Lab 1 – Art Guardian Product Description

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Table of Contents

List of Figures

List of Table

1 Introduction

While adapting to developing technologies, artists have found great value in the digital art sector; art can be minted into a non-fungible token (NFT) and sold on a blockchain. An NFT is a unique cryptographic token on a blockchain that cannot be replicated. In recent years, interest in NFTs have dramatically increased from an average of about 100 sales per week in late 2017 to about 80,000 per week in early 2020 (Barber 2022). In addition to popularity, the value of NFTs have also seen a quick uprising with statistics showing the NFT market was at $100 million in 2020 and hit $41 billion in 2021 (Dailey 2022). With the sudden rise of NFTs, artists have a new option for the distribution of their art. According to ArtDiction, an artist was able to sell an NFT of his collaged artwork for $69.3 million (ArtDiction 2021).

With these numbers in mind, it is clear to see that digital artists are directly impacted by any situation involving someone else stealing their original art and benefiting from it through NFTs. A popular digital art platform, Deviantart, reported a 300% increase of art theft in just a single month, reaching up to 90,000 possible cases of art theft (Beckett 2022). When an artist has their artwork stolen, minted into an NFT, and put for sale on the NFT marketplace, the original artist has to undergo a very tedious process. The artist will have to manually search for the NFT with their artwork on hundreds of NFT marketplaces with thousands of NFTs for auction, manually send a Digital Millennium Copyright Act (DMCA) takedown request, and repeat this process if their artwork is ever stolen and minted again.

Art Guardian seeks to provide assistance for these artists. Art Guardian is a progressive web application where digital artists can upload their artwork to the database, and through web crawlers, template matching, and efficient use of APIs, artists will have a tool that automatically

searches for stolen artwork on various NFT marketplaces and simplifies the process of requesting a DMCA takedown request.

2 Product Description

Art Guardian is a progressive web application, which provides availability on both desktops and mobile devices. It has a user-friendly interface to prevent any issues or complications that could disrupt the user experience. Art Guardian aims to give digital artists an essential layer of security to their digital artwork. The overall goal of Art Guardian is to prevent digital art from being sold on the blockchain as an NFT without the original artist's permission.

2.1 Key Product Description and Capabilities

When users sign up for Art Guardian, they will have to provide their legal information such as first and last name, contact information, address, and date of birth to allow legitimacy and verification of their identity. They are also able to link their art account to further verify that a user's artwork was actually created and owned by them. Art Guardian's database stores every user's original artwork. Users have a profile so they can see their uploaded art and view the DMCA takedown statuses of them. As soon as a piece of art is uploaded to the database, Art Guardian protects that artwork with its automatic NFT marketplace detection.

The major feature of Art Guardian is its automatic detection of stolen art as NFTs. Through web crawlers and template matching, Art Guardian prevents users from having to manually search for their stolen art on these various marketplaces. This feature will eliminate the need for an artist to manually search for their stolen artwork on hundreds of marketplaces with thousands of NFT transactions, which is a very time consuming, tedious process. Even if they manage to find the NFT with their artwork, it is relatively simple for another theft to occur with

the same piece of art, thus repeating this tedious process over again. Art Guardian's system of automatically detecting stolen art as NFTs runs on a periodic basis to allow for continuous NFT marketplace monitoring.

Once a stolen piece of art's NFT transaction has been found, a notification is automatically sent to the original artist; both through the user's email and the application. The notification provides in-depth information about the NFT transaction, such as the NFT image, token, seller, and link to the marketplace which it is being sold on. There is a procedure that ensures the user is, in good faith, the original artist and that they want to send a DMCA takedown request for that specific NFT. Once they approve of everything in this procedure, Art Guardian provides an automatically-filled DMCA takedown request for the user to review. This will have the correct information that follows the provided guidelines for a DMCA takedown request. Users provide an e-signature to send the request, and Art Guardian has a feature that allows artists to monitor the statuses of all of their DMCA takedown requests.

Art Guardian also has a general section that provides guidance to protect digital artwork. This section is simply for artists to read and browse, as it includes updated articles, posts, and FAQs pertaining to actions taken for users to protect their digital art. The interfaces of the desktop and mobile applications are very similar to ease navigation and user functionality between both systems. Users are able to use either form of the application, and all of Art Guardian's features are available to both forms.

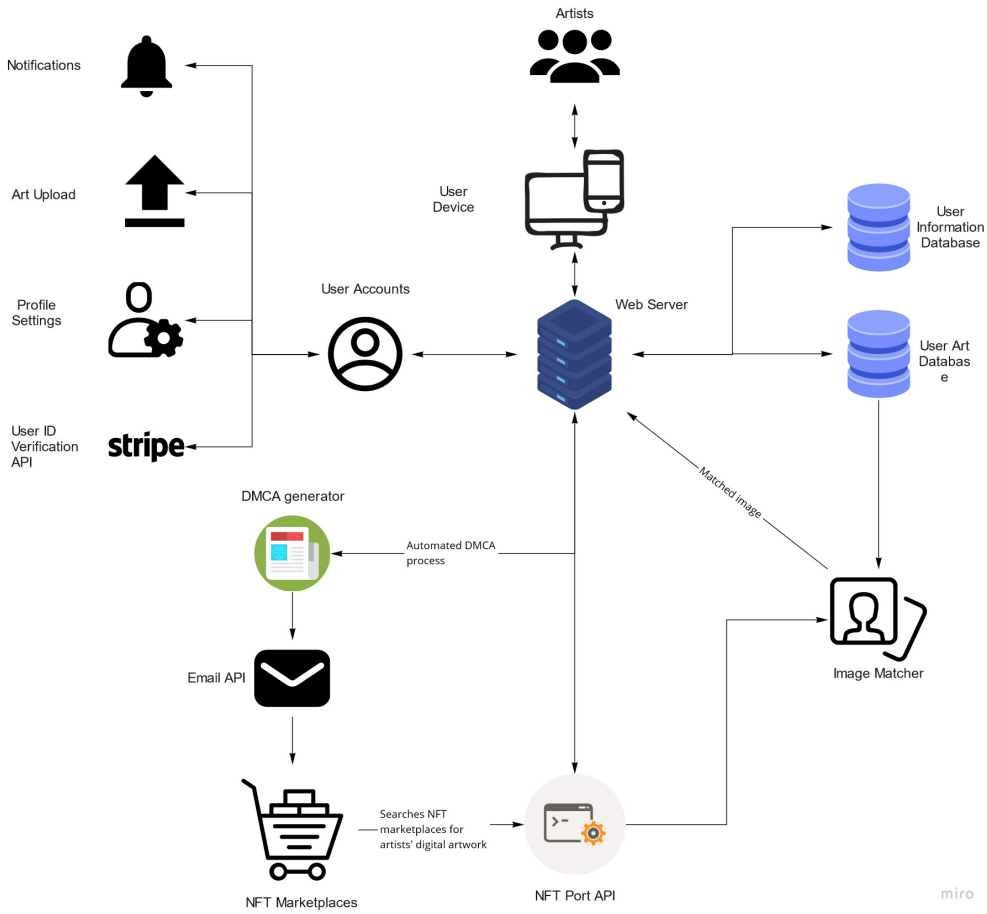
2.2 Major Functional Components

Art Guardian requires a web server, database server, and a device that can run this application. It utilizes the AWS web server and MySQL database server to send and receive requests between users' devices, the database, and the various APIs that are implemented.

Art Guardian's web application can be accessed through any device that has access to the internet (such as a desktop computer or a laptop), and its mobile application are available on both iOS and Android devices.

Figure 1

Art Guardian Major Functional Component Diagram



The React front-end framework is utilized for the website application along with HTML, CSS, and JavaScript. Art Guardian's mobile application is implemented with the React Native framework along with JavaScript. Git and GitHub are used for version control, continuous

integration, and continuous development. The Stripe API is used to assist in user identity verification. Amazon RDS and MySQL are used as the database to provide

encryption for the stored artwork. The database stores user information, artwork, and DMCA history. AWS is the standard web server for Art Guardian. OpenCV is used for the template matcher, which will compare NFTs with artwork on Art Guardian's database. The application utilizes the NFT Port API to assist in searching NFT marketplaces for stolen artwork as NFTs. The Gmail API is used to assist in sending the pre-filled DMCA takedown request to the NFT marketplace.

3 Identification of Case Study

Art Guardian is aimed directly towards digital artists to prevent unsolicited minting of their artwork. It provides digital artists with an essential layer of security for their original artwork as the popularity and economic value of NFTs are drastically growing. Commissioned artists are faced with a direct threat if their creative works are being infringed upon for a profit. NFT artists are also a group of interest because they may want to keep the integrity of NFT sales.

The case study group for the Art Guardian prototype will be NFT artists, commissioned artists, and students with a major in art from Old Dominion University. The case study will aim to create positive feedback towards the design, implementation, and overall effectiveness of the prototype. Art Guardian has the goal of safeguarding the proliferation of NFT that infringe on the originality of the artwork.

Major art platforms, such as DeviantArt, will have interest in Art Guardian because these platforms lack an effective system of preventing NFT sales with stolen artwork. They may seek interest in this system in order to provide their users with the same layer of protection for the

artwork on their databases. Additionally, NFT marketplaces may be a party of interest because they will have access to a system that can assess the problem firsthand on the marketplace of choice.

4 Product Prototype Description

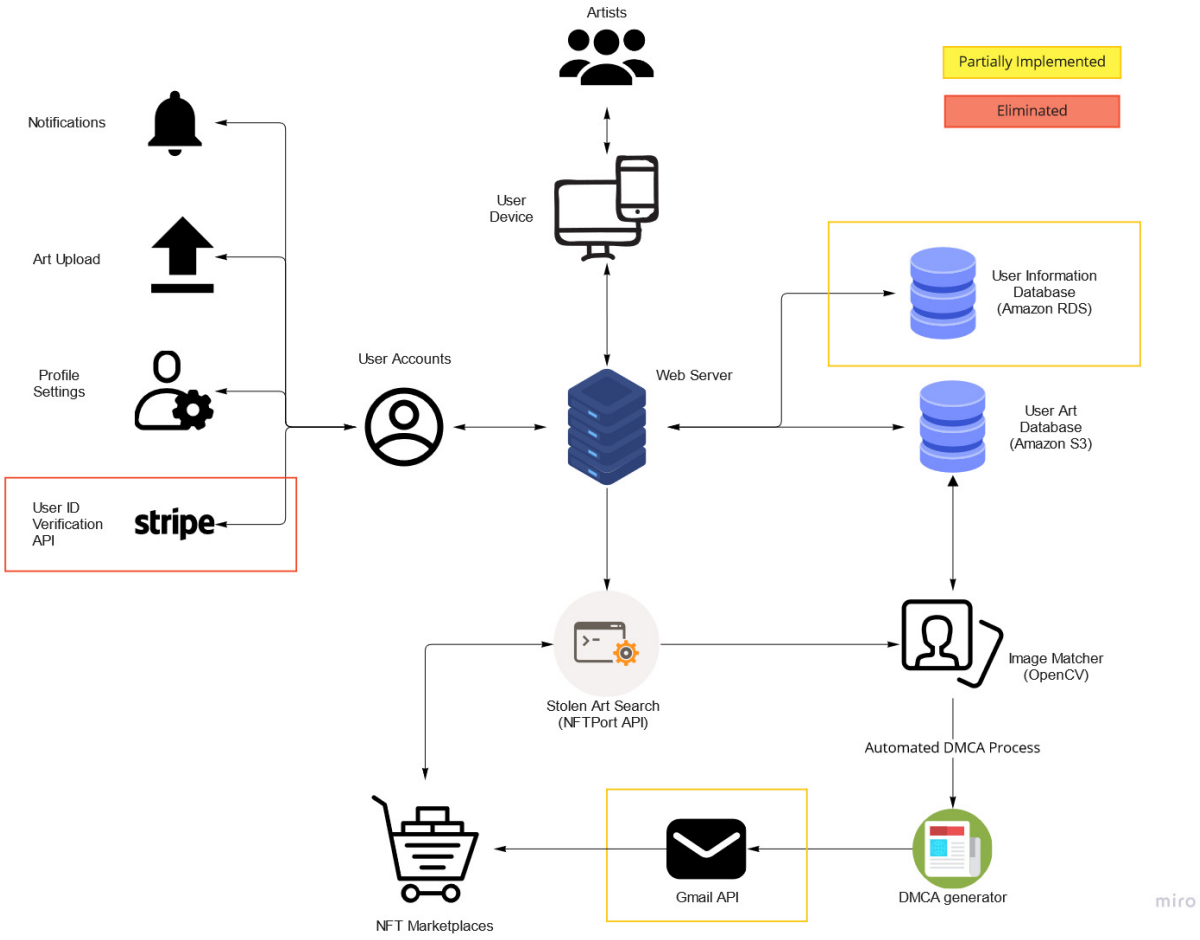
Art Guardian's purpose is to provide artists with an effective method against art theft and NFT minting. The prototype will only partially implement one feature and eliminate two features compared to the real world product. The exclusion of these features will show no major impact on the effectiveness of the major function of the application.

4.1 Architecture (Hardware/Software)

Art Guardian's prototype will require a variety of components in order to produce an expected end-to-end product. It will require specific hardware components that are up to date and will be able to handle the processes offered by the prototype. The hardware for Art Guardian includes three major components: a machine for the users and testers, a web server, and a database server. Initially, the team planned to develop both a mobile and desktop version of the application, but have decided to develop only the desktop version to save time and effort. The software includes tools familiar within any software development, with a handful of APIs. Developers will be using Git and Jira as code deployment and issue tracking, AWS for hosting the cloud computing, React for the desktop application, and Python for the backend of the application. The APIs utilized include OpenCV, NFTPort, and the Gmail API. Amazon RDS will be utilized for Art Guardian's database, managed by MySQL.

Figure 2

Prototype Major Functional Component Diagram



4.2 Features and Capabilities

The prototype for Art Guardian will include various features that are very essential to the core principles of the application. It will have an account creation feature in which it will utilize the database to store and encrypt account information such as emails and passwords. The prototype will not include two-step authentication because it will purely use mock data for account creation. Features relating to an art profile will be implemented such as art upload and viewing a user's art gallery. Because the prototype will allow for viewing a user's art gallery in the application, the image library will also be accessible through the database. Monitoring the

mock user's artwork will be implemented in the prototype with whitelisting, NFT marketplace monitoring, and image matching. These will be implemented and run on the backend of Art Guardian. Lastly, features relating to the takedown of an NFT, such as push notifications, DMCA takedown request generation and execution, and DMCA cataloging will be implemented; the filing of the DMCA takedown request will be partially implemented as it will send the request to a testing email because the prototype should not execute an actual DMCA takedown.

Table 1

Real World Product vs. Prototype Features

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

4.3 Development Challenges

Art Guardian has introduced development challenges, mainly relating to the difficulty of implementation. Most members of Team Blue have very little experience with the major components utilized, so a large learning curve with databases, AWS services, and our dependency API/library is present during the development of this prototype. Given this prototype with sophisticated, precise functionality shall be completed in 4 months, Team Blue may find difficulty in correctly and efficiently implementing all the desired features planned. The resources needed for Art Guardian, mainly the AWS cloud and databases, pose a learning curve that only one member has previous experience with. Utilizing various third-party libraries introduces a challenge in itself as the team may find difficulties learning the various APIs required for the prototype. Every algorithm required for Art Guardian's prototype will utilize either the OpenCV library or NFTPort API; this could be a large learning curve for the backend developers. The fact that mock or simulated data will be used for testing the prototype adds another level of effort because the team will need to manually produce mock data. The last significant challenge faced by the team is deciding whose artwork or NFTs to use for the prototype's mocks data; the team will need to reach out to external artists or NFT owners in order for the algorithms of Art Guardian to work as expected.

5 Glossary

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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