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Bachelor's thesis in computer engineering

NFT-based Decentralized XP System

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Abstraction

This project aims to create an XP-based reward system using the Polygon blockchain, which leverages the use of ERC-1155 and NFT technology. The system is designed to allow users to earn XP, transfer XP, and convert XP into NFTs, which can be used to represent achievements and rewards. The system is comprised of three main contracts: the User Contract, the NFT Explorer Contract, and the XpToken Contract.

The User Contract is responsible for keeping track of the user's XP balance and the history of XP gains and burns. It also allows the assignment of XP to users for certain actions and events. The NFT Explorer Contract serves as a bridge between the XP system and the NFT system, allowing users to convert XP into NFTs. The XpToken Contract serves as the main contract for the XP system, managing the issuance and transfer of XP, as well as the conversion of XP into NFTs.

The other importance part is The NFT Contract, the importance lies in its ability to store two types of images: public and private. Public images can be viewed by anyone, while private images can only be viewed by the owner. This allows for a level of privacy and security in the NFT system, as well as the flexibility to choose what information is shared publicly.

By leveraging the power of blockchain technology, this project provides a secure and transparent platform for the creation and management of an XP-based reward system. The use of ERC-1155 and NFTs allows for the creation of unique and valuable rewards, which can be used to recognize achievements and encourage user engagement. This project is an innovative solution for businesses and organizations looking to implement a reward system for their users, and has the potential to revolutionize the way rewards and achievements are recognized and valued.

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The world of technology is advancing at an unprecedented pace and one of the major areas that is transforming the way we live, work, and interact is the field of blockchain. With the advent of blockchain technology, we now have a new way of managing data, transactions, and assets that is more secure, transparent, and decentralized. This has led to a surge in the creation of new and innovative blockchain-based projects and applications, aimed at solving real-world problems and improving the lives of people.

One of the most exciting areas within blockchain technology is the creation of non-fungible tokens (NFTs). NFTs are unique digital assets that represent ownership of a specific item or piece of content, such as art, music, videos, or even tweets. Unlike other cryptocurrencies that are fungible and interchangeable with each other, NFTs are unique and have a one-of-a-kind value. This uniqueness makes NFTs ideal for use in various applications, such as digital collectibles, gaming, and even as a means of authentication and verification.

However, despite the numerous benefits of NFTs, there is still a lack of solutions that enable the creation of NFTs with multiple images, where one image is public and the other is private. This limitation has been a major obstacle to the full realization of the potential of NFTs, and has prevented many artists, creators, and enthusiasts from using NFTs to their fullest.

To address this limitation, the present project aims to create a decentralized experience (XP) system on the Polygon blockchain, that allows for the creation of NFTs with two images - a public image and a private image. This innovative solution provides users with greater flexibility and control over their NFTs, and opens up new possibilities for artists, collectors, and other stakeholders in the NFT ecosystem.

The present project will utilize the ERC-1155 standard, which is a multi-token standard that allows for the creation of both fungible and non-fungible tokens within a single contract. This standard will allow for the creation of the XP token, which will be used as the primary means of tracking and assigning XP within the system. Additionally, the project will include a user contract, an NFT explorer contract, and an NFT contract, all of which will work together to form a seamless and integrated XP system on the Polygon blockchain.

With the creation of this XP system, the present project aims to revolutionize the way that NFTs are used and to open up new possibilities for artists, creators, and other stakeholders in the NFT ecosystem. By combining the unique properties of NFTs with the flexibility and security of blockchain technology, the present project aims to create a more secure, transparent, and decentralized means of managing digital assets and experiences.

The objectives of this project are to design and develop a decentralized XP management system on the Polygon blockchain. This system will allow users to assign XP points, transfer XP between users, and exchange XP points for unique NFTs.

The main goal of this project is to create a system that can manage XP points in a secure and transparent manner, utilizing the benefits of the blockchain technology. The XP management system will provide a new way for users to recognize and reward achievements and contributions, and will serve as a valuable tool for communities and organizations.

Another objective of this project is to introduce a new type of NFT, one that contains two images, one public and one private, providing an additional layer of privacy for users. This new type of NFT will offer a new level of customization and flexibility, allowing users to showcase their XP achievements in a unique and personalized way.

Overall, the objectives of this project are to create a secure, transparent, and flexible XP management system on the Polygon blockchain, and to introduce a new type of NFT that provides an additional layer of privacy and customization for users.

The project aims to develop an XP system on the Polygon blockchain that connects several smart contracts to form a comprehensive and seamless system. This system provides a unique way for users to interact with their Non-Fungible Tokens (NFTs) by assigning XP points to them.

At its core, the project consists of several smart contracts, including a User Contract, NFT Explorer Contract, XpToken Contract, and NFT Contract. The User Contract allows users to interact with the XP system by assigning XP points to their NFTs. The NFT Explorer Contract is responsible for managing and storing information about NFTs. The XpToken Contract manages the XP balance of each user, while the NFT Contract enables the creation of NFTs with attached XP points.

What sets this project apart is the NFT Contract which allows two images NFTs, one public image and one private image, for the first time in web3 and blockchain. This is a major innovation that provides users with greater flexibility and control over their NFTs, and enhances the overall user experience.

The XP system allows users to assign XP points to their NFTs, transfer XP points between NFTs, and view their XP balance. This provides a new and unique way for users to interact with their NFTs and adds a new dimension to the way NFTs can be used.

In summary, the XP system on Polygon blockchain is a ground-breaking project that provides a unique way for users to interact with their NFTs. With its innovative NFT Contract, users have greater flexibility and control over their NFTs, and a more immersive and engaging user experience.

Blockchain technology is a digital ledger that records transactions and data in a secure and decentralized manner. It was originally introduced as a secure method for tracking digital currency transactions, but has since evolved into a versatile tool that can be used in a variety of industries and applications. The basic building blocks of blockchain technology are blocks, which contain a collection of transactions. These blocks are then linked together in a chain, hence the name "blockchain."

One of the key features of blockchain technology is that it is decentralized, meaning there is no central authority controlling the data. Instead, transactions and data are validated and recorded across a network of computers, which all maintain a copy of the blockchain. This makes it extremely difficult for anyone to tamper with the data, since any changes to the blockchain would need to be made across the entire network.

Another key feature of blockchain technology is that it is secure. All transactions and data are encrypted, and the decentralized network ensures that the data cannot be easily manipulated or hacked. Furthermore, the transparency of blockchain technology means that it is possible to track transactions and data back to their origin, making it possible to identify fraudulent or malicious activity.

Overall, blockchain technology is seen as a major technological innovation that has the potential to revolutionize a wide range of industries and applications. Its ability to securely and transparently record transactions and data, without the need for a central authority, has the potential to greatly increase efficiency and reduce the risk of fraud and corruption.

ERC-1155 is a token standard in the Ethereum blockchain that allows for the creation of tokens that can represent a combination of multiple token classes such as utility tokens and non-fungible tokens (NFTs) in a single smart contract. It was introduced as an improvement over the existing token standards ERC-20 and ERC-721, which were designed specifically for fungible and non-fungible tokens respectively.

The key advantage of ERC-1155 is its ability to handle multiple token classes in a single contract, which helps reduce the amount of gas (transaction fees) required to perform token transactions, and also simplifies the token management process for developers and users. Additionally, ERC-1155 enables users to perform transactions with multiple tokens in a single transaction, which can result in increased efficiency and reduced costs compared to using multiple transactions.

In terms of its implementation, ERC-1155 tokens are similar to ERC-20 tokens in that they use a standard interface and can be stored in standard Ethereum wallets. However, they also have the ability to hold multiple token classes, which is a unique feature compared to other token standards.

ERC-1155 is a flexible and effective token standard that offers several advantages to users and developers inside the Ethereum blockchain ecosystem. It is regarded as one of the most promising token standards for upcoming blockchain applications, and the Ethereum community is using it more and more frequently.

The term NFT stands for Non-Fungible Token. It refers to a unique digital asset that represents ownership or proof of authenticity of a certain item or piece of content on a blockchain network. Unlike fungible tokens such as cryptocurrencies, where each unit is interchangeable and has the same value, NFTs are unique and cannot be divided or exchanged for equal values. NFTs use blockchain technology to provide secure and transparent ownership verification, making it possible to track the origin and transfer of the asset from one owner to another.

The most common type of NFTs are digital collectibles, such as digital art, rare images, music, and video clips. These digital assets are often highly valued due to their rarity and uniqueness, which makes them ideal for use in various applications such as gaming, digital collectibles marketplaces, and more. NFTs have been gaining significant popularity in recent years, with several high-profile sales of digital art pieces and collectibles breaking records in the NFT market.

NFTs offer a wide range of benefits, including ownership verification, transferability, and scarcity. They provide a secure and transparent way to represent ownership of a digital asset, allowing the owner to transfer or sell the asset to another party without any intermediaries. Additionally, NFTs also help to solve the problem of content piracy and illegal distribution, as the ownership and authenticity of the asset can be easily verified on the blockchain network.

The ownership, trading, and valuation of digital assets have all been changed by NFTs, enabling individuals to amass rare and priceless digital goods in a safe and open environment.

Web3 is a term used to describe the next iteration of the internet, also known as the decentralized web. The main idea behind Web3 is to create a decentralized, distributed network where data can be shared and transactions can be made without the need for intermediaries such as banks or other financial institutions. Web3 uses blockchain technology to securely and transparently record transactions and store data, enabling the creation of new applications and services that were not possible with the traditional web.

In the Web3 ecosystem, individuals have full control over their data and assets, as there are no intermediaries to mediate transactions or hold data. This results in a more secure, transparent, and accessible internet, where anyone can participate and build new applications without the need for permission or centralized control.

Web3 also encompasses the idea of decentralized finance (DeFi), where financial services such as loans, insurance, and investments can be performed without the need for intermediaries. Additionally, Web3 supports decentralized autonomous organizations (DAOs), which are organizations run through code rather than traditional management structures.

With Web3, the internet becomes a more democratic and open space, allowing users to transact, interact, and exchange value directly with each other, without the need for intermediaries. This shift from the centralized web to the decentralized web represents a major change in the way we use the internet and has the potential to create new opportunities for individuals and businesses alike.

In this project, the system architecture is comprised of several key components, including the user contract, NFT explorer contract, XpToken contract, and the NFT contract. Each component has a specific role and function in the project, and the interaction between these components forms the backbone of the project's functionality.

The user contract is responsible for managing the interactions between the users and the system. It includes the functions required for assigning XP, transferring XP, and checking the XP balance. The NFT explorer contract is responsible for exploring the NFTs stored on the blockchain and providing information about the NFTs to the users. The XpToken contract is responsible for managing the XP tokens and keeping track of the XP balance of each user.

The NFT contract is the most innovative component of the project, allowing users to store two images in a single NFT for the first time in the web3 and blockchain space. One image is public, while the other is private, allowing users to showcase their NFTs in a unique and personalized way. The NFT contract is also responsible for managing the interactions between the NFTs and the XpToken contract.

The system architecture is designed to be scalable, secure, and efficient, ensuring that the project can handle a large number of users and transactions. The contracts are also designed to be upgradeable, allowing for future improvements and updates to the project.

Truffle is a popular development framework for writing smart contracts on the Ethereum blockchain. It provides a suite of tools and libraries for developers to easily write, test, and deploy smart contracts to the Ethereum network. In this project, Truffle was used as the primary tool for writing the contracts in Solidity, the programming language for Ethereum. The framework allowed for an organized and streamlined development process, with features such as automated contract testing, compilation, and deployment. Additionally, Truffle provided a comprehensive set of APIs for interaction with the Ethereum network and contracts, allowing for the efficient creation and execution of transactions. The use of Truffle in this project was crucial for ensuring the smooth and successful deployment of the NFT and XP token contracts to the Ethereum network.

system architecture. It defines the behavior and properties of the users in the system. This contract is responsible for managing the XP (experience points) balance of each user and providing an interface for assigning, transferring, and viewing the XP balance. The User Contract also serves as a bridge between the XpToken Contract, which represents the XP as a token, and the NFT Contract, which manages the NFTs in the system.

The User Contract is designed to provide a secure and transparent environment for the users to interact with their XP and NFTs. It uses smart contract functionality to enforce rules such as preventing negative XP balances, limiting the number of XP transfers per day, and so on. This helps maintain the integrity of the system and ensures that all users have a fair and equal experience.

The User Contract also includes a set of functions that allow users to view their XP balance, transfer XP to other users, and add XP to their NFTs. This provides users with complete control over their XP and NFTs, making the system user-friendly and accessible.

All things considered, the User Contract is a vital part of the system design and plays a significant role in guaranteeing the safety, openness, and accessibility of the system for all users.

The NFT Explorer Contract is an essential component of the overall system architecture of the project. This contract is responsible for managing and exploring the various NFTs within the system. It keeps track of all the NFTs and their respective attributes, such as the owner, the XP balance, and the public and private images. The NFT Explorer Contract provides an interface for the users to easily navigate and search for NFTs within the system, making it a crucial aspect of the user experience. Additionally, the contract also facilitates the transfer of NFTs between users, ensuring the seamless and secure transfer of ownership. With the NFT Explorer Contract in place, the users are given the ability to discover, explore, and interact with the various NFTs within the system, making it a key component of the overall project architecture.

The XpToken Contract is an integral component of the project, as it acts as the main token for the system. This contract is responsible for managing and storing the XP balance of the users. It allows users to transfer XP to other users and keep track of their XP balance. The XpToken Contract is built using the Ethereum network, which provides a secure and decentralized platform for the management of the XP token.

The XpToken Contract follows the ERC-20 standard, which is a widely adopted standard for the creation and management of tokens on the Ethereum network. The contract contains several key functions that allow users to interact with the token, including transfer, approve, and balanceOf functions.

The XpToken Contract also has several built-in security features to prevent malicious attacks and unauthorized access. For example, the contract implements the transfer and approve functions with a check on the XP balance of the users, ensuring that the users cannot spend more XP than they have in their balance.

The XpToken Contract also has a number of scalability-enhancing techniques, making it appropriate for large-scale applications. This enables the system to support a large number of users and effectively manage a high volume of transactions.

All things considered, the XpToken Contract is a crucial part of the project because it offers a safe, decentralized, and scalable platform for managing XP.

The NFT Contract is a critical component of the overall system architecture. It serves as the backbone for the creation and management of Non-Fungible Tokens (NFTs) within the platform. This contract is responsible for the creation and management of NFTs that are unique, indivisible and one-of-a-kind. The NFT Contract is designed to provide a secure and efficient way of creating, storing, and managing NFTs within the platform.

One of the key features of the NFT Contract is the ability to store two images for each NFT, one public image and one private image. This innovative feature allows for a new level of customization and privacy for the users of the platform. With this feature, users can choose to make their NFTs publicly visible to the world or keep their NFTs private, accessible only to a select group of individuals.

The NFT Contract uses smart contract technology to automate the creation, management, and transfer of NFTs. This eliminates the need for intermediaries and ensures that the NFTs are managed in a secure and transparent manner. The NFT Contract is also equipped with mechanisms to prevent fraud and abuse, such as double-spending and counterfeiting, ensuring the integrity of the NFTs within the platform.

In conclusion, the NFT Contract, which offers a secure and effective manner of creating, storing, and managing NFTs inside the platform, including the ground-breaking feature of permitting two images per NFT, is a crucial part of the platform's system design.

The various contracts involved in this project have been connected together in a structured manner to achieve the desired functionality. The contracts have been integrated in a way that each contract's functionality supports the functionality of the other contracts, forming a seamless experience for the end-users. The connections between the contracts have been established through the implementation of smart contract functions, which allow for interaction and communication between the contracts.

The user contract, NFT explorer contract, XpToken contract, and NFT contract have been connected together to form the core of the system. The user contract is responsible for handling user operations and storing user data. The NFT explorer contract provides an interface for users to explore the NFTs in the system. The XpToken contract manages the XPs in the system and the NFT contract handles the creation and management of NFTs.

Each contract has been designed and developed to serve a specific purpose, and their interactions have been carefully planned to ensure a smooth and efficient user experience. The connections between the contracts are established through the use of smart contract functions, which allow for communication and interaction between the contracts.

In conclusion, the successful integration of the various contracts in this project is a testament to the power of blockchain technology and smart contracts. By connecting the contracts in a structured manner, the system has been able to deliver a seamless and efficient experience for the end-users, allowing them to make the most of the innovative features offered by this project.

In this section of the project, the process of assigning XP (experience points) to NFTs will be discussed. Experience points serve as a way for users to showcase their engagement with their NFTs and provide a way for others to gauge the level of importance and popularity of the NFT.

Assigning XP to NFTs is a simple process that involves the interaction of the user with the XpToken Contract. This contract is responsible for managing the allocation of experience points to NFTs. To assign XP, the user must call the appropriate function within the XpToken Contract and provide the necessary parameters, such as the ID of the NFT and the number of XP to be assigned.

Once the function has been called, the XpToken Contract will validate the request and ensure that the user has the necessary permissions to assign XP to the NFT in question. If everything checks out, the XP will be added to the NFT's record and updated within the NFT Contract.

It is important to note that the process of assigning XP is secured through the use of smart contracts and blockchain technology, ensuring that all transactions are tamper-proof and recorded immutably on the Ethereum blockchain. This provides a level of trust and transparency for all users, making it easier for them to engage with the platform and interact with their NFTs.

The XP (Experience Point) system allows users to transfer XP to other users within the platform. The XP Token Contract is designed to handle all XP related transactions, including the transfer of XP. The transfer of XP is initiated by the sender and is executed through a call to the transfer function of the XP Token Contract.

This transfer function takes two parameters, the address of the recipient and the amount of XP to be transferred. The recipient must have a valid user contract for the XP to be transferred to their account. Once the transfer function is executed, the XP is transferred from the sender's account to the recipient's account.

The XP Token Contract also includes a function to check the balance of a user's XP account, allowing users to view their current XP balance at any time.

By implementing a transfer function, the platform provides users with the ability to trade XP with other users, making the platform more engaging and interactive. This feature also provides users with the ability to reward other users for contributions to the platform and incentivize positive behavior.

The XP to NFT conversion is a unique feature of the project that allows users to assign XP to their NFTs and make them more valuable. This conversion process involves assigning a specific amount of XP to an NFT, which can be later used to determine the value of the NFT in the marketplace. The conversion of XP to NFT is a straightforward process and can be performed by any user who holds both XP and NFT.

The conversion process starts by selecting the NFT to which the XP is to be assigned. Once the NFT is selected, the user can specify the amount of XP that they wish to assign to the NFT. After the XP is assigned, it becomes a part of the NFT's attributes and cannot be transferred or redeemed. The NFT's value is then determined based on the XP assigned to it and the current market value of XP.

This feature of assigning XP to NFTs opens up new opportunities for NFT owners to monetize their collections and add value to their NFTs. Additionally, it provides a new way for users to invest in the NFT market and acquire unique and valuable NFTs with the added benefit of XP.

The XP balance refers to the amount of XP a user has accumulated within the system. This balance is kept track of in the XpToken Contract and is represented in a numerical value. The balance is updated whenever a user earns XP, transfers XP to another user, or converts XP to an NFT. It is important to note that XP balance is unique to each user and cannot be transferred between users without the user's explicit permission. The XP balance is a crucial aspect of the system as it represents the user's level of engagement and contribution within the platform. By having a clear record of the XP balance, users can easily see how much XP they have accumulated, and the corresponding NFTs they can unlock.

In conclusion, the project has aimed to develop a platform for the creation, management and exchange of NFTs and XP Tokens. The NFTs and XP Tokens are based on the ERC-1155 standard and utilize the Ethereum blockchain to ensure immutability and security. The platform uses smart contracts to implement the functionalities of the NFTs and XP Tokens, including the creation, transfer and storage of tokens. The NFT Contract manages the creation and storage of NFTs, while the XP Token Contract is responsible for the management of XP Tokens.

The User Contract, NFT Explorer Contract and XP Token Contract are connected in a way that allows for seamless interaction between the contracts and provides a unified experience for the users. The NFTs and XP Tokens can be created, assigned, transferred, and viewed through the platform, making the process of managing the tokens effortless. The platform also provides a NFT Explorer for the users to view their NFTs and XP balances.

The platform provides an innovative solution for the creation, management, and exchange of NFTs and XP Tokens, providing a seamless experience for users while also ensuring the security and immutability of the tokens through the use of blockchain technology. The platform represents a major step forward in the integration of blockchain technology into everyday life and has the potential to revolutionize the way that we interact with digital assets.

The goal of this project was to create a platform where users could create, view and manage their own NFTs and XPs. This project has achieved that goal by utilizing the power of smart contracts and the Ethereum blockchain. The platform provides a secure and decentralized environment for users to store their NFTs and XPs, eliminating the risk of centralization and data breaches.

The project has also successfully incorporated the concept of XP, a unique feature that allows users to add and transfer XPs to their NFTs. This feature adds an extra layer of utility to the NFTs, making them not just unique collectibles, but also valuable assets with tangible benefits.

The system architecture of the platform was also well thought out, with contracts for the User, NFT Explorer, XpToken, and NFT, all connected together to provide a seamless and efficient experience for the user. The use of smart contracts ensures that all transactions are recorded immutably on the Ethereum blockchain, providing a high level of security and transparency.

In conclusion, this project has successfully created a platform for users to create, view and manage their own NFTs and XPs, providing a secure and decentralized environment for their assets. The project has also incorporated unique and valuable features, such as XPs, to enhance the utility and value of the NFTs. This project serves as a testament to the power of blockchain technology and its potential to revolutionize the way we manage our digital assets.

This project has been a success, and I am confident that it will provide a valuable service to users who are looking to create and manage their own NFTs and XPs. I look forward to continuing to improve and expand upon this platform in the future.

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