

A Study on Technology to Counter Copyright Infringement According to NFT Transaction Types

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ABSTRACT

In the digital world, the transactions of assets with intrinsic value can be applied to games, literature, art, and music by issuing NFTs (Non-Fungible Tokens) based on Blockchain; various NFT exchanges are emerging accordingly just like real world asset exchanges. However, there could be an issue of copyright infringement in those NFT transactions. Therefore, this paper has classified the types of copyright infringement that may occur in NFT exchanges and proposes the copyright infringement countermeasures according to them. For this purpose, 10 types of NFT exchange are examined. Eventually, it can be expected that the proposed countermeasures will contribute to the revitalization of the NFT market by providing solutions for those issues.

Key Words : NFT, Non-Fungible Token, Minting, Ethereum, Copyright, Infringement, Blockchain

1. Introduction

With the recent development of ICT, various types of content transaction are taking place in the digital environment; furthermore, transactions of assets with unique values in the digital world, same as asset transactions in the real world, are based on Blockchains NFT (Non-Fungible Token) issuance. It can be applied to games, literature, art, music, and so on [1].

NFT is a kind of cryptocurrency derived by smart contract of Ethereum. Unlike existing crypto tokens, NFT is a non-fungible crypto token that cannot be exchanged 1:1 with other crypto tokens. Therefore, it can give a separate unique recognition value and make it impossible to be exchanged [2]. Due to this characteristic, NFT can be used in various ways, from contents such as videos, pictures, and music to various certificates, licenses, and rights to copyrighted works. In particular, NFT is being widely used in the art field, and New York Christie's Auction House and Sotheby's have started an NFT auction. In March 2021, digital artist Mike Winkelmann (known as beeples)'s 'The First

5000 Day's' was sold for \$69 million at Christie's in New York [3].

In addition, Coinbase, a global virtual asset exchange, formed CCI (Crypto Council for Innovation), a lobbying organization for virtual asset policy discussions, together with global companies with evolutionary assets such as Square and Fidelity Invest. It said that it is making efforts to form and encourage responsible regulation [4].

In this environment, various NFT exchanges are emerging; in Korea, blockchain companies and auction companies are entering the NFT market together. However, copyright infringement is an issue in these NFT transactions, and in overseas cases, two or more works of digital artist Corbin Reinbolt were sold in the form of NFT without his consent [5]. In Korea, while creating NFT of Park Soogeun's work and selling it through an online auction, there was a controversy over whether copyright was violated or not. This was the case in which a company without copyright promoted the issuance and auction of NFTs with claiming that the copyright was transferred. from the company promoting the auction. Eventually, as the controversy grew, the auction was suspended [6].

From the above cases, NFT, a blockchain-based

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technology, can secure rarity and uniqueness in that it is not only recognized for its reliability, but also cannot be replaced unlike other tokens. However, it also has various copyright infringement issues, so countermeasures are needed. Therefore, this paper classifies the types of NFT exchanges and the corresponding types of copyright infringement and introduces technical countermeasures against them. The structure of this paper is as follows. Section 2 introduces the concept of NFT, ERC (Ethereum Request for Comments)-721, and ERC-1155, which are standard interfaces issued and traded on the Ethereum blockchain, including NFT models. Section 3 classifies the types of platforms currently trading NFTs and analyzes the types of copyright infringement. Section 4 proposes countermeasures for each type of copyright infringement, and Section 5 concludes.

2. Background

2.1 NFT

NFT is a kind of virtual asset, but each token has a different unique value, so it is a non-fungible token that cannot be exchanged 1:1 with other NFTs. NFT authenticates the uniqueness of digital assets through a series of unique data stored in the blockchain, and through this, digital assets such as movies, sound sources, images, game items, and artworks can have rarity [7]. Fig. 1 shows the comparison between Fungible and Non-fungible [6].

Also, there are several examples of transactions by assigning unique recognition values to various types of digital content using NFT. For example, on Feb. 3, 2021, the highest priced NFT was CryptoKitties Dragon, which sells for 600 Ether (ETH), which upbeat was worth 980 million Korean Won [15].



Fig. 1. The comparison between Fungible and Non-fungible.



Fig. 2. An example transaction by assigning unique recognition values to a digital content using NFT.

2.2 NFT Specification of Ethereum

The most representative blockchain platform used for NFT is Ethereum, and Ethereum token standards include ERC-20, ERC-721, and ERC-1155. Among them, NFT-related standards are ERC-721 and ERC-1155 [8-11] shown in Fig. 3 [8]. The ERC-1155 standard enables mixed transactions of fungible tokens (ERC-20 tokens) and non-fungible tokens (ERC-721 tokens). As such mixed transactions are made possible, the number of tokens per transaction can be up to 100-200 depending on the function. In addition, it implements multi-transfers that can send as many items as desired to one or more recipients in one transaction. The efficiency of the ERC-1155 standard can reduce GAS, fees that occur during Ethereum transactions, and bottlenecks. That is, the background of the ERC-1155 standard being proposed is due to the inefficiency and high cost of the current ERC token standard requiring separate smart contracts to be deployed for each token type. In addition, the ERC-1155 standard can solve the problems of accumulating a lot of redundant and unnecessary data in the ERC-20 token and ERC-721 token and consuming a large amount of storage space caused by unnecessary code remains forever due to the immutable property of blockchains.

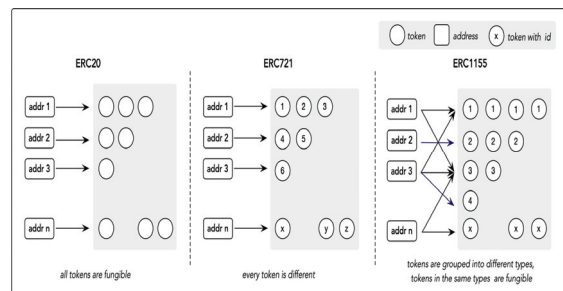


Fig. 3. NFT-related token standards.

2.3 NFT Model

The basic model of NFT was introduced in [11], in which NFT protocol consists of five stages: digitize, store, sign, issue and trade, and confirm shown in Fig. 4.

1. NFT Digitize: The NFT owner verifies that the files, titles, and descriptions are correct, and digitizes the raw data into an appropriate form.
2. NFT Store: The NFT owner stores the raw data in a database outside the blockchain.
3. NFT Sign: The NFT owner signs the transaction including the hash of the NFT data and sends it to the smart contract.
4. Mint & Trade (ERC-721 or ERC-1155): When the smart contract receives a transaction containing NFT data, the NFT minting (issuing) and trading process begins.
5. NFT Confirm: When the transaction is confirmed, the minting (issuing) process is completed, and at this time, the NFT records it in a unique blockchain address as a permanent proof.

Here, NFT Minting is the process of issuing NFTs, and Transaction is the minimum processing step/unit of work that cannot be divided anymore. Based on the existing reference model, copyright infringement can be made at each stage.

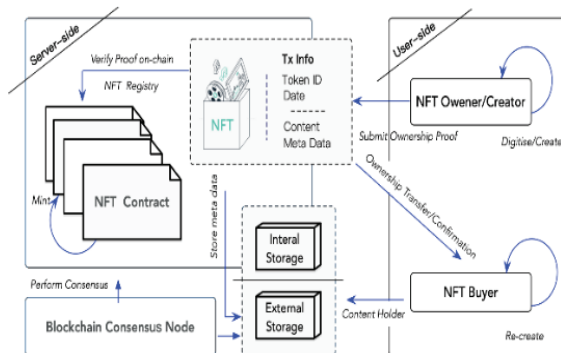


Fig. 4. Model of NFT systems.

3. Types of NFT Exchanges and Copyright Infringement

3.1 Types of NFT Exchange Infringement

Copyright infringement that may be found in the NFT

market usually occurs during the process of converting digital content into NFT and uploading it, called as minting, or when it is sold on an exchange. Until now, most cases of NFT exchange have not verified the fact that who owns the rights to the content in this process. However, from now on, it is necessary to consider all cases that may arise from stores that trade NFTs [12-14].

NFT exchange types can be classified based on the tokens traded on these exchanges and the corresponding assets. There are types of assets that can be sold on the NFT exchange that do not have real assets in the preferred selling assets but can be sold only with metadata. For example, it may be various certificates or copyright rights. The second type is the one that provides metadata of the work (including various rights of the work) and thumbnails of the work. Third, there may be types in which metadata, thumbnails, and original work files can be directly copied, transmitted, or downloaded through a link.

3.2 Platforms by NFT Exchange Type

Table 1 shows the representative platforms on domestic and overseas NFT exchanges. Most of them are provided in the form of metadata and thumbnails; Korbit and other sites allow to download works.

Table 1. NFT exchange platforms

Platforms	Types	Remarks
(Domestic) TBD (Overseas) TBD	Metadata	Future service expected
(Domestic) AEX (Overseas) Mintalbe, Makersplace, NFT Mania, Opensea	Metadata-thumbnail	
(Domestic) Korbit, NFTING (Overseas) Nifty Gateway, foundation, NFT Mania	Metadata-thumbnail-content	

3.3 Copyright Infringement by NFT Exchange Type

Previously, copyright issues occurred in NFT transactions may happen during the process of converting digital contents to NFT and uploading it; that is the stage of minting and selling. In general, the stage of minting, the NFT exchange should verify who has the right to the content. And in the rest of the cases, copyright issues that may occur in the type of exchange that trades NFTs are as follows.

Table 2. Copyright infringement by exchange types

	Service Type	Registration details	Type of Infringement
Trading	Metadata	- Title of work - Work information (author, year of production, size, etc.) - Description of work	Personal rights of authorship, All copyrights
	Meta data-thumbnail	- Title of work - Work information (author, year of production, size, etc.) - Description of work - Thumbnail	Personal rights of authorship t, Copy right Transmission right
	Meta data-thumbnail-content	- Title of work - Work information (author, year of production, size, etc.) - Description of work - Thumbnail - Content	Personal rights of authorship t, Copy right Transmission right
Creating NFT (Minting)	Common (block, separate storage)	- Meta data, - Thumbnail - Content	Personal rights of authorship, All copyrights

In a transaction based on metadata, there can be issues on personal rights of authorship and all copyrights because this is not selling assets but selling the information of meta data and copyrights. Here, in some cases, incorrect information may be provided. As for Metadata and thumbnails, we need to concern about personal rights of authorship, copy right, and transmission right. Finally, in metadata, thumbnail, and content, in addition to the second type, content can be downloaded directly or with link. There are problems with the infringement of personal rights of authorship, the copyright infringement on the transmission right of the uploaded work, and the illegal reproduction of the work through the NFT link. In the case of minting, if someone other than the copyright holder uploads another person's work, there may be infringement of personal rights of authorship and infringement of transmission or reproduction rights. If the author's name is written as someone else other than the author, personal rights of authorship can be violated. In the case of digitizing offline works to make NFTs, copyright infringement occurs. When storing in a separate storage, illegal copying of works through links may occur. Copyright infringement of most NFT transactions occurs

because it is possible to minting (publishing) works with NFTs without special restrictions. There is no problem with NFT issuance in shared works that have expired copyright or are public works.

4. Technologies for Copyright Infringement

In case of copyright infringement, there is possible damage caused by unauthorized theft due to the person responsible for the copyright is unclear. Especially when copyright infringement happens on overseas exchanges, international litigation is required. Therefore, this paper introduces the types of copyright infringement that can occur during NFT minting and trade and the technologies that can be coped with them. Here, the types of infringement can be divided into three categories: metadata, metadata-thumbnail, and metadata-thumbnail-content. The minting stage of making a content into an NFT becomes common.

In the case of the metadata type, information such as rights or certificates may be the subject of infringement in a situation where the work is not disclosed. Therefore, the type of infringement can be both personal rights of authorship and copyrights. To prevent such cases, the work verification technology is required such as original verification service, work integrity verification service, and original author verification.

In case of Metadata-thumbnail type because it is composed of thumbnails and additional information relevant to them, the required are related with verification and monitoring such as original verification, work integrity verification, original author confirmation, illegal use monitoring, technical measures for registration and permission system of trading sites, and so on. For this purpose, a system for registration and permission of trading site may be necessary; and then it allows to respond to inappropriate cases with Implemented copyright technical measures.

In the metadata-thumbnail-content type, additionally contents are downloadable, and they are stored in blocks or in a separate storage while minting. Such that users can access to them with the given link information. However, it is necessary to provide an anti-piracy service to prevent access to unauthorized users. Core technologies such as encryption, authentication, and access control are required in the service to prevent illegal copying of copyrighted contents.

In minting stage, both personal rights of authorship and all

copyrights can be infringed in common. Therefore, first, contents verification technology is required which includes the original verification technology to determine the authenticity of the original, the technology for verifying the integrity of the content, the technology for verifying the original author, the technology for preventing the leakage of contents that may occur when uploading the work, and the safe archiving skills. In the case of shared contents, shared contents verification service and shared contents license verification service that make sure whether or not they are violated.

5. Conclusion

In this paper, we look at the types of copyright infringement that can occur in the recent rapidly increasing NFT exchanges by examining the types of copyright infringement. In addition, countermeasures that can be dealt with according to the type of copyright infringement were presented. Type classification is divided into the mining stage and the transaction stage to make the work NFT. For the type of asset transaction, 10 representative NFT trading sites are looked at and based on the work being traded, metadata, metadata-thumbnail, metadata-thumbnail-content divided by type. In addition, the mining process for making works into NFTs is divided into common ones. Suppose the proposed methods are applied to NFT exchanges, it will be helpful to clear the current issues of verifying original authors and distorted use of contents. This result will further contribute to the activation of the NFT exchange by increasing its the reliability. For the future work, to secure these countermeasures, empirical research is needed to specify each technology item and apply them to various NFT exchange platforms.

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