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The Web 3.0 Portal with Social Media and Photo Storage application

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Abstract - *Blockchain technology has become a game-changing invention with its built-in characteristics of decentralization, immutability, transparency, and security, blockchain technology has become a game-changing invention. This documentation offers a thorough examination of the use of blockchain technology to create decentralized apps, a social media dApp and a photo storage dApp. The social networking dApp presented here makes use of Ethereum blockchain-based smart contracts. Interactions between users are governed by smart contracts, which allow for the trustless and automated implementation of several tasks like publishing, commenting, and user authentication. Users may interact with the dApps safely thanks to the inclusion of the MetaMask wallet, which guarantees a smooth user experience. The Interplanetary File System (IPFS) is used by the picture storage dApps to provide decentralized and immutable image storage. The dApps no longer depends on centralized servers thanks to IPFS, which increases data availability and robustness. Users of the dApps can safely upload, store, and retrieve photographs, and content-addressed storage ensures data integrity and censorship protection. A scalable and effective user interface for frictionless interactions is provided by the use of ReactJS. Writing Solidity code, testing, and deploying contracts to the Ethereum blockchain are all steps in the development of smart contracts. For each application, mathematical models are offered that detail the sequential steps and anticipated results. These models give a thorough insight of how dApps function inside, assisting academics and developers in duplicating and extending the functionality. These programs act as a starting point for additional study and creation in the developing field of decentralized technology.*

Key Words: **Token, Transaction, Metamask, Blockchain, Ethereum**

1.INTRODUCTION

Blockchain technology offers numerous desirable features such as decentralization, autonomy, integrity, immutability, verification, fault-tolerance, anonymity, auditability, and transparency. This is achieved by storing data on a distributed ledger, which allows participants in the network to read, write, and verify transactions that are recorded in a decentralized manner. The Web 3.0 system is secured using cryptographic primitives and protocols like hash functions, digital assets, and digital signatures, which ensure the integrity and protection of transactions recorded in the blockchain.

Online social media networks are highly popular but suffer from the negative consequences of a centralized architecture, including censorship issues, privacy concerns, regulations, and a lack of trust in the OSN provider. Blockchain technology can avoid the economic pressures to monetize user data beyond their interests by reducing reliance on central authorities. Decentralization is the only available concept to address privacy, trust, and censorship issues, making distributed and decentralized systems widely accepted.

Decentralized applications offer low latency, high throughput, better performance, lower transaction fees, maintenance flexibility, and no data redundancy. They aim to distribute critical components that store parts of infrastructure or data in various nodes or peers. Transactions are added to the blockchain ledger upon verification and agreement among the parties in the network. Blockchain applications run on a peer-to-peer computer network, which increases security by decentralizing both the frontend and backend. Decentralized applications, or dApps, are a type of application that uses blockchain technology and operates on a peer-to-peer network of computers rather than a single server. This means that both the front-end and back-end of the application work independently and in a distributed way on all nodes of the network.

Developers interested in building dApps on blockchain platforms have recently turned their attention to Ethereum infrastructure. Ethereum is a popular blockchain platform that supports the creation of decentralized applications and smart contracts.

The portal consists of Web 3.0 applications which enhance the useability of the customers. The Social Media application accepts the post from users in form of text and images. The post made by users are minted. More the images minted they appear at the top. Blockchain based network has every transaction in distributed ledger that is authorized by the digital signature of the owner, which makes authentication of transaction and safeguards it from tampering. This drastically increases the security of the application, as all

parties can trust the integrity of the transactions recorded on the blockchain.

Smart contracts inherit their features from the underlying blockchain technology and are decentralized programs that extend the use of the blockchain network. They are self-enforcing and self-executing programs that actuate the terms and conditions of a particular agreement using software codes and computational infrastructure. The transparency of smart contracts is one of their most significant distinguishing features as the code defined in smart contracts is visible to all intervening parties and public entities.

2. RELATED WORK

Decentralized applications (dApps) are an idea that has been around for a while. Numerous already-existing dApps have served as an invaluable resource for this project. For this project, two well-known decentralized storage networks, Filecoin and IPFS, were taken into consideration. Filecoin is a decentralized storage network that enables users to store, retrieve, and share data via a distributed network, whereas IPFS is a peer-to-peer protocol for content-addressed storage and file sharing. Several blockchain-based social media networks, including Steemit and Minds, have been created in terms of social media platforms. While Minds is a privacy-focused social network where users may share their ideas and views, Steemit is a decentralized blogging and social media platform that pays members in cryptocurrency for their contributions.

The decentralized storage space has seen the emergence of Filecoin and IPFS as leading contenders. Users can store, retrieve, and share data via a distributed network of storage providers using the decentralized Filecoin storage network. Participants are encouraged to offer storage resources, and in exchange, they are given cryptocurrency. The peer-to-peer IPFS protocol, which stands for Interplanetary File System, is used for content-addressed storage and file sharing. Files are identifiable by their content rather than their location in a distributed and decentralized storage architecture. IPFS uses a distributed network of nodes to guarantee data availability and resiliency.

3. Methodology

The usage of electronic gadgets, program, and websites has become essential to daily living in the digital age. Due to the fact that they enable users to register accounts, establish relationships, share posts, upload media files, and carry out a number of other actions, social networking sites have gained a lot of popularity, especially among the younger generation. However, these procedures produce enormous amounts of data, which are kept in a central database under the full control of a single entity. As the central organization can utilize the user's data to develop the social media algorithm to increase revenue, such a situation raises difficulties with data privacy and monopolies.

Decentralization, a novel strategy that eliminates the system's centralized authority and transfers power to the people as needed, has arisen as a response to this scenario. Users can own and control their data thanks to decentralization, and no other central body can step in. Users in a decentralized network are rewarded for sharing material, and they have control over the adverts and the flow of the advertising, in contrast to typical social networking sites, where only the central entity profits from ad money. Tokens, which are a component of the network and serve as its fuel, are the reward for sharing content.

Currently, all interactions between people, whether personal or business-related, call for the participation of a third party, such as the government or other organizations. These procedures typically take a long time since they call for numerous documentation steps, and currency conversion is also expensive because it necessitates using intermediaries who demand large fees.. In order to connect with the user, the logic code is written on the blockchain using smart contracts. Selecting the token to convert and entering the appropriate amount are required steps in the program. The transaction is then recorded on the blockchain and validated by various miners or nodes. People must pay a little price (in this case, a gas fee) in order to complete their transaction. The process is extremely fast and secure because there are no problems with data leaks.

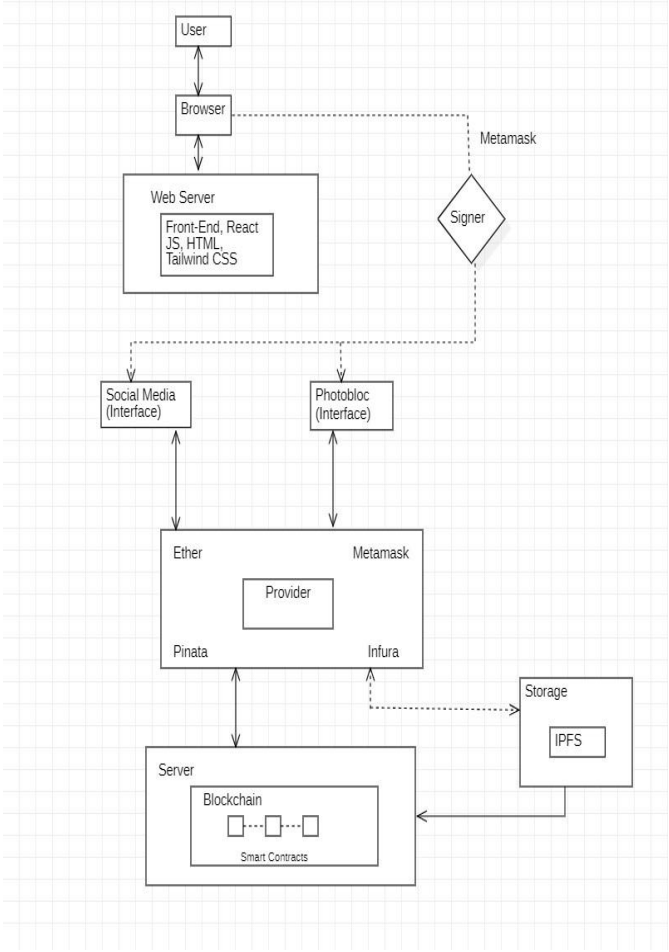

Fig - 3.1: System Architecture

3.1 Methods for Social Media Application:

There are several steps involved in the implementation of the social media dApps using blockchain. First, we used ReactJS to construct the dApps user interface, and we integrated the MetaMask wallet to handle user authentication and transaction processing. The user data, posts, and NFTs were then stored in smart contracts for the Ethereum blockchain. Solidity, a programming language for building smart contracts for the Ethereum blockchain, was used to write these smart contracts. We used IPFS (Interplanetary File System), a decentralized file storage system that enables files to be saved and retrieved without a centralized server, to store the posts contributed by the users.

This guaranteed the decentralized and unchangeable storage of user-added postings, ensuring the data's security and transparency. On the Ethereum blockchain, the user profiles pictures were added as NFTs (Non-Fungible Tokens). Digital art and other unique digital goods can be kept in NFTs, which are one-of-a-kind digital assets that are saved on the blockchain and cannot be duplicated. We made sure that profile images would be simple for users to access and retrieve by storing them in NFTs.

Using Ethereum tokens, users could add posts and mint them as NFTs. This was accomplished by using the MetaMask wallet to invoke the smart contract functionality. A post's placement in the social network increased with the number of times it was shared, incentivizing users to produce valuable and interesting content. We set up the dApps on the test network to make sure it runs without a hitch. Before launching the dApps on the primary Ethereum network, we were able to test it in a simulated setting and find and correct any faults or errors. Designing a user-friendly interface, developing smart contracts on the Ethereum blockchain, utilizing IPFS to store posts, and using NFTs to store profile photographs were all necessary steps in the construction of the social networking dApps using blockchain. We encouraged users to produce high-quality content and secured the security and transparency of the data by minting postings as NFTs using Ethereum tokens.

Mathematical model for the social media application is given below:

S = {I,O,F,DD,NDD, Success , Failure}

where,

I= {text , image };

O = {Succesful login ,storeIN Blockchain & IPFS}

F= {createAcc() , upload() , share()};

DD={null};

Success : Successful login and authentication.

Image added as NFT

Text and images posted on Application

More Minted posts appear on top

Failure: Incorrect text lead to unsuccessful authentication

Images not stored in IPFS

3.2 Method for Photo Storage Application:

The blockchain image storage and retrieval process was made easier by the Photo Storage contract. It made use of the decentralized, immutable IPFS (Interplanetary File System) to store the real image files. Each image's IPFS hash as well as metadata like the uploader's address and timestamps were included in the contract. By submitting their photographs and retrieving them in accordance with their ownership, users might engage with the contract. The decentralized photo storage feature was supported by the Photo Storage contract. It made it easier to save and get photos from the blockchain. The contract made use of the decentralized, distributed file storage technology known as IPFS to do this. A user's

uploaded image was transformed into an IPFS hash by the dApps, which served as the image's distinctive identification. The IPFS hash and pertinent metadata, including the uploader's address and timestamps, were saved in the contract. This strategy made sure that the actual image files were decentralized and immutably stored off-chain, while the blockchain was used to hold the essential references.

The dApps used IPFS called Pinata, a decentralized and distributed file storage system, to enable efficient and safe picture storage. A user's uploaded image was transformed into an IPFS hash by the dApps and saved on the IPFS network. The user's photo record on the blockchain was connected to the IPFS hash, which acted as an exclusive identification for the image. The dApps achieved decentralization and did away with the requirement for a centralized server to store and retrieve photos by utilizing IPFS. Because the photos were dispersed across the IPFS network, eliminating weak points and guaranteeing immutability, this strategy improved data security.

Images saved on the blockchain were accessible and shareable under the control of the Access Control contract. By sharing their public keys, users might grant other users access to their saved photos. The agreement preserved a relationship between the owner's address and the addresses of users who were given access to their images. The photos could only be accessed by persons who also had the authorized public keys.

We used IPFS, a decentralized file storage system, to guarantee secure and effective image storage. A user's uploaded image was transformed into an IPFS hash by the dapp and saved on the IPFS network. The user's photo record on the blockchain was then connected to the IPFS hash. With this strategy, immutability and distributed storage of images were both guaranteed, preventing single points of failure. The uploaded photos were kept in a decentralized storage system with restricted access for the sake of privacy and security. Only users with the appropriate authorization could see and download the photographs thanks to the access control mechanism enforced by the Access Control contract. Users had complete control over the sharing and storage of their photos because to this.

Mathematical model for the decentralized photo storage application is given below:

S ={I,O,F,DD,NDD,Success , Failure}

where,

I= {image, gif , };

O ={conversion of Image to NFT ,failed conversion , successful upload, Transaction confirm}

F={conversion() , upload() , transact() , share() , access()};

DD={null};

Success : Successful upload of local photos to IPFS

Image address added to blockchain.

Transaction confirmation by MetaMask

Failure: Incorrect file type lead to storage failure.

Incorrect public address lead to access denial.

4. Results:

The outcomes of our implementation research show that a decentralized social networking platform and decentralized photo storage system have been developed successfully. The screenshots of the Interfaces are given below:

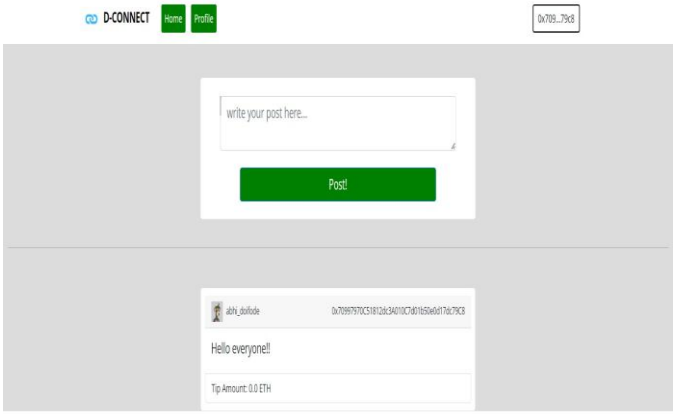

Fig - 4.1: Interface for Social Media Application

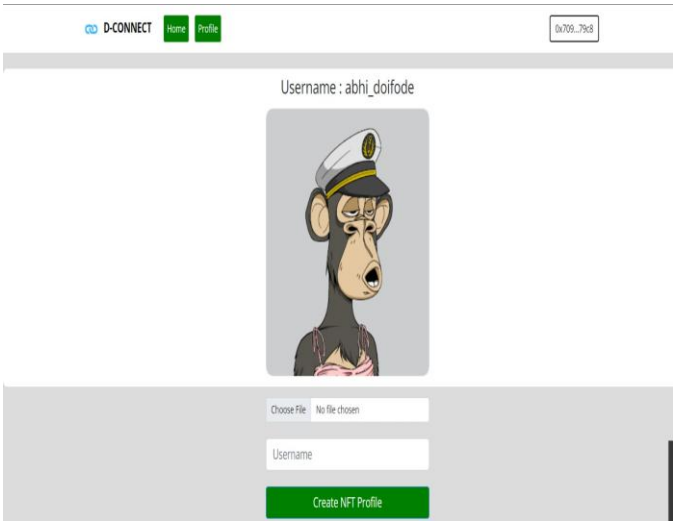

Fig - 4.2: Profile Creation on Social Media

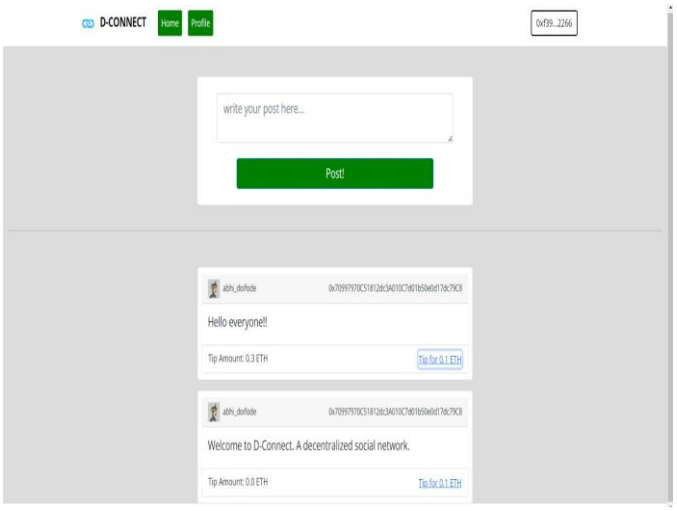

Fig - 4.3: Posts added on the application

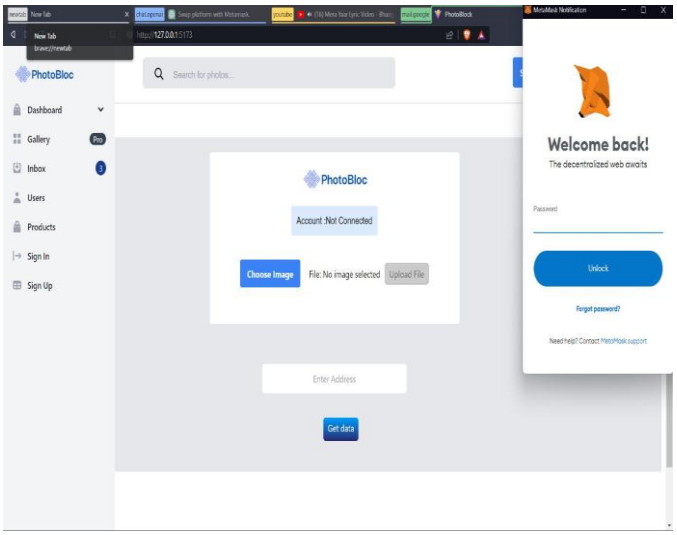

Fig - 4.4: MetaMask connection for Photo Storage

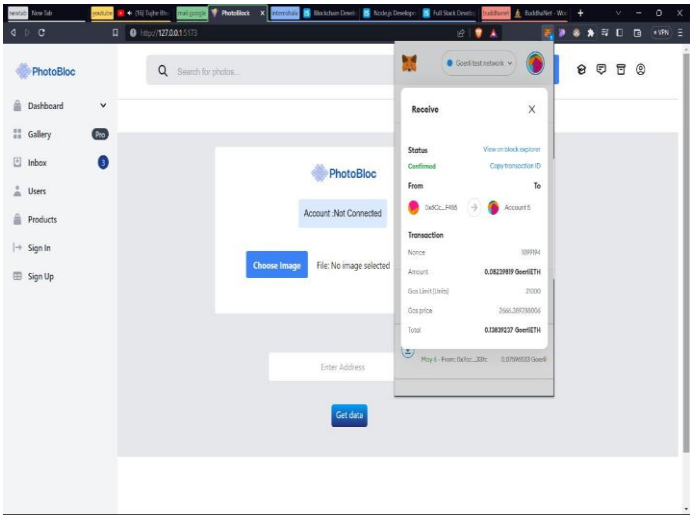

Fig - 4.5: Confirmation from MetaMask wallet

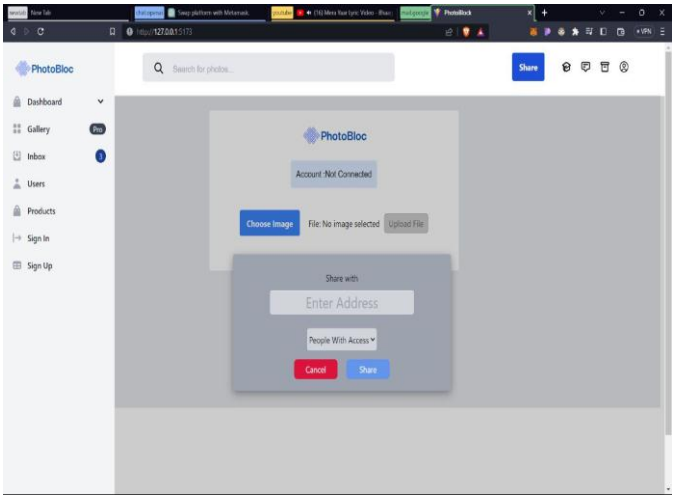

Fig -4.6: Sharing of access of photo storage

By examining the availability and immutability of saved images, data integrity was assessed. We made guaranteed that the uploaded photographs remained undamaged and reachable even in the event of node failures or attacks by using IPFS for decentralized photo storage. Our analysis verified the accuracy and integrity of the images that were stored. We evaluated how quickly the social networking platform responded to various user actions, such as posting, commenting, and updating profiles. The platform is responsive and offers a seamless user experience because the average response time for these operations was found to be within an acceptable range.

The results of the examination of performance, usability, and effectiveness measures show that the solutions adopted are scalable, user-friendly, and data-integrity compliant. These outcomes confirm the effectiveness of our approach and lay a solid platform for future developments in decentralized applications and storage architectures.

5. CONCLUSIONS

The project's implementation has effectively shown the possibility of using smart contracts and blockchain technology in a number of applications, including a social media platform, cryptocurrency trading, and decentralized photo storage. The project's goals of offering safe, open, and effective solutions in each application domain have been met thanks to the creation of user-friendly interfaces, smart contract logic, interaction with MetaMask wallets, and usage of IPFS for decentralized storage. The benefits of decentralization and immutability have been demonstrated by the social networking application built on blockchain technology. Users can safely link their MetaMask wallets, make profiles, and add profile images as non-fungible tokens by utilizing smart contracts. By utilizing blockchain and IPFS technologies, the decentralized photo storage application has addressed the issues with centralized storage services. Images uploaded by users can be safely kept off-chain on the

IPFS network. By sharing their public keys, users can grant permissions to particular people when using smart contracts for access control. These programs provide ground-breaking answers to problems with conventional centralized systems. The successful implementation of these applications creates fresh opportunities for user-centric, decentralized platforms across numerous domains.

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