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EcoCrowd: Sustainable Community Crowdfunding using Solana Blockchain

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***Abstract*— Crowdfunding enables individuals or organizations to raise funds for missions or social causes, where in multiple contributors donate small amounts, typically via online. Existing platforms like Kickstarter often focus on single cause for fund raise. Even though the existing crowdfunding platforms uses blockchain technology, especially decentralized cryptocurrencies like Bitcoin, Ethereum which has garnered attention for facilitating peer-to-peer transactions without third parties. However, they face limitations such as low throughput and high latency, which raise concerns about scalability and challenges including high fees, transparency issues, and trust deficits. Hence, there is a need for an efficient decentralized platform that supports multiple causes, benefiting both society and the environment. The proposed work supports the multiple causes for fund raise and tracking the donated funds on a single platform using Solana blockchain technology. Solana addresses the limitations faced by other existing decentralized cryptocurrencies and introduces advancements in data structures and processes that improve performance, transparency, and security, offering a more efficient and trustworthy solution for crowdfunding.**

***Index Terms*— Blockchain, Solana, Cryptocurrency, community, Scalability, Transactions, Multifaceted, Crowdfunding.**

I. INTRODUCTION

In today's world, we face a multitude of challenges ranging from economic disparities to environmental concerns. Issues such as the lack of funds for environmental sustainability, the development of government schools, and the rehabilitation of orphanages underscore the urgent need for collective action. Despite these challenges, there is significant potential for transformative change. One powerful tool that has emerged to harness the collective power of individuals is crowdfunding. This method transcends traditional fundraising by leveraging technology to connect donors directly with the initiatives they care about. The proposed system is designed to support a variety of social causes, including plantation activities, river cleaning, orphanage aid, and the improvement of school infrastructure. Crowdfunding for plantation activities, for instance, mobilizes support for environmental conservation. River cleaning initiatives engage communities in stewardship, fostering a sense of responsibility towards their local environment.

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Improving school infrastructure enhances educational opportunities for children, creating a foundation for a brighter future. Additionally, crowdfunding efforts aimed at supporting orphanages can significantly impact the lives of vulnerable children, providing them with essential resources and support. Each of these causes represents a unique opportunity for positive change, and crowdfunding serves as a platform to make a tangible difference in communities and in the lives of those in need.

What sets our platform apart is its diverse approach and commitment to creating a wide-ranging impact. By offering a space where individuals and organizations can rally behind a diverse array of causes, from tree planting to orphanage funding, we aim to foster a culture of collective responsibility and social innovation. Each cause on our platform offers an opportunity for tangible change, whether it involves preserving the environment, enhancing educational opportunities or supporting vulnerable children.

Crowdfunding for environmental initiatives, for example, not only raises funds but also mobilizes communities to participate in conservation efforts. This can include activities like tree planting or river cleaning, which have immediate and long-term benefits for the environment. Trees play a crucial role in sequestering carbon dioxide, improving air quality, and providing habitats for wildlife. Clean rivers are essential for maintaining biodiversity, ensuring clean drinking water, and providing recreational opportunities for communities. On the educational front, investments in school infrastructure can significantly improve the learning environment for children, making it more conducive to their development and success. Modern classrooms, better facilities, and access to educational resources can drastically enhance the quality of education and, consequently, the future prospects of these children. Similarly, funding for orphanages can directly improve the lives of marginalized youth, providing them with better living conditions, education, and emotional support. Orphanages can use these funds to provide nutritious meals, healthcare, clothing, and psychological support, which are vital for the overall development of the children.

Through our platform, individuals have the power to make a meaningful difference in communities around the world. By supporting diverse causes, donors can see the direct impact of their contributions, whether it is through the growth of a new forest, the cleanup of a polluted river, the refurbishment of a school, or the improved wellbeing of orphaned children. Our platform emphasizes the interconnectedness the significance of tackling these challenges and their implications collectively. This approach not only addresses immediate needs but also promotes long term sustainable development.

Moreover, our platform encourages transparency and accountability. Donors can track the progress of the projects they support, ensuring that their contributions are used effectively and efficiently. Regular updates, detailed reports, and success stories help build trust and cultivate a stronger bond between donors and the causes they support. This transparency is crucial in maintaining donor confidence and encouraging continued support.

As we look to the future, the capacity of crowdfunding to facilitate social change is immense. By continuously evolving and adapting to the needs of various communities, our platform can become a catalyst for widespread societal transformation. We envision a world where every individual feels empowered to contribute to the causes they care about, regardless of the size of their donation. This democratization of giving not only amplifies the impact of individual contributions but also It enhances the influence of individual efforts while also promoting a spirit of global unity. By creating a dynamic and interactive experience for donors, we can cultivate a more involved and informed community of supporters. Ultimately, the power of crowdfunding lies in its ability to bring together diverse groups of people to achieve common goals. With continued support and participation, we can tackle some of the most pressing challenges of our time and create a more sustainable, equitable, and compassionate world for all.

In conclusion, the challenges we face today, from economic disparities to environmental degradation, require innovative and collective solutions. Crowdfunding offers a powerful means to connect individuals with causes they are passionate about, enabling them to contribute to meaningful change. Our project harnesses this potential, supporting a range of social causes that together can create a significant positive impact. By fostering a culture of collective action and social innovation, By tackling urgent challenges, we can strive towards a fairer and more sustainable future. Crowdfunding's strength lies in its capacity to democratize charitable giving, enabling individuals from all financial backgrounds to support causes they care about. This combined effort can drive significant social transformation, creating a better world for both present and future generations. Thus, the main contribution of the proposed work is as follows:

- Provides a single crowdfunding platform for multiple missions to raise funds such as environmental sustainability, the development of government schools, and the rehabilitation of orphanages, River Cleaning, Plantation and etc.
- Tracks the donated funds by the donors.

- Uses an efficient blockchain technology called Solana that improves the performance of the system and also bridges the gap between donors and the people who are in need without the trusted third-party intervention such as NGOs.

II. Literature Survey

This paper provides a summary of crowdfunding, emphasizing its growth, types, motivations, challenges, and impact. It highlights the importance of transparency, trust, and social capital for successful crowdfunding. The platform allows investors to invest in initiatives of interest, while entrepreneurs raise funds by offering tokens. The user interface is designed to be flexible and user-friendly, with a voting mechanism for debiting [1]. This paper examines the role of crowdfunding in promoting financial inclusion and investigates the potential of blockchain technology to improve crowdfunding processes. The study seeks to assess the current developments in blockchain technology and its potential to revolutionize business operations [2]. This project utilizes Ethereum smart contracts within a crowdfunding platform to tackle security concerns and mitigate fraud. The platform seeks to build trust in the crowdfunding process by offering real-time transaction tracking, safeguarding investors' funds, and ensuring transactional integrity [3]. This paper proposes a decentralized platform to address the transparency and fraud issues found in traditional crowdfunding systems. The platform allows people to donate to worthy causes without concerns about scams, creating a transparent and trustworthy environment [4]. This paper explores the challenges of crowdfunding and how blockchain can solve these problems, both with and without cryptocurrency. It also discusses the potential for sustainable development through crowdfunding, by promoting initiatives that benefit the environment and local communities [5]. This research explores the implementation of a blockchain-based crowdfunding platform. The use of security technology ensures contributor confidentiality, with transparent transactions. Smart contracts are automatically triggered when campaign requirements are met, further building trust among contributors [6]. The project presents a decentralized crowdfunding platform where verified users can launch campaigns and receive donations using Ethereum wallets. Campaign details include name, description, deadline, and funding target. The funds can only be withdrawn if the target is achieved after the campaign's deadline [7]. The paper proposes the GreenChain platform, based on Solana blockchain and Agile methodologies. This solution facilitates secure access to research results and intellectual property for educational organizations, research institutions, and other stakeholders [8]. This paper explores the drawbacks of centralized crowdfunding platforms, including excessive fees and limited transparency. It presents a decentralized alternative, featuring a marketplace for crowdfunded products and a profit-sharing model designed to attract a broader user base [9]. This paper provides an overview of existing research on crowdfunding, with a focus on startups seeking capital. The study highlights the increasing importance of crowdfunding as an alternative funding option for early-stage companies [10]. Blockchain technology is essential for cryptocurrencies and provides a decentralized, secure ledger system. It ensures transparent, tamper-proof transactions and enables smart contracts, expanding the use of digital currencies in various industries [11]. This study focuses on tracking and forecasting dynamics in crowdfunding by collecting real-world data from Indiegogo. It uses regression models to predict campaign success and explores decision-making patterns in funding sequences [12]. This paper introduces a blockchain architecture utilizing Proof of History (PoH), a method that verifies the time intervals between events. By minimizing messaging overhead, the PoH ledger accelerates finality and strengthens confidence in the ledger's timekeeping and data storage [13].

III. System Analysis

In this section, our focus will be on critically examining the existing shortcomings of traditional crowdfunding platforms. We will delve into the issues that hinder efficiency, transparency, and user satisfaction within these platforms. Furthermore, we will conduct a thorough analysis of our proposed system, which aims to address these deficiencies and introduce innovative solutions to enhance the crowdfunding experience for both project creators and backers alike. 1. In the majority of existing crowdfunding platforms, the structure typically revolves around supporting singular causes or projects at any given time. These platforms are designed to facilitate fundraising efforts for specific initiatives, campaigns, or personal endeavors, with each campaign usually having its own dedicated space and visibility within the platform. In our platform we support various causes attracting diverse donors from various sectors which enriches crowdfunding initiatives by bringing a wide range of perspectives, resources, and by fostering community engagement across different sectors, our platforms can broaden its reach and maximize impact.

In the current system, although there are many benefits, one significant issue is that these platforms charge high fees to both project owners and contributors. For instance, Kickstarter takes 5% of the total funds as a fee for hosting the project on their platform. Additionally, there is a lack of transparency and no clear transaction records regarding how funds are utilized in the project. On the other hand, transaction fees on Solana are much lower compared to Ethereum. Solana's efficient processing capabilities result in minimal transaction costs, making it an appealing choice for microtransactions and decentralized applications (dApps) that require numerous transactions. As blockchain technology has advanced, scalability challenges have arisen on major public chain platforms such as Bitcoin and Ethereum, slowing the progress of blockchain development. Solana has garnered attention for its exceptional scalability and performance. Research by Zhang et al. (2022) showcased Solana's impressive throughput and minimal latency, emphasizing its capacity to handle a large number of transactions per second. With the ability to process over 65,000 TPS, Solana stands out as a highly scalable blockchain platform. The Blockchain Trilemma describes the difficulty of achieving a balance between three fundamental elements of a blockchain system: decentralization, security, and scalability. It suggests that all three cannot be achieved simultaneously at optimal levels. For example, introducing a centralized coordinator could improve efficiency and lower the resource consumption required for consensus (e.g., reducing computational power in proof-of-work). However, this compromises decentralization. Transaction throughput and confirmation latency, two critical performance metrics, remain unsatisfactory in many popular blockchain systems, negatively impacting user experience. Addressing this trilemma is crucial for blockchain's evolution to handle more complex, large-scale applications. Concerns have arisen about the energy consumption of Proof-of-Work (PoW)-based blockchain systems like Bitcoin and Ethereum. In PoW, miners compete to solve complex calculations, leading to significant electricity usage. While PoW is secure, it is not environmentally sustainable for future blockchain systems.

Solana, on the other hand, uses a more efficient mechanism called Proof of History (PoH). PoH helps with transaction ordering and validation by using a sequence of transactions that are prearranged by a "Leader" with timestamps embedded in the data structure. This ensures that time is real and unalterable, eliminating the need for excessive computational resources to synchronize time, making Solana more energy-efficient.

IV. PROPOSED WORK

The proposed system architecture consists of following three phases as shown in fig 4.1.

- Phase 1: Registration Phase
- Phase 2: Transaction Phase
- Phase 3: Tracking Phase

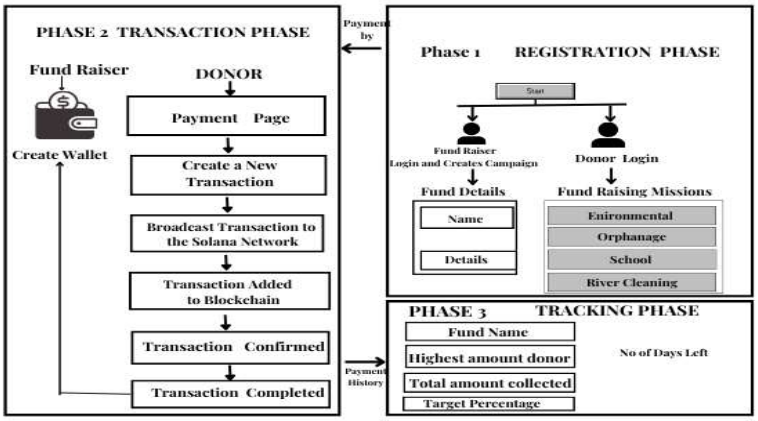

Fig. 1 System Architecture

Phase 1: Registration Phase : The receiver/fund raiser and donors have separate login sites in our suggested approach. A fund raiser can start a campaign, submit a request for funding by providing the necessary information, and check the campaign's details and summary. The donor will be able to approve for a request, finalize it and contribute to any of the domain he/she is interested in. The transaction between donor and receiver happens through solana blockchain and a block is created for each transaction. This also includes a tracking

system which keeps track of the funds raised. It has an interface for uploading photos to show how effectively the funds have been used which provides a transparency for users.
When donor visits our page, he/she has to login to our system and then a home page consisting of various campaigns will be displayed. For the campaign creator, when he logins he will be requested for his details and a phantom wallet will be created for him. Based on the details provided by him, wallet creation may be successful or it may get failed. This wallet must now get connected with our system for further transaction. The sequence diagram for this phase is shown in fig 4.2.

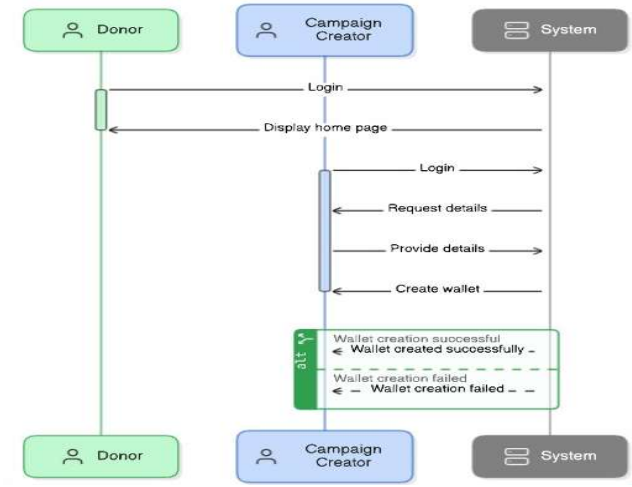

Fig. 2 Registration Phase

Phase 2: Transaction Phase: In this phase, Donor will initiate the donation. A new transaction is created and it is broadcasted to the Solana blockchain. Now the smart contract will validate the transaction and it confirms the transaction. Once the transaction gets confirmed the donated amount will be transferred to the wallet and the transaction gets completed. The sequence diagram for this phase is shown in fig 4.3.

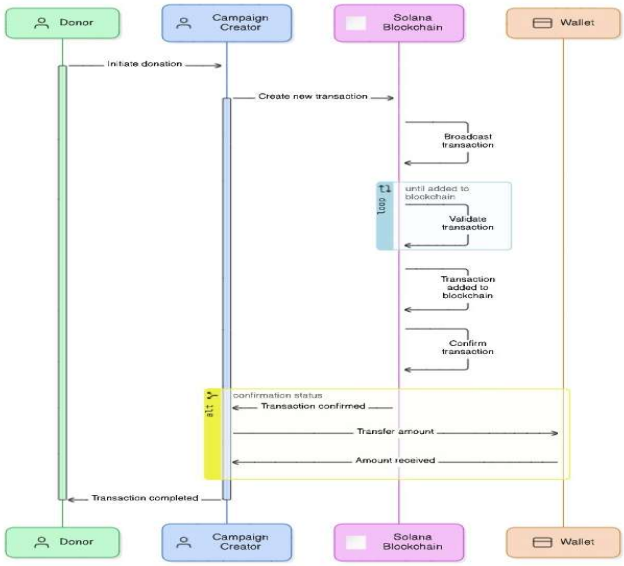

Fig. 3 Transaction Phase

Phase 3: Tracking Phase : In the fund tracking phase, the user will request for the fund track details. The system will fetch the details of the campaign from the blockchain and finally the user will be able to view the fund and campaign details. . The sequence diagram for this phase is shown in fig 4.4.

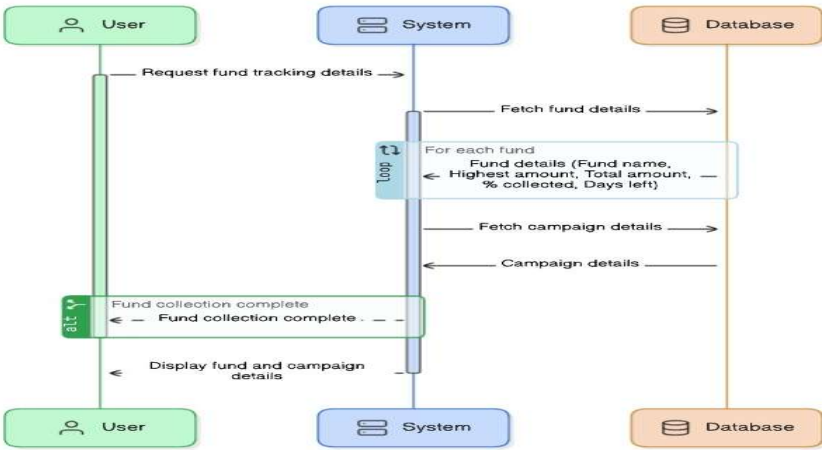

Fig. 4 Tracking Phase

V. Experimental Setup and Implementation

Dependencies needed for setting up the project:
Rust, Solana CLI, Anchor CLI are the prerequisites for setting up the project.
Pseudo code for smart contract:
The solana_crowdfunding module defines a Solana program
for managing crowdfunding projects.
Functions like initialize_project, donate, and
withdraw_funds interact with the Project account to
initialize, donate to, and withdraw funds from a
crowdfunding project.
Pseudocode 1: Creation of campaign:

```
function createCampaign(ctx, goal, deadline,
name):
// Validation checks
//Check for goal and deadline
// Update project details
project.name = name
project.auth = ctx.accounts.user.key()
project.goal = goal
project.donated_amount = 0
project.deadline = deadline
// Return success
return Ok(())
```

Donate function allows users to donate SOL to a
crowdfunding project. It Validates that the donation amount is greater than zero, transfers SOL tokens from the donor to the project and updates the donated amount and records the donor's public key.
Pseudocode 2:

```
function donate(ctx, amount):
// Validation check for amount greater than
0
If(amount > 0){
// Prepare transfer instruction
// Invoke transfer
// Update project state by adding amount to
the donated amount
}
// Return success
return Ok(())
```

Withdraw_funds allows the project owner to withdraw funds after the crowdfunding goal is met and the deadline has passed. It checks if the caller is the project owner, if the goal has been met, and if the deadline has passed. Then it transfers donated funds to the project owner and resets the donated amount.
Pseudocode 3: function withdraw(ctx):
// Validation checks: check for conditions
such as non-zero goals, future deadlines,
ownership, goal achievement, and deadline
expiration
// Withdraw funds from solana wallet
// Return success
return Ok(())
Error handling (CrowdfundingError) is defined to manage invalid operations or conditions.

VI. RESULTS

Ecocrowd is a user-centric platform tailored for individuals deeply committed to environmental conservation. Upon visiting the site, new users are prompted to register, securely storing their details in MongoDB Atlas. Once registered, users gain access to a robust array of functionalities upon logging in. These include the ability to initiate crowdfunding campaigns aimed at supporting diverse environmental projects. Campaigns, prominently displayed on the homepage, empower users to choose causes aligning with their passions and values.
A seamless donation process through the integration with Phantom wallet allows users to securely contribute funds in SOL tokens directly to campaigns of their choice. Transparent tracking mechanisms showcase real-time updates on donated amounts and progress towards campaign goals and deadlines. This transparency not only enhances user engagement but also fosters a sense of community and shared responsibility towards achieving impactful environmental outcomes.
Ecocrowd's commitment extends beyond facilitating donations. It serves as a catalyst for collective action, encouraging collaboration among users to make meaningful environmental impacts. By leveraging technology to connect passionate individuals with impactful projects, Ecocrowd stands as a beacon of hope and empowerment in the global fight for environmental sustainability.

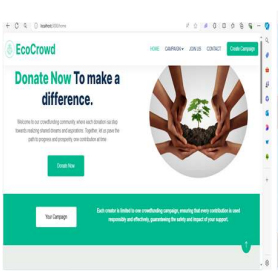

Fig. 5 EcoCrowd Home page

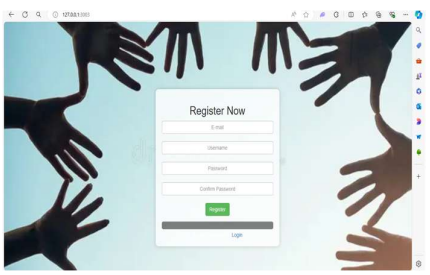

Fig. 6 Registration Phase

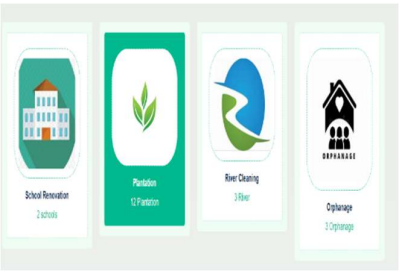

Fig. 7 Campaign Types

VII. CONCLUSION

In conclusion, creating a multifaceted and transparent crowdfunding platform has the potential to revolutionize societal challenges. A Solana-based crowdfunding application offers a promising solution to the issues faced by traditional platforms. By leveraging Solana's speed, scalability, and low transaction costs, the application can enhance the efficiency, transparency, and accessibility of crowdfunding.
Real-time impact tracking allows donors to see the immediate effects of their contributions, fostering trust and engagement. This transparency ensures that funds are used effectively, encouraging continuous support. The platform's ability to support diverse causes empowers individuals to make meaningful contributions that drive positive change.
This platform represents a shift towards harnessing collective power to address global issues. By facilitating collaboration, we can tackle challenges such as poverty, education, healthcare, and environmental sustainability more effectively. The future of crowdfunding lies in the integration of technology and human compassion. By continuing to innovate, we can create an ecosystem where everyone has the opportunity to contribute to and benefit from collective efforts, creating a brighter future for all.

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