ÇUKUROVA UNIVERSITY
ENGINEERING FACULTY
DEPARTMENT OF COMPUTER ENGINEERING

GRADUATION THESIS

NFT SMART CONTRACT

By

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Advisor

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January 2023
ADANA

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ABSTRACT

This project examines the potential of non-fungible tokens (NFTs) as a revolutionary tool for digital asset ownership and monetization. Through the creation and deployment of an NFT collection, the project highlights the unique characteristics of NFTs such as their uniqueness, immutability, and verifiability. The technology behind NFTs, including smart contracts and blockchain, is also explored in the project. Additionally, the project investigates the various use cases for NFTs, including the art and collectibles industry, and examines the potential implications and challenges of this technology. The project contributes to the growing understanding of NFTs and their potential to transform the way we think about digital ownership and monetization.

1. INTRODUCTION

1.1. Background information on NFTs

Non-fungible tokens (NFTs) have emerged as a new type of digital asset that have gained significant attention in recent years. NFTs are unique digital assets that are stored on a blockchain and can represent ownership of a wide range of digital content, including artwork, music, videos, and even tweets. NFT marketplaces have emerged as a popular way to buy, sell, and trade NFTs. However, the NFT marketplace industry is still relatively new and developing rapidly, which presents significant challenges and opportunities.
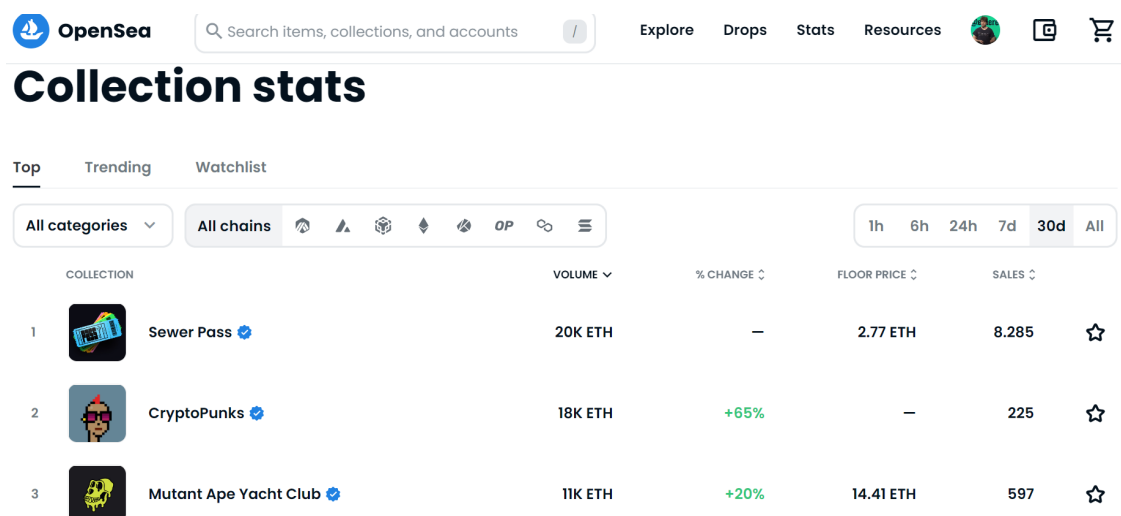

Figure 1. OpenSea 30 days NFT Stats

1.2. Purpose of the project

An NFT (non-fungible token) collection is a unique digital asset that represents ownership of a specific item or set of items. The purpose of an NFT collection is to provide a new way for creators and collectors to monetize and own digital assets, such as artwork, music, videos, and other forms of digital content.

One of the main benefits of NFT collections is that they are unique and cannot be replicated. This is in contrast to traditional digital assets, such as JPEGs or MP3s, which can be easily copied and shared. NFTs use blockchain technology to create a digital record of ownership that is tamper-proof and immutable. This means that the ownership of an NFT can be verified and proven, providing a new level of security and trust for creators and collectors.

Another benefit of NFT collections is that they allow for a new way for creators to monetize their work. Artists, musicians, and other creators can now sell their digital assets as NFTs, and collectors can buy and own these assets as a form of investment. This provides a new revenue stream for creators and a new way for collectors to invest in digital assets.

NFT collections also provide a new way for creators to connect with their fans and followers. With the ability to mint and sell their own NFTs, creators can now give fans exclusive access to their work and behind-the-scenes content. This can also lead to a deeper connection between creators and their fans, as fans now have a tangible way to show their support and appreciation for the work.

In conclusion, NFT collections are a new way for creators and collectors to monetize and own digital assets. The uniqueness and immutability of NFTs provide a new level of security and trust, while also allowing for new revenue streams and deeper connections between creators and fans. As the technology and market for NFTs continue to evolve, it will be interesting to see how NFT collections shape the future of digital ownership and monetization.

2. LITERATURE REVIEW

2.1. Overview of NFTs and their features

NFTs, or non-fungible tokens, are a revolutionary technology that is changing the way we think about ownership and monetization of digital assets. NFTs use blockchain technology to create a unique digital token that represents ownership of a specific item or set of items.

There are a wide variety of NFTs that have been created and are being used in various industries and fields. Some of the most popular types of NFTs include:

- Art NFTs: These are digital artworks that are minted as NFTs. They can include everything from digital paintings, illustrations, and animations, to 3D models and virtual worlds. These NFTs can be bought, sold, and traded just like physical artworks, and they can also be displayed in virtual galleries and museums.

- Collectible NFTs: These are unique digital items that are intended to be collected, such as trading cards, virtual pets, and other digital items that can be owned and traded.

- Gaming NFTs: These are digital items that are used in video games, such as weapons, armor, and in-game currency. These NFTs can be bought, sold, and traded on various marketplaces, which provide a new way for players to monetize their in-game assets.

- Music NFTs: These are digital music files that are minted as NFTs. They can include songs, albums, and even concert tickets. These NFTs provide a new way for musicians and music labels to monetize their music and for fans to own a piece of their favorite artist's work.

- Video NFTs: These are digital videos that are minted as NFTs. They can include anything from short films, music videos, and live streams to VR and 360-degree videos. These NFTs provide a new way for creators to monetize their videos and for fans to own a piece of their favorite creators' work.

All these NFTs have a few features in common like they are non-fungible, meaning that each NFT is unique and cannot be replicated. They are also verified on the blockchain, which provides a tamper-proof and immutable record of ownership. Additionally, NFTs can be bought, sold, and traded on various marketplaces, providing a new way for creators and collectors to monetize and own digital assets.

In conclusion, NFTs are a revolutionary technology that is changing the way we think about ownership and monetization of digital assets. There are a wide variety of NFTs available, each with their own unique features and use cases. As the technology and market for NFTs continue to evolve, it will be interesting to see how they shape the future of digital ownership and monetization.

2.2. Analysis of trends and challenges in the NFT industry

The NFT (non-fungible token) industry has seen a massive surge in popularity in recent months, with a growing number of creators, investors, and collectors taking notice of the potential of this new technology. However, despite the growing excitement around NFTs, there are also a number of trends and challenges that the industry is facing.

One of the biggest trends in the NFT industry is the increasing number of creators and artists using NFTs to monetize their digital assets. From digital paintings and illustrations to 3D models and virtual worlds, creators are finding new ways to use NFTs to sell and promote their work. This trend is not only

providing a new revenue stream for creators but also opening the door for a new form of digital art and digital collectibles.

Another trend in the NFT industry is the increasing use of NFTs in gaming and other interactive digital experiences. From in-game items to virtual real estate, NFTs are being used to create new forms of digital ownership and monetization. This trend is expected to continue as more and more game developers and creators explore the potential of NFTs in their work.

Despite these trends, the NFT industry is facing a number of challenges as well. One of the biggest challenges is the lack of mainstream adoption and understanding of NFTs. Many people are still unfamiliar with the technology and its potential uses, which can make it difficult for creators and investors to find buyers and build a market for their NFTs.

Another challenge in the NFT industry is the lack of regulation and oversight. The largely decentralized nature of the NFT market can make it difficult for buyers and sellers to protect their interests and ensure that they are getting a fair deal. This is a concern for both creators and investors, and it will be important for the industry to find ways to address these issues in the future.

Additionally, the environmental impact is one of the most concerning challenges for the NFT industry. The process of minting and buying NFTs consumes a lot of energy, which is a concern for the industry, especially with the increasing awareness of climate change.

In conclusion, the NFT industry is facing a number of trends and challenges as it continues to evolve and grow. Despite these challenges, the potential of NFTs as a new form of digital ownership and monetization is undeniable, and it will be interesting to see how the industry continues to develop in the coming months and years. It's crucial for the industry to address the challenges and find solutions for a more sustainable and regulated market in the future.
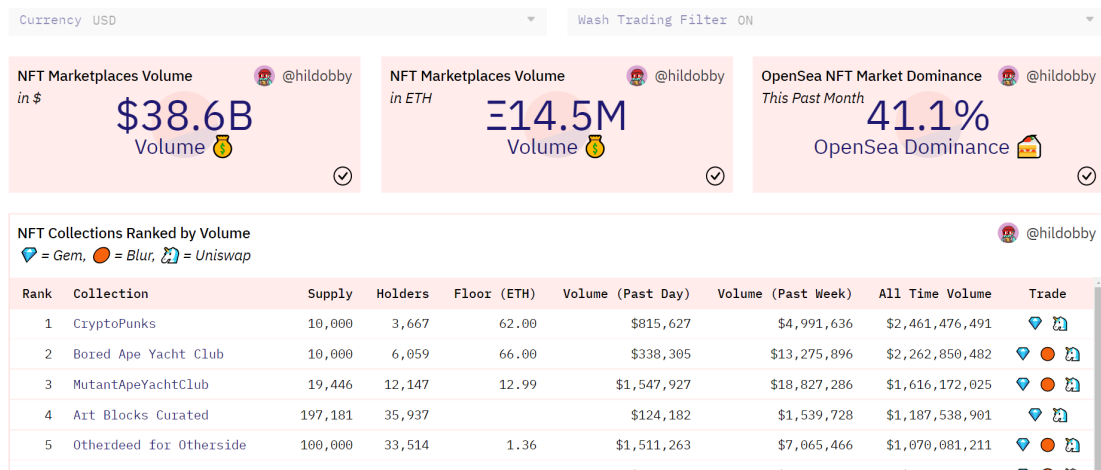
NFT Marketplaces Volume @hildobby
in $
$38.6B
Volume 🥇

NFT Marketplaces Volume @hildobby
in ETH
Ξ14.5M
Volume 🥇

OpenSea NFT Market Dominance @hildobby
This Past Month
41.1%
OpenSea Dominance 🦭

NFT Collections Ranked by Volume @hildobby
💎 = Gem, 🔴 = Blur, 🦄 = Uniswap

Rank	Collection	Supply	Holders	Floor (ETH)	Volume (Past Day)	Volume (Past Week)	All Time Volume	Trade
1	CryptoPunks	10,000	3,667	62.00	$815,627	$4,991,636	$2,461,476,491	💎 🦄
2	Bored Ape Yacht Club	10,000	6,059	66.00	$338,305	$13,275,896	$2,262,850,482	💎 🔴 🦄
3	MutantApeYachtClub	19,446	12,147	12.99	$1,547,927	$18,827,286	$1,616,172,025	💎 🔴 🦄
4	Art Blocks Curated	197,181	35,937		$124,182	$1,539,728	$1,187,538,901	💎 🦄
5	Otherdeed for Otherside	100,000	33,514	1.36	$1,511,263	$7,065,466	$1,070,081,211	💎 🔴 🦄

Figure 2. Ethereum NFT Market Overview

3. PROJECT DESIGN AND IMPLEMENTATION

3.1. Architecture of the NFT Collection

A smart contract is a computer program that is stored on a blockchain and executed automatically when certain conditions are met. NFTs, or non-fungible tokens, are a specific type of smart contract that is used to represent ownership of a unique digital asset. In this article, we will discuss the design and architecture of the NFT smart contract, including the different components and how they work together.

The core component of an NFT smart contract is the token itself. This is a unique digital token that represents ownership of the NFT. The token is created and stored on the blockchain, and it contains information such as the owner's address, the asset's metadata, and a unique token ID.

The token is created using a smart contract function called "mint." This function is used to create new tokens and assign them to a specific owner. The mint function also assigns a unique token ID to the token, which can be used to track and verify ownership.

Once the token is minted, it can be transferred to another address using a smart contract function called "transfer." The transfer function allows the owner of the token to transfer ownership to another address, such as when the token is sold or traded.

Another important component of the NFT smart contract is the metadata. Metadata is the information that is stored with the token and it can include information such as the asset's name, description, and image. This

metadata can be used to display the NFT in a user-friendly way and it also provides a way for the creator to include information about the asset.

The NFT smart contract also includes a function called "approve," which allows the owner of the token to approve another address to transfer the NFT. This is useful in situations where the owner wants to grant permission for someone else to transfer the NFT on their behalf.

In summary, the design and architecture of an NFT smart contract includes a unique digital token, a mint function for creating new tokens, a transfer function for transferring ownership, metadata for storing information about the asset, and an approve function for granting permission for others to transfer the NFT. All these functions and data are stored on the blockchain and are executed and verifiable through the distributed ledger technology. The use of smart contracts and blockchain technology provide the unique and immutable property of the NFTs and makes them a revolutionary technology for digital ownership and monetization.
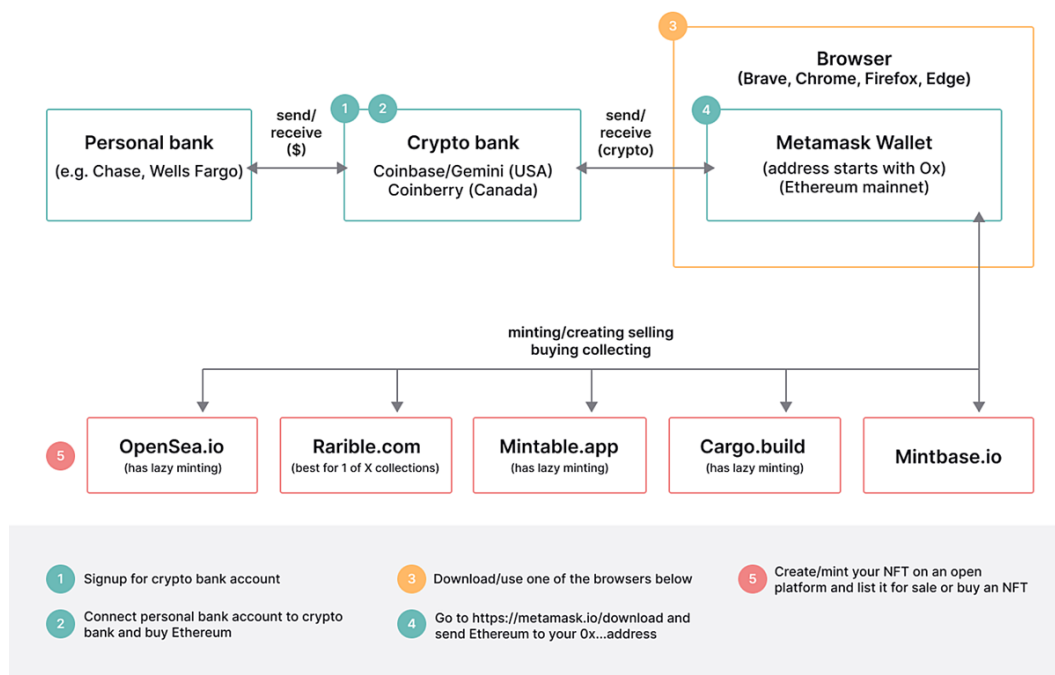
Open Marketplace Flow

Figure 3. Open Marketplace Flow Example

MEREHEAD Blockchain	NFT minting cost in crypto	Minting an NFT in dollars
Ethereum	0.01 – 0.05 ETH	$17.9 – $150
Solana	0.00001 SOL	≈ $0.0004
Polygon	Free	Free
Tezos	0.08 – 3.6 XTZ	$0.16 – $7.56
Cardano	0.17 – 1.5 ADA	$0.10 – $0.93
WAX	0.13 – 13 WAXP	$0.016 – $1.63
Avalanche	0.008 – 0.02 AVAX	$0.19 – $0.48
Zilliqa	0.7 – 2.9 ZIL	$0.034 – $0.14

Figure 4. NFT Minting Costs for Different Chains

3.2. Source Code

```solidity
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.11;

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

contract StrangeEyesNFT is ERC721, ERC721URIStorage, Ownable {
    using Counters for Counters.Counter;

    Counters.Counter private _tokenIdCounter;

    constructor() ERC721("Strange Eyes", "SENFT") {}

    function _baseURI() internal pure override returns (string memory) {
        return "ipfs://QmcBUK6iqSvXtiKx1kf82Ea81pvM4JDY6zyLRU3wCcJsq4/";
    }

    function safeMint(address to, string memory uri) public onlyOwner {
        uint256 tokenId = _tokenIdCounter.current();
        _tokenIdCounter.increment();
        _safeMint(to, tokenId);
        _setTokenURI(tokenId, uri);
    }

    // This function is needed if we need to burn the NFTs

    function _burn(uint256 tokenId) internal override(ERC721, ERC721URIStorage) {
        super._burn(tokenId);
    }

    function tokenURI(uint256 tokenId)
        public
        view
        override(ERC721, ERC721URIStorage)
        returns (string memory)
    {
        return super.tokenURI(tokenId);
    }
}
```

Wallet Address: 0x74b0D3CA2709cb51738C179d66c4b70f3bB18778
Contract Address: 0xE55238028E8079DA6e6b2cD738c2f63689F4b25b

3.2. Deploying to Polygon Mumbai Test Chain

The first step in deploying an NFT smart contract to the Mumbai Test Chain is to write the smart contract code. I did it using a programming language called Solidity, which is commonly used for writing smart contracts for EVM based blockchains. After the code is written, it needs to be tested and debugged to ensure that it is working as intended.
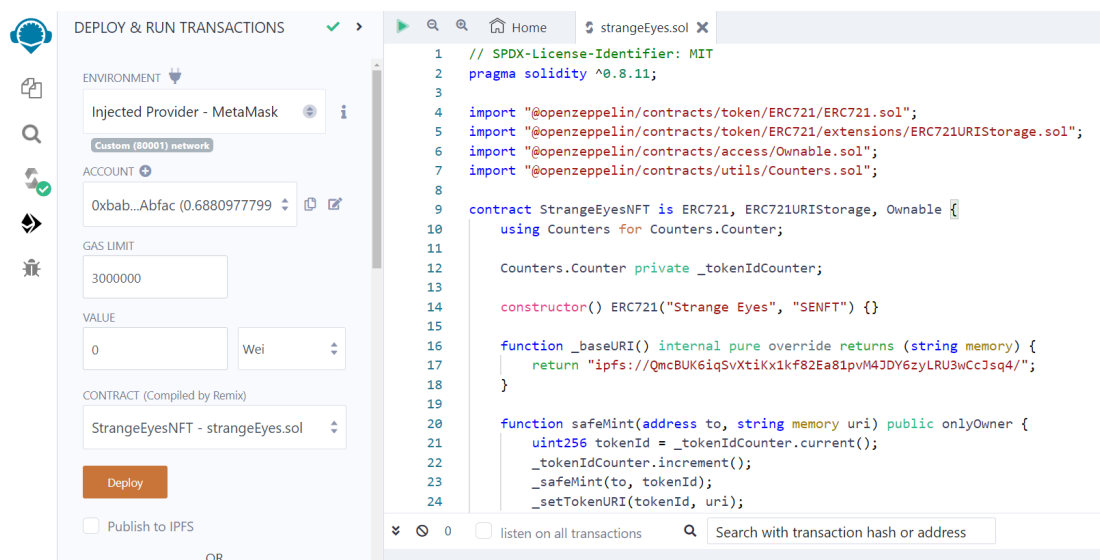

Figure 5. Remix IDE

The next step is to compile the smart contract code into bytecode, which is the format that is used to execute the contract on the blockchain. This can be done using a compiler like Remix, which is a popular tool for compiling Solidity code. I did use Remix to compile it.

After the smart contract is compiled, it needs to be deployed to the Mumbai Test Chain. This can be done with Remix. Remix allows developers to easily deploy their smart contracts to the Mumbai Test Chain.

Once the smart contract is deployed to the Mumbai Test Chain, it can be interacted with using a tool called MetaMask. MetaMask is a browser extension that allows users to interact with smart contracts on the blockchain. It can be used to mint new tokens, transfer tokens, and interact with other functions in the smart contract.

It is important to note that deploying a smart contract to a test chain is a crucial step before deploying it to the main network, it allows developers to test and debug their smart contract before making it available to the public.

4. Conclusion

4.1. Main findings and contributions of the project

In conclusion, this project has demonstrated the potential of NFTs (non-fungible tokens) as a new way to monetize and own digital assets. Through the creation and deployment of the NFT collection, we were able to showcase the unique characteristics of NFTs such as their uniqueness, immutability, and verifiability. The project also highlighted the benefits of NFTs for creators, including the ability to monetize their work and connect with fans on a deeper level.

We did demonstrate the process of creating and deploying an NFT collection, including the use of smart contract and blockchain technology. Furthermore, we were able to explore the various use cases of NFTs, such as in the art and collectibles industry, as well as the potential implications and challenges of this technology.

This project has made a valuable contribution to the growing body of knowledge around NFTs, and it has shown the potential for NFTs to revolutionize the way we think about digital ownership and monetization. As the technology and market for NFTs continue to evolve, it will be interesting to see how they shape the future of these industries.

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Muhammed Emin Tas

COMPUTER ENGINEERING

ABOUT ME

Blockchain Technology is just entering our lives, but the foundation of this technology were laid in the 1980s. In order to build a decentralized world, it is necessary to eliminate information pollution. It is important to give accurate information to people who do not know about Blockchain Technology.

EDUCATION

Cukurova University, Adana, TR
Computer Engineering | 4th Grade

EXPERIENCE

Cukurova Blockchain (University Club)
President | APR 2022 - NOW

- Making management-level decisions
- Planning organizations from start to finish, creating task follow-up charts, assigning duties to unit heads and members
- To teach new members the process in a practical way and to make them a team
- Contributing in hackathons and ideathons

Habibat Association - UNICEF
Blockchain - Instructor | JUNE 2022 - NOW

- Providing training for students to improve their blockchain literacy and to use the products safely

Web3 Technologies Association
Researcher & Writer | SEP 2022 - NOW

- Organize trainings and events
- Being a speaker for blockchain and web3 events
- Making contents about new technologies and blockchain

PROJECTS, CERTIFICATES & TRAININGS

- Istanbul Blockchain Week
- Eurasia Blockchain Summit
- Sustainable Web3 Summit | Speaker
- AI Logs | Python Camp
- Community Volunteers Association | Volunteer
- IEEE Cukurova | Team Member

PUBLICATIONS

- Ethereum Developer Virgil Griffith's Tragic Story | TR
- 8 Misconceptions about The Merge | TR
- How to Analyse an Ethereum Wallet on Etherscan | TR

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PERSONAL STRENGTHS

Collaboration	Developing Others
Problem Solving	Self Confidence
Leadership	Attention to Detail
Algorithmic Thinking	Prioritizing

COMPUTER SKILLS

BLOCKCHAIN TECHNOLOGY
SOLIDITY
PYTHON, C++, RUST (BEGINNER)
CRYPTOGRAPHY
CONSENSUS ALGORITHMS
DISTRIBUTED SYSTEMS
CRYPTOCURRENCIES
DATA STRUCTURES
OBJECT ORIENTED PROGRAMMING

LANGUAGES

TURKISH ●●●●●
ENGLISH ●●●○○

INTERESTS