A Next-Gen Marketplace for End-to-End Encrypted Buying, Selling, and Auctioning of NFTs

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Abstract: In today's fast-paced digital world, Non-Fungible Token *(*NFT*)* has become mainstream, reaching a market value of $50 billion. They act as digital certificates of ownership of online resources, reshaping how we perceive ourselves to be on the digital realm. Our plan is to have a BidCraft NFT Hub, a marketplace where people can easily buy, sell and trade NFT. We simplify the process by using blockchain technology. For the user interface, we use web3.js for a smooth experience. In the background, Node.js and Express.js ensure smooth operation. We integrate MetaMask, a trusted digital wallet for account management and secure transactions. To ensure security and transparency in transactions, the platform relies on contract written in Solidity. Testing is done on the Hardhat network, which is planned to run on the Polygon blockchain in the testing environment. In summary, the BidCraft NFT Hub aims to make blockchain technology and NFTs accessible to everyone by leveraging the Polygon blockchain and prioritizing user friendliness while maintaining safety and security.

Keywords: Non-Fungible token (NFT), blockchain, polygon, metamask, Web3.js

1. Introduction

In today's modern world, new technologies are constantly changing industries. One of the most revolutionary innovations in recent years is blockchain technology [1]. Originally built as a foundation for Bitcoin and other cryptocurrencies, blockchain has grown into a more versatile tool for use than digital currencies. One notable application garnering attention is Non-Fungible Tokens (NFTS) [2], which are changing our understanding of ownership and digital assets. Blockchain is like a digital ledger that keeps track of transactions, but it's different from regular ledgers because it's decentralized. Instead of being controlled by one central authority, it's spread out across a network of computers, called nodes. Each node has a full copy of the ledger, which means no single entity controls the information. This embedded system ensures that transactions recorded on the blockchain is transparent, immutable and secure. In the beginning stages of blockchain technology, NFTs represent unique digital assets that cannot be changed and cannot be duplicated. Unlike cryptocurrencies like Bitcoin or Ethereum, which are exchangeable, each NFT has unique features that set it apart from the others. This uniqueness makes NFT the best place to represent digital objects, collectibles, virtual real estate and ownership rights in the digital world. The emergence of NFT marketplaces has provided developers and collectors with an easy way to buy, sell and consume these digital assets. These marketplaces use blockchain to confirm ownership and history, ensuring transparency and verification in every transaction. Popular NFT marketplaces such as OpenSea, Rarible [3], and Foundation offer a range of digital assets and unique user experiences.

Our service, BidCraft NFT Hub is an easy-to-use platform that makes it simple to buy, sell, and trade unique digital assets called NFTs. NFT stands for digital objects such as art or ideas. We made our platform user-friendly using Node.js with web3.js for front-end integration and Express.js for server-side collaboration. We also integrated MetaMask for account management and secure services. Behind the scenes, we built the platform in smart contracts written in Solidity, to ensure secure and transparent communication. We use the Hardhat network to test our platform, and it is deployed on Polygon blockchain technology in a Testnet environment. Our goal is to simplify NFT trading, allowing people to express and sell their digital creations. Using blockchain technology, we offer trust, security and transparency. However, trust in our market depends on factors such as high regulatory standards, strong safety measures, and active community participation.

2. Related Work

Khan and Agnihotri [4] explained the complex process of creating NFTs. It starts with submitting a digital file to an NFT marketplace [5]. Once there, the file becomes an NFT on a digital ledger. Creators still own the copyright to their NFTs but can make more NFTs from the original file. It's important to realize that owning an NFT doesn't mean you own the copyright or exclusive rights to the original digital file. One of main problems in the NFT market is proving the origin of the NFT, which is common in blockchain technologies. This issue opens the door for imposters to sell NFTs fraudulently, claiming to be the original artist. Despite NFTs being designed to represent unique digital assets, proving the uniqueness and authenticity of virtual items can be challenging. Also, because code is made up of 1s and 0s and can be replicated, it questions the idea that virtual items are inherently non-fungible. This replication of code complicates matters in distinguishing between unique and replicated NFTs [6].

In their study of modern communication tools, Hasan and Salah [7] highlight how easy it is to access these tools, making it simple to create various digital content like audio, videos, online books, images, and articles. This accessibility has led to the emergence of digital marketplaces where content creators can connect with eager consumers. Just in the United States, the digital media industry brings in an estimated revenue of about $43.2 billion [8]. However, it's crucial to ensure that digital content reaches consumers smoothly, which calls for a strong Proof of Delivery (PoD) system. Centralized systems have several problems that make them hard to rely on, including weaknesses, lack of transparency, and an uneven distribution of power. Also, using third-party intermediaries for payment processing in these centralized systems can create uncertainties and reduce trust [9]. A Proof of Delivery system guarantees that digital content is delivered correctly and without any changes, protecting the rights of everyone involved and building trust for future transactions.

Ethereum, led by Wajiha Rehman and team [11], stands out as a groundbreaking decentralized software platform. At its core, Ethereum uses blockchain tech to help create and run decentralized applications. It comes with a built-in programming language and an abstract layer, giving users the power to define ownership rules, transaction formats, and how states change. One standout feature of Ethereum is how it smoothly incorporates digital artwork through something called NFTs. Just like physical coins are minted, NFTs are tokens created when digital art is made. These tokens act as unique versions of digital art, allowing them to be bought, sold, and tracked online. Digital art covers a wide range of creative works, from music and movies to paintings, appealing to art lovers, collectors, and creators alike. This highlights the many different ways NFTs can be used, which might not be widely recognized. A blockchain works like a digital ledger spread across many computers, keeping track of transactions without needing a central authority [12]. Bitcoin, the first cryptocurrency developed in 2008 and launched in 2009, was the pioneer in using blockchain technology [13].

In recent times, Decentralized Digital Asset Exchanges (DDAEs) have become a hot topic in finance. However, they face challenges like low trading activity and market instability, as pointed out by Shams and

Shayel [10]. Shams has suggested six new ways to evaluate DDAEs, drawing inspiration from the Principles of Financial Market Infrastructure (PFMI). The importance of strong financial systems was highlighted during the Global Financial Crisis (GFC), showing the need for resilient structures. Weak systems during the crisis made things worse, causing widespread problems. Currently, regulators are struggling to keep an eye on transactions on DDAEs. But this might change soon as regulators think about introducing rules for DDAEs. These rules might include Know Your Customer (KYC) procedures and Anti-Money Laundering (AML) measures. These are aimed at confirming the identities of customers and spotting suspicious activities linked to illegal money. Moreover, regulatory frameworks might require transparency regarding transactions on DDAEs.

Below Table 1 shows the summary of the related work and their research Gap.

Table 1. Related Work and Research Gap

Author Names and Title	Research Gap
NFT Market - blockchain - Digital Stack: A NFT Marketplace Saffan khan Student Lovely professional	Difficulty in proving the uniqueness and authenticity of digital assets in NFTs due to the inherent replicability of code; Lack of verification mechanisms leading to potential imposters in NFT auctions.
H. R. H and K. S – (PoD) of Digital Assets Using Blockchain and Smart Contracts	Need for a reliable and transparent system to ensure accurate and unaltered delivery of digital content; Challenges in centralized systems such as failure, lack of transparency, and reliance on third parties.
NFTs: Applications and Challenges, W. R, H. e. Z, J. I and N. Z. B	Exploration of the integration of digital art into blockchain technology through minting NFTs; Utility and applications of NFTs beyond their recognition in facilitating the purchase, sale, and tracking of digital art.
NFT Market Research - , Shams, Shayel.	Limited trade volume and volatile market conditions in Decentralized Digital-Asset Exchanges (DDAEs); Lack of regulatory oversight and standards for monitoring transactions on DDAEs.

3. System Design

In this chapter, we present blockchain-based solutions for facilitating seamless transactions of NFTs without relying on intermediaries [14]. Our proposed solution i.e., Fig. 1 which entails the development of a user-friendly front-end React application hosted on our website. This application necessitates users to link their MetaMask wallet [15], thereby granting them access to a range of functionalities, including NFT design. Throughout the NFT creation process, users are prompted to upload a file containing an image or artwork. Subsequently, smart contracts are employed to transform these uploaded files into NFTs. To ensure security against potential malicious activities, Pinata IPFS [16] is utilized for encryption. Once executed, the resulting hash is securely stored in the database and subsequently listed in the NFT market. When users initiate the production of NFTs from the market, they are provided with the option to select artifacts from the available NFTs. Changes in ownership are seamlessly facilitated within the integrated smart contracts by deducting the requisite amount. A platform that facilitates access to NFTs is becoming increasingly important due to their growing demand. The platform enables individuals to sell, buy and sell their NFTs, empowering users to shape the future of this growing market. Because of the high demand for some NFT banks, they often come with higher prices, offering opportunities for traders to make profits and improve their lives. The platform is designed to be as easy to use as any other marketing platform, providing seamless communication. It is a gateway for artists to showcase their work to a wider audience, thereby increasing greater interest in the NFT sector, which is expected to flourish in the long run Besides, the platform offers users receive up-to-date

information on the NFT market This ensures that users remain informed and can make informed decisions in the NFT project.

The main purpose of creating this platform is to make buying and selling easier by cutting out middlemen, which fits with the main idea behind blockchain technology. By connecting buyers and sellers directly, we want to reduce fraud and dishonesty that can happen in different industries. Blockchain tech, especially NFTs, offers a strong solution to guarantee the honesty and safety of transactions. NFTs are essentially immune to fraud because they can't be changed once they're made, which makes users trust the services provided more.

Our NFT Marketplace operates on Polygon's blockchain [17] technology, known for its security and decentralization features. This blockchain forms the foundation for all NFT transactions, ensuring reliability throughout the buying, selling, and trading processes. By utilizing Polygon's highly scalable infrastructure, our goal is to create a user-friendly platform for NFT enthusiasts. We prioritize transparency, irreversible transactions, and reliability in every transaction conducted on our platform, thanks to the benefits provided by Polygon's blockchain technology. With Polygon, we offer users a robust and dependable framework for participating in NFT activities within a decentralized and secure environment.

In our NFT marketplace project, we've chosen to use Solidity [18], a programming language designed specifically for creating smart contracts on networks such as Polygon. Its focus on simplicity, clarity, and security makes it perfect for building strong and safe smart contracts. By using Solidity, we've developed contracts that enable smooth and transparent communication between buyers and sellers on our platform.

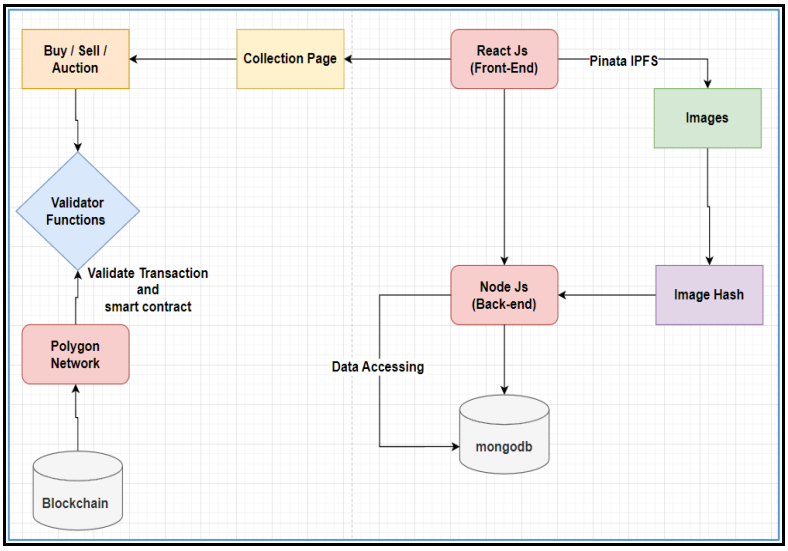

Fig. 1. Proposed system block diagram.

Various individuals and groups take part in this system:

1. Artist/Creator: This is the person who owns the NFTs and puts them up for sale. They are responsible for developing and pricing NFTs.
2. Consumers: Consumers are people who use smart contracts to access digital goods. They accept the rules and then ask for whatever they want. After that, they pay for it.
3. Events: Events are like reports that update everyone involved in the transaction. Think of it as little messages sent when something important happens in the process. When an action is performed, it triggers an action such as an alarm signal. This information is super helpful as it makes it easy to keep track of what's going on and fix any potential issues. Therefore, they have an important role to play in ensuring that everyone is informed and that issues can be resolved effectively

4. Implementation

When visitors arrive at the homepage, they will find a variety of options for markets, collections, artists, and more. The Marketplace section allows users to search for all available NFTs. There is also a build section where users can effortlessly upload their created NFTs. The aggregated section contains all uploaded non-fungible token displays.

The source code for the implementation using solidity is share in GitHub[1].

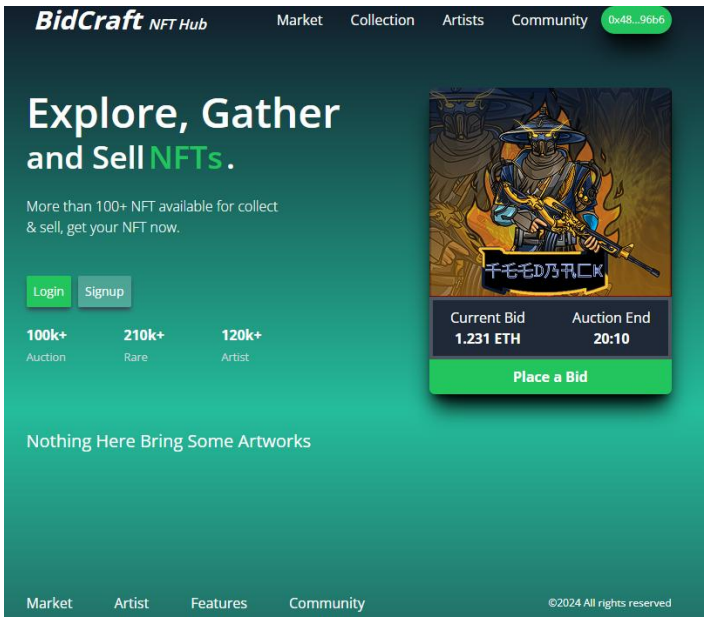

Fig. 2. Main page of the BidCraft NFT hub marketplace.

Fig. 2 displays the homepage of our BidCraft NFT Hub marketplace. It showcases different options such as market, collection, and a create section where users can create their own NFTs.

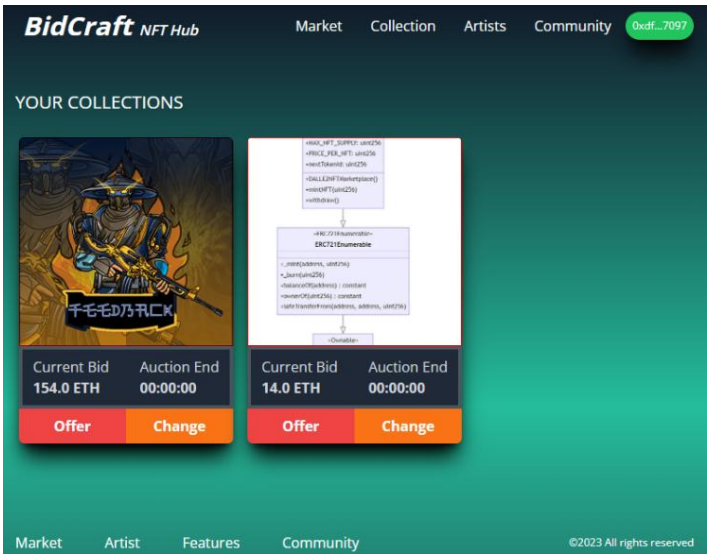

Fig. 3. Collection page of the BidCraft NFT Hub Marketplace.

The Collections Page is where users can see all the NFTs they've made. They can also put their NFTs up for sale in the marketplace right from this page. Users can change the prices of their NFTs and list them for sale,

[1] https://github.com/RahulTharammal/BidCraft_NFT

as depicted in Fig. 3. Each user gets special IDs for the NFTs they make, which are used in the marketplace. This platform lets users make their own unique digital items, called NFTs, and give them special IDs. Users can upload their NFT designs by picking a file and uploading it directly on the platform, as shown in Fig. 4.

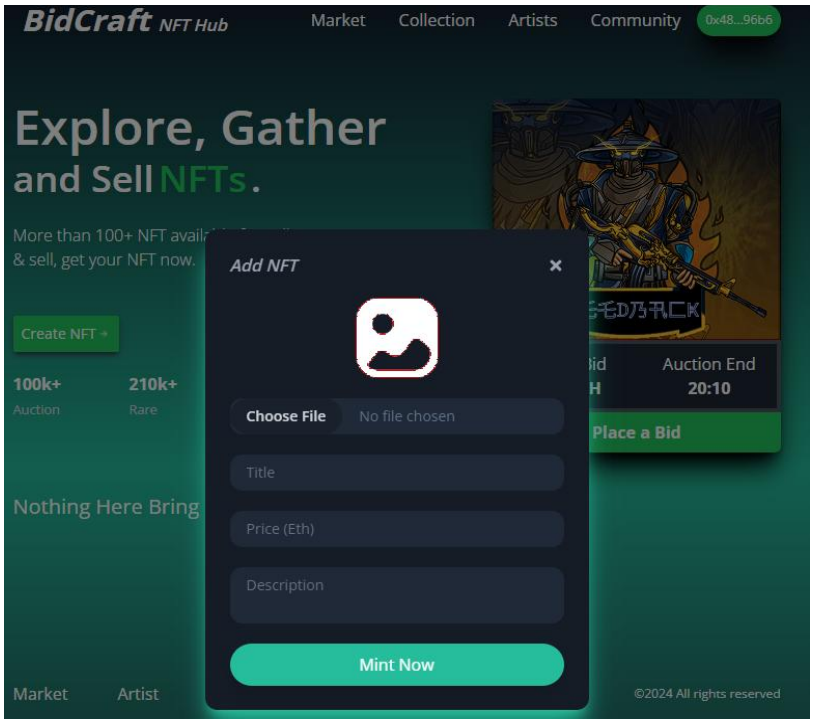

Fig. 4. Section for minting NFT.

When minting an NFT, users must upload the file by using the “choose file” option. They also need to provide details such as the title, selling price, and a description of the NFT. This is shown in Fig. 4.

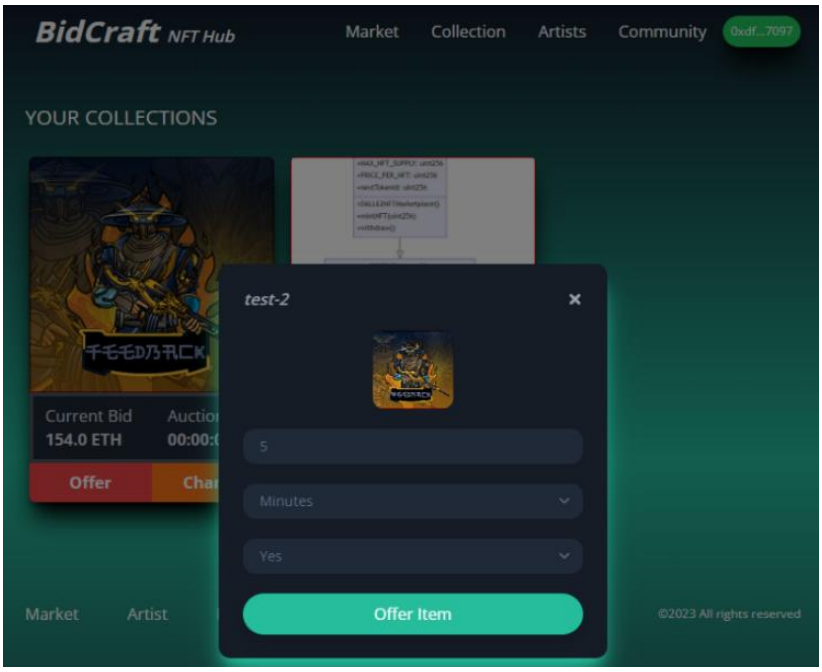

Fig. 5. Offer Submission Section.

In Fig. 5, users/authors have the option to make offers. Here, users are required to input details such as

time and duration (in minutes, seconds, or hours). If the user intends to participate in an auction, they must select “yes”; otherwise, they should select “no,” which will proceed to the buy option. Once an offer is created, the NFT is listed on the market page, and a live auction countdown is initiated as shown in Fig. 6.

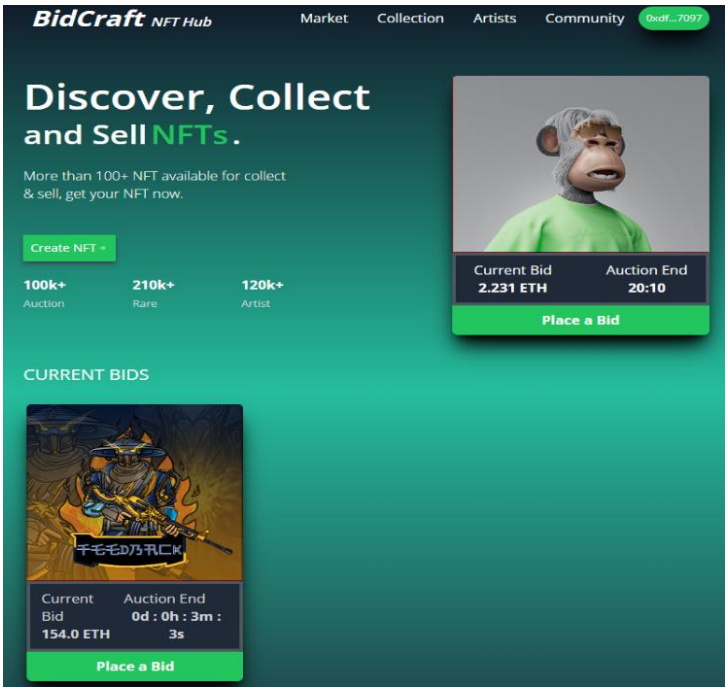

Fig. 6. NFT Market Live Auction Initiation.

Once the NFT is created, it will appear on your Collection Page. You can then sell it at a fixed price. Once listed, it will show up on the Market page where other users can buy it at the price you set or join the auction to bid. This process is shown in Fig. 7, which shows how NFT tokens are created and registered. Once the NFT is created, it will appear on your Collection Page. You can then sell it at a fixed price. Once listed, it will show up on the Market page where other users can buy it at the price you set or join the auction to bid. This process is shown in Fig. 7, which shows how NFT tokens are created and registered.

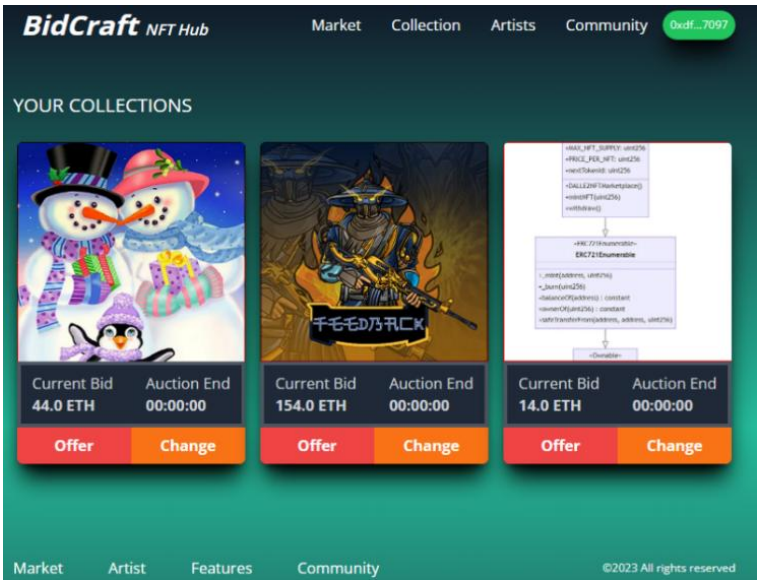

Fig. 7. Minted NFT to Marketplace.

5. Application

1. Digital Art: NFT marketplaces provide a platform for digital artists to tokenize their creations as NFTs. This allows artists to retain ownership and authenticity of their work while enabling buyers to purchase unique digital art pieces as collectibles.
2. Collectibles: NFTs can represent unique digital collectibles such as trading cards, virtual pets, or in-game items. NFT marketplaces enable collectors to buy, sell, and trade these digital assets securely.
3. Gaming: NFTs are increasingly being used in the gaming industry to represent in-game assets, characters, or skins. Players can buy, sell, and trade these NFTs on dedicated marketplaces, providing a new dimension to the gaming economy.
4. Virtual Real Estate: Some virtual worlds and metaverse platforms utilize NFTs to represent virtual real estate properties. Users can buy, sell, and rent virtual land parcels through NFT marketplaces.

Music and Media: Musicians, filmmakers, and other content creators can tokenize their work as NFTs, allowing fans to purchase limited editions or special versions. NFT marketplaces offer a platform for artists to monetize their content directly to their audience

6. Future Work

In the coming stages of development, our focus will be on fixing known limitations and making further enhancements. One of our main goals is to make our platform compatible with more blockchain networks like Binance Smart Chain and Solana, so more people can use it. We'll also be adding new features like real-time trading and improving the user interface to make it more advanced and user-friendly. To make our platform more independent and secure, we're planning to incorporate decentralized options for creating and storing images instead of relying on external APIs. It's also crucial for us to make our smart contracts more efficient and scalable to handle more users and transactions smoothly. We'll keep engaging with our community, asking for feedback from users, and keeping up with new technologies to ensure that our NFT Marketplace dApp stays relevant and adaptable in the fast-changing world of blockchain technology.

7. Conclusion

Our project aimed to create a safe platform where people could easily buy, sell, and trade NFTs directly with each other. We noticed that NFTs were becoming very popular in the blockchain world, so we wanted to make it simpler for people to deal with them while making sure everything worked smoothly. Our main goal was to make an interface that anyone could use easily to do the basics. We also wanted to make it easy for people to create their own NFTs, so they could make tokens that fit their own style and interests. In the end, we wanted to make a platform that anyone could use, making it simple to explore and take part in the growing NFT market, especially while it's still new and evolving.

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Conflict of Interest

The author certifies that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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