RV COLLEGE OF ENGINEERING
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DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

"Kalaakriti NFT Marketplace"
BLOCKCHAIN TECHNOLOGY AND USE CASE (18IS7F2)

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Submitted by

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CERTIFICATE

Certified that the work titled **"Kalaakriti NFT Marketplace"** has been carried out by **Santosh Vishwanathan (1RV20IS043)**, bona fide students of RV College of Engineering, Bengaluru, have submitted in partial fulfilment for the Assessment of Course: Blockchain Technology and Use Case **(18IS7F2) – Experiential Learning** during the year 2023-2024. It is certified that all corrections/suggestions indicated for the internal assessment have been incorporated in the report.

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ABSTRACT

The project, Kalaakriti NFT Marketplace is developed to stand as an innovative platform committed to the preservation and exhibition of India's diverse indigenous artworks and art forms through the utilization of Non-Fungible Tokens (NFTs). Tailored to cater to the needs of Indian artists and craftsmen, this marketplace offers an unprecedented opportunity for both small businesses and individual creatives to establish a presence in the dynamic retail industry. Within the Kalaakriti NFT Marketplace, users hold the capability to seamlessly list their artwork for sale, initiating a smooth transition of ownership from the original creator to the platform itself. The purchase process is equally straightforward – upon acquiring an item, the buyer transfers the purchase price to the seller, while ownership of the digital asset transitions from the marketplace to the buyer.

At the heart of this platform's functionality lie two key smart contracts: the NFT Contract, adhering to the ERC721 Standard, which facilitates the minting of unique digital assets, and the Marketplace Contract, empowering users to exhibit their digital assets on an open market for potential buyers. This decentralized approach eliminates intermediaries, ensuring a direct and secure channel for transactions.

The Kalaakriti NFT Marketplace prioritizes a user-centric experience by eliminating the burdensome process of registrations, allowing users to promptly commence their earning endeavors. Transactions within the platform are direct, transparent, and reliable, fostering a direct connection between creators and buyers.

Key features of the platform encompass access to India's rarest art forms and recipes, preserving cultural heritage; unlocking generational skills passed down through time; and embracing currency agnosticism, transcending barriers of exchange rates and taxes. Embarking on a journey with Kalaakriti NFT Marketplace promises an exploration of creativity without constraints, fostering direct connections between individuals and celebrating the diversity and richness of India's artistic heritage. Join us in redefining the valuation and sharing of art, where talent converges with technology in a revolutionary manner.

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Chapter 1

INTRODUCTION

India's cultural wealth, steeped in centuries of tradition and diversity, finds a contemporary expression in Kalaakriti NFT Marketplace. In the ever-evolving landscape where technology intersects with heritage, Kalaakriti serves as a digital bastion for preserving and sharing the nation's rich artistic legacy. The platform provides a unique space for artists and craftsmen to transcend borders and showcase their creations globally by converting them into Non-Fungible Tokens (NFTs).

Kalaakriti's significance lies in its ability to seamlessly blend tradition with innovation. By digitizing tangible and intangible cultural assets into NFTs, the platform not only preserves the authenticity of India's diverse artistry but also opens doors to a global audience. In fostering a decentralized marketplace, Kalaakriti eliminates intermediaries, fostering direct connections between creators and enthusiasts, creating a vibrant community that celebrates and supports India's artistic heritage.

This platform thus provides a livelihood for the local artisans and craftsmen and also incentivizes them to preserve India's rich cultural heritage. As we navigate the intersection of tradition and technology, Kalaakriti emerges as a catalyst, ushering India's rich cultural tapestry into the digital age. Join us on this journey of celebration, where Kalaakriti unfolds the limitless possibilities offered by the digital frontier, connecting art and heritage with a global audience.

1.1. Topic Relevance

1. **Preserving India's Rich Culture and Heritage:**
   The primary aim of Kalaakriti NFT Marketplace is to act as a digital sanctuary for preserving India's unparalleled cultural and artistic heritage. By facilitating the creation and trading of Non-Fungible Tokens (NFTs) representing indigenous artworks and art

forms, Kalaakriti ensures the documentation and digitization of traditional crafts, paintings, and performances. This not only provides a means of safeguarding these cultural treasures against the ravages of time but also enables their global dissemination, fostering a deeper appreciation for India's diverse heritage.

2. **Elimination of Intermediaries, Such as Banks:**
    Kalaakriti NFT Marketplace introduces a paradigm shift by eliminating the need for intermediaries, particularly financial institutions like banks. Traditionally, artists and craftsmen faced challenges in reaching a wider audience due to the involvement of intermediaries in transactions. By leveraging blockchain technology and smart contracts, Kalaakriti establishes a decentralized marketplace that enables direct transactions between creators and buyers. This not only reduces transaction costs but also empowers artists to have greater control over their creations, thus democratizing the art market.

3. **Source of Livelihood for Local Artisans and Craftsmen:**
    The project plays a pivotal role in addressing economic sustainability for local artisans and craftsmen. By providing them with a global platform to showcase and sell their creations, Kalaakriti becomes a source of livelihood and empowerment for these skilled individuals. The direct interaction between artists and buyers fosters a sense of community and support, ensuring that the economic benefits of artistic endeavors flow directly to the creators. This not only contributes to the financial well-being of local artisans but also sustains and encourages the continuation of traditional art forms across generations.

1.2. Objectives

1. **Smart Contract Development:** Development of the two integral smart contracts for the NFT marketplace which are NFT.sol contract using ERC721 standard which allows users to mint unique digital assets and have ownership of them and Marketplace.sol contract which allows users to put digital assets for sale on an open market.
2. **Development of responsive and user-friendly website:** To build a response and user-friendly website using EJS templating.

3. **Metamask Wallet Integration:** Integration of metamask wallet to the application to enable easy transactions using ETH.

CHAPTER 2
SYSTEM ARCHITECTURE AND TECHNOLOGY

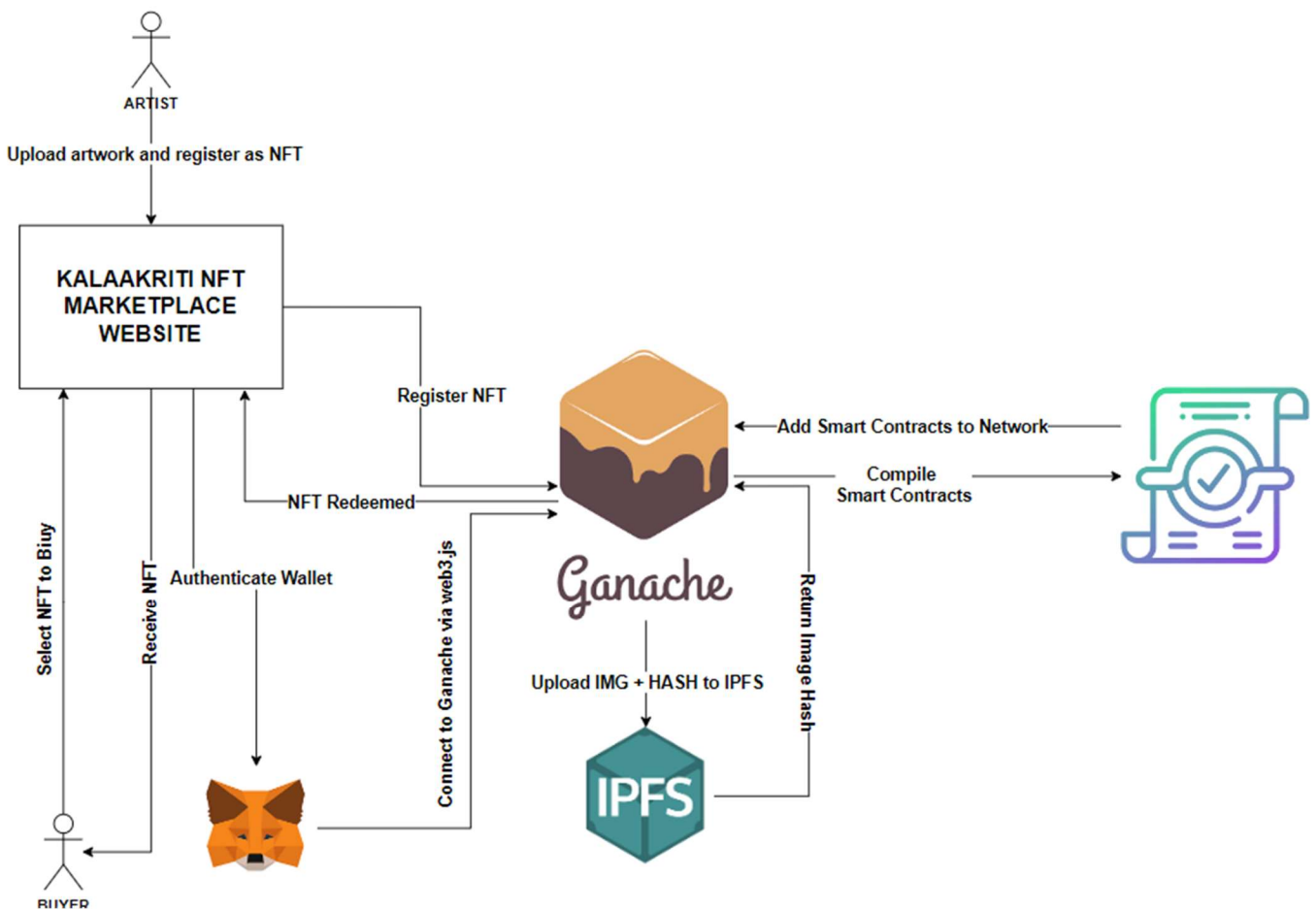## 2.1. Architecture Diagram

FIGURE 1: ARCHITECTURE & WORKFLOW

2.2. Technology Used

1. **Frontend – HTML/CSS with EJS (Embedded JavaScript) templating**

2. **Smart Contracts – Solidity**

   Solidity is the chosen programming language for developing smart contracts on the Ethereum blockchain. The project utilizes Solidity to define the logic and functionalities

of the NFT Contract and Marketplace Contract. Solidity's compatibility with Ethereum's Virtual Machine (EVM) ensures secure and reliable execution of smart contracts, facilitating the creation, ownership, and trading of Non-Fungible Tokens on the blockchain.

3. **Backend - Node.js**

   Node.js serves as the backend runtime environment, providing a scalable and event-driven architecture. With Node.js, the project efficiently handles server-side operations, facilitates asynchronous processing, and ensures seamless communication between the frontend and smart contracts. Its non-blocking I/O model makes it well-suited for handling concurrent connections, enhancing the responsiveness of the Kalaakriti NFT Marketplace.

4. **Blockchain Interaction - Web3.js:**

   Web3.js acts as the bridge between the frontend and the Ethereum blockchain, enabling seamless communication with smart contracts. This JavaScript library allows the project to interact with the Ethereum network, query blockchain data, and initiate transactions. Web3.js empowers the frontend to connect with the decentralized application, facilitating the minting, buying, and selling of NFTs on Kalaakriti.

CHAPTER 3
IMPLEMENTATION

3.1. Smart Contract Development

NFT.sol

```solidity
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.13;

import "@openzeppelin/contracts/token/ERC721/ERC721.sol";
import "@openzeppelin/contracts/token/ERC721/extensions/ERC721URIStorage.sol";
import "@openzeppelin/contracts/utils/Counters.sol";
```

```solidity
contract BoredPetsNFT is ERC721URIStorage {
    using Counters for Counters.Counter;
    Counters.Counter private _tokenIds;
    address marketplaceContract;
    event NFTMinted(uint256);

    constructor(
        address _marketplaceContract
    ) ERC721("Bored Pets Yacht Club", "BPYC") {
        marketplaceContract = _marketplaceContract;
    }

    function mint(string memory _tokenURI) public {
        _tokenIds.increment();
        uint256 newTokenId = _tokenIds.current();
        _safeMint(msg.sender, newTokenId);
        _setTokenURI(newTokenId, _tokenURI);
        setApprovalForAll(marketplaceContract, true);
        emit NFTMinted(newTokenId);
    }
}
```

Marketplace.sol

```solidity
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.13;

import "@openzeppelin/contracts/utils/Counters.sol";
import "@openzeppelin/contracts/token/ERC721/ERC721.sol";
import "@openzeppelin/contracts/security/ReentrancyGuard.sol";

contract Marketplace is ReentrancyGuard {
  using Counters for Counters.Counter;
  Counters.Counter private _nftsSold;
  Counters.Counter private _nftCount;
  uint256 public LISTING_FEE = 0.0001 ether;
  address payable private _marketOwner;
  mapping(uint256 => NFT) private _idToNFT;
  struct NFT {
    address nftContract;
    uint256 tokenId;
    address payable seller;
    address payable owner;
    uint256 price;
```

```solidity
    bool listed;
  }
  event NFTListed(
    address nftContract,
    uint256 tokenId,
    address seller,
    address owner,
    uint256 price
  );
  event NFTSold(
    address nftContract,
    uint256 tokenId,
    address seller,
    address owner,
    uint256 price
  );

  constructor() {
    _marketOwner = payable(msg.sender);
  }

  // List the NFT on the marketplace
  function listNft(address _nftContract, uint256 _tokenId, uint256 _price) public
payable nonReentrant {
    require(_price > 0, "Price must be at least 1 wei");
    require(msg.value == LISTING_FEE, "Not enough ether for listing fee");

    IERC721(_nftContract).transferFrom(msg.sender, address(this), _tokenId);
    _marketOwner.transfer(LISTING_FEE);
    _nftCount.increment();

    _idToNFT[_tokenId] = NFT(
      _nftContract,
      _tokenId,
      payable(msg.sender),
      payable(address(this)),
      _price,
      true
    );

    emit NFTListed(_nftContract, _tokenId, msg.sender, address(this), _price);
  }

  // Buy an NFT
  function buyNft(address _nftContract, uint256 _tokenId) public payable
nonReentrant {
```

```solidity
        NFT storage nft = _idToNFT[_tokenId];
        require(msg.value >= nft.price, "Not enough ether to cover asking price");

        address payable buyer = payable(msg.sender);
        payable(nft.seller).transfer(msg.value);
        IERC721(_nftContract).transferFrom(address(this), buyer, nft.tokenId);
        nft.owner = buyer;
        nft.listed = false;

        _nftsSold.increment();
        emit NFTSold(_nftContract, nft.tokenId, nft.seller, buyer, msg.value);
    }

    // Resell an NFT purchased from the marketplace
    function resellNft(address _nftContract, uint256 _tokenId, uint256 _price)
public payable nonReentrant {
        require(_price > 0, "Price must be at least 1 wei");
        require(msg.value == LISTING_FEE, "Not enough ether for listing fee");

        IERC721(_nftContract).transferFrom(msg.sender, address(this), _tokenId);

        NFT storage nft = _idToNFT[_tokenId];
        nft.seller = payable(msg.sender);
        nft.owner = payable(address(this));
        nft.listed = true;
        nft.price = _price;

        _nftsSold.decrement();
        emit NFTListed(_nftContract, _tokenId, msg.sender, address(this), _price);
    }

    function getListedNfts() public view returns (NFT[] memory) {
        uint256 nftCount = _nftCount.current();
        uint256 unsoldNftsCount = nftCount - _nftsSold.current();

        NFT[] memory nfts = new NFT[](unsoldNftsCount);
        uint nftsIndex = 0;
        for (uint i = 0; i < nftCount; i++) {
            if (_idToNFT[i + 1].listed) {
                nfts[nftsIndex] = _idToNFT[i + 1];
                nftsIndex++;
            }
        }
        return nfts;
    }
```

```solidity
function getMyNfts() public view returns (NFT[] memory) {
  uint nftCount = _nftCount.current();
  uint myNftCount = 0;
  for (uint i = 0; i < nftCount; i++) {
    if (_idToNFT[i + 1].owner == msg.sender) {
      myNftCount++;
    }
  }

  NFT[] memory nfts = new NFT[](myNftCount);
  uint nftsIndex = 0;
  for (uint i = 0; i < nftCount; i++) {
    if (_idToNFT[i + 1].owner == msg.sender) {
      nfts[nftsIndex] = _idToNFT[i + 1];
      nftsIndex++;
    }
  }
  return nfts;
}

function getMyListedNfts() public view returns (NFT[] memory) {
  uint nftCount = _nftCount.current();
  uint myListedNftCount = 0;
  for (uint i = 0; i < nftCount; i++) {
    if (_idToNFT[i + 1].seller == msg.sender && _idToNFT[i + 1].listed) {
      myListedNftCount++;
    }
  }

  NFT[] memory nfts = new NFT[](myListedNftCount);
  uint nftsIndex = 0;
  for (uint i = 0; i < nftCount; i++) {
    if (_idToNFT[i + 1].seller == msg.sender && _idToNFT[i + 1].listed) {
      nfts[nftsIndex] = _idToNFT[i + 1];
      nftsIndex++;
    }
  }
  return nfts;
}
}
```

CHAPTER 4

RESULTS AND OUTPUTS

FIGURE 2: KALAAKRITI WEBSITE - MARKET

FIGURE 3: KALAAKRITI WEBSITE - ABOUT

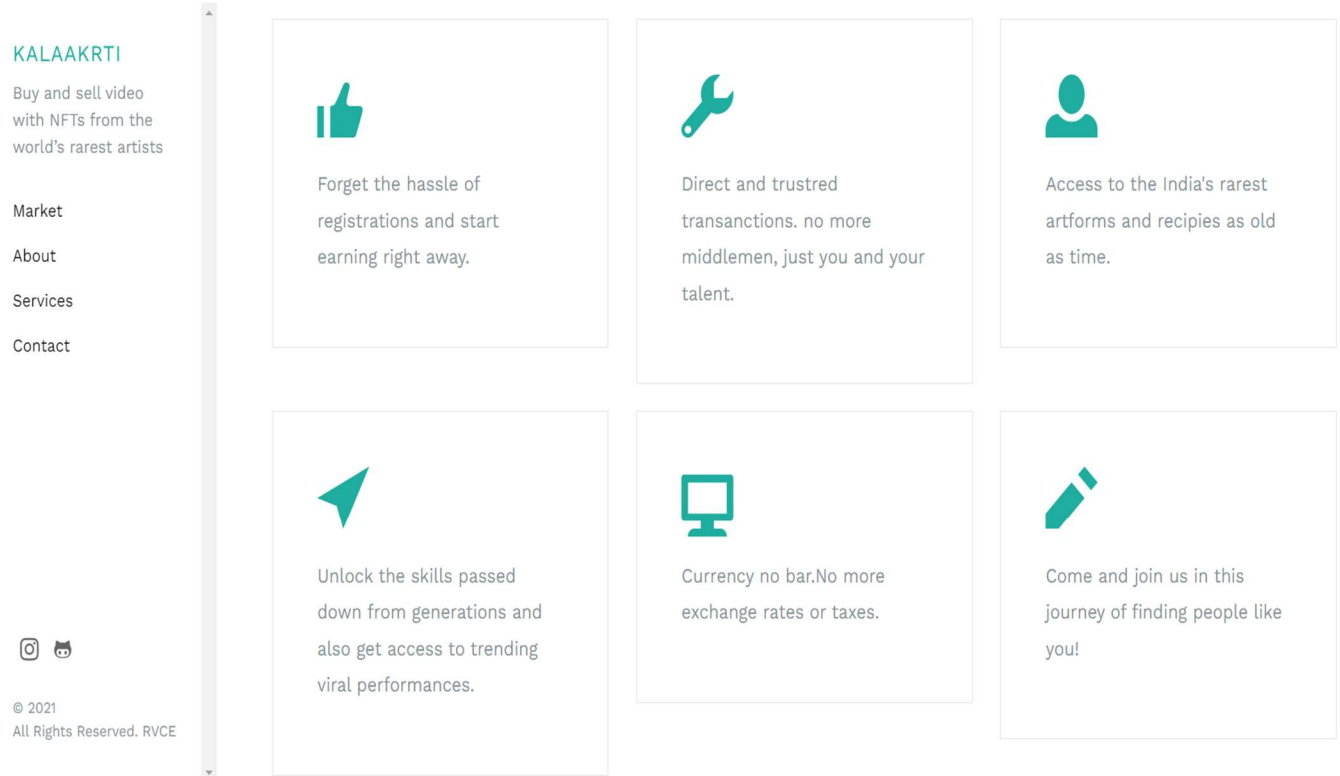**FIGURE 4: KALAAKRITI WEBSITE - CONTACT**
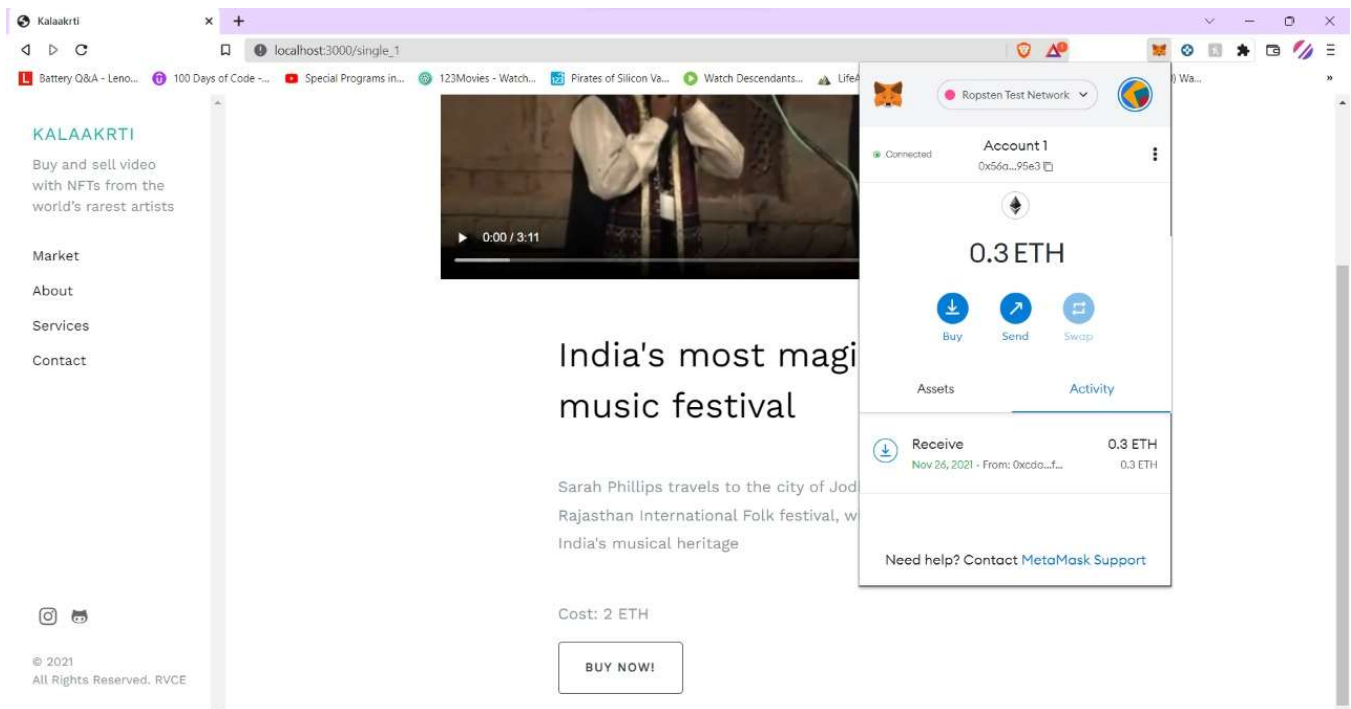
FIGURE 5: KALAAKRITI WEBSITE – ABOUT

FIGURE 6: BUY NFT FEATURE

CHAPTER 5
CONCLUSION AND FUTURE SCOPE

In conclusion, the Kalaakriti NFT Marketplace stands as a pioneering project at the crossroads of technology and cultural preservation. By employing an advanced tech stack that includes EJS templating for the frontend, Solidity for smart contracts, Node.js for backend development, and Web3.js for seamless blockchain interaction, the platform successfully achieves its primary goal of safeguarding India's rich cultural heritage. The utilization of smart contracts eliminates intermediaries, offering a decentralized and transparent marketplace that facilitates the digitization of traditional art forms into Non-Fungible Tokens (NFTs).

Looking ahead, the future of Kalaakriti NFT Marketplace holds promising avenues for growth and refinement. Enhancements to smart contract features, including royalties for artists on secondary sales and dynamic pricing models, could further enrich the platform. Continuous improvement in user experience, with a focus on optimizing the EJS templating frontend, ensures a seamless and engaging interface. The integration of emerging blockchain technologies may enhance scalability and reduce transaction costs.

Moreover, community building and marketing efforts will play a crucial role in expanding Kalaakriti's reach. Global outreach and collaboration with other NFT marketplaces, cultural organizations, and art institutions open doors for cross-cultural dialogue. As the project evolves, it has the potential to not only be a digital representation of India's cultural heritage but also a dynamic hub for the global appreciation of Indian artforms. Kalaakriti NFT Marketplace, with its commitment to innovation and cultural exchange, holds the promise of becoming a cornerstone in the realm of digital art and cultural preservation, fostering sustainable economic opportunities for local artisans and craftsmen.

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