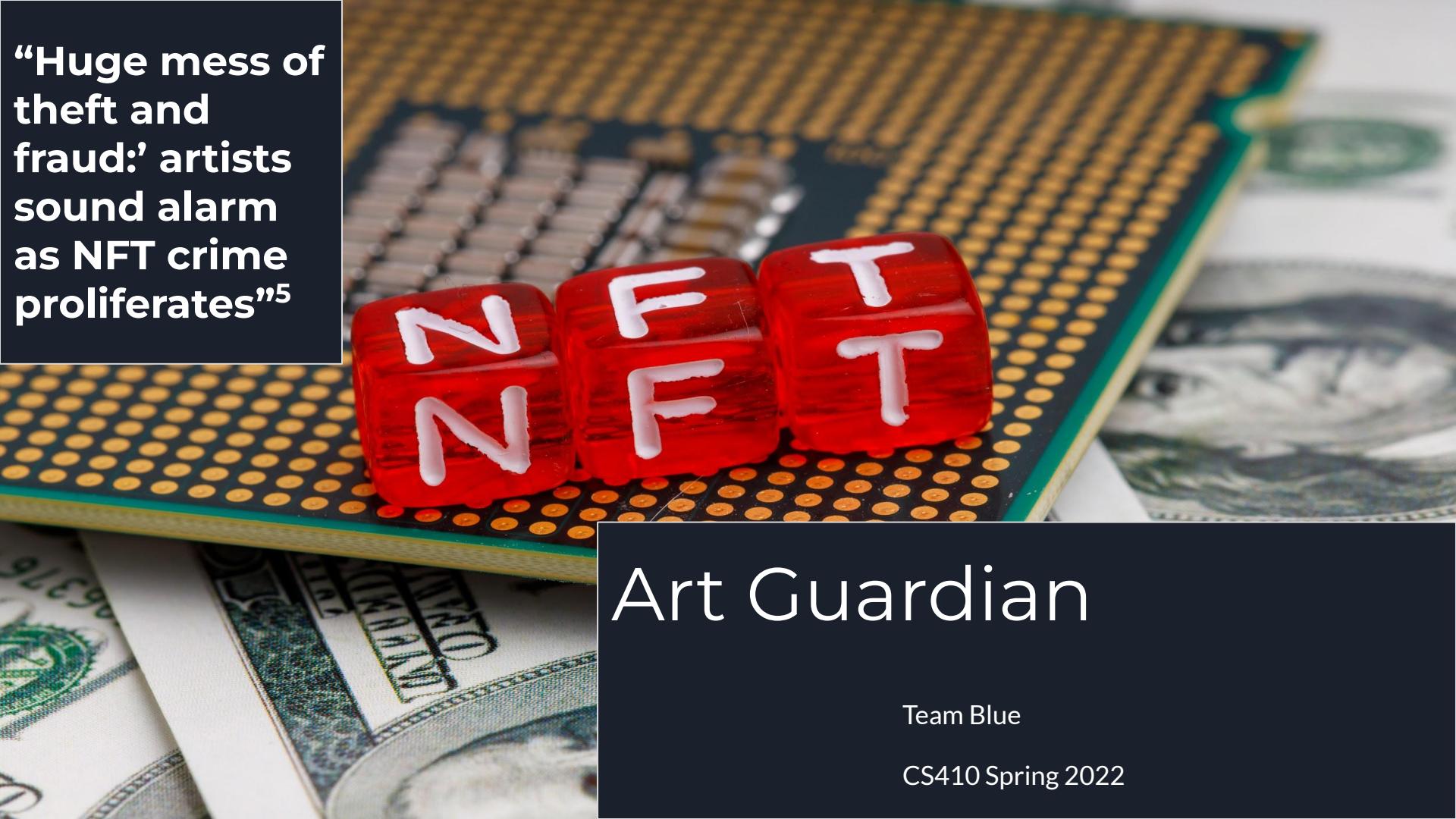


**“Huge mess of  
theft and  
fraud:’ artists  
sound alarm  
as NFT crime  
proliferates”<sup>5</sup>**



# Art Guardian

Team Blue

CS410 Spring 2022

# Table Of Contents

## Table of Contents

- 3. Biography
- 4. Glossary
- 5. A Growing Problem
- 6. Problem Characteristics
- 7. Problem Statement
- 8. Current Process Flow
- 9. Solution Statement
- 10. Solution Characteristics
- 11. Customers, Stakeholders, and Users
- 12. User Roles
- 13. Solution Process Flow
- 14. MFCD
- 15. WBS
- 16. UI WBS
- 17. UI Mockups
- 22. External WBS
- 23. Algorithm WBS
- 22. Algorithm Relationship Diagram
- 23. Algorithms
- 31. Data Management WBS
- 32. Data Management
- 33. Entity Relationship Diagram
- 34. Development Tools
- 35. Requirements
- 36. Development Model
- 37. Development Plan
- 38. Risk Matrices
- 41. Competition Matrix
- 42. Benefits
- 43. Art Guardian Will Not...
- 44. Conclusion
- 45. References
- 46. Appendix
- 47. Q&A

# Biography



Carlo Diaz  
Frontend



Paolo Ihde  
Frontend



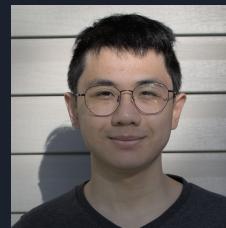
Brandon Kidd  
Database Specialist



Michael Thompson  
Backend



Autumn Roberts  
Team Leader/Front End



Tobin Zheng  
Web Master



Spencer Hite  
Database Specialist



# Glossary

- **NFT** stands for Non Fungible Token.
  - Non-fungible means unique, indivisible, and irreplaceable.<sup>1</sup>
  - NFTs are a certificate of ownership stored on a blockchain that links to a file.<sup>2</sup>
- **Blockchain**: an immutable ledger that anyone can validate.<sup>3</sup>
- **Minting**: the process in which the files become part of the blockchain.<sup>4</sup>
- **NFT Marketplace**: an online platform in which NFTs are minted, sold, and collected.<sup>7</sup>
- **DMCA (Digital Millennium Copyright Act) Takedown**: The owner of the copyrighted content requests the removal of the infringing content from the internet or platform.<sup>8</sup>
- **Art Platform**: A website in which users can post their digital art.



# A Growing Problem

- NFT Market rose from \$100 million in 2020 to \$41 billion by the end of 2021<sup>6</sup>
- Deviantart reported 90,000 possible thefts of digital art in December, 2021, an increase of 300% since November, 2021.<sup>5</sup>
- Vn-Parco reported that roughly 50% of NFT sales were over \$200 in 2022.<sup>6</sup>

# Problem Characteristics

- Artists are having their art minted as NFTs without permission.
- Artists must search on NFT Marketplaces manually for stolen art.
- Filing a DMCA takedown is a tedious manual process that artists must go through when they find their art is stolen.
- It can be hard to keep track of the success of a DMCA takedown as well as all the information associated with it

RJ Palmer  
@arvalis

Cool new scam artists should be aware of. Any rando can now turn your tweet and by extension, your artwork into an NFT by tagging this account @/tokenizedtweets

Block this guy

RJ Palmer @arvalis · Feb 27  
I always really appreciated that Pokemon could bring us together regardless of where we are in our lives.



Zach Cain @lamzachcain · 1h  
@tokenizedtweets 0x6261aa23E013B9A6825EB913398d0415517C32f

5:16 AM · Mar 9, 2021

[Read the full conversation on Twitter](#)

48.8K likes · 1.1K retweets · 7.4K favorites · Copy link to Tweet · Read 615 replies

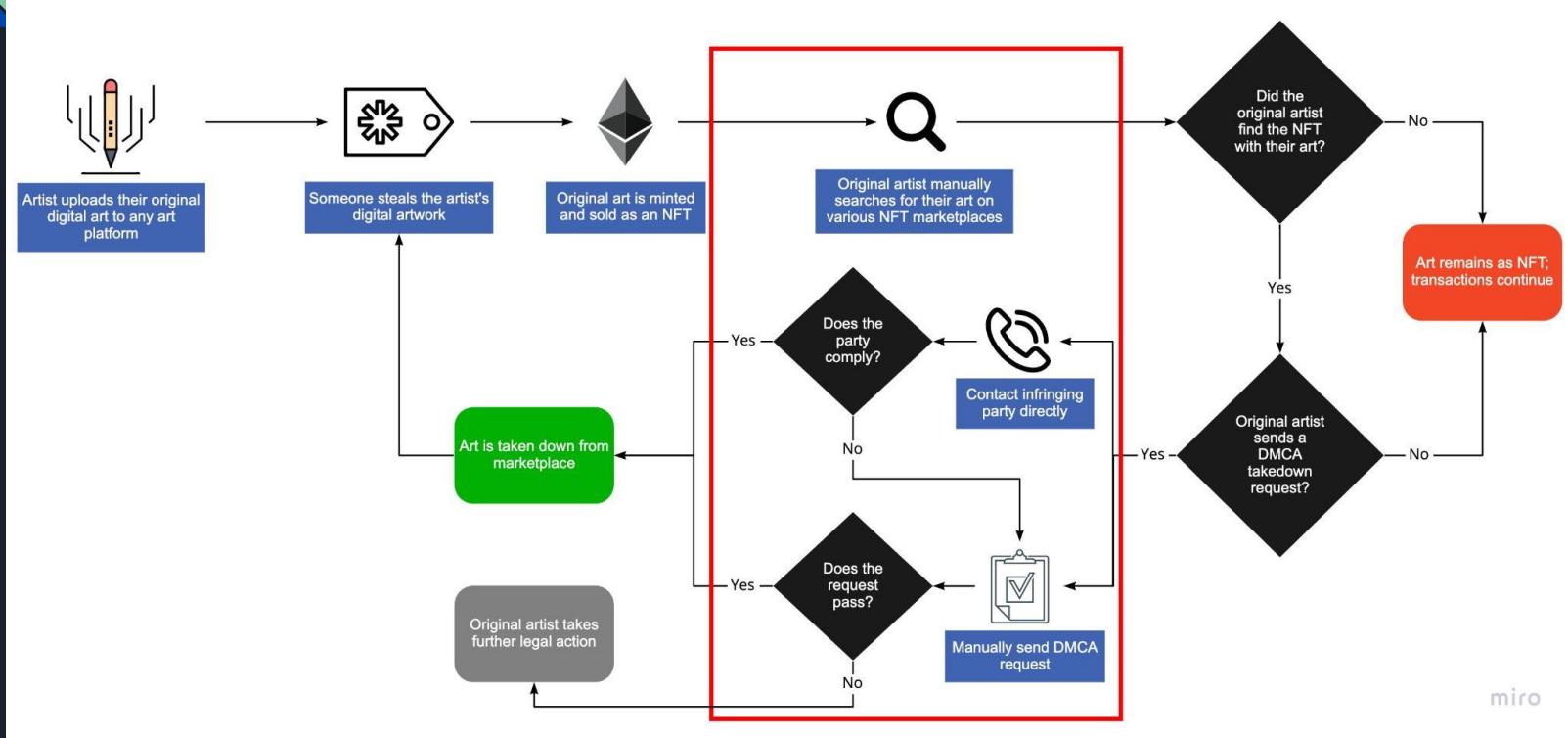
twitter.com/arvalis<sup>9</sup>



# Problem Statement

Digital artists lack an automated system that will detect art that has been minted on NFT Marketplaces without artists' permission and prevent future sale of their art by having it taken down from those marketplaces.

# Current Process Flow



miro



# Solution Statement

Art Guardian will provide an automated system for artists that will detect that their art has been minted as an NFT and file a DMCA takedown request to get it removed from the marketplace.



# Solution Characteristics

- Progressive Web App where artists upload their art into the database.
- Alerts users when stolen art is found on a marketplace.
- Automatically prepares and sends DMCA takedown requests once validated by the user.
- Keeps track of DMCA takedown requests:
  - Catalog DMCA takedowns.
  - Monitor the takedown status.



# Customers, Stakeholders, and Users

## Users and Customers

- Digital Commission Artists
- NFT Artists

## Stakeholders

### NFT Marketplaces:

- Marketplace users have more faith that their NFT is not stolen art.

### Art Platforms:

- Users feel more comfortable posting their art on public domain platforms.



# User Roles

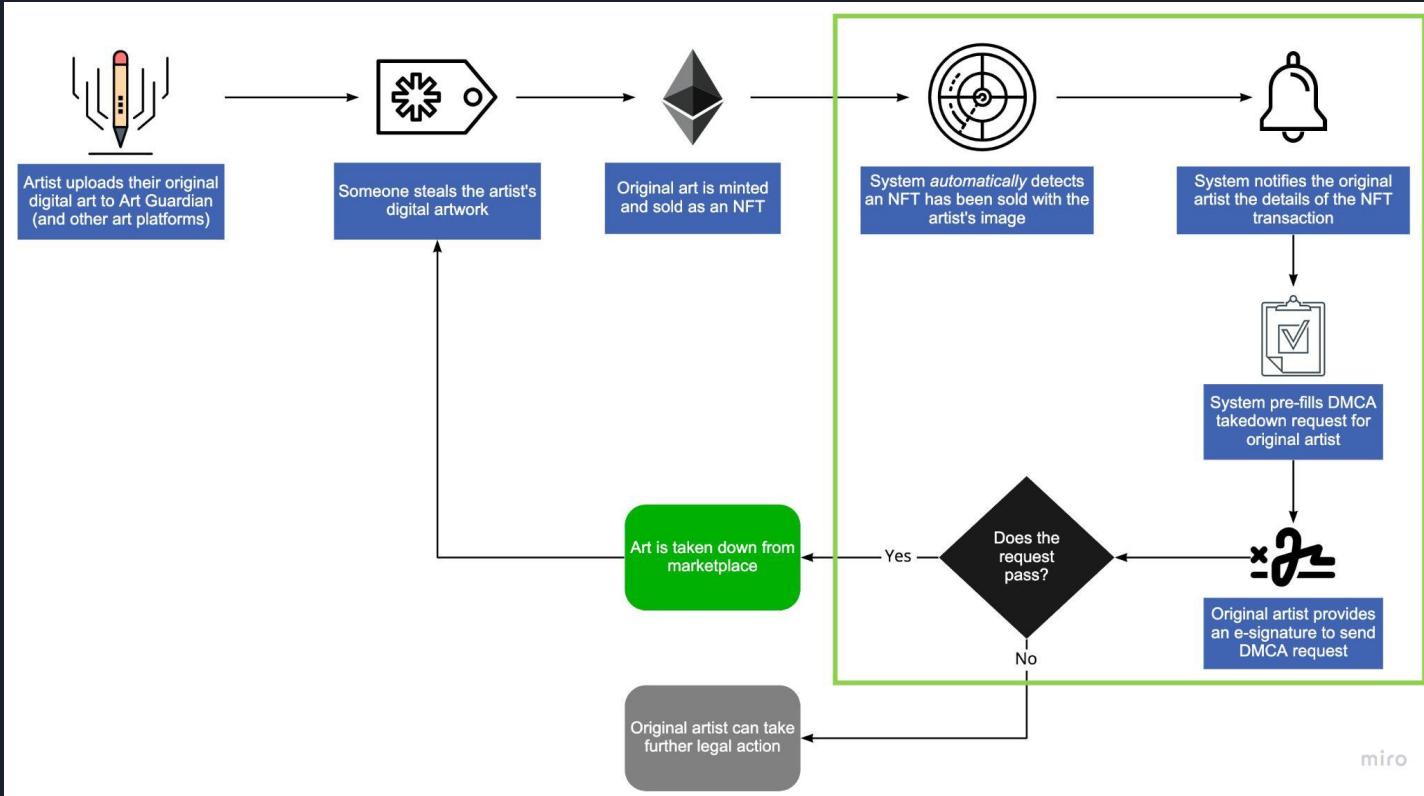
## Commissioned Artist:

- Artists who are paid to draw art by a customer
- Art is posted online and then stolen
- Uses Art Guardian to protect their brand and art from theft

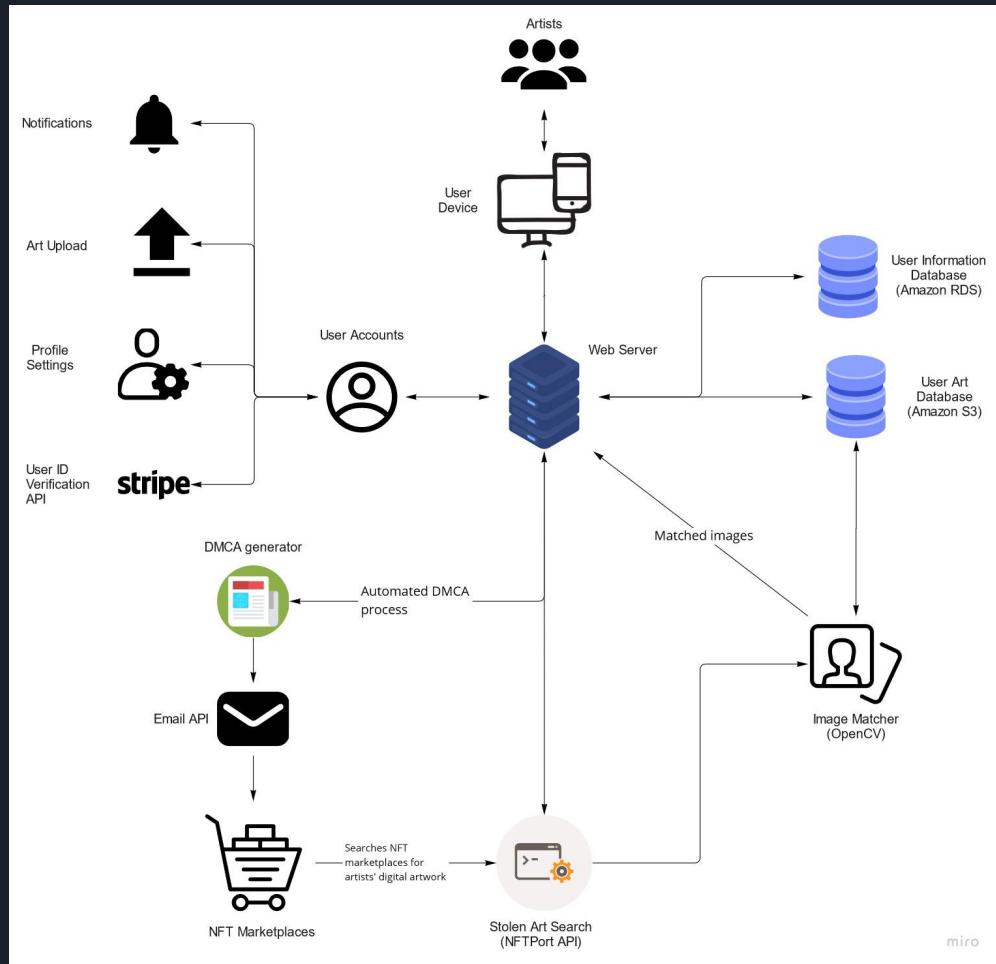
## NFT Artist

- Artist who mints NFTs
- NFTs are re-minted and sold
- Uses Art Guardian to protect brand and collection from art theft

# Solution Process Flow

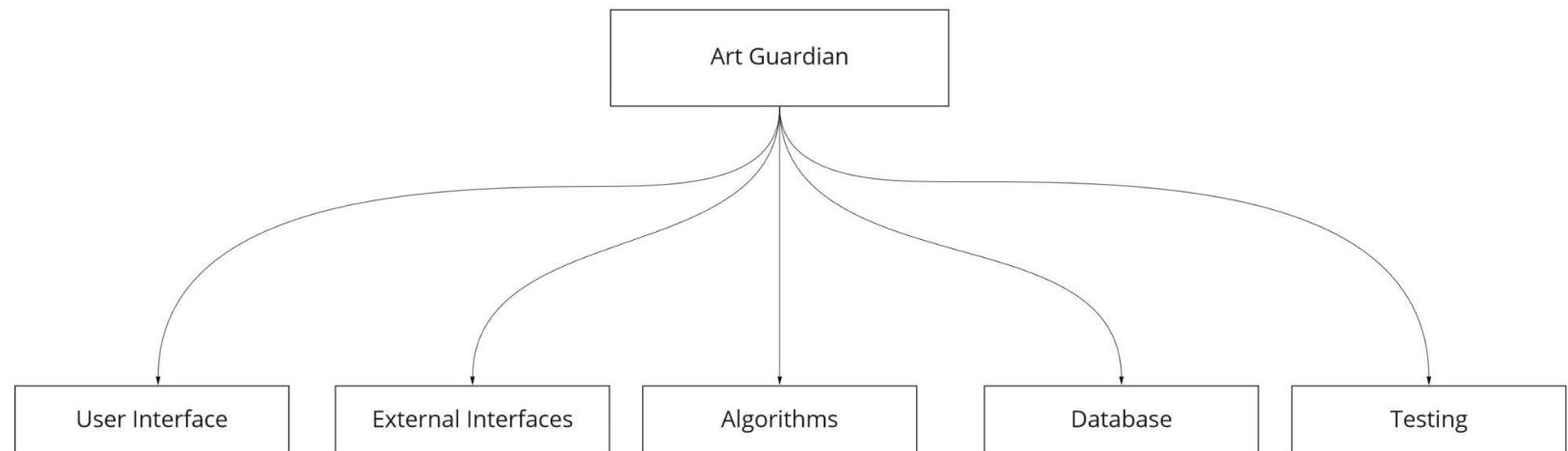


# Major Functional Component Diagram



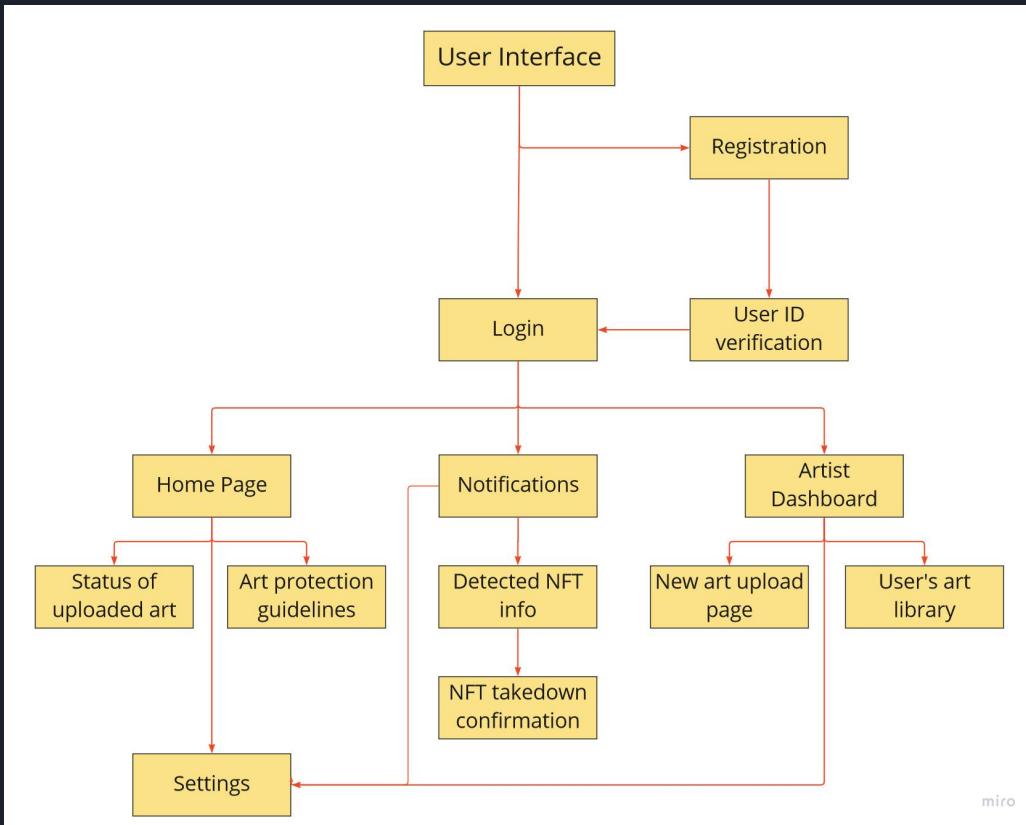
miro

# Work Breakdown Structure



miro

# User Interface WBS



# Desktop UI/UX: Sign Up and Login

ART  
GUARDIAN

USERNAME

PASSWORD

LOGIN

SIGNUP

SIGN UP

EMAIL

USERNAME

PASSWORD

RE-TYPE PASSWORD

FIRST NAME

LAST NAME

PHONE NUMBER

Link an Art Account



Verify Identity  
with ID scan



SUBMIT

# Desktop UI: Home and Art Library

ART GUARDIAN



Welcome back,  
John Doe

Today, we found 1 instance of theft

[Click here](#), or check your notifications  
for more info

## Art Protection Guidelines

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nunc lacinia ut ligula a facilisis. Phasellus et lacus eget magna blandit molestie

- non et ex. Donec quis dignissim nunc. Nam commodo ex quis auctor
- sollicitudin. Morbi eu fringilla eros. Maecenas eu leo auctor,
- interdum nisl fringilla, maximus tortor. Nam in libero a dolor lacinia eleifend ac non dui.

ART GUARDIAN

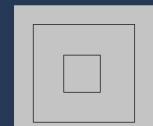


John Doe

6 art pieces

[Upload art](#)

## Art Library



# Desktop UI: Art Upload and Notifications

The image displays two side-by-side screenshots of the Art Guardian desktop application. Both screenshots show a dark blue header bar with the "ART GUARDIAN" logo on the left and four icons on the right: a house, a person, a bell with a red dot, and a gear.

**Left Screenshot (Upload Screen):**

- Title:** A text input field labeled "Title" with a small "Required" asterisk icon to its left.
- Add File:** A large blue button with the text "Add File" and a white plus sign icon inside a circle.
- File Format Note:** The text "Files must be in .foo, .bar, or .baz format" displayed below the file upload area.
- Upload Button:** A purple button labeled "Upload" at the bottom of the screen.

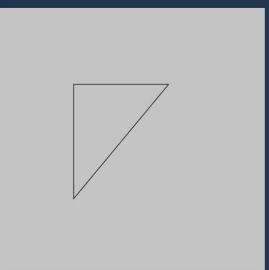
**Right Screenshot (Notification Screen):**

- Art Preview:** A small square thumbnail showing a white triangle on a gray background.
- Notification Text:** The text "Your art titled ‘Triangle’ has been found on an OpenSea transaction" followed by a blue "Click here for more information" link.
- Art Preview:** A small square thumbnail showing a white square inside a larger gray square.
- Notification Text:** The text "Your art titled ‘Squares’ has been found on an OpenSea transaction" followed by a blue "Click here for more information" link.

# Desktop UI: DMCA Takedown

ART GUARDIAN

Home User Profile Bell Gear



IMPORTANT, PLEASE READ  
By continuing further, confirm that:

You ARE the ORIGINAL artist  
of this piece of artwork

You ARE looking to request a  
takedown of this NFT

Marketplace: OpenSea  
URL: opensea.io/.....  
Blockchain: Ethereum  
Token: 0x0000000000000000  
User: Jane Doe

CONTINUE

\*Both boxes must be checked off before continuing

ART GUARDIAN

Home User Profile Bell Gear

## DMCA Takedown Request

To OpenSea,  
Art Guardian is acting on behalf of the copyright owner of the art "Triangle".  
[Link and token ID would go here]

This letter is official notification under the provisions of Section 512(c) of the Digital Millennium Copyright Act ("DMCA") for removal of the above-referenced copyright infringement(s). Art Guardian hereby requests that you immediately issue a cancellation message as specified in RFC 1036 for the specified postings and prevent the infringer, who is identified by its Web address, from posting the infringing art to your servers in the future. The law requires you to "expeditiously remove or disable access to" the infringing works of art upon receiving this notice. As a service provider, noncompliance may result in a loss of immunity for liability under the DMCA as cited above.

I have a good faith belief that use of the material in the manner complained of herein is not authorized by the copyright holder, or the law. The information provided is true and accurate to the best of my knowledge. I swear under penalty of perjury that I am the copyright owner or have the authority to act on behalf of the copyright owner.

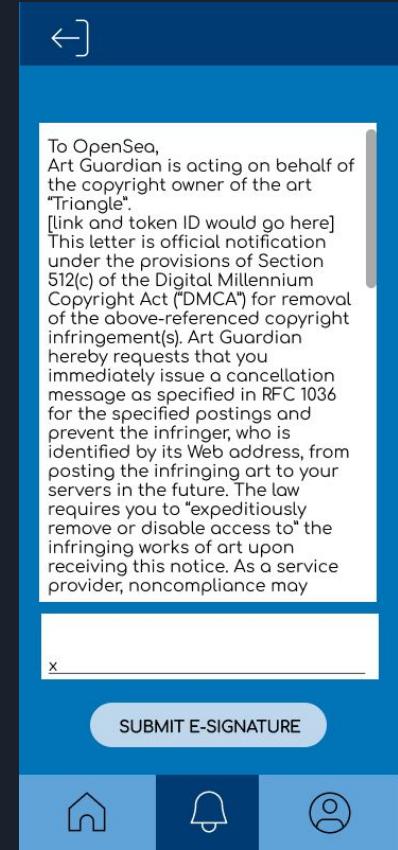
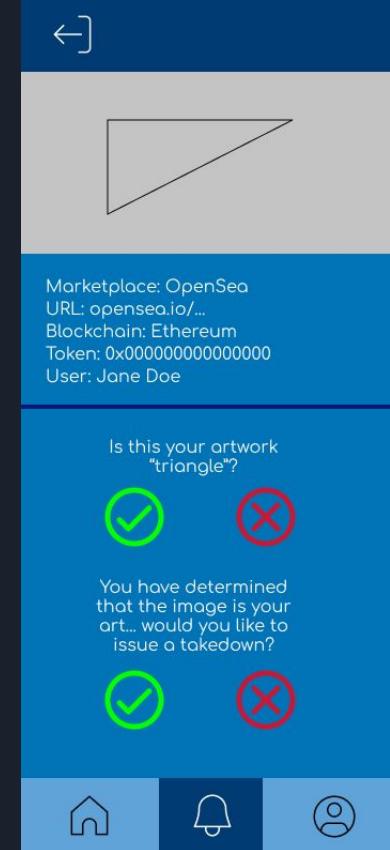
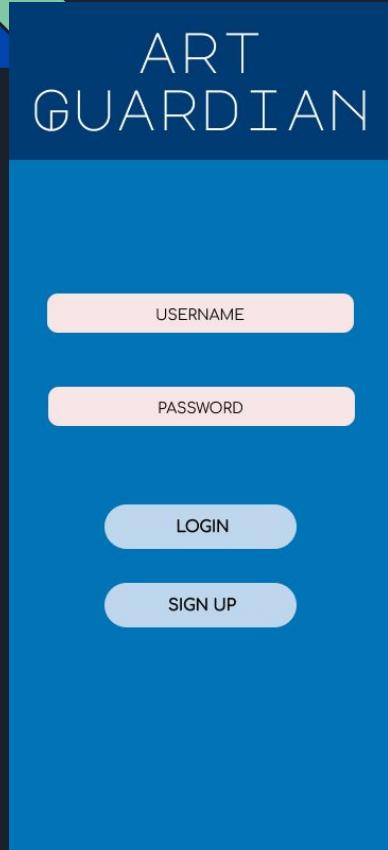
Sincerely,  
Art Guardian  
Email  
Address  
Phone Number

Required

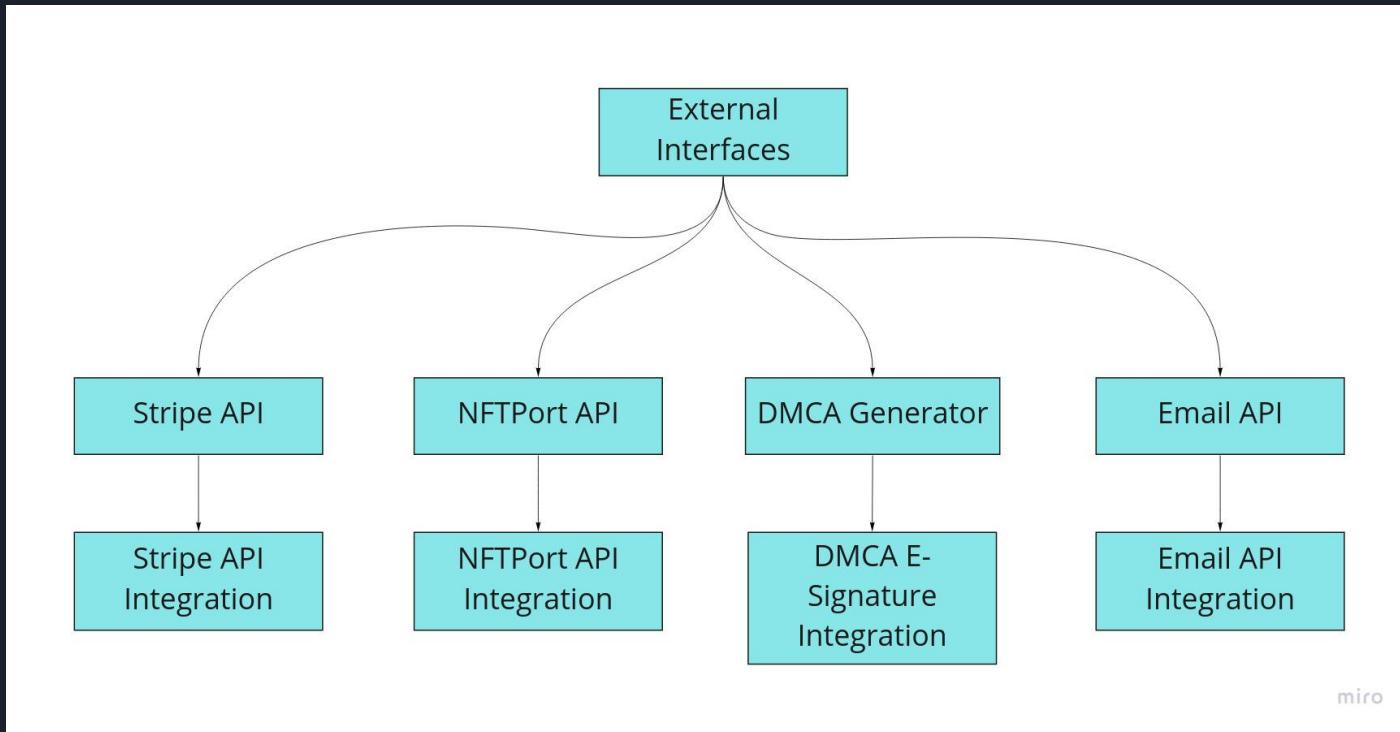
X

SUBMIT E-SIGNATURE

# UI/UX Structures: Mobile Sample

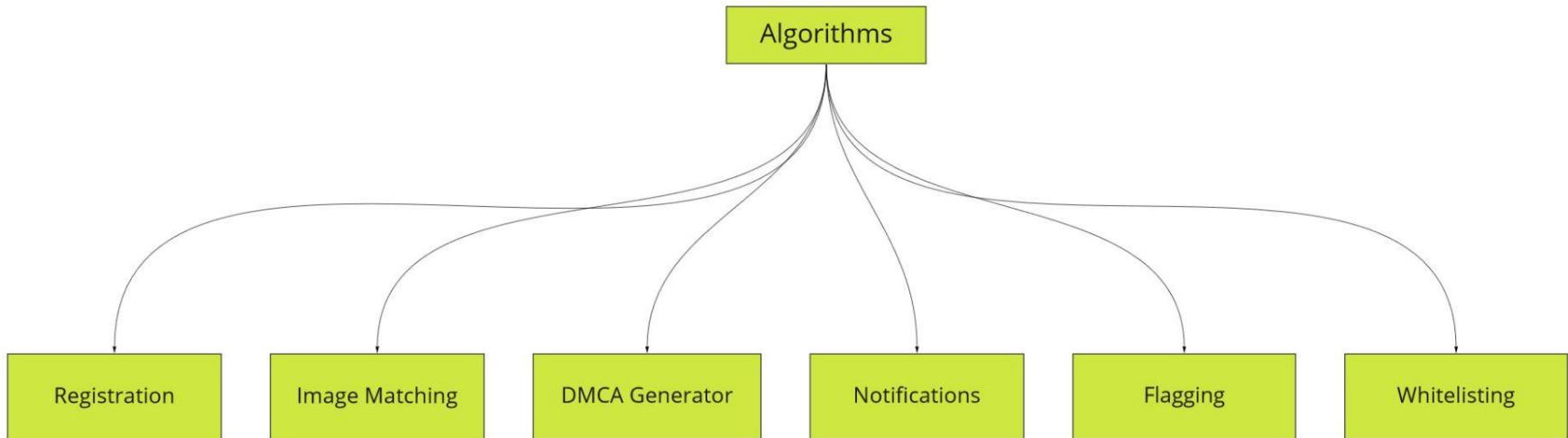


# External Interfaces WBS



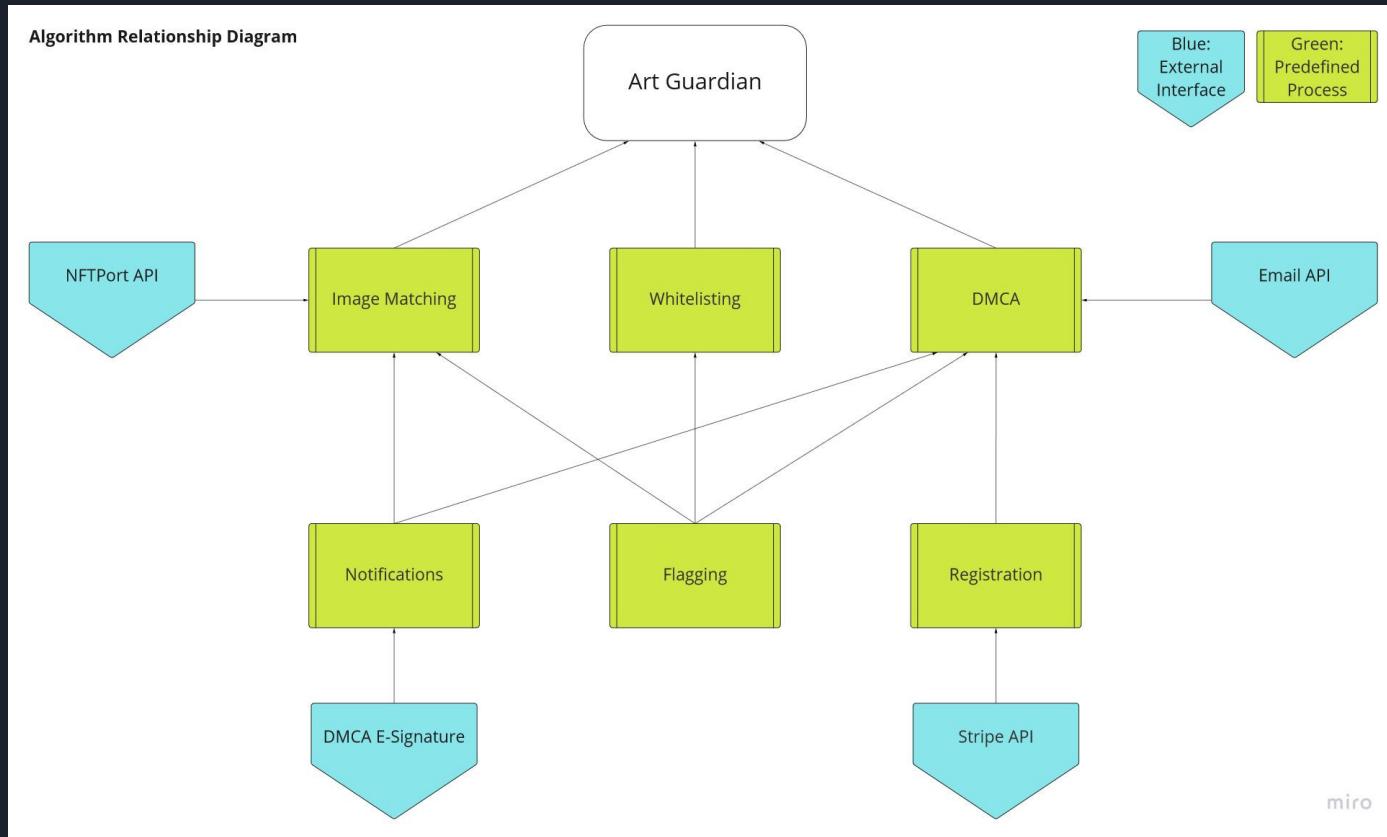
miro

# Algorithms WBS

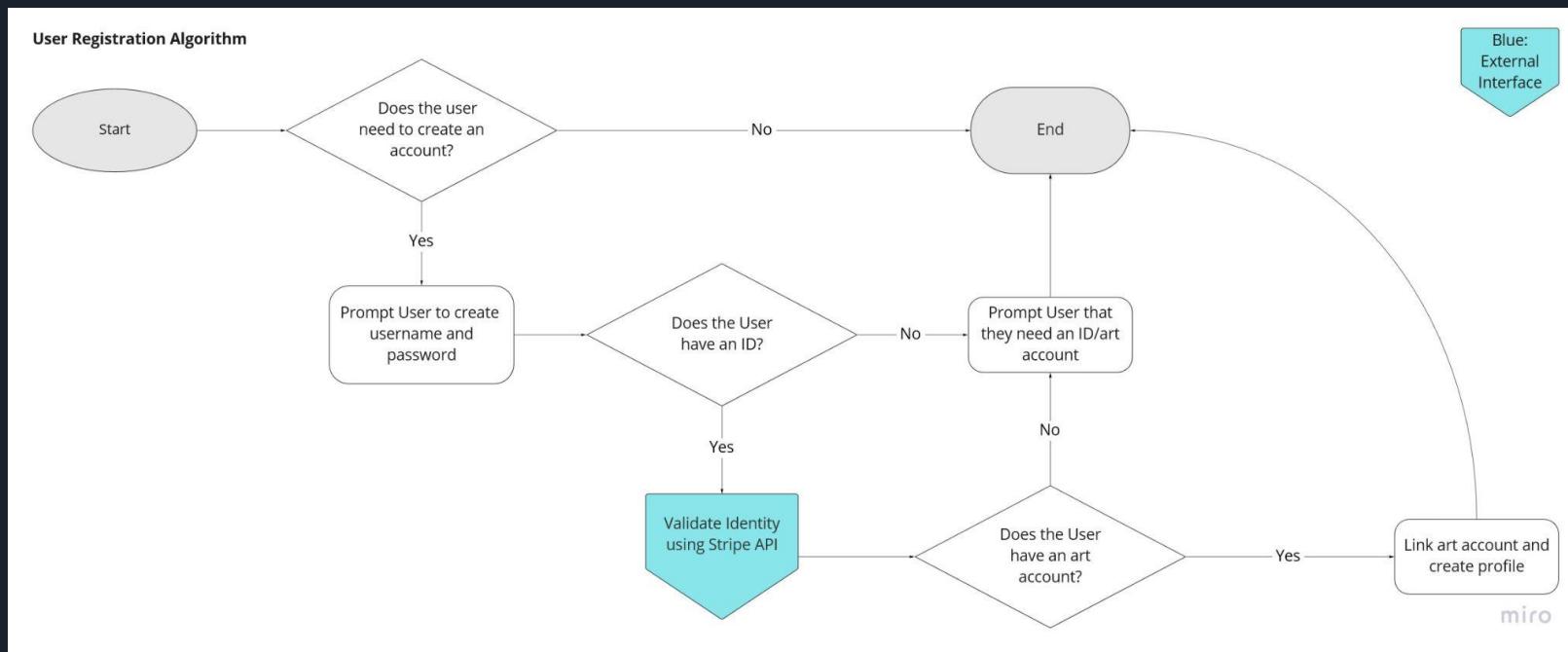


miro

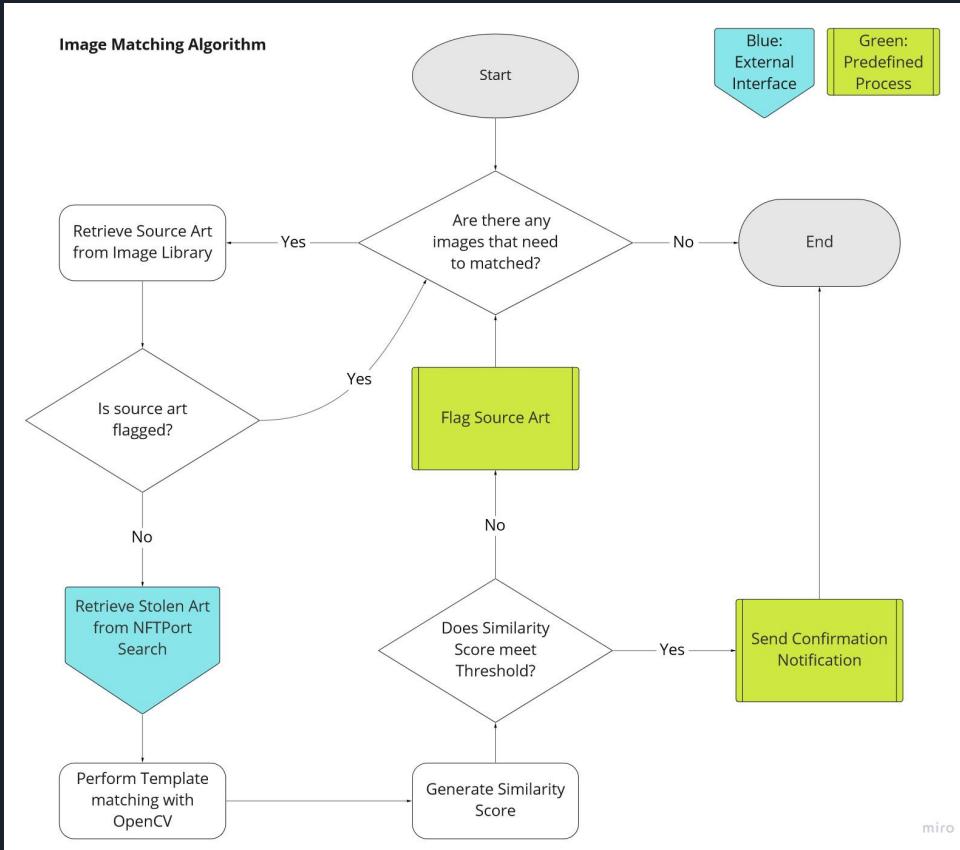
# Algorithm Relationship Diagram



# Registration Algorithm

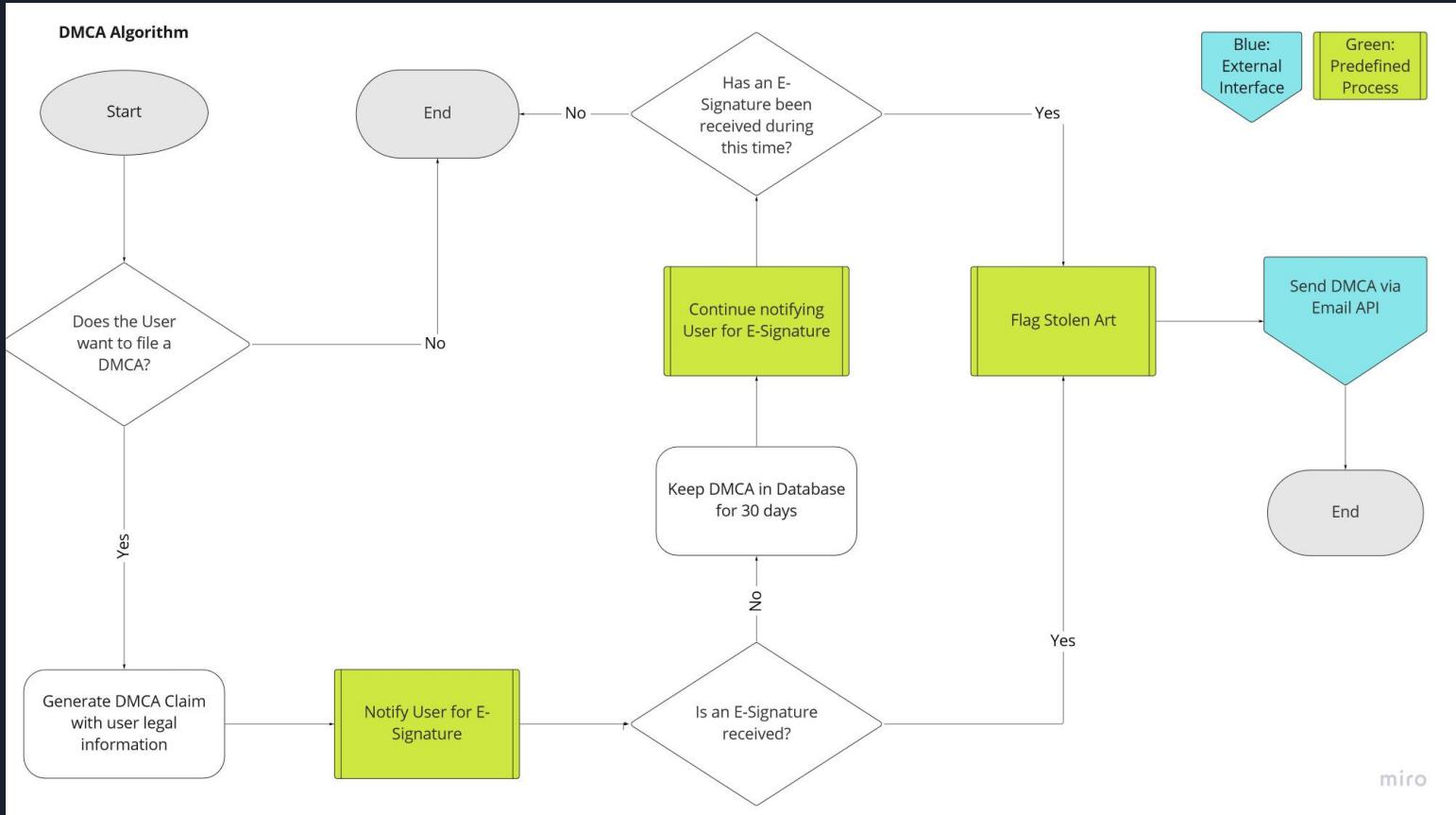


# Image Matching Algorithm



- Source art is searched once every 30 days.
- The end of the algorithm is just for the source art.
- Flagging source art shows that there were no matches.

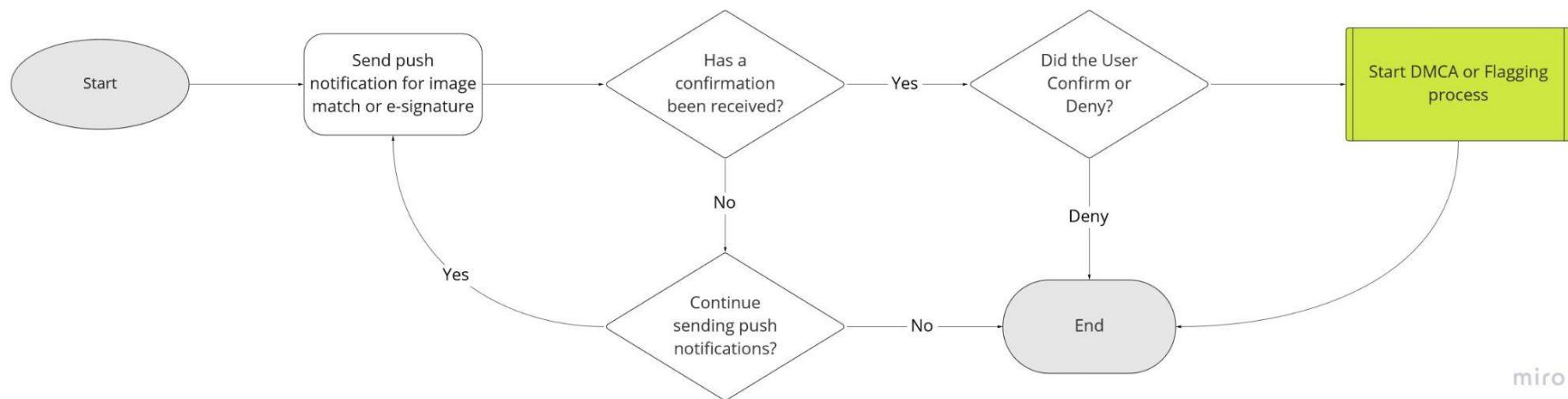
# DMCA Algorithm



# Notifications Algorithm

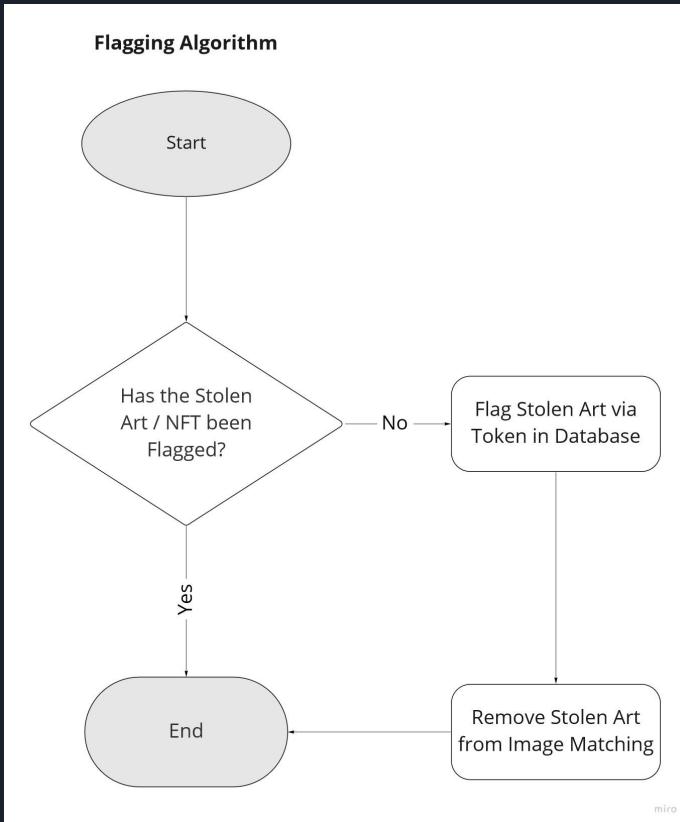
Notifications Algorithm

Green:  
Predefined  
Process



miro

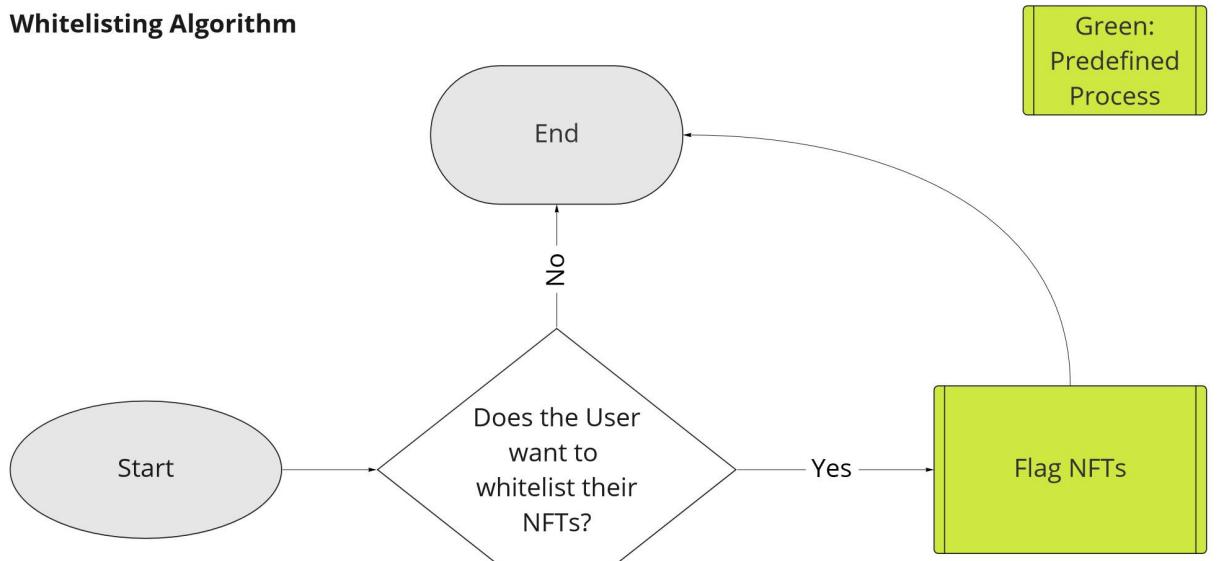
# Flagging Algorithm



- Flagged art is exempt from all algorithms.

# Whitelisting Algorithm

Whitelisting Algorithm

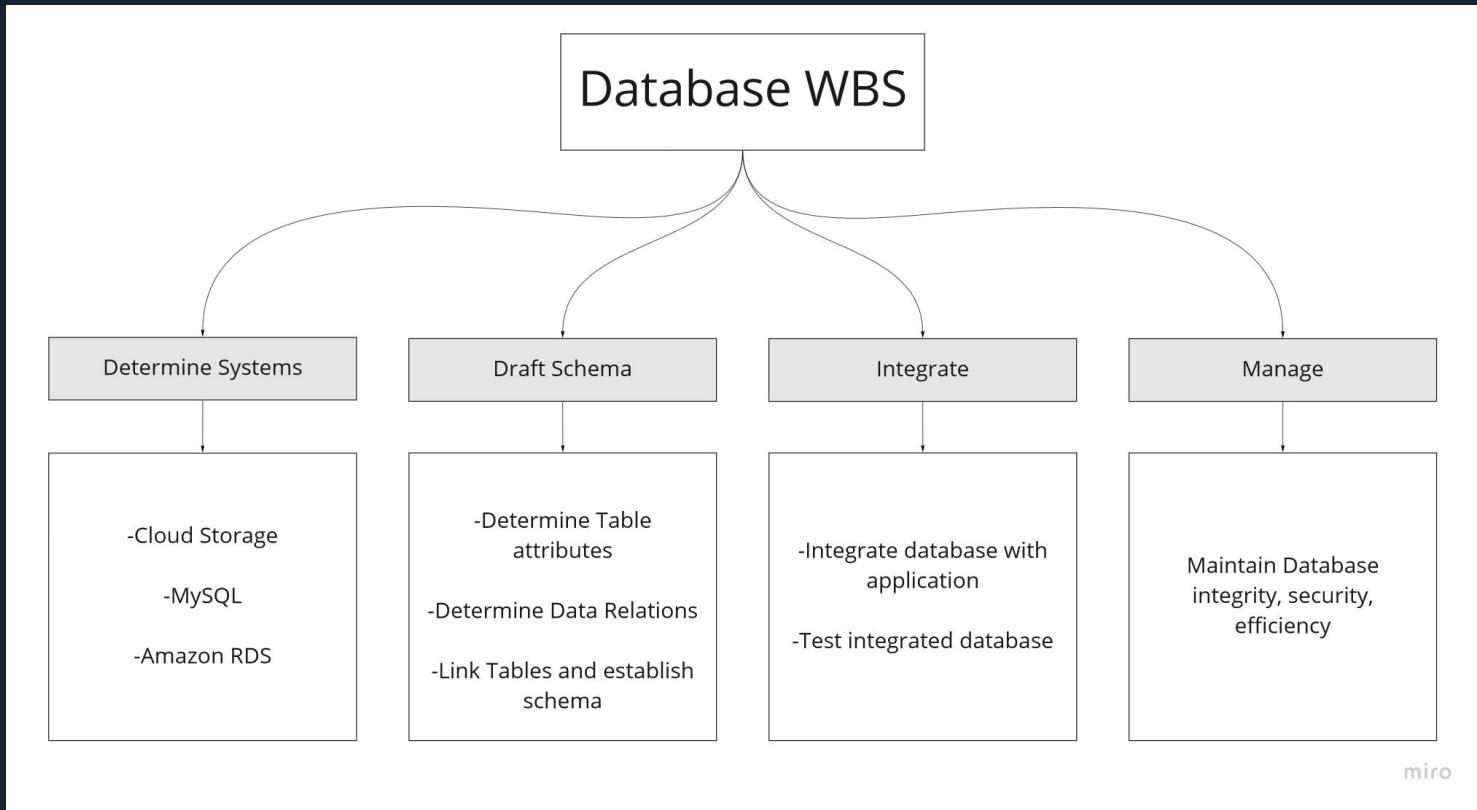


Green:  
Predefined  
Process

- Whitelisting NFTs exempts them from all algorithms.
- Whitelisting must be initiated by the user.

miro

# Data Management WBS



miro

# Data Management

## Data Source:

- Commissioned Artist Input
- NFT Artist Input

## Data Collected:

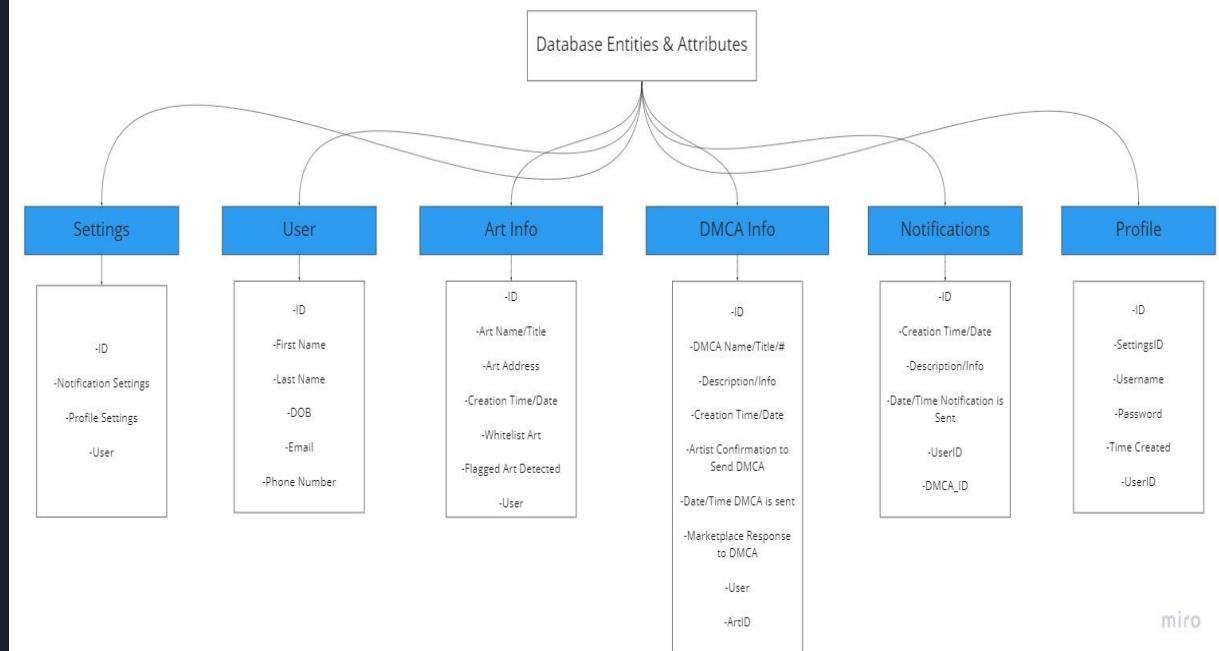
- User Information
- User Artwork Information
- DMCAAs sent by Art Guardian

## Data Security:

- Dedicated DB users
- Amazon Guard Duty
- Encryption of Data at rest and in Transit

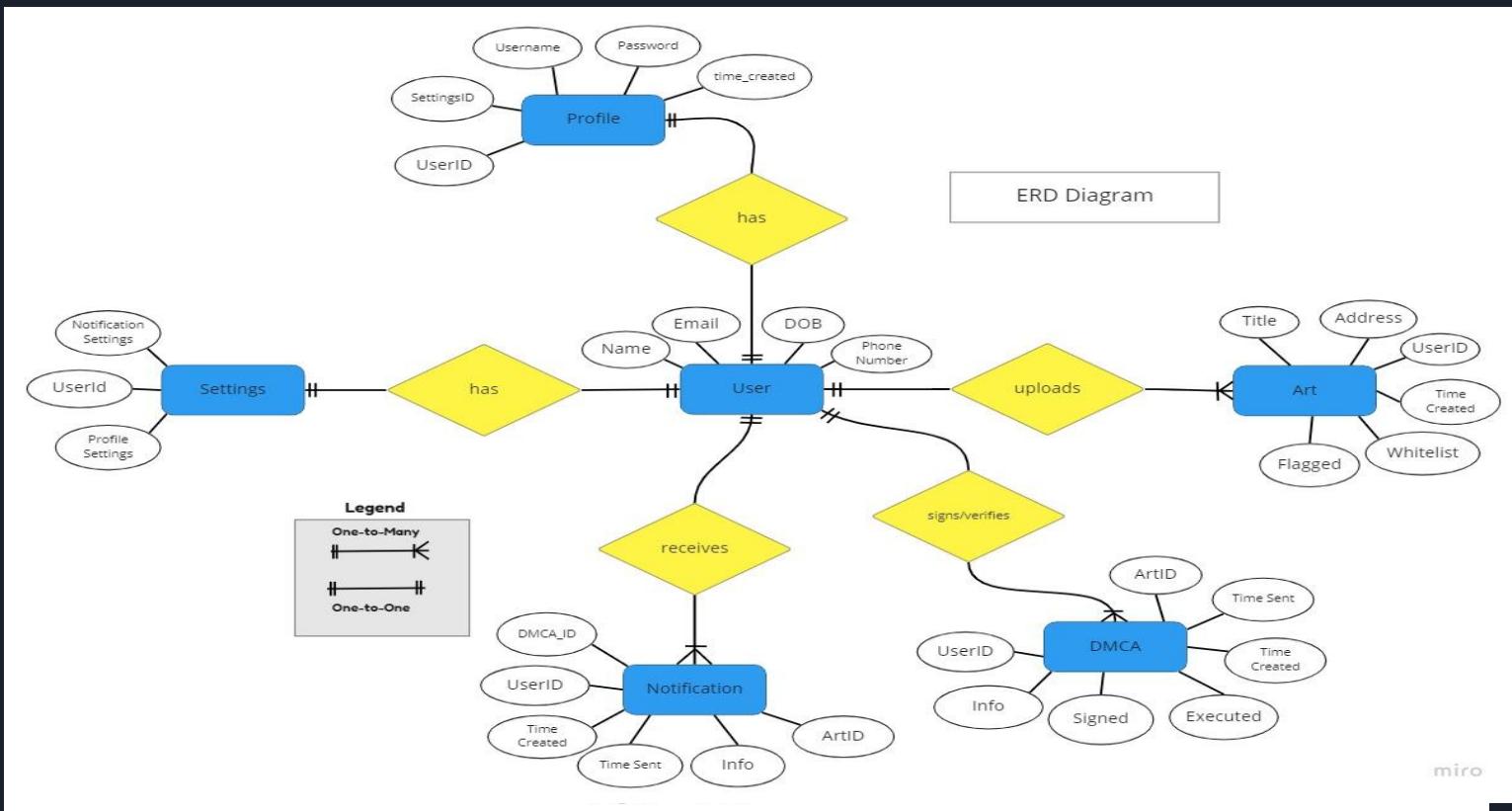
## Data Storage:

- Amazon RDS with MySQL
- S3 or EBS for BLOB data



miro

# Entity Relationship Diagram



miro



# Development Tools

Component	Mobile	Desktop
Language	JavaScript	HTML, CSS, Javascript
Framework	React Native	React
IDE	Visual Studio Code	Visual Studio Code
Database	Amazon RDS And AWS	Amazon RDS And AWS
Version Control	Git	Git
Issue Tracking	GitHub	GitHub
API Documentation	jsdoc	jsdoc



# Requirements

## Hardware

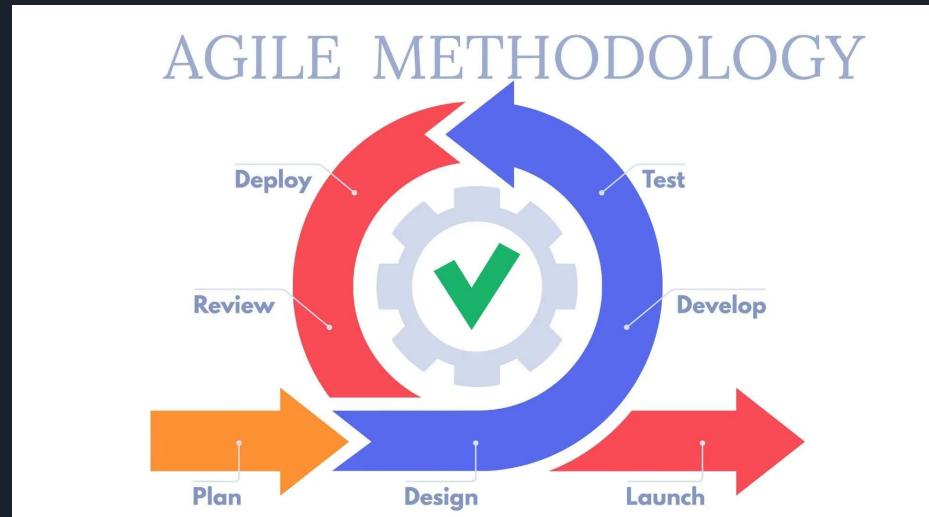
- Desktop:
  - An Intel Pentium 4 processor or later that's SSE3 capable.
- Mobile:
  - Any smartphone released after 2010.
- Stable Internet connection to browse the web:
  - At least 10 Mbps download speed per person.
  - At least 1 Mbps upload speed per person.

## Software

- Chromium based Web Browsers:
  - Google Chrome
  - Opera
  - Microsoft Edge
  - Etc.
- Windows 7, Windows 8, Windows 8.1, Windows 10 or later.
- OS X El Capitan 10.11 or later
- 64-bit Ubuntu 18.04+, Debian 10+, openSUSE 15.2+, or Fedora Linux 32+
- Android Marshmallow 6.0 or later

# Development Model: Agile

- Improves small team cooperation
- Improves communication between team members
- Flexible for adjustments or feedback
- Allows for continuous development



Jon, M<sup>10</sup>

# Development Model: Agile Sprints

Sprint 1:

Setup Dev Environments

Implement Version Control

Configure AWS

Startup Database

Sprint 3:

Image Search &

Matching

Image Upload

Whitelisting

Sprint 5:

User Notifications

DMCA Tracking



Sprint 2:

Profile Creation

User Identification &

Verification

User Interface

Sprint 4:

DMCA Generator

Email Generation &

Dispatch

Sprint 6:

Penetration Testing

Sanitization

# Technical Risk Matrix

		Impact				
		Very Low	Low	Medium	High	Very High
Probability	Very High					
	High					
	Medium		T-2	T-1		
	Low					
	Very Low				T-4	T-3

## Technical Risks

- T-1: Matching API yields a false match
- T-2: Market does not comply with DMCA.
- T-3: ID API does not correctly verify identity.
- T-4: Automatic DMCA has wrong information

## Technical Risk Mitigations:

- T-1: User verifies art is theirs before sending DMCA.
- T-2: Flag art that reappears in the market place and notify user.
- T-3: Multiple ways to submit ID information
- T-4: Final verification check.

# Customer Risk Matrix

		Impact				
		Very Low	Low	Medium	High	Very High
Probability	Very High	Yellow	Yellow	Red	Red	Red
	High	Yellow	Yellow	Yellow	Red	Red
	Medium	Green	C-2	Yellow	C-1	Red
	Low	Green	Green	Yellow	Yellow	Yellow
	Very Low	Green	Green	C-3	Yellow	Yellow

## Customer Risks

- C-1: Users abuse the system by uploading/issuing DMCA for art they do not own.
- C-2: User doesn't know how to use the app.
- C-3: User forgets to issue the DMCA

## Customer Risk Mitigation

- C-1: Sign up using art accounts.
- C-2: Integrated User Tutorial.
- C-3: Timer that reminds user to cancel or send the DMCA

# Security Risk Matrix

		Impact				
		Very Low	Low	Medium	High	Very High
Probability	Very High	Yellow	Yellow	Red	Red	Red
	High	Yellow	Yellow	Yellow	Red	Red
	Medium	Green	Yellow	Yellow	Yellow	Red
	Low	Green	Green	S-1	Yellow	S-2
	Very Low	Green	Green	Green	Yellow	Yellow

## Security Risks

- S-1: Unauthorized access to a user account.
- S-2: Database Integrity.

## Security Risk Mitigation:

- S-1: Two Factor Authentication for Login.
- S-2: Use Secure Databases and Encrypt user data (AWS)



# Competition Matrix

		Competition		
Features		Art Guardian	DeviantArt Protect	Image Search Engines
	Art Match	✓	✓	✓
	Whitelisting Capabilities	✓	✗	✗
	Marketplace Monitoring	✓	✓	✗
	Stolen Art Alert	✓	✓	✗
	Automatic Takedown Requests	✓	✗	✗
	Monitor Takedown Requests	✓	✗	✗
	DMCA Catalogue	✓	✗	✗
	Artist Resources	✓	✓	✗



# Benefits

- Give artists the ability to automatically detect stolen art in NFT marketplaces.
- Automating the DMCA preparation and submission process for artists.
- Track DMCA takedown progress for artists.



# Art Guardian will not...

- Pursue legal action beyond a DMCA takedown request for the user
- Add watermarks or other features to uploaded art
- Prevent art theft before it happens



# Conclusion

- Art Guardian works to implement existing technologies to monitor stolen art in NFT markets.
- It will generate, send, and monitor DMCA takedown requests into one simple application.
- This is a new and evolving situation, and the digital art world needs a solution.



# 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](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. Jon, M. (n.d.). *Agile Method* [Diagram]. [Https://Mobile-Jon.Com/2021/04/05/Applying-the-Agile-Methodology-to-the-Modern-Workplace/](https://Mobile-Jon.Com/2021/04/05/Applying-the-Agile-Methodology-to-the-Modern-Workplace/).  
<https://mobile-jon.com/2021/04/05/applying-the-agile-methodology-to-the-modern-workplace/>



# Appendix

## Artist:

As an artist, I need to be able to sign in to my account to access the app.

As an artist, I need to be able to sign up for an account to join and protect my art.

As an artist, I need to be able to reset my password in case I forget my password.

As an artist, I would like a tutorial on how to use the app so I can properly protect my art.

As an artist, I need to be able to upload my art to keep my art safe.

As an artist, I would like to see a collection of the art that I have uploaded in order to know what is or is not protected.

As an artist, I would like to know which pieces of my art have been found on the NFT marketplaces so I can take further action.

As an artist, I would like to see information to help me protect my art so I can prevent theft.

As an artist, I would like to be able to issue takedowns of stolen art found on the marketplace so I can prevent an illegal sale.

As an artist, I would like Art Guardian to automatically generate DMCA takedowns for stolen art so I do not have to do that myself.

As an artist, I would like to be updated on the status of the DMCA Takedown so I can know when it is taken down or if I have to take further action.

As an artist, I need my information to be secure and private so I can remain anonymous.

As an artist, I would like to see information about the NFT using my art so I can see who stole it and what marketplace it is on.

As a NFT Artist I need to be able to whitelist my minted NFT so my own NFT doesn't trigger a theft alert.



# Appendix

## Tester

- As a back-end tester I need to be able to trigger the 2-Factor-Authentication for testing.
- As a back-end tester I need to be able to trigger a push notification for testing.
- As a back-end tester I need to be able to access the image database for reading and uploading images.
- As a back-end tester I need to be able to make a fake NFT to test our DMCA Generation system.
- As a back-end tester I need to be able to make a fake NFT to test our flagging system.
- As a back-end tester I need to be able to invoke the image matcher to receive test matching values.
- As a back-end tester I need to be able to make a fake NFT to test our Whitelisting system.
- As a back-end tester I need a testing mode for our app to access tests easier.
- As a back-end tester I need to be able to access the image database for reading and writing user information.
- As a back-end tester I need to be able to verify my identity using the Stripe-API.
- As a back-end tester I need to be able to access the email API to send test emails.



# Q&A