KALASARASWATI - WHERE CAMPUS CREATIVITY MINTS DIGITAL NFTS

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Abstract
Kalasaraswati is an innovative NFT trading platform that allows staff and students at colleges to exhibit their creative works through digital tokens. It is modeled after the Vedic goddess of wisdom. It redefines the campus experience by creating a decentralized economy that encourages responsible invention, cooperation, and recognition. This paper presents a decentralized application (dApp) that integrates deep learning and blockchain technology for secure digital asset management, with a particular focus on NFTs. Secure wallet connections, minting, NFT image generation, marketplace functionality, and profile management are all guaranteed by the dApp. The project exhibits real-world blockchain and deep learning applications using Solidity-based smart contracts, IPFS, ReactJS, and the OpenAI API, transforming digital asset management in our increasingly digital economy.
Keywords: *Blockchain, Decentralized Applications (dApps), Smart Contracts, Wallets, Non-Fungible Token (NFT).*

I. Introduction

The need for a ground-breaking platform that preserves and honors the originality of student work in the dynamic academic setting has never been higher. Every student's contribution, whether it be in the form of scholarly papers or artistic creations, should be recognized and preserved in the digital age, when authenticity is vital. Assume that all assignments, research papers, and presentations can be saved as unique, irreplaceable digital artifacts that honor the author's effort and imagination. Introducing Kalasaraswati, a cutting-edge NFT trading platform inspired by the teachings of the goddess of wisdom from Vedic mythology. Teachers and staff at universities can transcend traditional boundaries and transform their creative and intellectual endeavors into tangible digital tokens of creation with the aid of Kalasaraswati.

Each classroom report, homework project, and college competition entry made possible by Kalasaraswati serves as evidence of the extraordinary creativity and brilliance that flourish on college campuses. In addition to revolutionizing the way student work is acknowledged and shared, Kalasaraswati addresses the urgent demand for authenticity and individuality in academic and artistic endeavors by adopting blockchain technology and non-fungible tokens (NFTs).

Blockchain technology has opened up new possibilities for the management and trading of digital assets, and one particularly interesting example of its power is the creation of non-fungible tokens, or NFTs. However, ensuring NFT security presents a major challenge, particularly when it comes to user private key protection. By developing the NFT Marketplace, a decentralized application (dApp), our project seeks to address these issues.

This dApp addresses worries about the security of users' private keys by offering a safe and convenient environment for managing NFTs. Decentralized digital currency meant for use in online transactions is referred to as cryptocurrency [1]. Ether (ETH), Dogecoin (DOGE), and Bitcoin (BTC) are a few notable examples. Cryptocurrency operates in a decentralized environment and is based on the concepts of Blockchain, a developing topic that has seen significant growth in recent years. Numerous industries use blockchain technology, but the Non-Fungible Token (NFT) industry is one that stands out in particular. Non-fungible tokens, or NFTs, are a type of cryptocurrency that use smart contracts to function on the Ethereum blockchain. Understanding the definition of "fungible," which comes from economic and accounting contexts and refers to things that may be substituted, is essential to understanding the idea of non-fungibility.

Defined more simply, the valuations of fungible assets—such as money, stocks, and bonds—can be substituted. Non-fungible tokens, on the other hand, set themselves out by being unique, and their value varies according to their unique characteristics. For example, the uniqueness of Pokémon trade cards determines their individual valuations. NFTs make it possible to tokenize a variety of assets, including artwork and collectibles (pictures, sounds, videos, etc.), while maintaining ownership through the Ethereum blockchain's immutable record-keeping. This guarantees that ownership records cannot be changed, and it also stops the generation of new NFTs. [3]

Influential people like Amitabh Bachchan have released movie posters as NFTs and auctioned them for high prices, including the $9,66,000 deal at BeyondLife.club [4], contributing to the rise in popularity of NFTs.NFTs are well-received around the world, but it's important to know why NFT marketplaces were established in the first place, beyond the general market buzz.

II. Literature Survey

Three independent publications that each provide a unique contribution to the understanding and development of NFT platforms are included in the literature survey on NFT marketplaces. The integration of blockchain technology for the construction of NFT marketplaces is the main subject of the paper "NFT Marketplace using Blockchain" authored by Samreen Kazi and colleagues. The research is expected to explore the technical elements of integrating blockchain technology in the context of NFT marketplaces and will be presented at the International Conference on Innovative Data Communication Technologies and Applications in 2023. Important discoveries might include information about the technological complexities of this integration and any potential drawbacks or difficulties related to the suggested marketplace.

Sandip Ranjan Behera and colleagues' second paper, "Proposal of user-friendly design of NFT marketplace," is notable for emphasizing the need for an approachable NFT marketplace design. The research was published in an IEEE journal in 2023, indicating its academic rigor and perhaps going through a scholarly review procedure. This paper's conclusions might center on the suggested design components and how they improve user experience. Addressing issues with user interactions in NFT marketplaces can be greatly aided by an understanding of usability factors and design ideas.

Finally, the work "NFT Marketplace" by Piyush Batra and colleagues seems to provide a thorough analysis of NFT marketplaces. The research, which was published in a 2023 IEEE magazine, is probably academically sound and could offer light on a number of aspects of the dynamics of the NFT market. An examination of the NFT marketplace's patterns, user involvement, and trading volume may fall under this category. The study may also explore technological details and economic models used in the NFT marketplace that is being detailed.

Below table shows brief summary of literature survey:

Table 1: Literature survey

Author Name	Title of paper	Method/ Algorithm used	Result Accuracy	limitation	Future Scope
Samreen Kazi, Arsheen Kazi, Leon D'souza, Akshay Loke	NFT Marketplace using Blockchain	Blockchain Technology, Testnetworks and Faucets, IPFS, Smart Contracts	demonstrates creating a decentralized NFT marketplace. covers important ideas including wallets, token standards, and smart contracts.	explains the difficulties that NFT marketplaces face, such as gas costs, legal troubles, and environmental worries.	presents the possibility of creating a platform for NFT trading. identifies areas for additional research, such as NFT minting, listing, purchasing, and selling.
Sandip Ranjan Behera, Saswati Parida, Aditya Ranjan Patro, Debani Prasad Mishra.	PROPOSAL OF USER-FRIENDL DESIGN OF NFT MARKETPLACE	dAPP,Blockchain Technology, NFT Smart contract, Solidity, Polygon, IPFS, React.js, Web.js, Next.js,	focuses on NFTs in order to address the safe management and trading of digital assets. creates a dApp by combining deep learning models with blockchain technology.	----	provides a contribution to the study of safe digital asset management. demonstrates how deep learning and blockchain technology may be used for digital asset management.

Ritik Gandhi, Gagan Raj Singh, Piyush Batra	NFT MARKETPLACE	Blockchain Technology ,DALL.E, React.js And Etherjs, IPFS, dAPP, Solidity	compares Fantom, Avalanche, and Polygon in terms of price and functionality for minting and transferring NFTs. finds Polygon to be more transaction fee-efficient	outlines the drawbacks of blockchain technology, including as transaction costs, inefficient use of energy, and scalability.	provides the groundwork for choosing the best public blockchain platform for NFTs. recommends more investigation regarding the blockchain's effectiveness for NFT markets.

III. Problem Statement

College faculty and students have untapped artistic potential, but there is no platform to share their creative endeavors. Current marketplaces don't fully cater to the unique needs of the academic community, limiting recognition, collaboration, and financial opportunities. The lack of a platform that acknowledges academic innovation widens the gap between academic and digital domains. A bridge between academics and the digital world is crucial for responsible invention, teamwork, and access to opportunities. A platform that not only showcases artistic creations but also promotes ethical interactions is needed to help instructors and students reach their full potential in digital innovation.

IV. Need Of An NFT Marketplace

NFT marketplaces are online spaces where NFTs can be stored, displayed, traded, and in certain cases, created (minted). Similar to how tangible items are facilitated by Amazon or eBay [5], these markets are integral to the NFT economy. As was previously said, NFTs are unique digital assets that include a variety of artistic mediums such as audio, video, and photographs. Because of their intrinsic novelty and impossibility to be duplicated, NFTs are treated as assets on par with gold or real estate, allowing people to trade them.

Because NFTs aren't fungible and are instead valued uniquely based on factors like scarcity and desirable features, they present potential for profitable trading and business decisions.

An NFT marketplace is also important since NFTs are a type of digital art and artists and content creators need a place to display their work. Through the use of a digital decentralized platform for NFT sales, third-party art galleries are not required.

The blockchain-based NFT marketplace, which is designed with a decentralized architecture, not only keeps NFTs organized into discrete blocks but also improves security to reduce the possibility of fraud. Every NFT that is created in the market is distinct from the others by virtue of having a digital signature that includes all related metadata and proves its legitimacy.[5]

V. Key Elements for Establishing an NFT Marketplace

A. Blockchain

Similar to a bank's organizational structure, data is concentrated in a single database that is housed at a single location in a centralized framework. On the other hand, a blockchain functions as a distributed ledger or database that is shared by all nodes within a computer network, signifying a decentralized structure. A blockchain is an electronic database that maintains data in an unchangeable format [6]. Bitcoins are a type of cryptocurrency that serve as an illustration of a fundamental idea in blockchain technology. Peer-to-peer technology used by bitcoins allows money transfers between users directly, doing away with the need for middlemen [7]. Although Bitcoin was the first cryptocurrency, there are currently a number of other prominent ones that are used for transactions within NFT marketplaces, including Ether, MATIC, Dogecoin, etc.

B. NFT

A non-fungible token (NFT) is a unique digital asset that can be photos, audio, or video that is intended to be traded. NFTs are special since they can't be copied, which guarantees their legitimacy and acts as a user authentication mechanism [8]. One notable example of a real-world use of NFTs was Hoseo University in South Korea, which replaced traditional paper-based credentials with non-fungible token (NFT) degrees and certificates for its alumni. The university's faith in the legitimacy of NFTs motivated this creative action, which aims to safeguard students' academic achievements and deter future forgeries [9].

C. Token Standards

A set of rules guiding the creation, functionality, behavior, and operation of cryptocurrency tokens within a particular blockchain protocol is known as token standards [10]. Specifically, the Ethereum Requests for Token (ERC) standards—namely, ERC-20, ERC-721, and ERC-1155—are essential.

Despite being a commonly used fungible currency, ERC-20 is not appropriate for NFT marketplaces. The creation of distinct, non-fungible tokens is standardized by ERC-721, and even with the advent of ERC-1155, many developers still favor its single purpose. A single contract can contain both fungible and non-fungible assets according to ERC-1155, an improved version of ERC-721.

D. Smart Contract

Smart contracts are blockchain-based programs that carry out predetermined actions to automate workflows and agreements without the need for middlemen or delays. Smart contracts in the context of an NFT marketplace comprise code for operations including minting, listing, purchasing, and selling NFTs. Smart contracts can be written in a number of computer languages, the most widely used being Solidity because of its similarity to popular object-oriented languages such as Java or JavaScript. Other programming languages that can be used to build smart contracts include Rust and Vyper.

E. Wallets

Unlike conventional wallets, cryptocurrency wallets use private keys to grant access to holdings on the blockchain rather than storing digital cash. Private keys are used to prove ownership, and losing them means you'll never be able to access the digital items you've stored again [11].

F. Addresses and Transactions

An address in blockchain serves as a unique user identification for transmitting and receiving digital assets, just like an account does in a bank [12]. Digital asset transfers, or transactions, need a wallet with a distinct address linked to a set of public and private keys.

G. IPFS (InterPlanetary File System)

IPFS functions as a distributed file system protocol and peer-to-peer network, addressing shortcomings in the HTTP protocol and storing and distributing data in a decentralized fashion [5]. IPFS uses content-based addressing, secures data with a hash, and distributes it among decentralized nodes in contrast to HTTP's location-based addressing. Data retrieval is guaranteed by this decentralized method, even in the event of server outages or denial-of-service assaults. IPFS is used in the context of NFT marketplaces to store token_ids and metadata for different NFTs, hence contributing to their decentralization.

VI. Existing Systems

A. OpenSea:

One of the most well-known and often utilized NFT marketplaces is OpenSea. It offers an easy-to-use platform for the creation, purchase, and sale of different digital assets, such as artwork, collectibles, and virtual real estate, and operates on the Ethereum blockchain. OpenSea offers a wide variety of NFTs and supports several token standards, including ERC-20 and ERC-721.[13]

B. Rarible:

Another well-known NFT marketplace developed on the Ethereum network is Rarible. It sets itself apart by making it simple for consumers to generate and mint their NFTs. Digital content produced by artists and creators can be tokenized and sold on the platform[14].The decentralized nature of Rarible gives artists direct control over their works and sales.

C. Mintable:

Mintable is an NFT marketplace that serves both producers and collectors by making it easier to create, purchase, and sell NFTs. It uses the Ethereum blockchain for operation and is compatible with several token standards, such as ERC-721 and ERC-1155. Because of its special feature, which makes minting NFTs possible even for non-programmers, a wider range of people can utilize Mintable.[15]

VII. Proposed system

As was previously said, NFT Marketplace is a platform that will allow NFT producers and others to browse and exchange these exclusive digital products..Typically, a scripting language like ReactJs is used to develop the front end. Fig.1 image shows UI of NFT marketplace with metamask wallet connected:

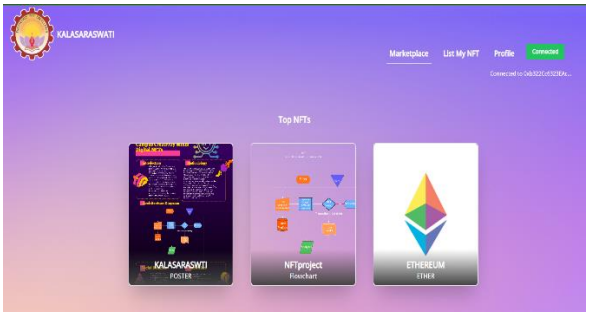

fig. 1:NFT marketplace UI

Our NFT Marketplace would primarily comprise the following elements in addition to the front end:

A. Metamask Wallet:

A wallet is a unique feature on a blockchain website that allows users to transact anonymously. It lacks a name and uses an alphanumeric wallet address, unlike traditional usernames and passwords. This system uses the Metamask Wallet, which uses a secret recovery phrase stored on multiple blockchain nodes instead of a single database. This prevents users from losing their

cryptocurrency or NFT purchases. Despite its popularity, Metamask is not without risk. Developers can use it to run and test code securely by connecting to the test network[21].

The Metamask Wallet functions as the NFT Marketplace's core hub, enabling all transactions, including listing, purchasing, selling, and minting.For kalasaraswati platform we have used sepolia testnet for blockchain transaction amd wallet management.

The fig.2 appears to be a user's profile page on a platform called Kalasaraswati, displays users's connected wallet address, The profile also shows that the user currently has 0 NFTs (Non-Fungible Tokens) and a total value of 0.00 ETH (Ethereum):

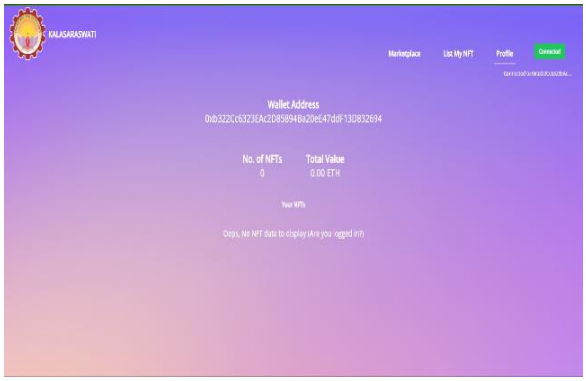

fig. 2:User profile with connected metamask wallet

B. Minting

Minting an NFT is the process of converting digital data into cryptocurrency collections or digital assets that are kept on the blockchain [16]. To put it simply, minting is the act of setting up a network file transfer (NFT) so that each image uploaded has its own digital signature, encrypting all metadata into a safe hash that stops duplication. Instead of storing the image on a single server, the IPFS protocol is used for storage, which divides the image's storage over several dispersed nodes or servers. A name, a description, and an image of the vessel must be uploaded in order to mint the NFT.

The fig.3 shows a user interface for uploading an NFT (Non-Fungible Token) to the Kalasaraswati marketplace. The interface consists of several input fields:

1)NFT Name
2) NFT Description
3) Price (in ETH)
4)Upload Image: The user can choose a file to upload as the image for the NFT.

Below these input fields, there is a "List NFT" button that the user can click to complete the upload process and list the NFT on the marketplace:

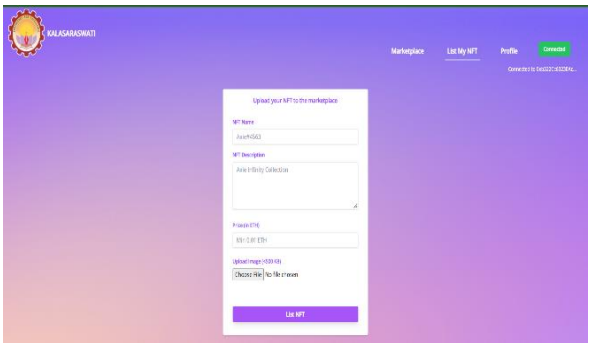

fig. 3 NFT minting

C. Listing

The NFT's creator or artist can decide what price they believe is appropriate for the minted work of art before putting it up for sale. The NFT will incur additional expenses in order to list on the market.

Fig.4 image shows the "Top NFTs" section of the Kalasaraswati platform and shows listed NFTs in marketplace:

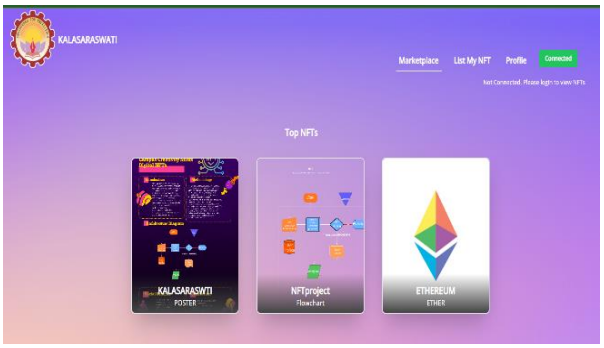

fig. 4:NFT marketplace

D. Selling

The inventor's collection should contain the remaining NFTs; only those that have been listed for sale can be purchased. The creator is able to offer the ones for sale on the public market.

E. Purchasing

The stated NFT is available for purchase by an admirer; the procedure would work similarly to any other online purchase mechanism, with the difference that gas costs would be added to the listed price. The price of ETH is automatically used to calculate the gas charge at the time of purchase. The buyer can also check the wallet address from where the NFT was published to ensure that it is the actual owner. After the amount is deducted and sent to the creator's wallet address, the purchased NFT ought to be available in the buyer's collection. This is a result of the NFT being digitally transferred to the wallet address used by the customer to complete the transaction.

F. IPFS storage

Using content-based addressing, IPFS distributes data amongst decentralized nodes while hashing and protecting it. Because of its decentralized design, data retrieval is guaranteed even in the

event of server outages or denial-of-service assaults[20][21].

The Fig.5 shows the file manager interface of the Pinata platform, which is a decentralized storage and sharing solution. The main section of the interface displays a list of files that have been uploaded or stored on the platform:

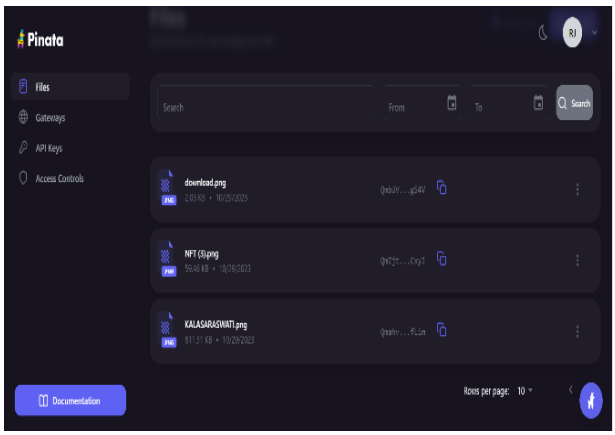

fig. 5:IPFS storage

Below image shows flow chart for a decentralized platform (Kalasaraswati):

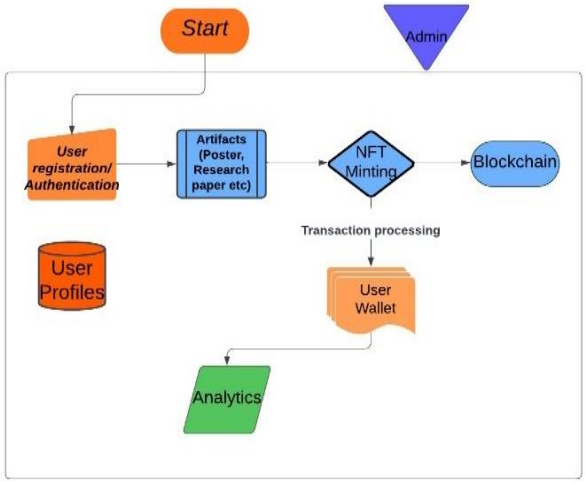

fig. 6:Flowchart of NFT marketplace

1.start:
Users access the NFT marketplace portal to start the procedure.

2. User Registration/Authentication:
By entering the required details, such as their email address, username, and password, users start the registration process.Users must go through an authentication process after registering, which could involve further identity verification processes or email verification.

3. Managing Artifacts (Poster, Research Paper): Users who have verified their identity are able to submit digital content, including posters and research papers.The user's identity on the platform might be linked to artifacts, which are part of their profile.

4. NFT Minting:
Users choose to mint new NFTs, particularly content providers or artists.The digital artifact is uploaded by the creator, who also include metadata, including a title, a description, and any pertinent properties.In order to guarantee that they get a cut of future sales, creators can establish their own royalty percentages.Before confirming the minting process, the creator is provided with a preview of the NFT to evaluate.

5. User Wallet - Transaction Processing: Interaction of Smart Contracts:Engaging with blockchain smart contracts is part of the minting process.By confirming the transaction with their linked wallet, users give their approval for the NFT to be minted. The transaction has to be confirmed after it is posted to the blockchain. Users might have to wait for mining to complete the transaction. Once verified, the newly created NFT's ownership is recorded on the blockchain and linked to user's wallet

6. Analytics:
The platform gathers information about user interactions, such as the history of transactions, NFTs created, and uploaded artifacts.Analytics software analyzes gathered data to provide insights regarding popular artifacts, market trends, and user behavior.

VIII. Expected Outcomes:

1. Empowering College Creatives: Kalasaraswati gives instructors and students access to a specialized NFT trading platform that allows them to profit from and display their distinctive originality.

2. Encouraging Responsible Creation: The platform places a high priority on responsible creation by promoting moral behavior and offering standards for the production of content and the defense of copyright.

3. Bridging the Gap between Academics and the World of Digital Art: Kalasaraswati provides a smooth platform for instructors and students to convert their concepts into concrete digital assets.

4. Global Recognition and Cultural Exchange: Kalasaraswati promotes recognition and cooperation among college creatives globally with its cutting-edge features and global reach, which supports innovation and cultural exchange in the NFT sector.

IX. Conclusion:

To sum up, the creation of the NFT Marketplace dApp shows how blockchain technology and deep learning models can be used to build safe, open, and intuitive platforms for trading and managing digital assets. Our dApp tackles a number of core NFT management issues, such as safe wallet connections, deep learning-based NFT creation, blockchain-based NFT minting, and an NFT trading market. The results of the usability study show how intuitive and user-friendly our dApp is. Research and development in this field may go in several ways in the future, such as enhancing the scalability of NFT marketplaces, investigating fresh methods for generating NFTs, and resolving any security risks that might emerge from the administration and exchange of digital assets.

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