Lab 2 – Art Guardian Product Specification

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10/21/22

Version 1.0

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1. Introduction

The market value and popularity of Non-fungible Tokens (NFTs) have increased dramatically over the span of Q1 2021. This unprecedented rise resulted in a year over year growth from less than $100 million in Q1 2020 to $1.5 billion in Q1 2021 of tradable volume within NFT marketplaces. (Chang, 2021) By the end of 2021, the volume of these NFT marketplaces increased to $41 billion. (Collins, 2021) Throughout the course of 2021, it was observed that more NFTs were basing their content off counterfeiting copyrighted digital works of art from artists. DeviantArt, a popular platform for hosting and sharing digital artwork, had reported that there were 90,000 probable counterfeit thefts in December 2021, which was a three-times increase from the reported 30,000 thefts in November 2021. (Beckett, 2022) These NFT sales are also highly profitable, with approximately 50% of all sales reaching over $200 at the beginning of 2022. (Dailey, 2022)

The solutions that aim to prevent digital artwork from being counterfeited and sold on NFT marketplaces for a profit are currently lacking. Many digital artists must follow a long manual process to remove counterfeit NFTs from NFT marketplaces. The first step of this process requires artists to discover which of their works of art were stolen and put up for sale as NFTs. This is done by manually searching on NFT marketplaces. After identifying counterfeit NFTs, artists must then issue a Digital Millennium Copyright Act (DMCA) takedown request through the host NFT marketplace. This process is overall time consuming and tiresome for the artist. It also does not effectively counter the increasing number of counterfeit NFTs.

1.1 Purpose

Art Guardian is a desktop web application designed to protect copyrighted artwork owned by digital artists from being stolen, minted as NFTs, and sold on NFT marketplaces. The product aims to prevent the future sale of counterfeit NFTs through the DMCA takedown process. To achieve this, Art Guardian provides an automated system which searches for counterfeit NFTs on NFT marketplaces using artwork submitted by the artists. Art Guardian also provides an automated process which issues DMCA takedown notices to NFT marketplaces for any counterfeit NFTs. The goal of Art Guardian is to legally compel NFT marketplaces to remove counterfeit NFTs detected by Art Guardian, essentially automating the manual process described in the previous section. The product does not aim to be a solution which will completely fix the issue of NFT counterfeiting. Instead, it seeks to provide mitigation on the issue through an effective automated system.

1.2 Scope

Art Guardian aims to protect digital artists who are active in NFT minting and those who are not through an effective automated system. The software solution achieves this goal through three key objectives. The first objective is to serve artists a product capable of automatically searching NFT marketplaces for counterfeit NFTs. The second objective is to incorporate an automated process which generates DMCA takedown requests and emails them to NFT marketplaces on the artists behalf. The last objective is to provide artists with up-to-date information on important details of their DMCA takedown requests, such as status and dates. There are three minor differences that will detract from these objectives within the prototype. First, DMCA takedown requests will not be sent directly to NFT marketplaces. Second, the prototype will also not implement additional verification through legal documents, and third, it will not be a progressive web application.

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

1. 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/

2. BBC. (2021, March 12). What are NFTs and why are some worth millions? BBC News. https://www.bbc.com/news/technology-56371912

3. Telmo Subira Rodriguez. (2018, December 2). Blockchain for Dummies. Medium; The Startup. https://medium.com/swlh/blockchain-for-dummies-d3daf2170068

4. Coincorner. (2022, February 11). What Is Nft Minting? Coin-Corner. https://coin-corner.com/what-is-nft-minting/

5. 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-alarm-theft-nfts-proliferates

6. 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

7. 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/

8. 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

9. Palmer, R. (2022). @arvalis. Retrieved 1 March 2022, from https://twitter.com/arvalis/status/1369230566843813891?s=20

10. Chang, J. (2021, April 12). How Did NFTs Become So Popular? Medium. https://medium.com/geekculture/how-did-nfts-become-so-popular-f894eea22f90

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1.5 Overview

The rest of the paper includes specifications on the major components, capabilities and constraints, hardware and software performance, external interfaces, requirements, and functionalities of the Art Guardian Prototype.

2. General Description

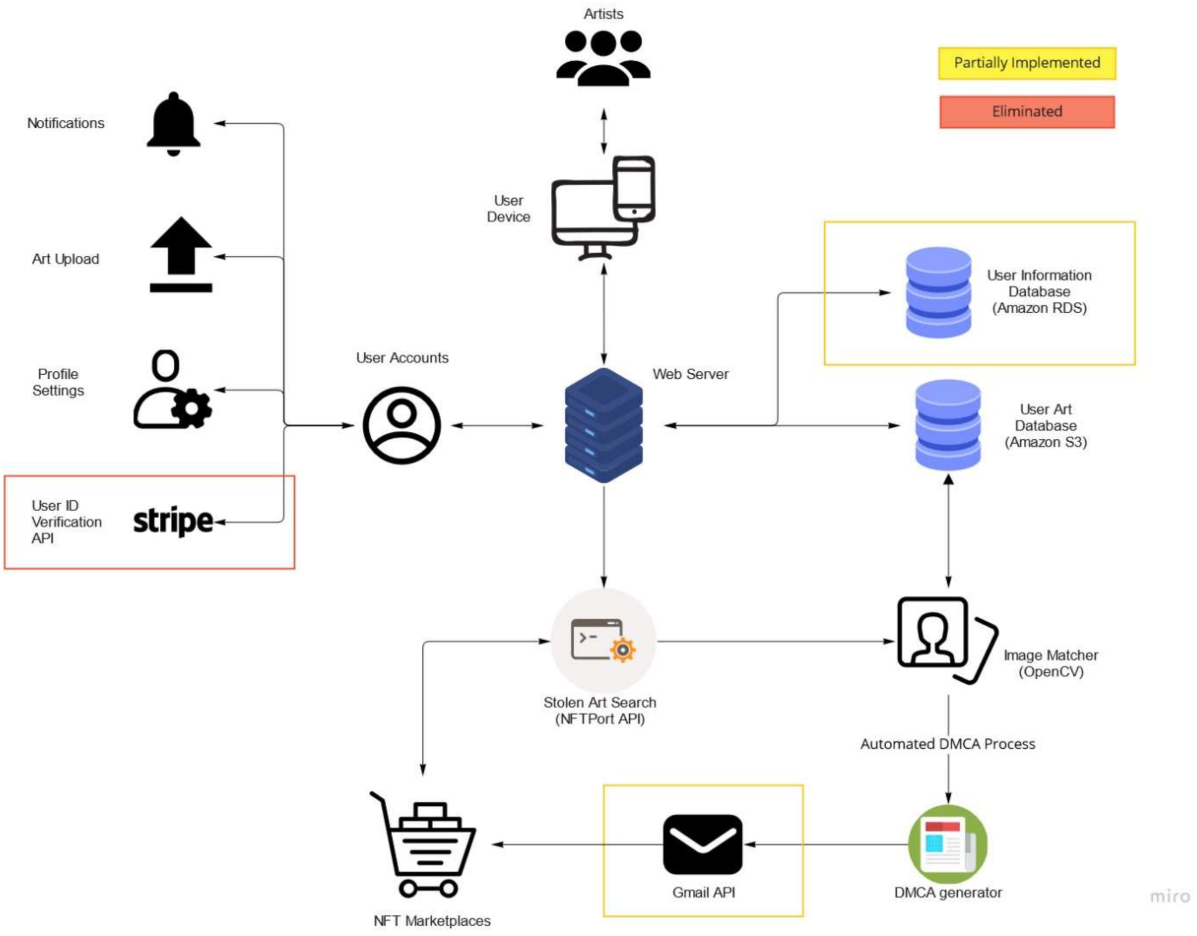
The Art Guardian Prototype will be a web application designed for desktop environments on personal computers and laptops. The prototype will include all the major functionalities for user accounts, marketplace monitoring, image matching, DMCA generation, DMCA tracking and DMCA cataloging. However, the prototype will contain minor differences in functionalities that require legal information or copyrighted artwork. Simulated data will be used instead of real legal information or artwork for functionalities that require such parameters.

2.1 Prototype Architecture Description

The Art Guardian Prototype will be hosted by the AWS Amplify service, which will connect front-end user interfaces, back-end algorithms, and databases. The AWS Amplify service will act as a central web server that will facilitate requests and responses between the major component types. The two databases will rely on the AWS DynamoDB service; one database will store user information, such as profile settings, and the other will store uploaded artwork. The Art Guardian Prototype will use three APIs: GraphQL will be used to connect and communicate with the central Amplify host, NFTPort API will be used for marketplace monitoring, and the Gmail API will be used for sending DMCA takedown notices to the OpenSea NFT marketplace.

Figure 1

Art Guardian Prototype Major Functional Component Diagram



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2.2 Prototype Functional Description

As seen in Figure 1, there will be three major components that will be partially implemented or removed from the Art Guardian prototype. The three affected components are the user identification component powered by the Stripe API, the Gmail API, and data within the user information database. The user identification component that relies on Stripe API will be eliminated from the prototype as the component requires real legal information. The Gmail API will not send actual DMCA takedown notices to the OpenSea NFT marketplace, so the component will only be partially implemented. The data within the user information database will only contain mock user accounts, and thus will only be partially implemented. Every other major component will be fully implemented. Table 1 describes the full extent of which features will be fully implemented or partially implemented in the prototype. Features eliminated from the prototype will not be present in the table.

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Table 1

Comparison of implementation between Art Guardian RWP and Prototype

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

2.3 External Interfaces

The Art Guardian prototype will rely on specific hardware, software, user, along with communication protocols and interfaces that will enable the components and features to function. Hardware interfaces include requirements regarding operating systems (OS), processing speeds, etc. Software interfaces will be used to develop the functionalities of the user interface. Communication protocols and interfaces will define the recommended network technologies that the user should have to use the prototype.

2.3.1 Hardware Interfaces

The Art Guardian prototype will run on desktops or laptops that have an Intel Pentium 4 processor or later that's SSE3 capable. The prototype will run on Windows 7, Windows 8, Windows 8.1, Windows 10 or later. For MacOS systems, the version of the operating system must be OS X El Capitan 10.11 or later. For Linux-based systems, the following distributions are accepted: 64-bit Ubuntu 18.04+, Debian 10+, openSUSE 15.2+, or Fedora Linux 32+.

2.3.2 Software Interfaces

The prototype product will be developed using the React framework of JavaScript for the web application, and the OpenCV library of Python for the image matching feature. The NFTPort API will be used for marketplace monitoring and the Gmail API will be used to issue DMCA takedown notices to OpenSea. AWS Amplify and AWS RDS/DynamoDB will be the two AWS cloud computing services that will host the databases and the web application. GitHub and Git will be used for version control purposes.

2.3.3 User Interfaces

The Art Guardian web application will be accessed through a web browser on a desktop or laptop device. The list of targeted browsers for the prototype are Google Chrome, Opera, Firefox, and Microsoft Edge, but other browsers may be compatible with the prototype web application. The size of the web application, along with other styling elements, will be adjusted accordingly to the user's desktop or laptop resolution. Targeted resolution sizes for the web application will range from 1280x720 to 1920x1080. The landing page of the web application will be the login or registration page. Once logged in, the features of the web application will be accessible to the user. There are no plans for the prototype in terms of caching or storing logins within the browser. In terms of input/output devices, the user must have a mouse for navigation, a keyboard for data input, and a monitor with a resolution within the targeted range.

2.3.4 Communication Protocols and Interfaces

The two web protocols that should exist on the user's network are the HTTPS protocol for secure hypermedia communications over the internet, and the standard TCP/IP protocol for communications between the device and the internet. The user should have network speeds of at least 10 Mbps for downloads, and 1 Mbps for uploads.

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