Trailmix

Project Part 2: Specification

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Table of Contents

Introduction

Data security remains an integral part of the ever growing age of technology. As digital privacy is not largely considered during the creation of applications, larger corporations are able to get away with tracking and logging user preferences and data; which may potentially be used in questionable ways. Commonly seen is third party advertisements and corporations selling user's data to other companies where they can then target those users with advertisements. With the increase of users connecting to the internet and signing up for applications such as Facebook, YouTube and other social media without being cautious of their digital footprint, the increased need for applications that can protect them against companies who may use their data.

Team 8's recommendation is to develop a data obfuscator application that will be implemented as a Google Chrome web extension, and rolled out onto the Google Chrome Web Store. Throughout the development process, the team had considered various features that were ultimately approved, denied, or changed from its original form. For starters, Team 8 had elected to use React, a JavaScript-based framework, as the primary development environment; eliminating the need to build the entirety of the application from the ground-up. The second change made by the team was the transition from a white-list to general user preferences. The primary reason for this change was to ensure customization of the plugin and maintain user control as they personally see fit. The last improvement we made was in the specificity for each feature we aim to implement, this includes: the layout and front-facing features of the drop-down application, the personal user information the application will not collect, as well as the time frame for which the user profiles and data logs will be reset.

One of Team 8's main goals for this project include security and prioritizing the anonymity of the users. To ensure the users are being heard, the team interviewed potential users to gauge how the users respond to advertisement tracking and their digital footprint and digital security. Team 8 then created a list of requirements that Trailmix will use to provide the best user experience. The requirements are classified in three different categories based on their importance in the project. Priority one consists of security features that will be implemented. Priority two consists of features that will be implemented that are essential to the functionality of the project. Priority three are quality of life and extra features that the team hopes to add on. Along with user cases, the team created a basic user interface to demonstrate the use of the application in a "pop-down" fashion.

Summary of Stakeholders' Interviews

Team 8 prepared ten interview questions for two external advisors (Jay Thom and Nathaniel Thom) and one member of Team 8 (Marc Montesa). These individuals were chosen for the interview because they all specialize in cybersecurity and the team felt it would be interesting to hear their point of view. The questions asked involved online habits as well as privacy in the digital age. Below are the ten questions asked along with a summary of answers:

1. What is your phone screen time?
The average is an hour and a half. Jay was an outlier; he doesn't own a cell phone, so therefore his screen time is zero.

2. In the past year how many times have you clicked on or purchased a product because of a targeted ad? (Estimate is fine)
Most said they have never purchased a product because of an ad recommended to them.

3. Do you find yourself clicking on recommended videos or do you search for what you need and end it there?
The three interviewees will occasionally click on recommended YouTube videos.

4. Do you worry about companies tracking your digital footprint?
They all worry about being tracked. One goes as far as avoiding cell phones, using DuckDuckGo, Protonmail, a VPN, etc.

5. Whether or not you have anything of use to the government, do you believe that online privacy is a right?
The consensus is that they believe privacy is a right, but it would be naive to think your online rights will be protected by the government or by private individuals.

6. Do you like having videos, ads, and posts being recommended to you?
They all dislike it; it reminds them they're being watched and treated as a product for advertisers.

7. Many applications are designed to keep you on for as long as possible. Is this ethical, unethical, or neither?
They see this as unethical, although it is the user's decision on whether or not to stay engaged with the platform.

8. Do you know how companies like Google use your data?

Most are aware of how Google uses their data, but no one really knows to what extent. “Any data that can be collected will be collected, and any data collected will be used.”

9. Would you be interested in using a product that randomizes user preferences to prevent targeted ads and recommended posts? (Yes or no)
All would be interested in using a product that Team 8 will build.

10. We have come up with a few possible product names. The first is Scrambledex (scrambles data). The second is CryptOwn (encrypt, and own your data). The third is Trailmix (the product randomizes your “trail”). Which do you like best?
“Trailmix” was decided as the best name.

High Level Business Requirements

One of Trailmix’s goals is to reduce the user’s targeted ads on the Internet to zero. This would not only save the user money by removing products they’re not interested in from their sight, but it would also force advertisers to find another targeting method. Companies would no longer have an incentive to keep the user on their application for as long as possible. Another goal is to prevent users from going through a “rabbit hole” of pictures, posts, and videos. If their preferences are shuffled, users are likely to be uninterested after some period of time. The ultimate goal of Trailmix is anonymity; users will be free to browse the web and use applications without worrying about being tracked.

Requirements Specification

Functional Requirements

[1]	FR-01	Trailmix shall allow for a user to check their logs in the extension
[1]	FR-02	Trailmix shall not hold any information regarding the users that does not pertain to Trailmix. This includes: name, ip address, cookies, etc.
[1]	FR-03	Trailmix shall update all profiles everyday at 5:00 PST with a new set of preferences
[1]	FR-04	Trailmix shall wipe all logs at 5:00 PST after FR-13 has been enacted
[1]	FR-05	Trailmix shall require users to create an account
[1]	FR-06	Trailmix shall require users to use a 10 character long password
[1]	FR-07	Trailmix shall require users to create a username without their real name
[1]	FR-08	Trailmix shall not show other users, even their fake profiles
[2]	FR-09	Trailmix shall include a list of preferences that are currently set for the user
[2]	FR-10	Trailmix shall include a way to remove preferences from a profile
[2]	FR-11	Trailmix shall require a reload of the page to enact any changes
[2]	FR-12	Trailmix shall use a block chain to collect preferences of the users
[2]	FR-13	Trailmix shall allow for the user to pause the extension
[2]	FR-14	Trailmix shall allow for the user to resume the extension
[2]	FR-15	Trailmix shall only collect the searched topics of the users in non-private mode
[2]	FR-16	Trailmix shall allow users to change their user settings
[2]	FR-17	Trailmix shall allow users to generate a new profile
[2]	FR-18	Trailmix shall show a list of websites that are not logged
[2]	FR-19	Trailmix will allow users to toggle on or off the list of not-logged preferences

[2]	FR-20	Trailmix will include a list of okay domains which will be logged
[3]	FR-21	Trailmix shall include a list of preferences that the user has already accepted
[3]	FR-22	Trailmix shall have a pop down user interface in the browser
[3]	FR-23	Trailmix shall allow users to include preferences

Non-Functional Requirements

NR-01	Trailmix will work on Windows 7+/MacOS/Linux
NR-02	Trailmix will work on Android/ iOS
NR-03	Trailmix will require Chrome browser
NR-04	Trailmix shall maintain a simple user interface
NR-05	Trailmix shall maintain an easy to understand interface
NR-06	Trailmix shall be implemented with JavaScript (React)
NR-07	Trailmix shall not be open source
NR-08	Trailmix should never collect user information including: name, ip address, etc.
NR-09	Trailmix shall maintain user privacy and security
NR-10	Trailmix shall only take up the minimum amount of computer resources

Use Case Diagram

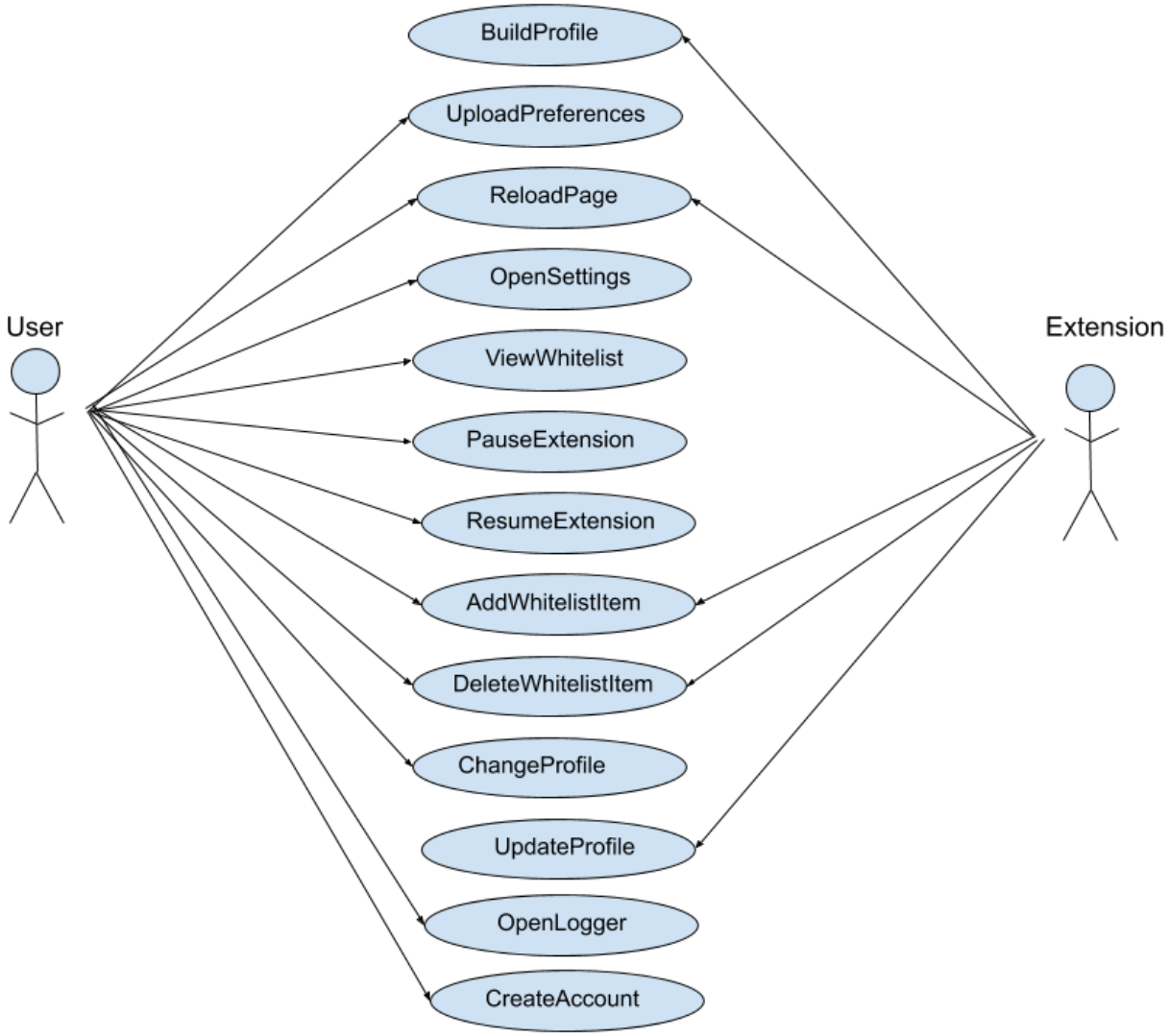

Figure 1: Use case diagram for Trailmix.

Detailed Use Cases

ID	Use Case	Description

UC01	BuildProfile	The extension will generate a new profile based on data preferences that were pushed onto the blockchain network.
UC02	UploadPreferences	The user can upload specific user preferences to the blockchain network.
UC03	ReloadPage	Once a setting has been changed, the user can press reload to reload the page. This will then enact the changes made.
UC04	OpenSettings	The user can press the settings icon to enter user settings. This is where the user can view and change preferences.
UC05	ViewWhitelist	The user can view their list of preferences which influence the recommendations they see.
UC06	PauseExtension	The user can turn off the extension temporarily by pressing the power button.
UC07	ResumeExtension	The user can enable the extension's functionalities by pressing the power button.
UC08	AddWhitelistItem	The user can add an item to their whitelist. This list influences what recommendations they see.
UC09	DeleteWhitelistItem	The user can remove an item from their whitelist. This list influences what recommendations they see.
UC10	ChangeProfile	The user can press a button to get a different profile from the blockchain network.
UC11	UpdateProfile	The extension will pull a new profile from the blockchain network and set it as the current profile.
UC12	OpenLogger	The user can check the logs for the extension.
UC13	CreateAccount	This allows the user to create an account to use the extension.

Detailed Templates for Use Cases

	Use Case: ReloadPage
Use Case ID	UC03

Actor	User
Precondition(s)	1. User has entered the settings 2. User has made a change within settings
Flow of Events	1. A button appears with a reload icon 2. User clicks the icon
Postcondition(s)	1. Page has been reloaded

	Use Case: AddWhitelistItem
Use Case ID	UC08
Actor	User
Precondition(s)	1. The user is viewing the Whitelist 2. The user has entered edit mode
Flow of Events	1. User clicks the add (+) button 2. User types in keyword 3. User presses “enter” 4. User saves changes and leaves edit mode
Postcondition(s)	1. A new preference has been added

	Use Case: BuildProfile
Use Case ID	UC01
Actor	Extension
Precondition(s)	1. User has uploaded preferences to profile
Flow of Events	1. The extension groups those user preferences with preferences from other users 2. A new profile based on preferences of multiple users is created

	3. Profile is sent to the blockchain
Postcondition(s)	1. A new profile has been generated

	Use Case: UploadPreferences
Use Case ID	UC02
Actor	User
Precondition(s)	1. User has opened settings
Flow of Events	1. User selects user preferences a. user can select specific preferences or select all 2. User clicks “upload”
Postcondition(s)	1. More user preferences are in the blockchain network

Traceability Matrix

	UC01	UC02	UC03	UC04	UC05	UC06	UC07	UC08	UC09	UC10	UC11	UC12	UC13
FR-01												■	
FR-02				■									■
FR-03	■											■	
FR-04													■
FR-05				■									■
FR-06				■									■
FR-07													■
FR-08	■												■
FR-09	■	■								■	■		
FR-10										■	■		
FR-11			■										
FR-12		■									■		
FR-13							■						
FR-14						■							
FR-15		■										■	
FR-16				■									
FR-17		■								■	■		
FR-18					■								
FR-19					■	■	■	■	■				
FR-20					■				■				
FR-21					■			■					
FR-22	■												
FR-23					■			■					

Initial Snapshots of the Proposed User Interface

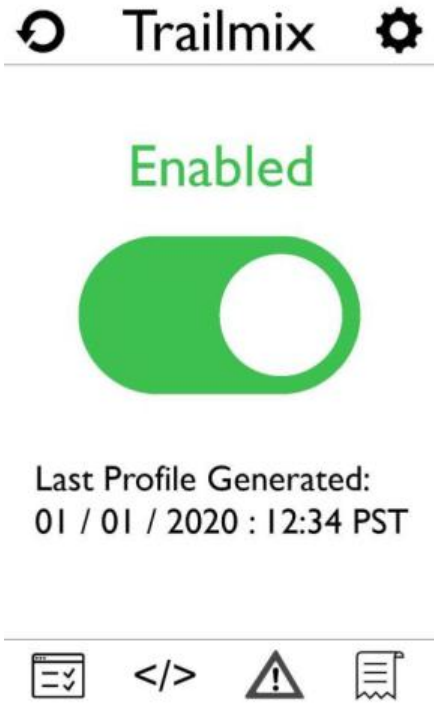

Figure 2: Our proposed design for the drop-down browser extension. This proposed minimalist design allows for the ease-of-use between enabling and disabling the application.

Figure 3: When the application is disabled for any reason, the user is alerted on the icon below.

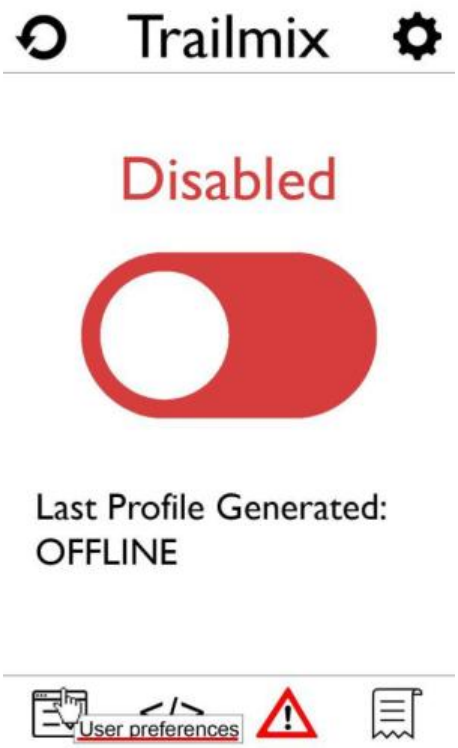

Figure 4: User preferences. Ideally this is where the black/whitelist is implemented, as well as the individual user options.

Figure 5: Script log. This inspect the elements of the page.

Figure 6: User alerts. This is generally from if the application is disabled, if there's an update, or otherwise.

Figure 7: User logs, based on what and where does the user browse -- similar to a history.

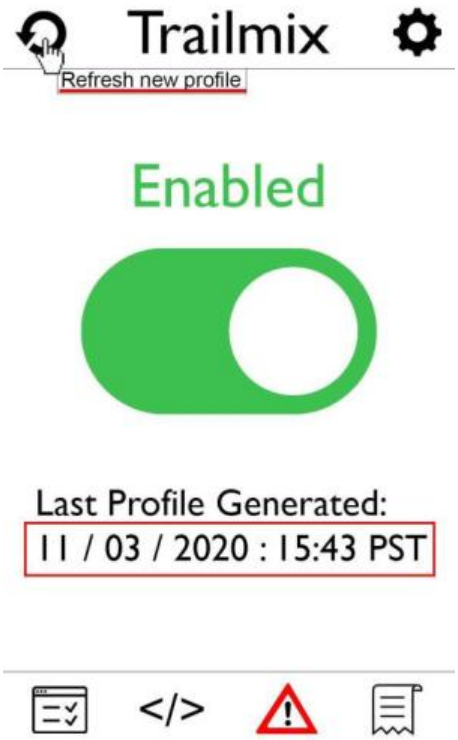

Figure 8: Refreshes the user's browsing profile and logs. This also updates when the profile generated in the main body of the application.

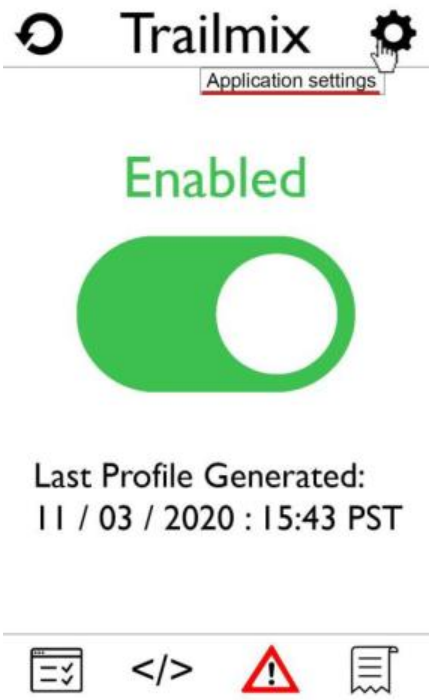

Figure 9: Application settings. This differs from the user preferences, as this specifically to change quality-of-life options for the app.

Glossary

A

Algorithm	A process or set of rules or instructions to be followed in either calculations or problem-solving operations in order to make a computer perform a specific task.
Anonymity	The quality or state of being unknown.

B

Blacklist	A list of objects or things that is regarded as untrustworthy.
Blockchain	An immutable, securely hashed record of user data or transactions, distributed over a peer-to-peer network. Often defined as a digital ledger, a "block" Blockchain is made up of three components: the data, the hash of the data, and the hash of the previous data. The hash to the previous block of data is what creates the chain illustration often attributed to this concept. This provides a security benefit as if one specific block of data were to be altered, then every block in the chain from that point after must be altered as well.
Browser Extension	A module for an internet or web browser to add functions and features for day-to-day browsing.

C

Cookie	Saved information about a user, based on their search history
Computer Script	A list of commands that are executed by either a program or a scripting engine, mainly used to automate processes or generate some desired outcome.

D

Digital Footprint	Trail of data created while using the Internet.
Domain	A domain name is an identification that defines the administrative authority or control within the internet. (e.g., .com, .net, .gov, etc.)

E

Encryption	Process of encoding information.The process of encoding information into secret code to hide the true meaning of the information.

F

Framework	A platform that provides a generic functionality for which the user may stage applications, that provides a library, compiler, and other developer tools to streamline the development process. In simpler terms, it is a general foundation that a program can be built on top of. An example of this would be React.

I

Incognito	Incognito or private browsing is a feature of web browser's that allows the user to search without saving search history and cookies.

L

Logger	A piece of software used to track a systematic recording of events, observations, and measurements.

O

Obfuscation	To make something obscure, unintelligible, or otherwise unclear to where it cannot provide any relevant information.
Open Source	Denoting software for which the original source code is made freely available and may be redistributed and modified

U

User Interface	The means by which the user and a computer system interact, in particular the use of input devices and software.

V

VPN	Virtual private network, or VPN, extends private networks over public networks to enable users to send and receive data across public networks as if they were using a private network

W

Web Browser	A way to retrieve information from the internet. Also called an internet browser.
Whitelist	A list of objects or things that is regarded as trustworthy.

List of References

Carbo, J. “Don’t Just Rely on Data Privacy Laws to Protect Information,” Security Magazine, Journal, accessed on November 3rd, 2020 :
https://www.securitymagazine.com/articles/91775-dont-just-rely-on-data-privacy-laws-to-protect-information
This journal emphasizes the importance of data security, stating that while there are various laws that help preserve user privacy, many of these can be interpreted in ways that still forgoes user confidentiality. The journal also describes the best practices in preserving data privacy while browsing through the web.

Goldfarb A., Tucker C. “Privacy Regulation and Online Advertising,” MIT Open Access Articles, Journal, accessed on November 3rd, 2020 :
https://dspace.mit.edu/bitstream/handle/1721.1/64920/Tucker_Privacy%20Regulation.pdf%3Bjsessionid%3D25925F96FD45465F5B3993D583629D45?sequence%3D1
This journal describes how advertising agencies use consumer data to target users in various advertising campaigns. This also writes of the European Union's response to these agencies, creating various laws with the intent to secure user privacy; however, this also demonstrates the loss of effectiveness against these targeted campaigns based on the generalized content and presence of some of these companies.

Google Chrome, “Getting started Tutorial,” website, accessed on September 27th, 2020:
https://developer.chrome.com/extensions/getstarted
This website is very valuable to Team 8’s ability to develop a Google chrome browser extension. This just gives the basic idea of how to build an extension and how to upload it to the Google Chrome Web Store where all the browser extensions are.

React, “Tutorial: Intro to React,” website, accessed on October 10th, 2020:
https://reactjs.org/tutorial/tutorial.html
This website will allow Team 8 to use JavaScript’s React to create Trailmix. Without using react, the whole extension would be done in HTML, CSS and JavaScript, however with the help of React, team 8 can reduce the amount of HTML and CSS that needs to be written and thus make the code simpler and easier to read and understand. Less code also means less overhead time which is important for a security application.

Tucker, C. “Social Networks, Personalized Advertising and Privacy Controls,” MIT Open Access Articles, Journal, accessed on November 4th, 2020 :

https://dspace.mit.edu/bitstream/handle/1721.1/99170/Tucker_Social%20networks.pdf?sequence=1&isAllowed=y
This report reflects on how advertising data is shaped based on the user's browsing habits and preferences through the use of a randomized field experiment. The journal describes the effectiveness of the advertisements based on how much information the users provide to the website, and shows how proportionally likely it is for a user to explore an advertisement based on their browsing habits.

Xu L., Jiang C., Wang J., Yuan J., Ren Y. "Information Security in Big Data: Privacy and Data Mining," IEEE Access, Journal :
https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=6919256
This journal elaborates on how privacy-preserving data mining (PPDM) can help resolve some of the privacy issues related to data mining. The journal also describes the four types of users involved in data mining applications and the various methods each user can employ to protect his or her sensitive information.

Contributions of Team Members

Team 8 worked together on the cover page, table of contents, glossary and references pages.

Sarah Cooper worked on the functional and non-functional requirements and the traceability matrix (along with Matthew). She spent about 3 hours total.

Matthew Deagen worked on the use case portion. This includes the use case diagram, use case descriptions, and detailed use case descriptions. He spent around 3 hours total.

Leo Galang worked on the interview questions and the business requirements. He spent 3 hours total.

Marc Ace Montesa worked on the introduction and the concept screenshots of the application. He spent around 3 hours total.