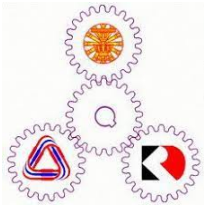

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BlockChain Capstone Project
Decentralized Application Report: Charity Fundraising for Animal Welfare (AniChain)

DES484 Blockchain Development

By

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1. Overview

This report focuses on the development and implementation of a decentralized animal welfare fundraising application. The project's core objective is to provide a transparent and accessible platform for users to contribute Ethereum donations towards supporting animals in need. The decentralized animal welfare fundraising application combines transparency, accessibility, and a user-friendly interface to not only facilitate financial contributions but also promote awareness and engagement in the crucial cause of animal welfare.

1.1 Project Goals

The capstone project aims to design and implement a decentralized application facilitating charity fundraising and donations for animal welfare. The project includes the development of a smart contract backend and a user-friendly frontend interface.

Project Features:

- Donation Tracking: The application dynamically displays the cumulative donation amount along with the donor's name and personalized message.

- Information Pages: Various pages on the website are dedicated to describing and promoting the animal welfare cause.

Technical Details:

- Smart Contract: Written in Solidity, the smart contract orchestrates secure and transparent donation transactions on the Ethereum blockchain.

-Frontend: Developed using third web and written in Typescript. Our frontend has a simple and minimalist design that integrates well with our smart contract.

- Deployment: Utilized the third web platform for seamless smart contract integration and deployment.

- Testing: Rigorous testing, including initial phases on Remix, ensured the functionality and security of the smart contract.

1.2 Problem Domain Understanding

Before embarking on the design of our software application, it was imperative to gain a comprehensive understanding of the problem domain. This involved a thorough exploration of the use case for the smart contract and decentralized app, as well as an analysis of relevant regulations, standards, and best practices in the context of animal welfare fundraising.

Our decision to incorporate blockchain technology and decentralization into our animal charity welfare initiative is driven by a commitment to address critical challenges and enhance the overall impact of our efforts. The following summarizes the problems we aim to solve and why blockchain is integral to our welfare project:

1.2.1 Transparency and Trust

Problem: Traditional charity systems lack transparency, leading to concerns about fund utilization.

Blockchain Solution: By leveraging blockchain, we establish an immutable and transparent ledger. This ensures that every transaction, from donation to fund allocation, is visible to all stakeholders, fostering trust and accountability. The decentralized nature of blockchain enables donors to trace the flow of funds in real-time. This transparency ensures that contributions directly contribute to animal welfare, enhancing accountability.

1.2.2. Removing Middleman Dependency

Problem: Traditional charity models involve multiple intermediaries, leading to less money being spent on the organization themselves.

Blockchain Solution: Decentralization minimizing costs for numerous intermediaries, ensuring a larger proportion of donations directly benefits animal welfare, reducing administrative costs.

1.2.3. Global Accessibility

Problem: Geographic constraints and banking limitations hinder global participation in charity initiatives.

Blockchain Solution: By accepting cryptocurrencies on a blockchain, our charity becomes globally accessible, allowing anyone with an internet connection to contribute, fostering a more inclusive community.

1.2.4. Security and Fraud Prevention

Problem: Traditional financial systems may be susceptible to embezzlement or mismanagement.

Blockchain Solution: Blockchain's cryptographic features and decentralized architecture enhance security, prevent the risk of embezzlement or misappropriation with transparency. Smart contracts further enforce predefined rules for fund allocation.

1.2.5. Efficiency and Direct Transactions

Problem: Traditional financial transactions can be slow, especially for international transfers due to intermediaries.

Blockchain Solution: Cryptocurrency transactions on the blockchain are faster and more efficient since they are decentralized so the transactional speed is consistent, allowing for swift and direct transfers of funds, crucial in responding promptly to urgent animal welfare needs.

1.2.6. Immutable Donation Records

Problem: Records of charitable transactions in traditional systems can be altered or lost.

Blockchain Solution: Blockchain's immutability ensures the integrity and permanence of donation records, providing an auditable history of contributions.

In summary, integrating blockchain and decentralization into our animal charity welfare project addresses challenges by promoting transparency, accountability, global accessibility, security, and efficiency in the donation process. These features collectively contribute to building a more trustworthy and effective animal welfare fundraising platform.

2. Case Study Selection System Architecture

Overview

In defining the architecture for our animal welfare fundraiser blockchain project, our focus is on creating a streamlined system that effectively integrates the smart contract and decentralized application

components. This architecture is designed to meet the identified requirements, emphasizing transparency, security, and efficiency throughout the entire donation process.

The chosen use case focuses on "Charity Fundraising and Donations for Animal Welfare." The justification for this selection is:

- **Transparency and Trust**: Utilizing blockchain technology ensures transparency in financial transactions, building trust among donors by providing a verifiable and immutable record of donations.

- **Decentralization:** By decentralizing the fundraising process, the application reduces reliance on centralized authorities, promoting a more inclusive and open fundraising environment.

- **Global Accessibility**: A decentralized application allows for global participation, enabling animal welfare enthusiasts from around the world to contribute to the cause without geographical restrictions.

Further in depth details were discussed in section 1.2

2.1 Smart Contract Architecture:

Components:

- Transaction Handler: Manages incoming donation transactions, ensuring proper validation and processing.
- Data Storage: Stores immutable records of donations, fund allocations, and project details.
- Business Logic: Executes predefined rules for fund allocation, ensuring accountability and transparency.
- Event Emitter: Triggers events for real-time updates on donation transactions and fund utilization.

Interactions:

- User Interaction: Users interact with the smart contract primarily through donation transactions, triggering the execution of the business logic.
- Decentralized App Interface: The decentralized application interfaces with the smart contract to retrieve real-time data for display to users.
- Blockchain Network: The smart contract interacts with the underlying blockchain network, recording transactions on the immutable ledger.

Technologies and Frameworks:

- Solidity: Utilized for writing the smart contract code, ensuring compatibility with the Ethereum blockchain.
- Web3.js: Facilitates communication between the decentralized app and the smart contract, enhancing user interaction

.

2.3 Decentralized App Architecture:

Components:

- Usemake contributions.
- Front-End Logic: Manages the interaction between the UI and the smart contract, ensuring a seamless user experience.
- User Authentication: Secures user accounts and ensures the integrity of donor information.

Interactions:

- Smart Contract Integration: The decentralized app interacts with the smart contract to retrieve and display donation data, ensuring real-time updates for users.
- User Interaction: Donors navigate the UI to make contributions, view donation history, and explore project-related information.
- Blockchain Network: The decentralized app communicates with the Ethereum blockchain to facilitate secure and transparent transactions.

Blockchain Network and Framework:

- Consensus Mechanism: Utilizes Ethereum's consensus mechanism (e.g., Proof-of-Stake) for secure and decentralized validation of transactions.
- Smart Contract Deployment: The smart contract is deployed to the blockchain network, ensuring accessibility and visibility to all participants.
- Network Nodes: Nodes validate and propagate transactions, maintaining the integrity of the blockchain.
- Ethereum Framework: Chosen for its established and secure decentralized platform, providing a robust foundation for our animal welfare fundraiser.

This architecture is tailored to meet the specific needs of our animal welfare fundraising initiative, promoting transparency and efficiency in every transaction. As we move forward, continuous refinement and adaptation will be key, ensuring that our platform remains agile and responsive to the evolving landscape of blockchain technology and charitable fundraising.

3. Smart Contract Development

3.1 Design of the Smart Contract

3.1.1 Overview

Our smart contract is designed to facilitate transparent and secure donation transactions. It includes functions for:
- Receiving Ether donations either in monthly or one time payments
- Recording user messages and names
- Tracking the total accumulated donations

3.1.2 Considerations

- Security: Implemented security measures to prevent unauthorized access or manipulation of funds.
- Efficiency: Optimized gas usage to minimize transaction costs.
- Reliability: Ensured the contract's reliability through rigorous testing.

3.2 Functionality of the Smart Contract

3.2.1 Overview

The smart contract successfully performs the intended functions:

- Validates incoming transactions
- Updates the total donation amount
- Records and displays user messages

3.2.2 Bug-Free Implementation

A thorough testing process was conducted to identify and rectify any bugs, resulting in a robust and bug-free smart contract.

3.3 Use of Smart Contract Best Practices

3.3.1 Error Handling

Implemented robust error-handling mechanisms to handle unexpected scenarios gracefully.

One error we encountered was when the user refuses to connect their smart wallet after pressing the donation button. We solved this issue by creating a hook that will update the connection state. Then, an error message below the button would appear informing that the connection was not successful. Other syntax errors were carefully navigated.

3.3.2 Gas Optimization

Carefully optimized gas consumption to ensure cost-effective transactions for users. Deployment was carefully done after checking for errors on remix for malfunctions.

3.3.3 Secure Coding Practices

Followed industry-standard secure coding practices to mitigate potential vulnerabilities.

4. Frontend Development

4.1 User Interface Design

4.1.1 Overview

The user interface is thoughtfully designed, offering a seamless and intuitive experience for users. It contains 3 main pages: donation,home, and about us. The donation page contains different options for types of donations. It includes one time and monthly payments. Custom donation amounts can be inputted in the text box below the fixed value buttons. The home page contains all the links to other various pages of our website.

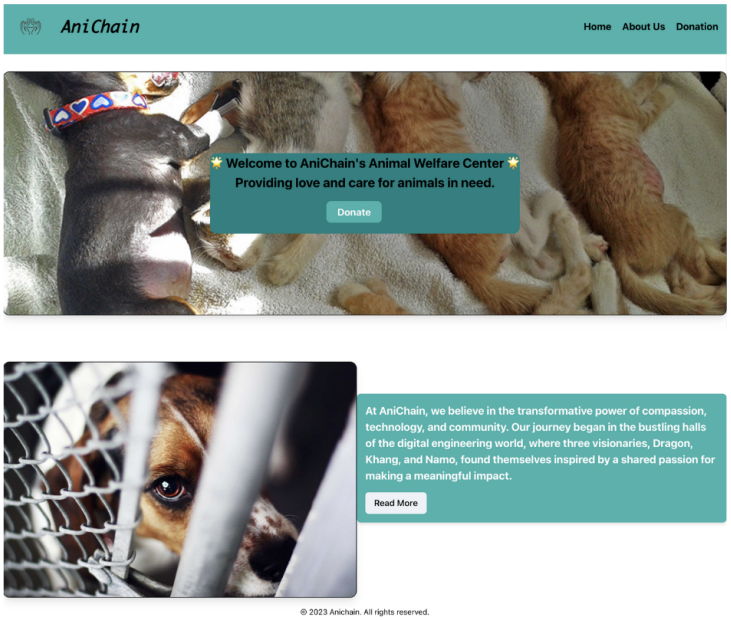

Figure 1: AniChain's Homepage

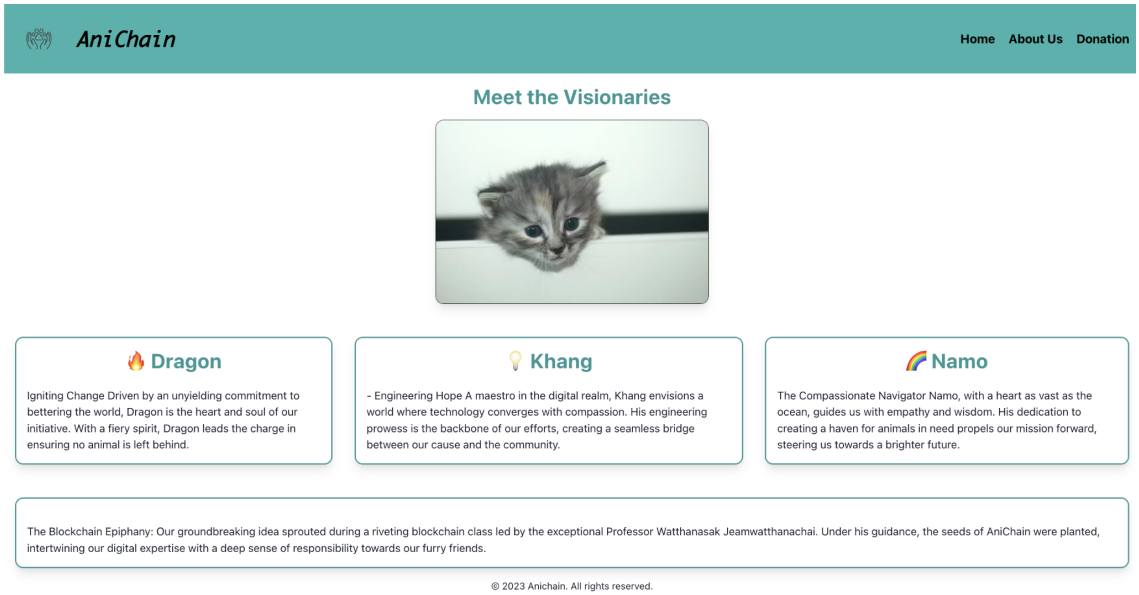

Figure 2: AniChain's About Us page

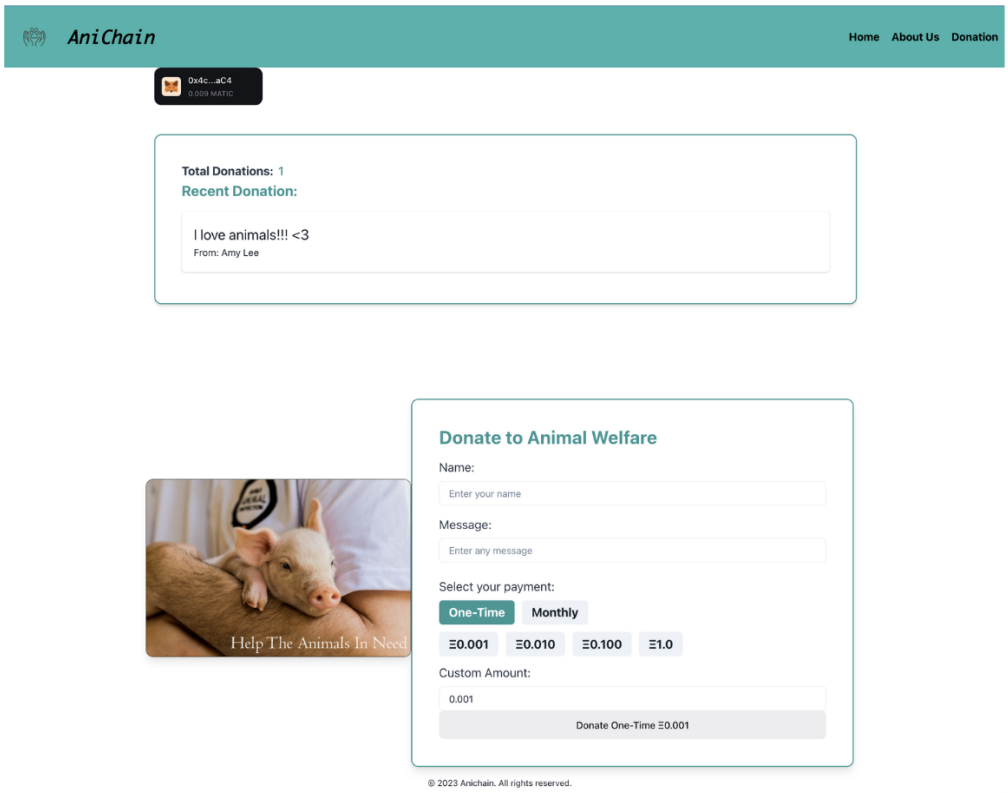

Figure 3: AniChain's Donation Page

4.1.2 Suitability for the Case Study

The design aligns with the charitable nature of the project, fostering a sense of goodwill and engagement among users. It is a functional integration of fundraising utilizing the ethereum blockchain.

4.2 Integration with Smart Contract

4.2.1 Overview

The frontend is seamlessly integrated with the smart contract, allowing users to interact with the decentralized application effortlessly. It allows users to donate and learn about animal welfare.

4.2.2 Features

Includes user-friendly interface for donation inputs, and informative page about organization.

5. Testing and Deployment

5.1 Testing

5.1.1 Thorough Testing

Comprehensive testing procedures were employed, covering unit testing, integration testing, and user acceptance testing.

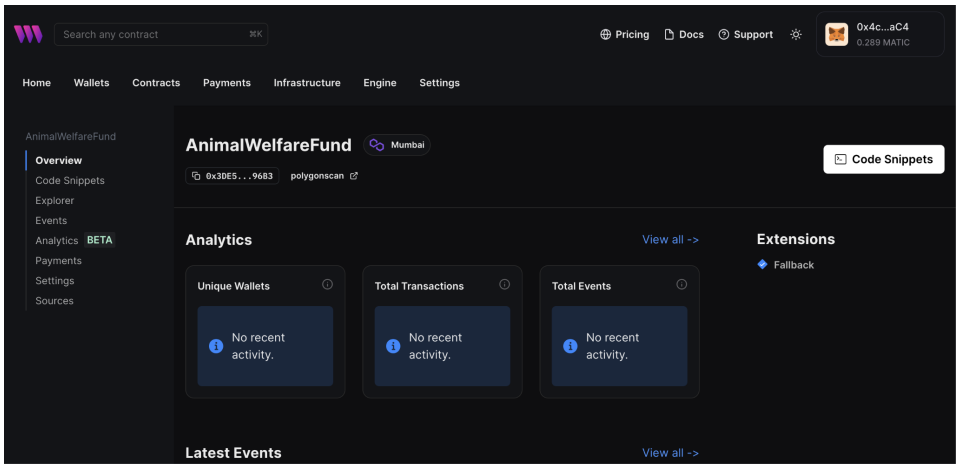

Figure 4: Example of ThirdWeb deployed

5.1.2 Issue Resolution

Identified and resolved issues promptly to ensure the reliability and stability of the application.

5.2 Deployment

5.2.1 Blockchain Network

Successfully deployed the application to a blockchain network, ensuring operational efficiency and security. Initial gas and ethereum were found in public ethereum faucets. Deployed in the Mumbai Network.

6. Conclusion

In conclusion, the decentralized application for charity fundraising and donations for animal welfare successfully combines transparency, efficiency, and user-friendliness. The smart contract and frontend development align with best practices, ensuring a reliable and secure platform for users to contribute to the noble cause of animal welfare. If given more time, our team would like to implement the following features for our capstone project.

Advancing Transparency:

- Future Implementation: Explore advanced visualization tools to enhance the transparency of fund utilization, providing donors with more detailed insights into project-specific expenditures.
- Extended Timeframe: Allocate resources for continuous refinement of the transparency feature to adapt to emerging technologies and donor expectations.

Elevating Accountability in Fund Utilization:

- Future Implementation: Integrate machine learning algorithms to generate predictive analytics on the potential impact of specific allocations, allowing donors to foresee the outcomes of their contributions.
- Extended Timeframe: Establish a feedback loop with donors to gather insights on the effectiveness of fund allocation reports and implement improvements accordingly.

Further Reducing Middleman Dependency:

- Future Implementation: Investigate the incorporation of decentralized finance (DeFi) solutions to minimize reliance on traditional financial intermediaries, enhancing the efficiency and cost-effectiveness of transactions.
- Extended Timeframe: Collaborate with blockchain experts to explore emerging technologies and trends in DeFi for continuous optimization.

Expanding Global Accessibility:

- Future Implementation: Evaluate the integration of additional blockchain networks or layer 2 solutions to broaden the range of accepted cryptocurrencies, catering to an even more diverse global donor base.
- Extended Timeframe: Conduct regular market research to identify new and emerging cryptocurrencies that align with our project's goals and integrate them into our donation platform.

Strengthening Security and Fraud Prevention:

- Future Implementation: Explore the integration of biometric authentication for donors, adding an extra layer of security to the platform and mitigating potential fraudulent activities.
- Extended Timeframe: Engage with cybersecurity experts for ongoing threat assessments and proactive security measures to adapt to evolving cyber threats.

Enhancing Efficient and Direct Transactions:

- Future Implementation: Investigate the adoption of blockchain scalability solutions, such as layer 2 scaling solutions or sidechains, to further optimize transaction speed and reduce costs.
- Extended Timeframe: Monitor advancements in blockchain scalability and integrate solutions that align with our project's objectives.

Ensuring Immutable Donation Records:

- Future Implementation: Explore advanced cryptographic techniques and zero-knowledge proofs to enhance the immutability and privacy aspects of our donation records.
- Extended Timeframe: Collaborate with blockchain security experts to stay abreast of emerging cryptographic technologies and integrate them into our system.