Lab 1 – Art Guardian Product Description

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1. Introduction

The popularity of non-fungible tokens (NFTs) has drastically increased within the past few years. By the end of 2021, the NFT market had an estimated worth of 41 billion dollars, which is a significant increase from its estimated worth of 100 million dollars in 2020 (Dailey, 2022). These NFT markets do not have many regulations on what can be minted as NFTs, which has caused an art theft problem within the digital art community. Digital artists are having their artwork minted as NFTs without their permission and then sold on these marketplaces. There is evidence that this problem is only getting worse. DeviantArt, an art hosting platform which tracks fraudulent NFTs, reported that the number of alerts, that notified users if their art had been minted as an NFT, doubled from October and November last year, and they have sent over 90,000 alerts in total (Beckett, 2022). If artists find their art stolen on a NFT marketplace they will have to manually fill out a Digital Millennium Copyright Act (DMCA) request and send it to the marketplace. They will have to repeat this process each time they find stolen artwork. Currently, there is no automated process for digital artists to search for stolen art and send DMCA requests to the NFT marketplace.

The solution to this problem is Art Guardian. Art Guardian constantly monitors popular NFT marketplaces for stolen art and sends DMCA requests to take down the fraudulent NFTs. With Art Guardian, digital artists can protect their art from being sold on NFT marketplaces without their permission and stop thieves from profiting off their work. Art guardian automates all the difficult parts of keeping a user's art off the NFT marketplace such as stolen art detection and the DMCA process.

2. Art Guardian Product Description

Art Guardian is a progressive web application that automatically finds solen art and sends DMCA takedown requests to NFT marketplaces to remove fraudulent NFTs. Users can protect their art by uploading their art to the application. Once the art is uploaded, Art Guardian will scan the NFT marketplaces for the art and notify the user if their art has been minted as an NFT. If their art is on the NFT marketplace, Art Guardian will also generate a DMCA request which can be sent to the NFT marketplace.

2.1. Key Product Features and Capabilities

Users can access Art Guardian through a web browser or mobile application on iOS or Android. They will first have to create an account with Art Guardian. Since DMCAs are a legal issue, the identity of the user must be correct, which is why Art Guardian has an identity verification system, and users must connect their art accounts to make sure that they are a legit artist. After creating an Art Guardian account, users can upload their original art to the art database. Art Guardian uses the art in this database and image matching to detect stolen art on the NFT marketplace. If users wish to allow their art on NFT marketplaces, then they can whitelist their art, which will bypass our stolen art detection system. Also, users can see all their uploaded art within their art library.

Once Art Guardian detects a piece of stolen art, it creates a pre-filled DMCA takedown request based on the user's information. Users can send this DMCA request after verifying that the stolen art is their own. After the DMCA request is sent, users can monitor the status of the request. All DMCA requests are stored in a database, so users can obtain information about previous DMCAs if needed. Art Guardian's notification system will alert users when their art is

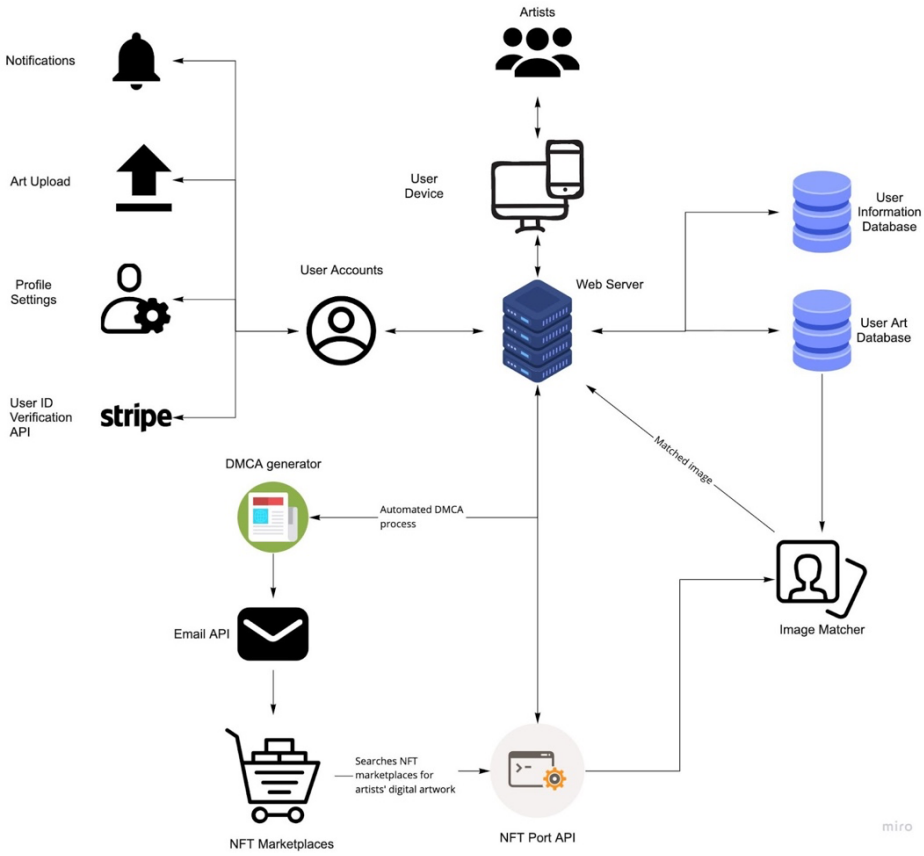
detected on the NFT marketplace and when the DMCA request has been approved or denied. Art Guardian also provides a section on tips and tricks for protecting one's digital art against theft.

2.2. Major Functional Components

Users can use Art Guardian through the browser or a mobile application on iOS or Android. The mobile application uses the React Native framework, which allows it to run on both iOS and Android, and it is written in the JavaScript programming language. The Art Guardian website provides all the same functionality as the mobile site, and it uses the React front-end framework, JavaScript, HTML, and CSS. Git and GitHub are used for version control during the development process. The user devices connect with a web server, which is powered by AWS. The web server connects with all the APIs and databases, as seen in Figure 1.

Figure 1

Art Guardian Major Functional Component Diagram



The databases that will store the user information and original art use Amazon Relational Database Services and MySQL. These technologies organize the data and aid in the retrieval of information from the databases. The user information database stores information about the user's information, profile settings, and DMCA history. User accounts are verified through Stripe, which is a user ID verification API. The NFT Port API is used to search for art on the NFT marketplace. The image matcher uses template matching to compare art found on the NFT marketplace with the art in the art database. Then, it sends the matched image back to the web server which starts the DMCA process. The image matcher uses the OpenCV library for template matching. The automated DMCA process uses a custom DMCA generator, which creates DMCAs based on the user and the stolen art. The DMCA is sent to the NFT marketplace as an email by using the Gmail API.

3. Identification of Case Study

The targeted users are commissioned artists and NFT artists. Commissioned artists would get the most benefit since they have a larger monetary incentive to protect their art from being sold without their permission. These artists can protect their art by uploading it to Art Guardian, which will search the NFT marketplace for their art, and alert them if it is found. Then, they can send an automatically generated DMCA request to prevent the sale of their art on the NFT marketplace. Art Guardian also provides these artists with tips on how to prevent any further theft of their art. These artists will feel more at ease knowing that they now have an easy process of removing their art from the NFT marketplace. NFT artists will benefit from Art Guardian, since they know that the NFTs they are selling are not using stolen art.

A case study group for Art Guardian is ODU art students. ODU art students can provide valuable feedback on the Art Guardian prototype, since they are most similar to digital artists.

Students will be able to upload their art to the prototype. Art Guardian allows the students to check if their art has been minted as an NFT and is being sold on the NFT marketplace without their permission. Feedback from this group is especially valuable, since it will give insight into how artists will use features such as the art library, art upload, and notification system.

While Art Guardian is currently targeting commissioned artists and NFT artists, in the future, Art Guardian will expand to meet the needs of all digital artists and possibly non-digital artists, who do not want images of their art being sold as NFTs.

4. Art Guardian Prototype Description

The Art Guardian prototype will contain most of the major features that will appear in the end product, such as DMCA generation, art uploading, image matching, etc. The prototype will have most of the capabilities of the end product, but some features will be partially implemented or eliminated, and simulated data will be used instead. The prototype will still be capable of demonstrating the main purpose of Art Guardian, which is to automate the DMCA process for stolen art on the NFT marketplace.

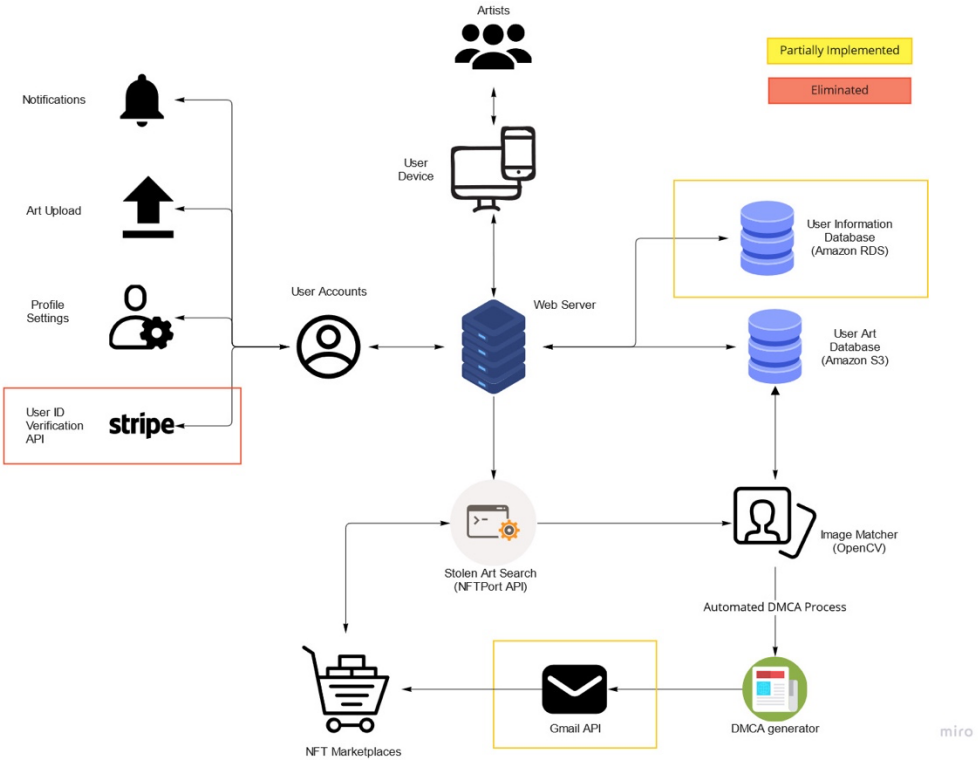
4.1. Prototype Architecture

The prototype architecture for Art Guardian will be similar to the end product architecture. Artists will connect to the web application through a user device. Then, they will have access to their user accounts which has features such as notifications, profile settings, and art upload. As seen in Figure 2, one of the major differences between the end product and prototype is that user ID verification will be eliminated from the prototype. The user information will be stored in a data user information database using Amazon RDS, which will only be partially implemented. The art uploaded by users will be stored in a user art database using Amazon S3. The NFT Port API will search the NFT marketplaces for art, then the image matcher

will compare these images to what is stored in the art database. If a match is found, then the DMCA generator will generate a DMCA takedown request, but since the Gmail API will only be partially implemented, the DMCA takedown request will not be sent to the NFT marketplace.

Figure 2

Art Guardian Prototype Major Functional Component Diagram



4.2. Prototype Features and Capabilities

Most of the features and capabilities of the Art Guardian real-world product will be available in the prototype. As seen in Table 1, only three of the features in the real-world product will either be eliminated or partially implemented in the prototype. User verification will be eliminated from the prototype and mock user data will be used in its place for testing purposes. While the prototype is capable of DMCA generation, those DMCAs will not be sent to the NFT marketplaces, since the purpose of the prototype is only to prove that it is possible to automatically generate a DMCA based on stolen art found in the NFT marketplaces. When

testing the prototype, DMCAs will be sent to a testing email instead of the actual NFT marketplaces. The last major feature that will not be present in the prototype is DMCA tracking. Since the DMCA will not be sent to the marketplace, there is no purpose in tracking its status, so simulated data will be used instead. Despite some of the features of the real-world product being partially implemented or eliminated from the prototype, the main goal of Art Guardian, which is to automate the DMCA process for stolen artwork on the NFT marketplaces, will still be demonstratable in the prototype.

Table 1

Real-World Product vs Prototype Features

Art Guardian	***Real-World Product***	***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. Prototype Development Challenges

The Art Guardian prototype will be a complex, full-stack web application, which presents many challenges to its developers. The prototype will need development in the front-end and back-end. Therefore, it will incorporate many different technologies such as React, AWS, OpenCV, Git, and many more, which means that a lot of time will be needed for the learning of these technologies. Since the prototype must be developed within a single semester, spending time efficiently among developing, planning, and learning is of upmost importance. The limited time frame may mean that not all planned, prototype features will be available. Work will have to be separated into front-end, back-end, and database categories, which also introduces the challenge of ensuring that effective communication occurs between different parts of the team. If the team does not effectively communicate, then there is the possibility that different parts of the prototype will not work well with each other. This could lead to extensive refactoring, which would take up a lot of time and resources.

5. Glossary

- **Art Platform** - A website in which users can post their digital art
- **Blockchain** - An immutable ledger that anyone can validate
- **DMCA (Digital Millennium Copyright Act) Takedown** - A request sent by the owner of the copyrighted content to remove the infringing content from the internet or platform
- **Minting** - The process in which the files become part of the blockchain
- **NFT** – Non-Fungible Token
    - Non-fungible - Unique, indivisible, and irreplaceable
    - NFTs are a certificate of ownership stored on a blockchain that links to a file
- **NFT Marketplace** - An online platform in which NFTs are minted, sold, and collected

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