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Decentralized File System Using Blockchain

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***Abstract*—Blockchain-based decentralized file sharing is a new technology that enables people to share data securely and openly without relying on a centralized middleman. Blockchain-based decentralized file sharing can be accomplished in a number of ways, including IPFS. It gives a general overview of the blockchain technology and highlights its advantages for decentralized file sharing. The report discusses the advantages of decentralized file sharing and blockchain technology, as well as issues with scalability, security, and privacy. It concludes by providing case studies of active decentralized file sharing networks and the uses for them. The findings imply that blockchain-based decentralized file sharing has the potential to fundamentally alter how we exchange and store files, and that additional research and development in this area could result in even better decentralization,security, and user experience.**

Keywords—Blockchain Technology,Ethereum,IPFS (InterPlanetary File System),Decentralized File Storage React.js,Pinata

I.INTRODUCTION

In today's digital age, data privacy and security are paramount concerns. Traditional file storage solutions often rely on centralized servers, making them susceptible to data breaches and censorship. To address these issues, our project introduces a decentralized file system powered by blockchain technology. By utilizing Ethereum smart contracts and IPFS, we aim to provide a secure, transparent, and censorship-resistant platform for storing and accessing files. The frontend of the application is developed using React.js, providing users with an intuitive interface for interacting with the decentralized file system[1].The decentralized file system project aims to leverage blockchain technology, specifically Ethereum and IPFS (InterPlanetary File System), to create a secure and censorship-resistant platform for storing and accessing files. The project utilizes React.js for the frontend, Solidity for the smart contracts deployed on the Ethereum blockchain, and Pinata as an intermediary for storing files on the IPFS network[2]. This combination of technologies ensures that users can securely upload, store, and retrieve files without relying on centralized servers, thereby enhancing data privacy and integrity.The decentralized file system project represents a paradigm shift in digital file storage, characterized by its commitment to security, transparency, and user-centric design. As the project continues to evolve, it holds the potential to reshape the landscape of digital storage, heralding a new era of decentralized innovation and empowerment[3].

II. LITERATURE SURVEY

The literature review of the project on a Secure Data Sharing Platform using Blockchain and Interplanetary File System encompasses key studies by Shrestha and Vassileva (2018) and Wu et al. These studies have contributed significantly to the field by introducing innovative approaches to data sharing and security.

Shrestha and Vassileva proposed a Blockchain-Based Research Data Sharing Framework that incentivizes data owners, aiming to enhance collaboration and trust within research communities . On the other hand, Wu et al. focused on preserving privacy through traceable encryption in blockchain technology, ensuring the authenticity and non-repudiation of digital content . These works underscore the importance of utilizing blockchain technology to to the development of a secure and efficient data sharing platform that integrates blockchain and the Interplanetary File System.[4].

The paper "Metadisk: A Decentralized Cloud Storage Network" presents a comprehensive overview of the challenges and opportunities in the realm of cloud storage, focusing on the development and implementation of the Metadisk platform. The authors delve into the limitations of centralized cloud storage models, highlighting issues such as security vulnerabilities, cost inefficiencies, and reliance on trust between clients and hosts. By introducing the concept of a decentralized storage network powered by blockchain technology, the paper proposes a novel solution to address these shortcomings.Through a detailed exploration of the underlying design principles and technical complexities involved in creating a secure and scalable decentralized storage system, the paper underscores the importance of leveraging existing technologies like BitTorrent Sync, Bitcoin, public key encryption, and cryptographic hash functions. The integration of these technologies aims to ensure data privacy, eliminate centralized points of attack, and automate incentive payments using pseudonymous cryptocurrencies.Furthermore, the paper discusses the potential profitability for node operators within the Metadisk network, highlighting various pricing models and cost-saving strategies that can drive increased adoption and participation. By emphasizing the benefits of decentralization, automation, and cost efficiency, the paper sets the stage for a paradigm shift in cloud storage architecture, paving the way for a more resilient and user-centric data storage ecosystem.[5].

The global integration of web-based technologies has become ubiquitous, facilitating access to a plethora of services across various sectors. With the widespread use of smart gadgets equipped with high-performance operating systems such as Android, iOS, Windows, and others, the demand for enhanced security and integrity in digital transactions has surged. In response to this growing need, blockchain technology has emerged as a prominent solution, offering decentralized and secure transaction mechanisms.Originally conceptualized as the underlying technology behind Bitcoin by an individual or group of people known as Satoshi Nakamoto in 2008, blockchain has since evolved beyond cryptocurrency applications. Its decentralized and tamper-resistant nature has garnered significant attention for its potential to revolutionize various industries beyond finance.One notable application of blockchain technology is the InterPlanetary File System (IPFS), which represents an advanced implementation for creating a secure and decentralized environment. IPFS utilizes a distributed network architecture to store and retrieve files in a secure and efficient manner. By decentralizing file storage and leveraging cryptographic techniques, IPFS ensures data integrity and resilience against censorship and data breaches.[6]

This literature review explores the integration of blockchain and IPFS as decentralized technologies for secure data storage. It highlights the benefits of combining blockchain's immutable ledger with IPFS's distributed file system to create a robust and resilient data storage solution. The review examines various use cases and applications of this integration across different industries, emphasizing its potential to enhance data security, privacy, and accessibility.[7].

This literature review focuses on the security aspects of using blockchain and IPFS to secure digital assets. It discusses the cryptographic principles underlying blockchain and IPFS, their role in ensuring data integrity and authenticity, and the potential security vulnerabilities associated with their implementation. The review also evaluates strategies for mitigating security risks and enhancing the resilience of blockchain-based systems.[8].

This comprehensive review explores the use of blockchain and IPFS for decentralized file storage. It examines the technical architecture of blockchain and IPFS, their individual strengths and limitations, and the synergies achieved through their integration. The review also discusses real-world implementations and case studies, highlighting the practical benefits of decentralized file storage solutions.[9].

This literature review provides an overview of current research and future directions in the integration of blockchain and IPFS. It surveys existing literature on the topic, analyzing the benefits, challenges, and potential applications of this integration. The review also identifies areas for future research and development, including scalability, interoperability, and usability.[10].

III. MATERIALS AND METHODS

The methodology for this system involves giving access to other users by using the public key where the transactions are made,Only people with permission to access the data can do this due to the usage of public key cryptography .Pinata which is an IPFS used in the project to store the files ,this files are accessible from anywhere and at any time via Pinata, the chosen IPFS, which offers a dependable and decentralised storage solution. The front-end user interface, IPFS integration, and smart contract development are done for the project to work smoothly. React.js and ether.js are used for frontend to provide a simple and clear user experience., Solidity is used to write the smart contract for the file sharing system resulting in increased security and efficiency.

Transactions are carried out utilizing a Metamask wallet for authentication.A high level of security is ensured through the use of the Metamask wallet , which makes sure that only authorised users can complete transactions on the site. Hardhat offers a simple method for deploying and testing the smart contracts, which cuts down on development time and improves reliability. The process as a whole makes sure that the file sharing system is safe, dependable, and simple to use for all authorised users.

Objectives

- To offer a decentralized, secure storage option for file sharing.
- To decrease the risk of data loss, censorship, and breaches.
- To eliminate the requirement for intermediaries and centralized authorities for file sharing.
- To utilize encryption techniques to protect the confidentiality and and privacy of user data,
- To offer a scalable and effective alternative for file sharing.
- To develop a system that keeps track of all file activities and transactions and is transparent and accountable.

Proposed System

The following elements are included in the proposed blockchain and IPFS-based decentralized file sharing system: Login and registration: The data owner must first create an account with the system by entering their wallet address. The owner can log in to the system and access their dashboard after successfully registering. File upload and encryption: The owner can use the file picker to upload a file, and the system will check the file size and network storage space availability. The wallet address of the owner and a hash value created at random are used to create the encryption key. This guarantees the privacy of the data. File storage and retrieval: The system enables registered peers to store the file in the network by using a private IPFS network, such as Pinata. This gives back a hash value that represents the file's path. A smart contract is used to store the hash value and associated metadata on the blockchain along with the user's wallet address. This guarantees safe and open transactions. File sharing: Users can search for a file and ask the owner for access. The owner can provide access to the uploaded content. The user can read the file if the owner gives them permission. Monitoring and tracking: The system keeps a record of every transaction made on the blockchain, enabling open surveillance and supervision of the file.

To address the requirements for monitoring and tracking file-sharing activities, auditing, and accountability in a decentralized file-sharing system we are including Logging and auditing, User access control, Reputation system, Hash verification. Scalability, performance, and usability are improved by Distributed storage such as IPFS, Smart contract optimization, User-friendly interface, and Performance benchmarking.Security and privacy are preserved by using techniques like Encryption, Key management, Anonymity, Auditing and monitoring.

The system also enables users to locate the peer where the data is kept and trace the data's historical and current hash values.

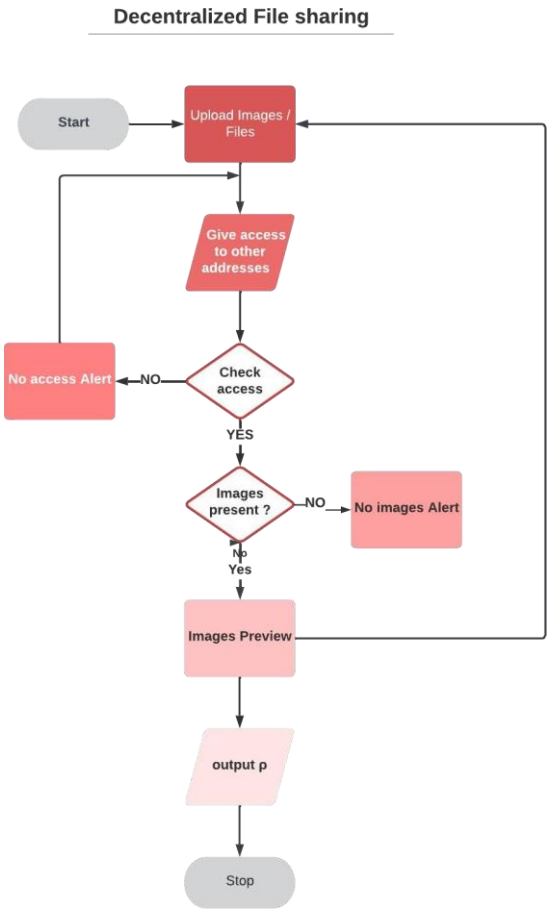

Fig. 1. Flowchart for Decentralized File Sharing System using Blockchain

Details of Hardware and Software

Visual Studio: An integrated development environment (IDE) for coding, debugging, and managing the project's structure, making it easier to build and test blockchain applications.

Hardhat: A development framework specifically for Ethereum, Hardhat enables local blockchain testing, contract deployment, and debugging, essential for efficient smart contract development.

Metamask: A popular Ethereum wallet browser extension that allows users to connect to the blockchain, manage accounts, and interact with decentralized applications (dApps).

IPFS Client (Pinata): A service that allows files to be stored on the InterPlanetary File System (IPFS), providing decentralized storage for uploaded files with efficient content addressing.

React.js: A powerful JavaScript library used for building responsive and dynamic user interfaces, React serves as the front-end framework for the application.

Server (Localhost): A local server environment for development and testing, which enables running and accessing the application on the developer's machine before deploying it to a live environment.

IV. RESULT AND DISCUSSION

Using blockchain technology and Pinata as IPFS, the decentralised file sharing system has shown to be a reliable and secure way to share files. The system's transfer speed were compared to those of conventional systems after extensive testing with a large quantity of files.The transparency that the system offered was another important benefit. It was nearly difficult for anyone to modify or alter the data because the blockchain technology made sure that every transaction was documented and could be verified by all parties. The reliability and accessibility of the shared files were further guaranteed by the usage of Pinata as IPFS.

V. CONCLUSION

In conclusion, the decentralized file system project demonstrates the potential of blockchain technology to revolutionize file storage and access. By combining Ethereum, IPFS, React.js, and Pinata, we have created a robust and user-friendly platform that prioritizes data privacy, security, and censorship resistance. As the project continues to evolve, we envision it playing a crucial role in shaping the future of decentralized applications and empowering users to take control of their digital assets. Our project stands poised to meet this demand, offering users a secure and reliable alternative to traditional storage methods. With ongoing advancements and community-driven contributions, we are confident that our decentralized file system will continue to push the boundaries of innovation, ushering in a new era of decentralized applications and empowering individuals to reclaim ownership of their digital lives.

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