Lab 2 - Art Guardian Product Specification

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CS411W, Fall 2022

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17 November 2022

Final Version

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1   Introduction

Non-fungible tokens (NFTs) have increased in market value and popularity, especially during Q1 2021. In Q1 2020, the tradeable volume within NFT marketplaces was less than $100 million; this dramatically increased to $1.5 billion in Q1 2021 (Chang, 2021). Throughout 2021, NFTs have consistently increased in popularity and trading volume, eventually causing NFT marketplace volumes to reach $41 billion by the end of 2021 (Collins, 2021).

However, a major problem within the scope of NFTs was the copyright infringement of digital artwork. People mint artwork into NFTs without the original artist's permission and can make a large profit from it. DeviantArt, a popular platform for hosting and sharing digital artwork, reported 30,000 probable counterfeit thefts of digital artwork in November 2021; this number increased to 90,000 probable counterfeit thefts, tripling the number of thefts within a single month (Beckett, 2022). These thefts become a major issue considering the high profitability of NFTs because approximately 50% of all NFT sales were over $200 at the beginning of 2022 (Dailey, 2022).

Currently, there is a lack of security against NFT minting and digital artists do not have an effective solution in protecting their artwork. Digital artists must perform a manual process in order to have NFTs taken down by NFT marketplaces, which can be very tedious. The artist must first have knowledge of their artwork being minted and sold on NFT marketplaces, in which the artist may not even know about these actions being performed on their art. Next, they must manually fill out a Digital Millennium Copyright Act (DMCA) takedown request to the NFT marketplace where the minting or transaction occurred, and must repeat this process for every single marketplace the artwork is found on. Given that there is no effective way to

prevent an artwork from being minted without the original artist's permission, a victim of art theft will most likely find this process to be tedious and frustrating.

1.1   Purpose

Art Guardian is a desktop web application intended to protect the integrity of NFT transactions and protect digital artwork from NFT minting without the original artist's consent. The product prevents the future sale of counterfeit NFTs by providing an automated system that periodically searches through NFT marketplaces and performs image matching to compare the images on Art Guardian's database and the artwork on a given NFT. Art Guardian also auto-fills DMCA takedown requests with provided fields for an intuitive process of issuing takedown requests. The goal of Art Guardian is to grant digital artists an automated process that can halt further NFT profits from being made on stolen artwork.

1.2   Scope

Art Guardian aims to prevent stolen artwork from being sold as an NFT in order to maintain integrity in NFT transactions. The prototype shall do this by performing various algorithms that track art uploaded onto the database and comparing it to artwork found on NFT marketplaces.

Art Guardian's prototype will fully implement art upload, whitelisting, art tracking, image matching, theft alert, DMCA generation, and DMCA cataloging. The prototype will partially implement DMCA filing because these DMCA requests will be sent to test emails instead of real NFT marketplaces. The prototype will eliminate user verification and DMCA tracking.

1.3   Definitions, Acronyms, and Abbreviations

- **NFT**: A sellable, tradeable, non-fungible token that exists on the blockchain and represents some form of data

- **Blockchain**: A decentralized, immutable, public ledger that is split among multiple computers

- **Art Platform**: A site that artists use to publish their art

- **DMCA (Digital Millennium Copyright Act) takedown**: act of taking down a copyrighted work from a website on behalf of the owner of that work

- **Minting**: Using a piece of data, such as an image, to create a unique NFT

- **NFT Marketplace**: website where NFTs are sold

- **AWS (Amazon Web Services)**: Largest provider of various cloud computing services

- **AWS Amplify:** an AWS service for building full-stack web applications

- **Amazon RDS (Relational Database Service)**: cloud-based database service which can work with other AWS services

- **Amazon DynamoDB**: cloud-based database service which can work with other AWS services

- **NFTport API**: interface for working with popular NFT blockchains and markets

- **React**: open-source, front-end JavaScript library for creating websites with modern user interfaces

- **Stripe API**: programming interface for verifying a user's identity

- **OpenCV**: open-source computer vision library for Python

- **Gmail API**: a programming interface for the creation and sending of emails

- **MySQL**: a relational database management system

- **Git**: version control system for tracking software changes

- **GitHub**: online hosting of the git version control system

- **JavaScript**: a general purpose programming language often used for web development

- **HTML**: markup language for displaying documents in the web browser

- **CSS**: style sheet language that specifies the style and layout of how documents are

  displayed in a web browser

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1.4 References

Collins, B. (2021, December 23). Fungible vs Non-Fungible Tokens: What's The Difference?

Bryan Collins. https://www.bryancollins.com/fungible-vs-non-fungible-tokens/

BBC. (2021, March 12). What are NFTs and why are some worth millions? BBC News.

https://www.bbc.com/news/technology-56371912

Telmo Subira Rodriguez. (2018, December 2). Blockchain for Dummies. Medium; The

Startup. https://medium.com/swlh/blockchain-for-dummies-d3daf2170068

Coincorner. (2022, February 11). What Is Nft Minting? Coin-Corner.

https://coin-corner.com/what-is-nft-minting/

Beckett, L. (2022, January 29). 'Huge mess of theft and fraud:'artists sound alarm as NFT

crime proliferates. The Guardian. Retrieved January 31, 2022, from

https://www.theguardian.com/global/2022/jan/29/huge-mess-of-theft-artists-sound-alar

m-theft-nfts-proliferates

Dailey, N. (2022, January 6). NFTs ballooned to a $41 billion market in 2021 and are catching

up to the total size of the global fine art market. Markets Insider. Retrieved February

23, 2022, from

https://markets.businessinsider.com/news/currencies/nft-market-41-billion-nearing-fine

-art-market-size-2022-1

Abrol, A. (2022, January 14). What is an NFT marketplace and How Do You Create Your

Own? Blockchain Council. Retrieved February 23, 2022, from

https://www.blockchain-council.org/nft/nft-marketplace/

Mr. DMCA Helper. (2022, February 23). What is a DMCA Takedown? Dmca.com.

https://www.dmca.com/FAQ/What-is-a-DMCA-Takedown?ref=why_is_sol5a32

Palmer, R. (2022). @arvalis. Retrieved 1 March 2022, from

https://twitter.com/arvalis/status/1369230566843813891?s=20

Chang, J. (2021, April 12). How Did NFTs Become So Popular? Medium.

https://medium.com/geekculture/how-did-nfts-become-so-popular-f894eea22f90

1.5   Overview

This product specification provides the hardware and software configurations, external interfaces, capabilities, and features of the Art Guardian Prototype. The remaining sections of the documents include detailed descriptions of the hardware, software, and external interface architectures of the Art Guardian prototype. It will also include the key features and the parameters that will be used to implement the feature as well as the performance characteristics of that feature in terms of user interaction, display, and output**.**

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2   General Description

2.1   Prototype Architecture Description

The Art Guardian prototype has various components within its architecture to complete hosting, connecting the frontend to the backend, and general functionality of the application. The relationship and interaction between each component is shown in Figure 1. The Art Guardian prototype will be hosted using AWS Amplify, which shall host both the web application and the backend environment. AWS Amplify is capable of connecting the frontend to the backend, allowing the client to call any APIs needed for any operation. AWS DynamoDB shall be used as the database of the Art Guardian prototype and it will store end users' information, profiles, and artwork. The prototype's backend shall use third-party libraries and dependency APIs in order to assist with the functional features of the prototype, whether fully implemented or partially implemented. The GraphQL APIs shall be used to connect the Art Guardians' database to its web server.

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Figure 1. Art Guardian Prototype Architecture Diagram.
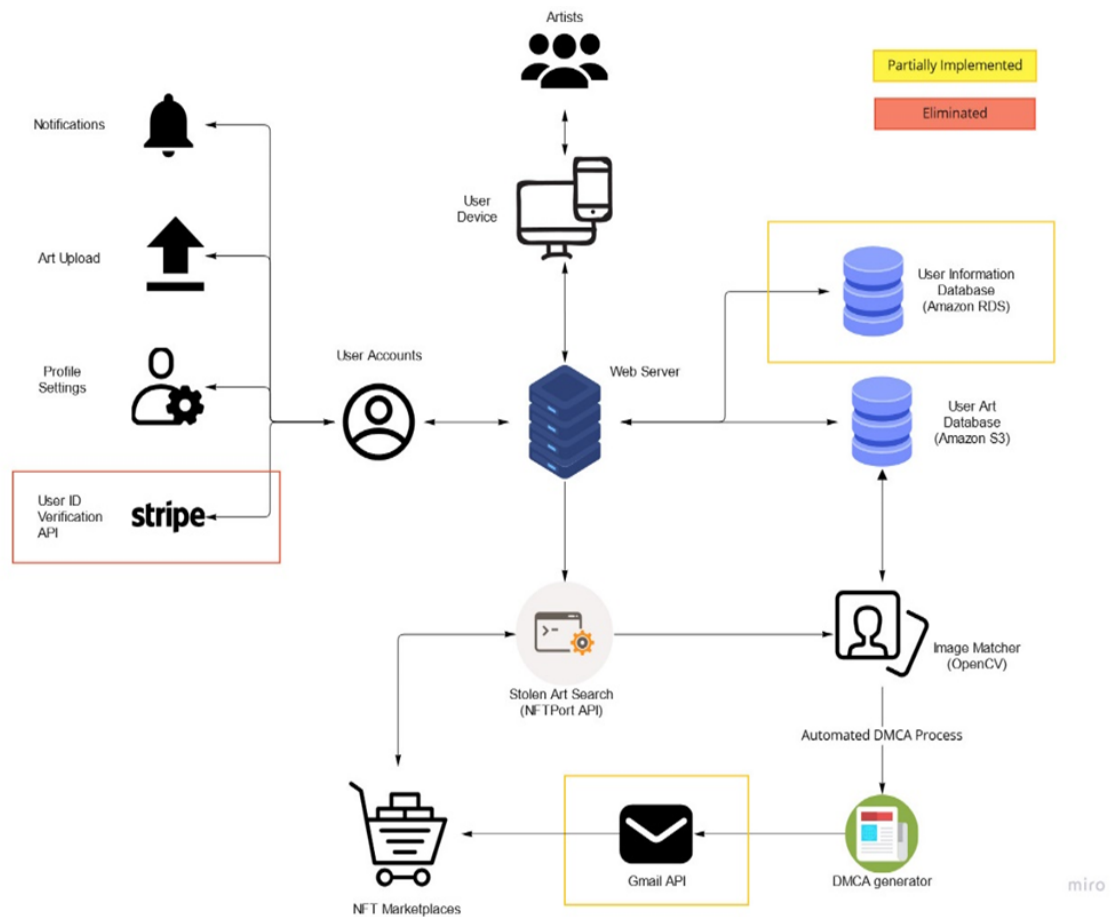
2.2   Prototype Functional Description

Users must have an account in order to access the Art Guardian prototype's features. Alerts and push notifications shall be sent to the user for art theft detection and DMCA status updates. Users shall upload images of their art to be stored on the database, where the backend fetches these images and performs image matching and NFT marketplace detection. The database shall also store and encrypt account information. The NFTPort API shall assist with NFT marketplace detection. The OpenCV Python library shall be used during image matching. Once the backend detects that an image on the prototype's database has been minted, it shall initiate the DMCA generator feature, which automatically generates a DMCA

takedown request with a fixed format while including the correct information of the NFT. A

Gmail API shall be used to send the DMCA request; this feature will only be partially

implemented and the DMCA requests will be sent to a testing email. Figure 2 lists all the

features of the real-world product (RWP) and which features shall be fully implemented,

partially implemented, or eliminated from the prototype.

Figure 2. RWP vs Prototype Diagram.

Features	Description	Prototype Implementation
Account Controls		
Account Creation	Create account for users to utilize Art Guardian features	Fully Implemented
GUI		
Art Upload	Users upload images of artwork to the database	Fully Implemented
Image Library	Users view the artwork they have uploaded	Fully Implemented
Whitelisting	Remove art previously uploaded to the database	Fully Implemented
Automated Processes		

Marketplace Monitoring	Checks NFT marketplaces periodically for image matching	Fully Implemented
Image Matching	Matches images from NFT marketplaces to images on the database	Fully Implemented
Stolen Art Alert	Send the user notifications of stolen art and DMCA request statuses	Fully Implemented
DMCA Takedown		
DMCA Generation	Generate DMCA takedown notices that are automatically prefilled based on a template.	Fully Implemented
DMCA Filing	Issue generated DMCA takedown notice to the offending NFT marketplace through the Gmail API.	Partially Implemented
DMCA Cataloging	Catalog and monitor all generated DMCA takedown notices.	Fully Implemented

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2.3   External Interfaces

A connection to the Internet via WAN shall be required to utilize the Art Guardian prototype.

2.3.1   Hardware Interfaces

A desktop or laptop running Windows, MacOS, or Linux that has access to the Internet shall be required to utilize the Art Guardian prototype.

2.3.2   Software Interfaces

The prototype shall utilize various software interfaces to assist with full-stack development. AWS Amplify hosts the backend, frontend, and database of the prototype. Github shall be the software collaboration tool for version control. The frontend shall be coded using the React framework and utilize UI components provided by AWS Amplify. AWS DynamoDB shall be used to store users' art and profile information. The backend shall use the NFTPort API and OpenCV library for NFT image matching and art detection. A Gmail API shall be partially implemented for sending the DMCA request to a testing email.

2.3.3   User Interfaces

The prototype's web application shall require a mouse for desktop navigation and a keyboard for data input. Any traditional monitor shall be required.

2.3.4   Communications Protocols and Interfaces

The prototype shall be hosting using the HTTPS protocol for secure communication over the internet and maintaining security during the authentication process. TCP/IP protocols shall be used for communications between the internet and the user's desktop or laptop.