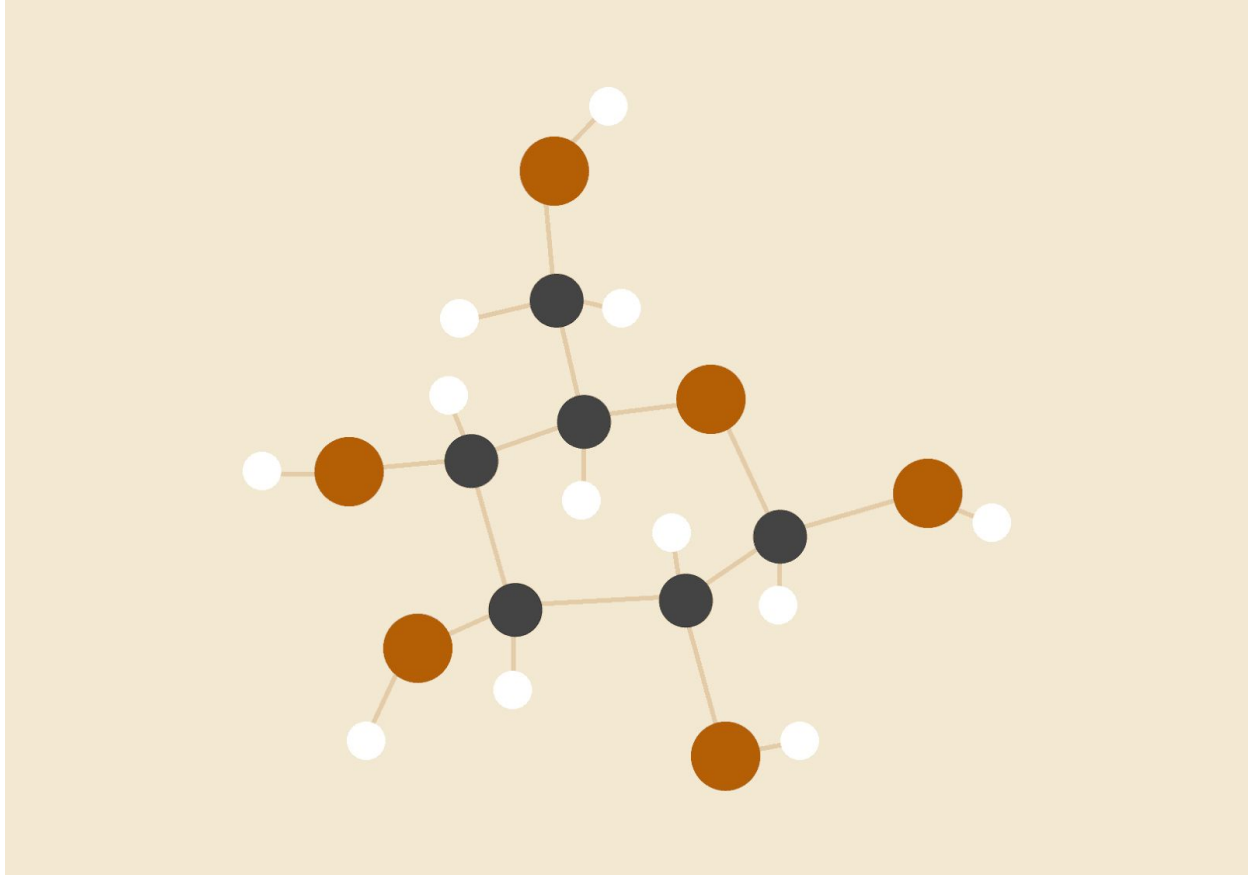


Project Proposal: Trace

“An image-sharing platform featuring steganographic tracking.”



[Group 4]

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Prof. Callahan -- Web Science Systems Development

Proposal Summary

Trace is an image gallery that additionally provides a unique steganographic tracking service for artists, photographers, and other visual creators who upload exclusive images on the web. For a price, creators can create private albums of images they can show to a select group of others, such as customers or work-partners. Before the image is served to any member of that select group, Trace will identify who is looking at the image and mark the image with a hidden “fingerprint” with that information. In normal cases, the image is viewed and enjoyed, and then that group member will continue browsing other images on our service. However, should the user decide to reupload the image elsewhere, that fingerprint is embedded, and travels with the image. Once the reuploaded image is found elsewhere, the artist can upload the infringing image to determine who leaked it. What creators will do with this information is up to them.

Trace intends to provide a valuable service for commercial creators, and will compete with other image galleries on the basis of being able to render this particular steganographic service. It is intended to complement creators’ existing image distribution methods, such as those who upload their work to Patreon, Twitter, and other social media websites. For our non-commercially-inclined audiences, Trace provides a free service to host images and public image albums that can be freely accessed by anybody at any time, but without any capacity to restrict who can view what album or make use of steganographic tracing. This arrangement will allow users, creators and consumers alike, to better enjoy art knowing that their creators will see their work protected and their fans will better enjoy the art they paid to look at exclusively, knowing that Trace provides the tools to help enforce that arrangement.

Trace's Problem Space

Artists, photographers, and all those who produce and distribute images for any purpose, whether they be hobby or commercial, operate in a fragile arrangement: they produce their images, determine which will be released for free and which will be made exclusive, arrange to sell access to the exclusive images, and can only trust those images will stay with those who have purchased that access. Some platforms exist to manage that access, but the best they can do is delay the one event that ruins the arrangement: a buyer deciding to publicly upload the image elsewhere.

This is an unavoidable problem. When an image is sent to a computer and opened on a browser, users can download it. If they're somehow prevented from right-clicking and downloading the image, the user can just check their browser cache and get the image that way. If need be, they can just screenshot the picture. There is not a good way to control the image and what can be done with it after it is sent to the recipient. Anybody who purchases the access and is sufficiently motivated will eventually download the image. They can then choose to go to most other image platforms online and upload the image, thus eliminating the exclusivity that the artist and the other buyers agreed to.

The unfortunate truth of the matter is that these situations can not be fully prevented. For all of those who produce art, photos, and other images intended for exclusive audiences, there is no silver-bullet solution that solves this problem outright. If there is anything to be done about this problem, it must be approached from a different angle.

Trace's Solution to the Problem

Although we cannot prevent the problem outright, we propose Trace as a viable solution that allows image creators to track those who leak their images after the fact. A creator would first sign up for Trace and pay for our tracing feature, then set about uploading their images both free and exclusive. After determining which photos are exclusive, they can send invitations to whoever they like, who will then either log in with a preexisting account or create a new account and look at the photos as much as they would like. Trace will employ steganographic techniques to apply a special “fingerprint” to the visible image before it is served to the viewer. Should the user download the image and later upload the image elsewhere, the fingerprint remains. If the image is discovered, the creator can run the picture back through Trace and learn which of the invited users leaked the image without their permission.

What the creator does with that information is up to them. Trace is intended to be an image gallery with a decent attempt at a forensic tool for determining who violates the exclusivity arrangement. With Trace, we expect that whatever the creators do to respond to the infringement will create a disincentive for future content-leaking behaviors, as it can be traced back to where the leak came from assuming that the only distributor of the exclusive content is Trace. At minimum, creators can always rescind that user's access to their images and all future releases to decrease the likelihood that the situation is repeated in the future.

Beyond the exclusive steganographic tracing feature, Trace functions as an image gallery with public and private albums, uploader pages, and easy interaction with other sites to make the images that creators want to share easily shareable.

Trace's Competitors

As it stands, there are dozens, if not hundreds, of image hosting services online. Services such as Google Images and Imgur, which allow basic image hosting and sharing, have been around for years. Although sites like these are worth acknowledging as competitors, their purpose and user base is much more general than that of Trace.

Online creators-- our target user base-- tend to rely on services with a more social aspect. Many of the creators that would use our website may in fact use a larger social media site as their primary means of proliferation, such as Twitter. These sites allow creators to easily reach a larger audience. However, image compression and automatic cropping can make these sites inconvenient to the creators that use them. Trace's focus on image hosting allows creators to preserve image quality in a way that may normally be unfeasible.

Additionally, many of these artists with a larger following may utilize a secondary service to share art, like Patreon. Sites like Patreon allow users to financially support their favorite creators with monthly subscriptions. In return, these "patrons" may be given access to exclusive content that creators won't post publicly. Patreon's business model differs from Trace, but both services cater to the viewer and creator, and both services provide a means of privately sharing content.

Where Trace differs from Patreon, as well as all of the aforementioned sites, is in its usage of steganography to trace the source of unauthorized image theft and redistribution. This can be an invaluable security measure for artists, who can often lose profits when their own work

is stolen by a third party. Ideally, Trace could even be used in tandem with sites like Twitter or Patreon, allowing users to link to their Trace content from other sites.

Trace's Targeted Users/Stakeholders

Creators of content: Trace's primary demographic. Specifically, these are creators of static image-based content (e.g. artists, photographers). As a straightforward image hosting service, Trace can serve any purpose ranging from personal image backup, to providing public portfolios, to preserving exclusive content for paying customers of said creators. For those with a paid subscription, creators can also benefit from being able to easily track down who leaked their stolen content that they would have otherwise lost profit from.

Casual viewers of content: These users, who would require an account to view content, would in turn benefit from creators who post on Trace. As an image hosting service, viewers can appreciate creator content at a higher resolution than they may normally be able to. The security that subscribed users gain from Trace is passed on to these viewers as well. Otherwise, creators that fear having their work stolen or reuploaded may be more reluctant to share their work, which leaves viewers with less content to enjoy.

Moderators of other sites: Since Trace is not necessarily a standalone service, but rather an additional means of security for creators, it's entirely likely that the images hosted on Trace may be reposted on other sites (whether or not by the original creator). Social media sites are heavily utilized by content creators and content thieves alike. Many of these websites have means of reporting stolen content, but this process can be tedious or lengthy. With the use of Trace, moderators are given infallible proof for these claims, which makes conflict resolution much simpler on both sides of the exchange.

Technologies We Intend to Use

1. Open-Source Steganography Library (To be determined)
2. MongoDB
3. Express
4. Angular.js (HTML, CSS, JavaScript)
5. Node.js

Functional Requirements

1. The ability to apply and decode information to and from images using a reliable steganography library.
2. Differentiation of permissions between unregistered, non-paying registered, paid registered users, and site administrators.
3. The ability for paid registered users to make their own image albums private and invite-only, restricting access to those registered who are invited to view the uploaded content.
4. The ability for artists tag images for search purposes.
5. The ability for any user to search for particular images on the basis of title, description, artist, album, and other tag data.

Non-Functional Requirements

1. Images should be quickly served before anything else, as users come to image galleries for images first and foremost.
2. The webpage to upload the leaked image should handle different types of input, such as copying the image link to get the picture, or handle file uploads.
3. The site should be aesthetically neutral and quiet enough so that the user's focus is naturally drawn to the photos they look at.

Note: Although this project will recognize users that have paid to make use of special features on the site, there will be no payment processing implemented in this project over the course of this semester.

An Estimated Project Schedule

February:

- 9th -- Submit project proposal for review and approval.
- 13th -- Begin designing and working on the website.
- 15th -- Determine which steganographic library we will be using for the project.
- 22nd -- Implement user registration, logins, and authentication.
- 28th -- Have the basic steganographic encoding and decoding implemented. The steganographic part of the site should be able to determine who is looking at the image and return that upon successful decoding.

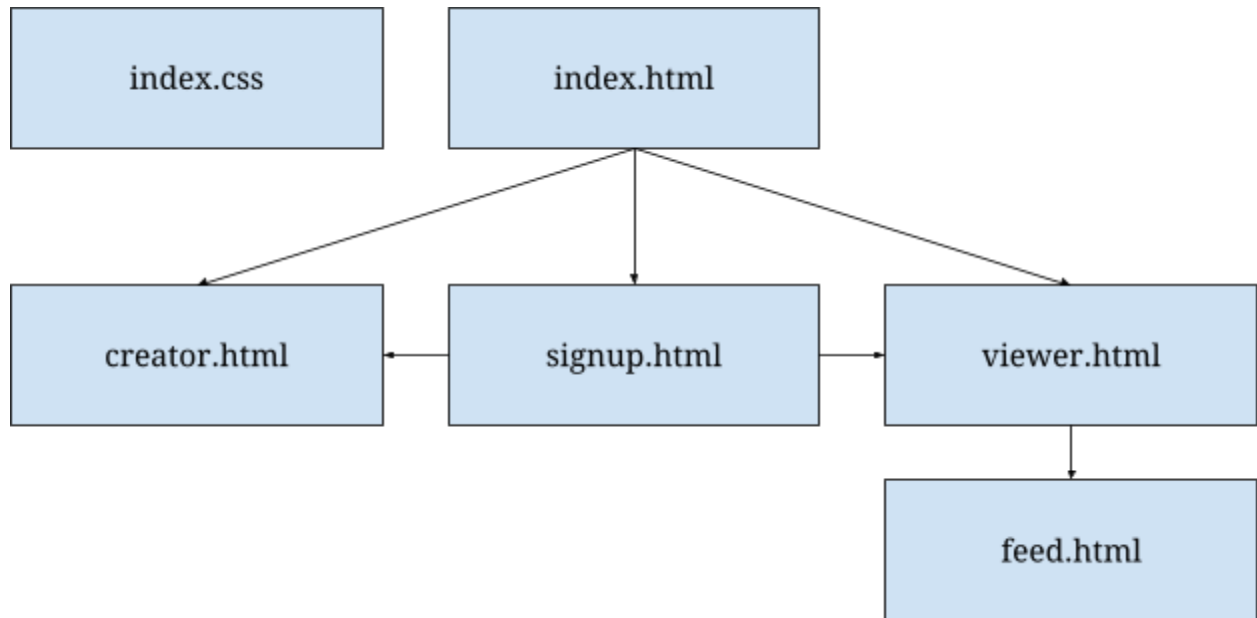
March:

- 5th -- Public and private photos and albums should be implemented.
- 12th -- Midterm presentations. Site should be able to demonstrate the steganographic use case.
- 19th -- Anybody should be able to use the website to look up its photos and albums using tags and other criteria.
- 26th -- User access to particular features should be permitted or restricted based on registration and payment status.

April:

- 2nd -- The ability to register for accounts should be implemented.
- 9th -- Registered users should have their own profile pages, complete with private albums of saved materials that nobody else can see and a feed of what they have publicly uploaded to the site.
- 16th -- Site cleanup should have commenced. Clean API pages for developers, FAQs and How-Tos for users, and an effort to make the aesthetics of the site consistent at minimum.
- 23rd -- Final presentations begin. Site should demonstrate non-registered users, non-paying registered users, paid registered users, and the steganographic tracing feature.

Site Map



As the UI of the website is going to be similar, `index.css` will be used on all html files to ensure consistent structure, fonts and colors. The homepage, `index.html`, will contain information about the website and tell the user what Trace provides. The `signup.html` page will be for first-time users, after they sign up / log in, they will be led directly to `viewer.html` or `creator.html`.

`Creator.html` page will have the necessary information about their account as well as another page, `upload.html`, to apply the steganography and upload their content. `Viewer.html` page `feed.html` page to access creators' content that they have subscribed to.

Wire frames of 2 pages

Homepage



Creator's page

