IJACT 20-12-32

Modeling of Artworks Blockchain Platform Using Colored Petri Net

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Abstract

Most works of art are done through brokers, and transaction details are not disclosed to the public and are always at risk of tampering. To solve these problems, many Artworks Blockchain Platforms that apply blockchain technology to art transactions are being used. Several companies are currently operating these platforms, but since various blockchain platforms are operated according to the content, the operating methods of each platform are different, and a related model is needed to solve these problems due to compatibility issues between platforms. In this paper, we collect the latest Artworks Blockchain Platforms data, and based on this, we will create and analyze the Color Petri net model of Artworks Blockchain Platform.

Keywords: Artworks Platform, Blockchain, Colored Petri Net, Modeling

1. Introduction

Blockchain platforms are transforming the art market in a variety of fields, including artists, collectors, art investors and auctioneers. Artists are increasingly creating digital artwork and registering their work on the blockchain to prove ownership. Collectors who are concerned about the authenticity of their purchases can use the blockchain to track ownership. Art investors can use blockchain technology to own or liquidate parts of their work. Blockchain-based cryptographic and registration services in the auction market allow you to record descriptions of actions and prices, and track origins when buying or selling [1].

Currently, most art works are done through brokers. Transaction details are not disclosed to the outside and are always at risk of tampering. For this reason, art works are often traded for tax evasion.

Art Together, a platform for joint ownership of artworks, introduces a blockchain with TEMCO, a supply chain data platform company based on bitcoin for transparent distribution management of artworks. Basically, in the form of crowdfunding, blue-chip works are purchased from famous art auction companies such as Seoul Auction and K Auction, and artists are recruited on the Art Together website, displayed at affiliated hotels, department stores, and public institutions, and then voted by co-owners at the time of sale. It is a structure in which profits are realized through market price gains and exhibited at an auction company. It has the advantage of being able to manage and disclose more transparently through the blockchain during the process of purchasing works, transporting, storing, and transferring ownership.

Art auction company Christie is using blockchain technology to safely store auction records with Atori, a blockchain-based digital art registration company. Atori records all transaction information such as the title of the work, description, final successful bid price, and transaction date on the blockchain network. Recorded

information is issued in the form of a digital certificate. The purchaser receives a registration card and reads the encrypted transaction information through it.

Art auction site Maecenas uses blockchain technology to create unique digital signatures that cannot be tampered with. Like a company issuing stocks, an artwork is split into thousands of digital signatures. Investors can own part of the artwork by purchasing this signature, and can sell this share back to other investors at any time through the same system. It also provides art rental services.

As such, various art block chain platforms are operated individually, making it difficult to share information or use other platforms between platforms. There is a need for an integrated model to solve these problems.

In this paper, we collect the latest Artworks Blockchain Platforms data, and based on this, we will create and analyze the Color Petri net model of Artworks Blockchain Platform.

2. Blockchain Technology and Artworks Blockchain Platform

Blockchain is a small data called 'block' to be managed in a chain-based distributed data storage environment created based on P2P method. Ledger management technology based on distributed computing technology[1].

Immutable ledgers using blockchain can be applied to specific works of art to track the journey from artist to owner. This technology is a revolutionary tool for the arts world, providing a new means of exchange for exchange.

The art blockchain platform utilizes blockchain to create new business channels and make it easier for a wider audience to access the art world[2].

Table 1. Types of Artworks Blockchain Platform

Type	Artworks Blockchain Platform Name
Art Auction Platform	Maecenas
Digital Art Platform	DADA, Cryptopunk

Figure 1 shows the processing flow of the artworks blockchain platform[3]. The artworks blockchain platform identifies suitable art pieces and carries out the due diligence process. Investors can view the painting's details, history, condition report, high-resolution images of the artwork, and the full provenance before registering interest in a bid. Using blockchain technology, an "Asset Token", a unique digital signature that cannot be tampered with, is created, and a single artwork is split into thousands of asset tokens. Investors can own some of the artwork by purchasing these asset tokens, and they can resell this stake to other investors at any time through the same system. Investors can pay in any accepted fiat currency (such as USD) or cryptocurrency, and they can buy and sell Asset Tokens on any exchange they are listed.

Curation → Due Diligence → Tokenisation → Sale Distribution → Trading Exchange

Figure 1. Process Flow of Artworks Blockchain Platform

3. Artworks Blockchain Platform Model

3.1 Artworks Blockchain Platform Model

The artworks blockchain platform model is a model that shows the flow chart in which blockchain technology is applied to art transactions and processed, and consists of several components as shown in Figure 2.
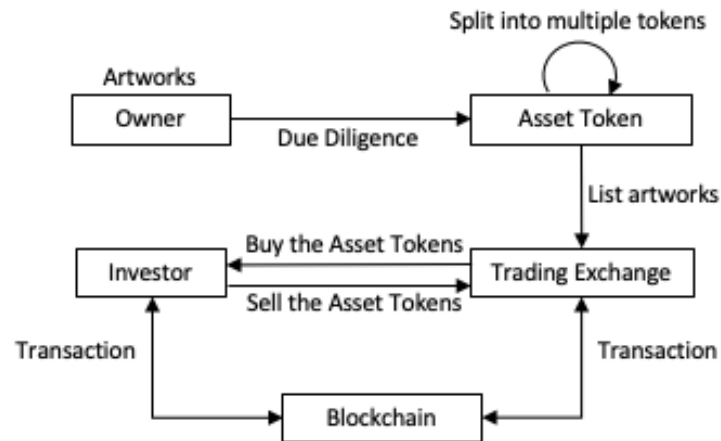

Figure 2. Artworks Blockchain Platform Model

The artworks blockchain platform model performs a due diligence process through the artwork's details, history, condition report, etc. to confirm the artwork data and source. An "Asset Token" representing the shared ownership of the work is issued. Tokenization is the process of converting rights to assets into digital tokens hosted on the blockchain, tokenizing something means the storage and management of assets digitally represented as tokens[4]. It creates a unique digital signature that cannot be tampered with, and separates a single artwork into thousands of digital signatures. Art owners can list artworks on trading exchange and sell the Asset Tokens to investors. Investors can buy and sell their Asset Tokens on any exchange they are listed. The transaction details for the Asset Token are stored in the blockchain, and transaction details can be checked through the blockchain.

3.2 Modeling of Artworks Blockchain Platform Model Using CPN Tools

Artworks blockchain platform model is constructed based on the color petri net by Jensen[6], and the artworks blockchain platform model is modeled using a tool called CPN Tools[7]. CPN Tools is a program that allows modeling and simulation with color petri nets.

Figure 3 shows the artworks blockchain platform model as a CPN tool. The input pattern is expressed in the form of (Artwork). In 1` ("artwork") of the input pattern of Figure 3, artwork represents a specific artwork.

The Artworks blockchain platform model consists of a Due Diligence module that examines artwork's details, history, condition report, and its full provenance, an AssetToken module that issues "asset tokens" representing the shared ownership of works, a ListArtwork module that lists artwork in a trading exchange, and stores transactions when buying and selling Asset Tokens. It is composed of a block chain module.
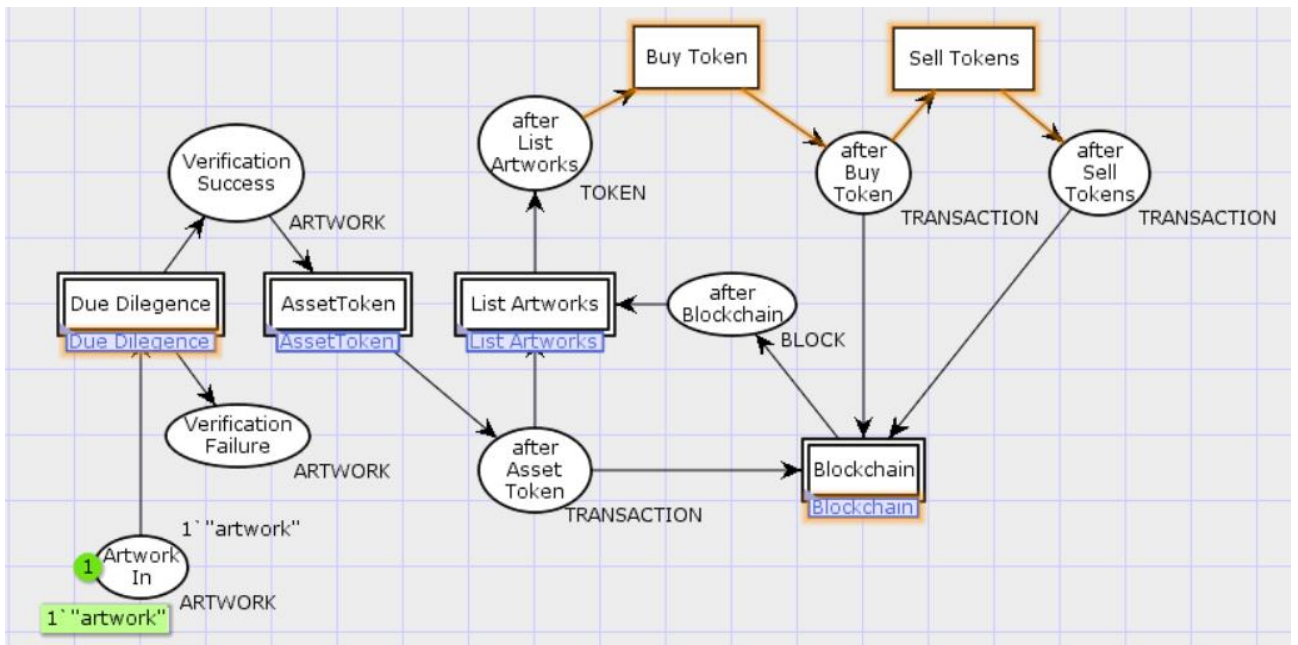
Figure 3. Artworks Blockchain Platform Model in CPN Tools

In the Due Diligence module in Figure 4, the artwork's details, history, condition report, and its full provenance is examined by a third party expert. When the result of the investigation is confirmed, it proceeds to the stage of issuing an asset token, and if a problem occurs, the process is stopped.
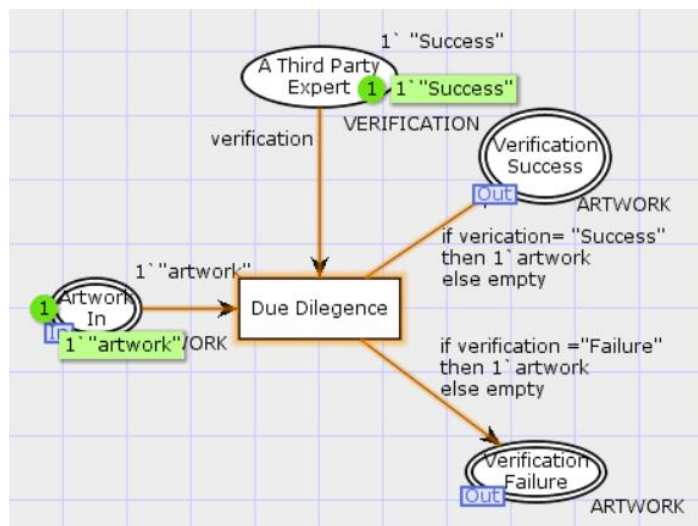

Figure 4. Due Dilegence Module

In the AssetToken module shown in Figure 5, Asset Tokens representing the shared ownership of the work are issued in the form of a unique digital signature that cannot be tampered with. In this module, we also work to split an artwork into thousands of asset tokens.
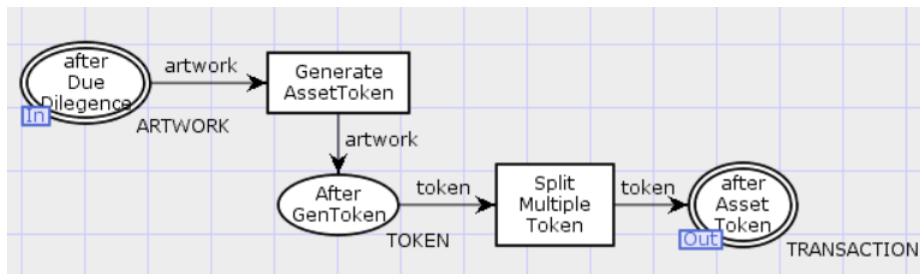
Figure 5. AssetToken Module

In the ListArtwork module in Figure 6, artwork is listed in a trading exchange, and according to changes due to transactions or ownership transfer, the gallery of the trading exchange is updated by reading blocks from the blockchain.
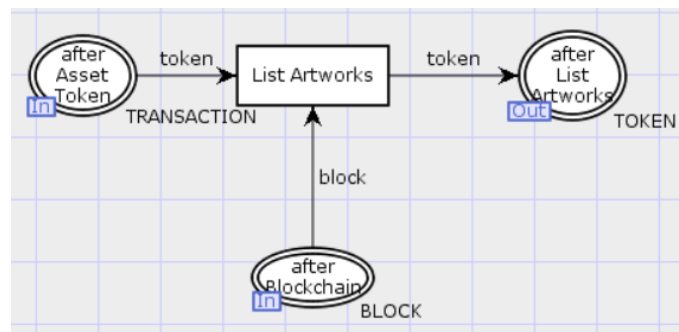

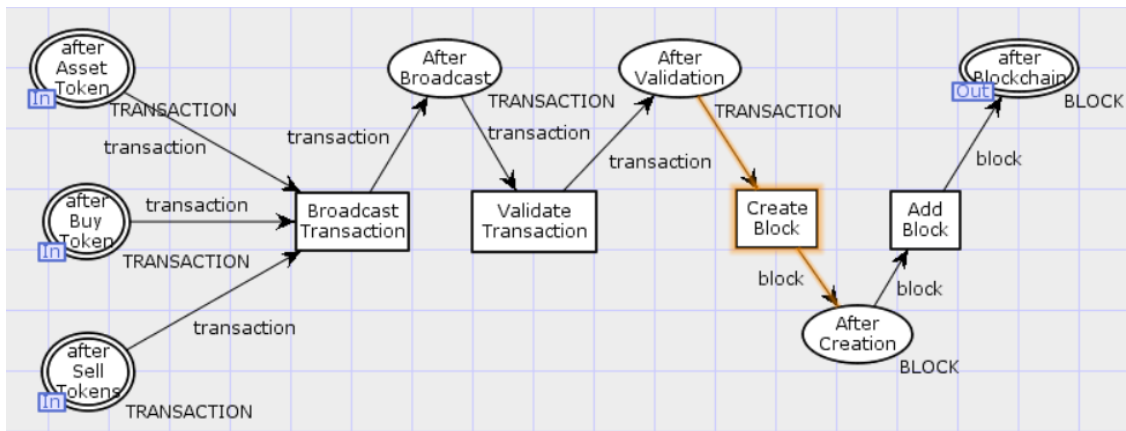**Figure 6. ListArtwork Module**

Figure 7. Blockchain Module

In the Blockchain module in Figure 7, the transaction that occurs when an Asset Token is issued or an Asset Token is bought or sold is broadcast to other nodes, and the node verifies the transaction. When verification is completed in this module, a new block is created and added to the existing block.

4. Analysis of Artworks Blockchain Platform Model

4.1 Modeling of Artwork's Asset Token Transaction

The Artworks blockchain platform model expresses that it is impossible to tamper with by modeling the tokenization of artwork through the Due Diligence module and the AssetToken module, and that one artwork is divided into thousands of tokens. In the Blockchain module, transaction details and ownership history are all stored in a blockchain, so that an information sharing system that does not require intermediary intervention is modeled.

4.2 Analysis of the Proposed Model using the Occurrence Graph

The Artworks blockchain platform model is modeled by a color Petri net, and uses the occurrence graph to construct a directional graph representing the state of the system that the node can reach and the state where the arc can change. A complete analysis of the model is possible using this graph.

Figure 8 shows the graph of occurrence when artwork is converted to Asset Token. After the due diligence is performed by an expert, the ownership of the artwork is created as an asset token, and it can be confirmed that it is separated into several asset tokens.
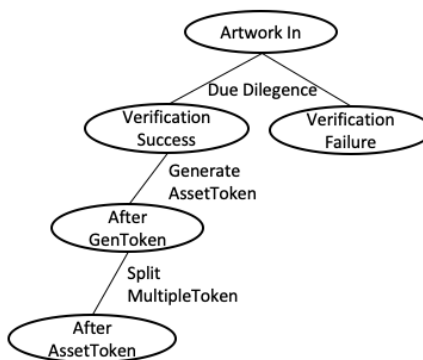

Figure 8. Occurrence Graph when Artwork is converted to Asset Token

Figure 9 shows the graph of occurrence when a block is registered in the blockchain after a transaction for an asset token occurs.

You can check the status of the process after the asset token is created and registered in the trading exchange, the process after the asset token is sold, the process after the asset token is purchased, and the process until a new block is added to the blockchain.

5. Conclusion

The platform that provides information on the distribution history of art works on a blockchain basis can be used when information on the work history is suspected or needs verification, and can also be used to manage the information on the distribution history of stolen and lost art works, and art works confiscated by the police.

Currently, several companies operate these platforms, but they operate various blockchain platforms according to their respective contents. In order to integrate these platforms into a single platform, an integration model for a blockchain platform is required. In this paper, data on the artwork blockchain platforms were collected, and based on this, a color petri net model of the artwork blockchain platform was created and analyzed.

Figure 9. Occurrence Graph when a Block is registered in the Blockchain after a transaction occurs

Through this model, it can provide a foundation for integrating various art block chain platforms, and additional requirements can be easily applied. In addition, it can help design and develop the software for the art block chain platform, and I think it will help in the analysis and integration of the art block chain platform.

As the art block chain service market grows, it will help revitalize the safe art transaction market in the future.

Acknowledgement

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