Lab 2 -Art Guardian Product Specification

Michael Thompson

Old Dominion University

CS411w

Professor J. Brunelle

20 November, 2022

Final Version

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1 Introduction

Non-fungible tokens (NFTs) have seen an increase of popularity and market value within the Q1 of 2021. The growth in popularity resulted in NFT marketplaces growing from a worth of less than $100 million in Q1 of 2020 to $1.5 billion in Q1 2021 (Chang, 2021). The volume of these marketplaces grew to a worth of $41 billion (Collins, 2021). The surge of NFTs that came about contained content that was counterfeiting copyrighted digital art that derived from digital artists. The art platform DevaintArt has reported 90,000 NFTs containing counterfeited art in December 2021, a three-times increase in comparison to a reported 30,000 NFTs in November 2021 (Becket,2022). These NFT sales rake in profit as approximately 50% of all sales reach over $200 during the beginning of 2022 (Dailey, 2022)

There are very limited protections towards any possible counterfeiting of digital art for NFTs and selling them on NFT marketplaces. A digital artist would need to go through a process which includes manually searching for NFTs with infringing artwork on various marketplaces and filing a Digital Millennium Copyright Act (DMCA) takedown request to the marketplace holding the infringing NFT. The process to takedown an illicit NFT is time consuming and tedious, and it doesn't stop the creation of more NFTs containing infringing art.

1.1 Purpose

Art Guardian is a web application designed to protect a digital artist's artwork from being sold on NFT marketplaces as illicit NFTs. The product streamlines the process of searching for infringing NFTs and sending a DMCA takedown request to the marketplace containing them. Art Guardian achieves this by using an automated system that combs through various NFT marketplaces in search of infringing NFTs based on artwork uploaded by the user. Once an

infringing NFT is found, Art Guardian will allow the user to generate and send a DMCA takedown request to the marketplace hosting the NFT. Art Guardian is designed to legally pressure NFT marketplaces to remove counterfeit NFTs by sending DMCA takedown requests. The application itself can not prevent NFT minting that uses copyrighted artwork. The Art Guardian application will also have systems in place that prevent any misidentification of NFTs and or abuse of the system.

1.2 Scope

Art Guardian aims to protect digital artists who may or may not want to mint their own NFTs using their artwork. Art Guardians achieves this by scanning NFT marketplaces for NFTs containing artwork that was uploaded into the database by the user. If an infringing NFt is found, Art Guardian will allow the user to send an automatically generated DMCA takedown request to the marketplace containing the NFT.

The Art Guardian prototype will have full implementations of the art upload, whitelisting, art tracking, image matching, theft alert, DMCA generation, and DMCA cataloging. DMCA filing will be partially implemented as test DMCA takedown requests can not be sent to real websites due to legal repercussions and will instead be sent to test emails. The prototype will not have any implementations on 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

1.4 References

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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**.**

2 General Description

The Art Guardian prototype is a web application that demonstrates a simulation of finding an infringing NFT, generating a DMCA takedown request, and sending it to the NFT marketplace hosting the NFT.

2.1 Prototype Architecture Description

The Art Guardian prototype has various components that together completes its architecture. Figure 1 displays the relationships that the components share with each other.

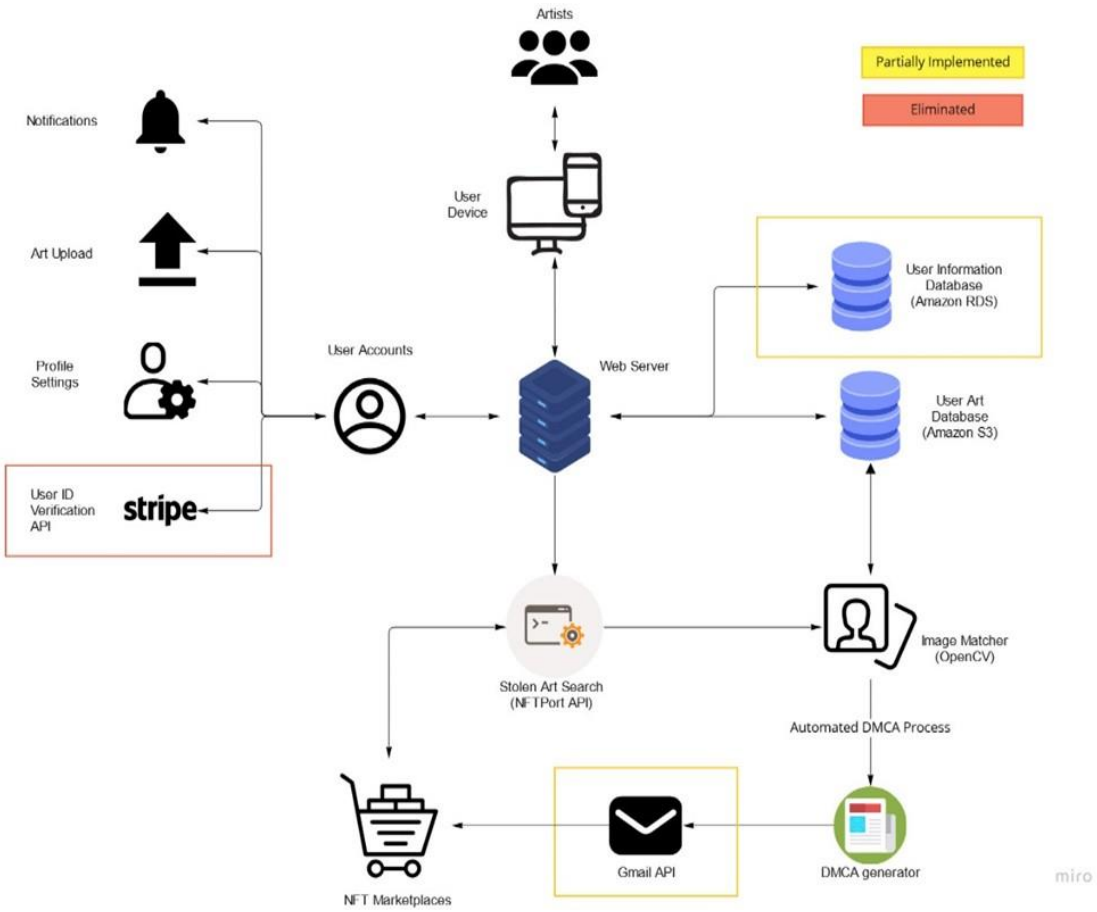

Figure 1. Art Guardian Prototype Architecture Diagram.

The web server is the central component that ties all other components together. The server is accessed through a browser via user device which includes desktops and laptops. Accessing the server allows access to a user account, which hosts profile settings, notifications, art upload, and the user identification API. User information will be stored into a database provided by AWS DynamoDB. The notifications are responsible for alerting the user on possible art theft on NFT marketplaces and the status of DMCA takedown requests. The user will use the art upload function to upload art into the application for the art detection to function. The uploaded art will be stored in an Amazon S3 database. Both DynamoDB and Amazon S3 will use the GraphQL API to connect the databases to the web server. User ID verification is eliminated from the

prototype and will be substituted with mock user data. By proxy the user information database will be partially implemented as it holds no real personal information.

The NFTPort API is responsible for conducting searcher on NFT marketplaces for NFTs that may contain stolen artwork. NFTPort will pass the results to the image matcher which in turn will compare the images from the search results to user uploaded artworks. If a match is found and the user confirms that a piece of art was stolen, the DMCA generator will generate a DMCA takedown request. The takedown request will be sent to the NFT marketplace hosting the infringing NFT via the Gmail API. The Gmail API is only partially implemented to prevent NFT marketplaces from receiving takedown requests that were derived from testing. A test email will receive the takedown requests instead.

2.2 Prototype Functional Description

Most features will be fully implemented in the Art Guardian prototype. Figure 2 showcases what features will be fully implemented.

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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

Figure 2. RWP vs Prototype Diagram.

Nearly all the functionalities planned for Art Guardian will be implemented into the prototype. A user shall be able to create an account to utilize the features of Art Guardian. Access to an account enables the use of art upload, image library, and whitelisting. The user can upload art into the Amazon S3 database to use Art Guardian's marketplace monitoring. The image library also pulls from the S3 database to allow the user to view all the artwork they have uploaded. The whitelisting function allows the user to register a NFT they minted of a piece of uploaded artwork so that when marketplace monitoring occurs, the monitoring will ignore that NFT.

Marketplace monitoring is an automated feature that will search for infringing NFTs on NFT marketplace in intervals. The image matcher feature will compare NFT artwork with user uploaded artwork to find any stolen art. If the art is confirmed to be matching, a stolen art alert will be sent via notifications to the user for further investigation. If the user confirms that the art is stolen, the DMCA generation feature will generate a DMCA takedown request using a template that will be filled with user provided legal information. DMCA filing is the only feature to be partially implemented, where the email will be sent to a test email instead of a NFT marketplace. The DMCA cataloging feature will catalogue and monitor any DMCA takedown requests that were sent.

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2.3 External Interfaces

The Art Guardian prototype is reliant on specific hardware, software, user, and communication protocols and interfaces to function properly. Hardware interface requirements focus on the hardware the prototype shall run on. Software interfaces are responsible for the build of the prototype and how it interacts with the user interface. The communication protocols and interfaces showcase the recommended network requirements to run the prototype.

2.3.1 Hardware Interfaces

The Art Guardian prototype will run on desktops or laptops that contain a CPU that is SSe3 capable and is at minimum an Intel Pentium 4. The prototype will run on Windows machines that contain Windows 7 or later. MacOS systems need OS X El Captain 10.11 or later to run the prototype. Linux systems can either have 64-bit Ubuntu 18.04+, Debian 10+, openSUSE 15.2+, or Fedora Linux 32+ to run the prototype.

2.3.2 Software Interfaces

The Art Guardian prototype will utilize the React Framework JavaScript library for the web application. The web application will be hosted on AWS Amplify and AWS DynamoDB and AWS S3 will host the database. The Python library OpenCV is used for the image matching feature. The NFTPort API will be used for the marketplace monitoring feature while the Gmail API will be used to send DMCA takedown requests to marketplaces hosting infringing NFTs. Github and git will be utilized for version control and AWS Lambda will be used to connect and implement most of the automated features.

2.3.3 User Interfaces

The Art Guardian prototype will require a mouse for desktop navigation and a keyboard for data input. The prototype will be accessed via a web browser through a desktop or laptop. The recommended bowsers to access the prototype include Google Chrome, Firefox, Opera, or Microsoft Edge. The size and layout of the web application will be adjusted to fit the user's display, with targeted resolutions ranging from 1280x720 to 1920x1080. The landing page of the prototype will be a login page with a sign-up option listed as well. Once the user has logged in, they will be able to use the Art Guardian prototype.

2.3.4 Communication Protocols and Interfaces

The Art Guardian prototype will require the HTTPS protocol for secure communications and the TCP/IP protocol for device and internet communications. The user should have at minimum 10 Mbps for downloads and 1 Mbps for uploads.

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