaigns);
        for(uint i = 0; i < numberOfCampaigns; i++) {
            Campaign storage item = campaigns[i];
            allCampaigns[i] = item;
        }
        return allCampaigns;
    }
}
```

The GUI of the DApp is meticulously designed to provide users with a seamless and intuitive experience. Upon launching the DApp, users are greeted with a visually appealing interface that guides them through the various features and functionalities of the platform. The main window of the DApp presents users with a curated list of ongoing crowdfunding campaigns, each accompanied by relevant details such as campaign descriptions, funding progress, and contribution options. Through the GUI, users can easily browse through available campaigns, view detailed information about each campaign, and initiate contributions with just a few clicks.

In addition to its visual appeal, the UI developed using React.js and Tailwind CSS also boasts advanced functionality and user-friendly features. Real-time updates and notifications keep users informed about the latest developments in their chosen campaigns, while interactive elements such as buttons, forms, and modals enable seamless navigation and input. Furthermore, the UI provides users with access to comprehensive analytics and reporting tools, allowing them to track the progress of their contributions and gain insights into the overall performance of the crowdfunding platform.

Blockchain-driven collective funding DApp represents a pioneering effort to democratize access to finance and empower individuals to support meaningful causes directly on the blockchain. Through a combination of cutting-edge technologies, intuitive design, and robust functionality, the DApp offers users a seamless and transparent crowdfunding experience that transcends traditional financial barriers. As blockchain continues to redefine the future of finance, our DApp stands at the forefront of innovation, poised to revolutionize the way we fund and support initiatives for years to come.

VIII. TECHNOLOGIES USED

In the development of our blockchain-driven collective funding DApp, a diverse range of technologies are employed to ensure robust functionality and seamless user experience. Here's an overview of the key technologies utilized:

1) *Solidity:* Ethereum's native programming language, Solidity, is utilized for writing smart contracts that govern the behavior of our collective funding DApp. These smart contracts define the rules and logic for project creation, fund allocation, voting, and other essential operations.
2) *Web3.js:* This JavaScript library facilitates communication between our frontend application and the Ethereum blockchain, enabling seamless integration of blockchain features such as smart contract interactions and transaction processing.
3) *React.js:* Utilized for building dynamic and interactive user interfaces, React.js enhances the frontend of our DApp, providing users with an intuitive and visually appealing experience while navigating through crowdfunding campaigns and contributing funds.
4) *Metamask:* Integrated with our DApp to enable secure management of Ethereum wallets and facilitate blockchain transactions, Metamask ensures that users can interact with our platform seamlessly while maintaining control over their digital assets.

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IX. CONCLUSION

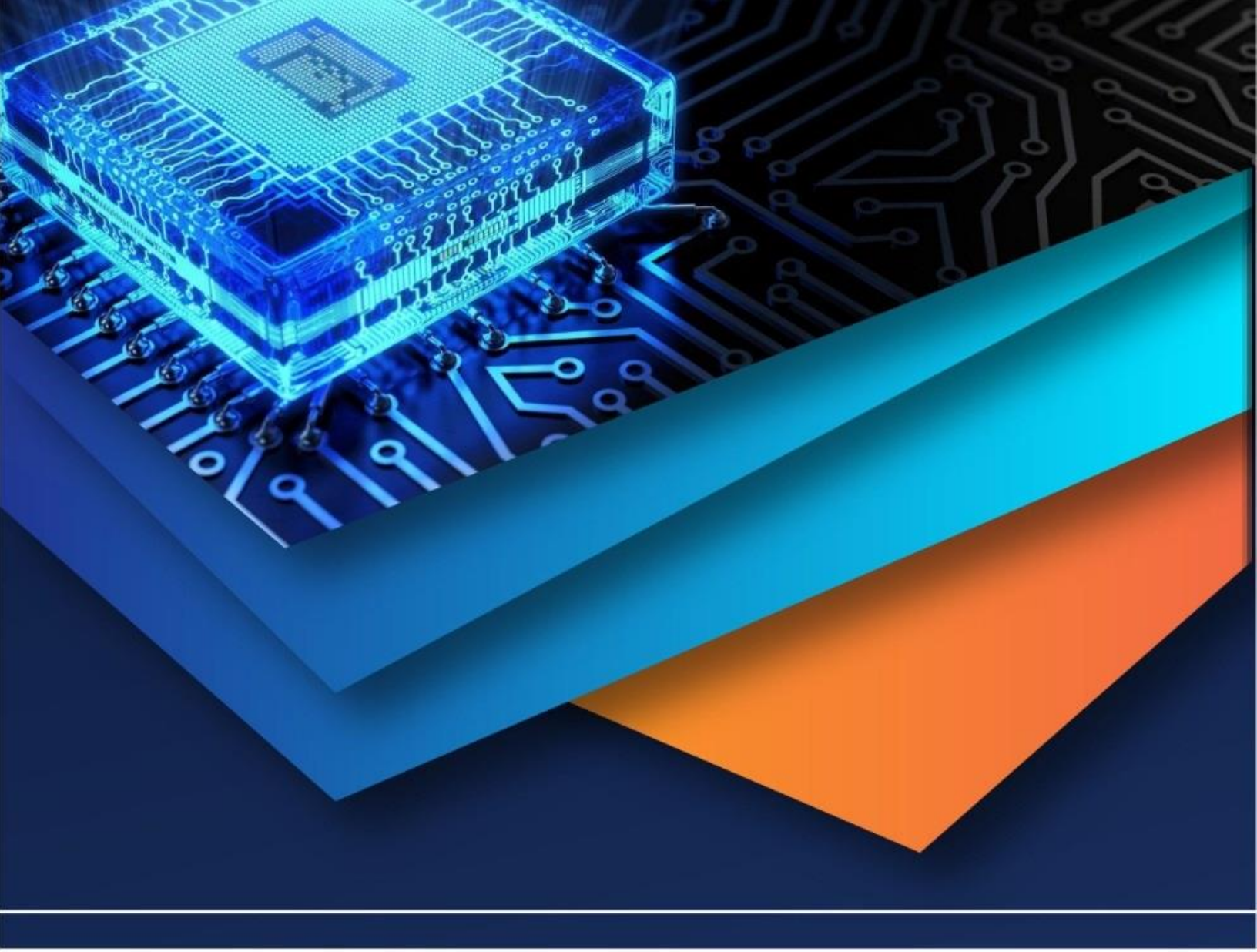
The Sustainable Development Goals Good health plus well-being; Decent work plus economic growth; Industry, innovation, and infrastructure; Reduced inequalities; Responsible consumption plus production

According to this direction, in this paper, we propose a decentralized web3 application that utilizes blockchain technology and addresses the problems of traditional donation systems by creating a platform where people can create and manage charitable campaigns to support educational causes, all of which are performed by interacting with a smart contract deployed on a public blockchain. The platform leverages decentralized protocols and smart contracts to ensure secure and transparent transactions, enabling donors to track the utilization of their contributions and ensure their funds reach their intended beneficiaries. The main contributions are highlighted in a separate section. The limitations and future works are also provided. The software application can be used for now in education, but not only, and it will have some new features in the near future.

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