

Lab 1 – Art Guardian Product Description

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1. Introduction

On February 19, 2021 an Non-fungible Token of “nyan cat”, a popular meme from 2011, sold for \$500,000 worth of crypto currency (BBC, 2021). This sale sparked a rise in interest of NFTs, with multiple artists joining in the craze. As the value of the market increased from \$100 million to \$41 billion (Dailey, 2022). This craze then developed from online influencers and tech giants like Jack Dorsey selling NFTs of his first tweets, to everyday artists creating art, sometimes procedurally generated, in collections, and selling pieces of these collections for a high markup. This burgeoning market has seen up to 50% of all sales reach over \$200 (Dailey, 2022), and due to the unregulated nature of the blockchain, this incentive has led to a rise in theft.

From November of 2021 to December of 2021 Deviantart, a popular platform for digital artists, reported 90,000 possible cases of digital art theft, an increase of 300% in one month (Beckett, 2022). Artists must find each case of art theft, file each Digital Millennium Copyright Act takedown themselves, and keep track of all related documents on their own, a tedious and drawn out process. Not all artists have the knowledge to fulfill these tasks, something that a solution would have to take into consideration.

One solution is Art Guardian, a progressive web application that allows users to register and upload their art on both desktop and mobile devices. The application will monitor NFT marketplaces for stolen art and alert the artist when the art is found. The application will also need to generate a DMCA for artists to e-sign and issue within minutes. This would greatly reduce the work artists are required to do to protect their art and streamline the takedown process.

2. Product Description

Art Guardian is a progressive web application, where users upload their original artwork into a database. Art Guardian will then monitor popular NFT marketplaces, searching for stolen art. If stolen art is found, Art Guardian will notify the artist and generate a DMCA which can be sent to the infringing marketplace.

The goal of Art Guardian is to streamline the DMCA process and ease the burden on artists during an increase in theft for the art community. Art Guardian will also educate users on how they can protect their art with a “Tips and Tricks” section. This will help artists avoid theft before it happens.

2.1 Key Product Features and Capabilities

Art Guardian provides artists a secure platform that will continuously monitor the NFT marketplace for unauthorized instances of their digital artwork. When art is uploaded to Art Guardian the option to whitelist it is given, in which the token ID of the original NFT is collected for use. In the case of an incident of theft, notifications will be sent to the users desktop and mobile device. The notification provides access to the DMCA generation feature of Art Guardian, where users will be prompted to identify their art and whether or not they wish to pursue the claim. If a claim is not pursued Art Guardian will offer the whitelist feature again to the user. If the notification is ignored, or DMCA closed out part way through the process, Art Guardian will send notifications every 6 days for 30 days, thereafter the database will delete the flagged NFT and no longer notify the artist of the theft.

Artists will have a profile with Art Guardian, this will contain the artists legal information, such as: name, contact information, address, and date of birth. This information is

collected in order to file DMCA's and verify artist identity. The profile will also be linked to an account on an art platform, this is done to verify the user is the artist they say they are. All information will be encrypted and securely stored to retain user anonymity.

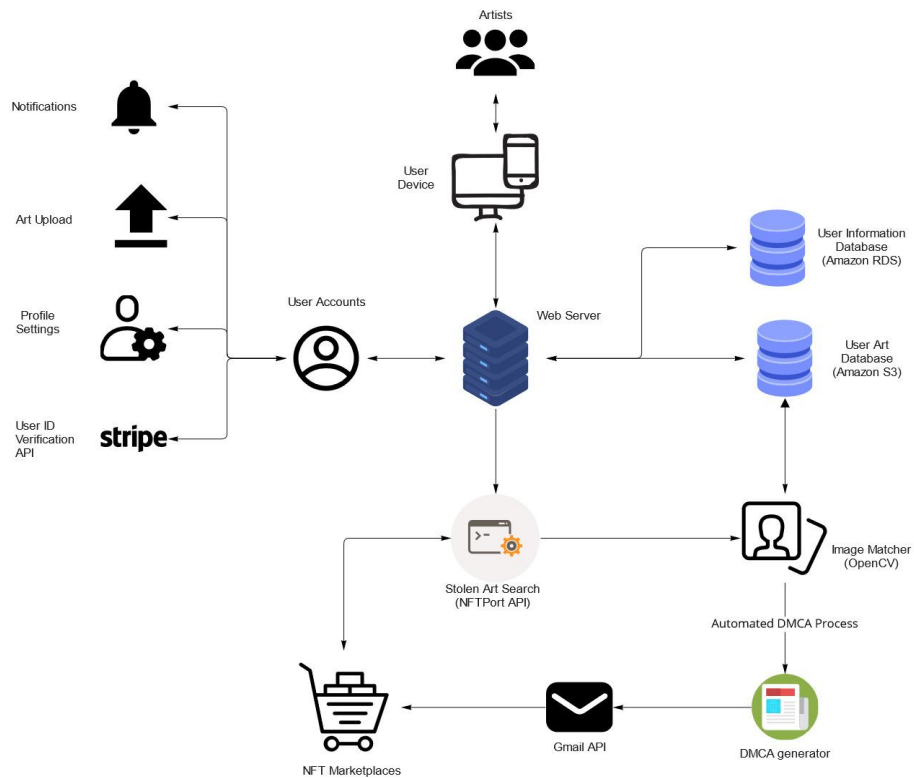
All filed and in-progress DMCA requests are stored in the database. Filed DMCA claims are monitored and status updates are reported to the user. If the user needs to access information on the claims in order to pursue further legal action, all information is available to them in the application.

Artists will also be able to access a "Tips and Tricks" section to receive further help. This section will include articles and posts regarding how to guard art from theft, as well as a tutorial for the application. This section will also include a Frequently Asked Questions section to help artists find help for common problems or questions.

2.2 Major Functional Components (Hardware and Software)

Art Guardian will be available on IOS and Android mobile devices, as well as on tablet and desktop computers. The desktop website will be programmed using React, HTML, CSS, and JavaScript. For mobile devices JavaScript and React will be used for the development of the mobile app. The major hardware and software components of Art Guardian are shown in Figure 2.

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Figure 1*Art Guardian MFCD*

Art Guardian will utilize Amazon RDS and AWS to store and encrypt all user data and art. Git will be used for version control and collaborative development. The NFT Port API will be used to monitor art on marketplaces, with OpenCV being used for the image matcher. To verify user identity Stripe API will be used to scan a valid ID card. A DMCA Generator will be used to automatically generate DMCA's with the Gmail API being used to send the DMCA's via email.

3. Identification of Case Study

Art Guardian is primarily oriented towards Commissioned Artists in order to protect their art from theft in the form of illegal NFT minting. It will allow them to upload their art into our database, where we will monitor the marketplaces for cases of theft. If one is found the artist will be alerted and can choose to issue a DMCA. Art Guardian will also serve artists who wish to mint their art as NFTs allowing them to whitelist an NFT when a work of art is uploaded, or later found. They will then be alerted to NFTs that were minted using their art and can then choose to perform a DMCA takedown.

The group for the case study will be ODU undergraduate art students. They will upload their art, either from assignments or personal projects, into the application and Art Guardian will use that art to search for theft. One test will, with artist permission, simulate theft of a piece of art in order to test the image matching algorithm. This will be done by slightly modifying a work of art and inserting it into a group of similar but unrelated works of art to see if the image matching algorithm can identify the case of theft. Another test will have the student upload an image known to be an NFT, then try to find instances of theft on live market places to test the search functionality and DMCA generation. A variation of the last test will be used to test the whitelisting feature of Art Guardian. The students will then provide feedback on the UI and the accuracy of the algorithms, allowing the developers to make further improvements.

Art Guardian hopes to expand its protection to all digital artists in the future, but due to the limitations of the app, is focussing on commissioned artists and NFT artists. Marketplaces may also adopt Art Guardian to help protect their artists from theft as well as protect the trust

they have earned with consumers. It may also be used by art platforms themselves in the future to help protect artists everywhere on the internet.

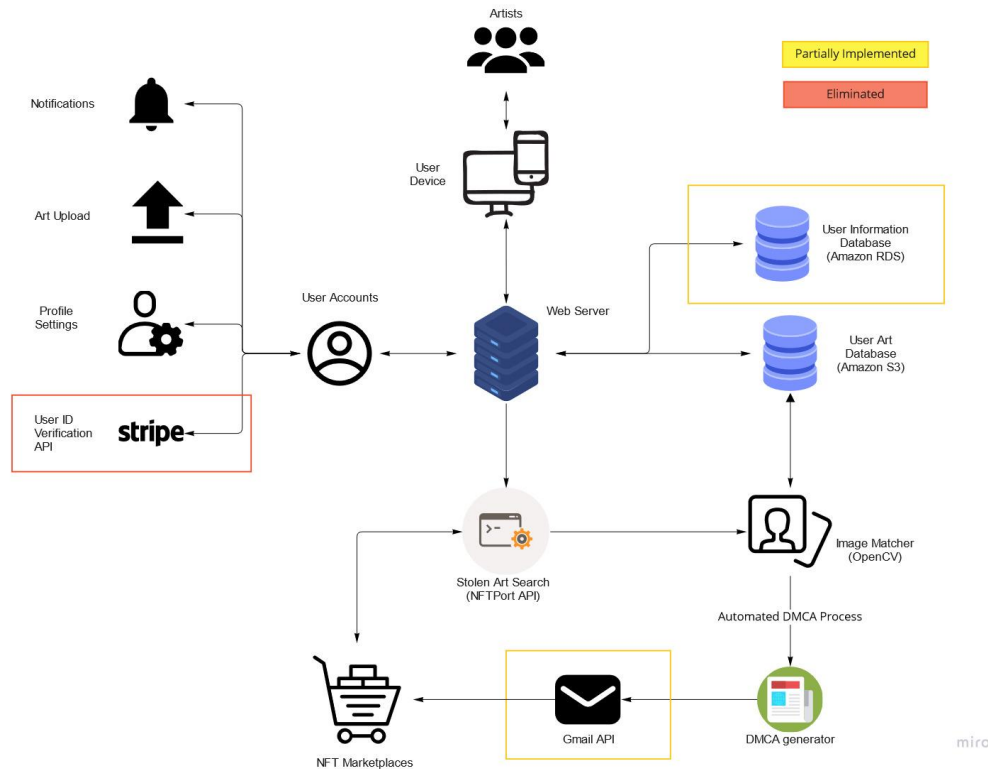
4. Art Guardian Prototype Design Description

The prototype of Art Guardian will show the core features of Art Guardian and demonstrate its core ideals of art protection. The prototype will retain the image matching, DMCA generation features, and whitelisting features that are at the core of the application. User data and DMCA status will need to be simulated, and the DMCA's will not be sent to the legitimate marketplace addresses.

4.1 Prototype Architecture (Hardware/Software)

The prototype will have the similar architecture as the real world product. It will not be cross platform focussing on the desktop application. The application will utilize Amazon RDS and Amazon Web Services for the user data and art databases. Git will be used for version control and Github will be used for issue tracking. Due to differences in the prototype and real world product, the MFCD has been changed. The MFCD for the prototype can be seen in figure 2.

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Figure 2*Art Guardian Prototype MFCD*

The Gmail API and User Information Database will be partially implemented as emails will be sent to a test account instead of real NFT marketplaces and user data will be spoofed and stored manually instead of automatically collected and stored. The user verification API, Stripe, will not be used in the prototype as the prototype will not implement user authentication.

4.2 Prototype Features and Capabilities

The prototype of Art Guardian will retain most of the real world product features. Capabilities and features that cannot be demonstrated in the prototype will be partially implemented or eliminated. The features that will be fully implemented in the prototype, as well as those that will be partially implemented or eliminated can be seen in table 1.

Table 1*RWP vs Prototype*

Art Guardian	RWP	Prototype
Account Creation	Fully Implemented	Fully Implemented
User Verification	Fully Implemented	Eliminated: Mock data
Art Upload	Fully Implemented	Fully Implemented
Image Library	Fully Implemented	Fully Implemented
Whitelisting	Fully Implemented	Fully Implemented
Marketplace Monitoring	Fully Implemented	Fully Implemented
Image Matching	Fully Implemented	Fully Implemented
Stolen Art Alert	Fully Implemented	Fully Implemented
DMCA Generation	Fully Implemented	Fully Implemented
DMCA Filing	Fully Implemented	Partially Implemented: Send to testing email
DMCA Cataloging	Fully Implemented	Fully Implemented
DMCA Tracking	Fully Implemented	Eliminated: Simulated Data

Due to the fact that all user data will be manually generated for testing, user verification using the Stripe API is eliminated. For the DMCA process, the DMCA's the prototype will be generating and filing will use mock data, as such they will be sent to a testing email. Due to this the DMCA Tracking feature will be eliminated from the prototype as there will be no DMCA for it to track.

The Art Guardian prototype will have the core features of the real world product that will demonstrate the ability to protect artists and their art from NFT art theft. It will be able to search the NFT marketplaces to find art that has been uploaded to the application. Art Guardian will be able to alert the user to potentially stolen art, generate a DMCA for the user to verify, file the takedown and catalog the information. The prototype will also implement the whitelisting feature, allowing users to prevent false flags of NFTs they themselves have minted.

4.3 Development Challenges

Some of the development challenges will come from the image matching. The image matching algorithm must be accurate enough to prevent false positives, but flexible enough to catch any mirrored or color shifted images. A sufficiently large amount of test images must be collected to be used for the purpose of testing, this may be hard to do as artists may not be willing to let us use their art for testing, and NFT collectors may not be willing to let us use their NFTs to practice DMCA's for.

Another challenge may come from the choice to develop a progressive web application. Having both mobile and desktop applications will take additional time and effort. This may cause hiccups and force us to either decide to drop functionality, or cancel the mobile application all together. Team scheduling may become an issue as everyone on our team is available at varying times, getting the team together for meetings and planning may become a challenge of its own.

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5. Glossary

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

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

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

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

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

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

CSS: style sheet language that specifies the style and layout of how documents are displayed in a web browser

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

HTML: markup language for displaying documents in the web browser

Git: version control system for tracking software changes

GitHub: online hosting of the git version control system

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

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

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

MySQL: a relational database management system

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

NFT Marketplace: website where NFTs are sold

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

OpenCV: open-source computer vision library for Python

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

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

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