UBlock: Distracting App Redirector

CS 4980: Capstone

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ABSTRACT

How can software be used to reduce screen time on mobile devices?

A vast majority of young Americans report that they believe they spend too much time using their smartphones. On iPhone, Apple provides the *Screen Time* app and third-party apps via the App Store to help users set app time limits - however, existing solutions are unsatisfactory due to the minimal friction they provide in accessing distracting apps and the easy workarounds that are built into these limits.

This technical capstone set out to design and implement a more effective iPhone application that helps user's reduce overall screen time. Using Apple's IDE (*Xcode* with *SwiftUI*) and Apple's *Screen Time* API, a minimum viable product was developed that allows users to select distracting apps, block them during specified hours, and create a list of productive alternatives that they would rather do besides wasting time online.

Although a larger technical tool was initially planned, technical hurdles and software capabilities lead to a shift in scope for the project, resulting in a focus on the features that truly define how users interact with the proposed application.

The successful development of the minimum viable product means that it can now be uploaded to Apple's App Store and distributed to the public to be used to reduce individual screen times.

CCS CONCEPTS

• Human Computer Interaction (HCI) • Software and its engineering • Data management systems • Development frameworks and environments

1 Motivation

As our lives become increasingly digitized, excessive screen time is becoming common: "During July 2021 through December 2023, one-half of teenagers ages 12–17 had 4 hours or more of daily screen time (50.4%)" [1]. Yet, many overlook that excessive use has been associated with negative mental outcomes including depressive symptoms [2] and disrupted sleep [3], necessitating change as more users are affected by this phenomenon.

Unfortunately, this issue is only progressing as devices become more accessible and are used by younger demographics. Excessive screen time among children has been found to negatively impact sleep duration and parental control [4], stifling development in ways measurable but also in ways still unknown.

Progress has been made in finding a solution. Researchers have helped define what factors contribute to addiction, using findings to help social media providers and health professionals mitigate it [5]. Physical activity is found to be inversely associated with negative mental health symptoms [2]. Multifaceted teams have combined public health and economic findings with legal analysis to provide recommendations to lawmakers [6].

This project continues off of work suggesting that technical tools themselves can be helpful in reducing screen time. Promising results have emerged in studies where users addressed problematic usage via device settings and screen time trackers [7].

In interviews conducted with 23 potential UBlock users (a majority of them UVA undergraduates), over 90% admitted that they feel as though they spend too much time on their smartphones. Only 2 of the 23 tried installing an app (*Opal*) to try and limit their screen usage, though both uninstalled it after they found it was ineffective for them at its intended purpose.

Some companies, including social media providers (e.g. Instagram, TikTok) and device manufacturers (i.e. Apple) provide features that these companies claim are intended to help users reduce their screen time. These typically include daily limits that display screens blocking content once a specified threshold is reached.

However, many of these features are ineffective by design. The screens displayed by various providers often have buttons that allow users to bypass the limit. TikTok found that their daily limit feature only resulted in a 1.3% decrease in time spent on the app, and internal communications reveal that the company purposely directed its employees to avoid reducing the amount of time users spend using the service [8]. Meta's "Take a Break" reminders proved equally ineffective, with users choosing to continue using Instagram 40 times more often than actually choosing to take a break [9].

As such, an effective product needs to limit access to distracting applications in a way that is not easily bypassed.

Additionally, the interviews with potential users highlighted that there exists a desire for a technical solution that redirects users to productive alternatives from distracting applications instead of simply blocking said distractions.

2 Prior and Related Work

There exist applications one can install in an effort to reduce one's screen time, including but not limited to:

1. *Opal*
2. *one sec*
3. *Refocus*
4. *ScreenZen*
5. *Clearspace*

one sec is a standout, as this app uses the iPhone *Shortcuts* app to redirect users from distracting apps to *one sec* and forces them to take a breather before they can return to the initial distracting app. However, most of the other applications utilize Apple's *Screen Time* API to implement features that allow users to select a subset of installed apps and block said apps during preselected times of day.

Opal, for example, provides users with the ability to view their device usage data, set up specific schedules during which selected apps are blocked, compare their screen times with friends, and edit their profiles. However, like the features offered by Meta, TikTok, and Apple, *Opal* allows users to bypass app limits by taking breaks. The app also does not direct users towards productive alternatives. However, its base functionality is helpful as a guide to what an app blocker can look like and what features it can provide.

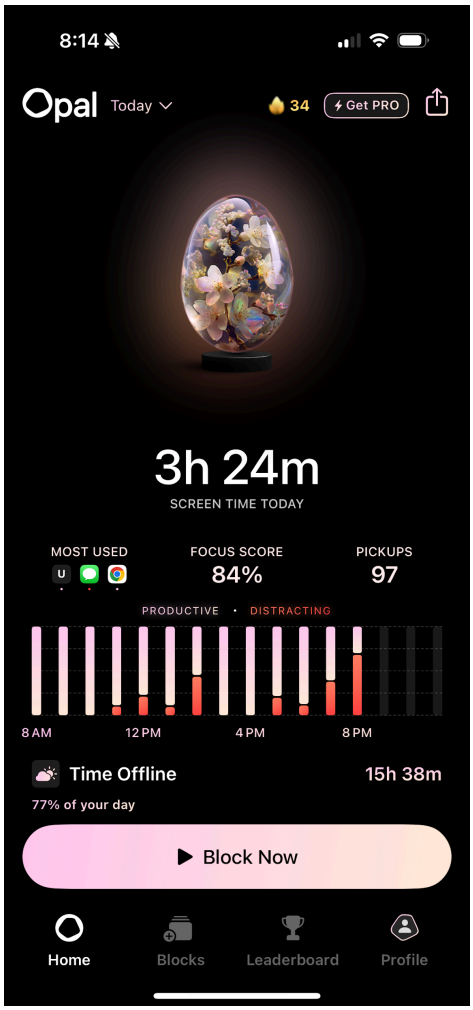

Figure 1: ***Opal*'s "Home" screen, which displays device activity data to the user [users can access the other features via the tabs located at the bottom of the screen]**

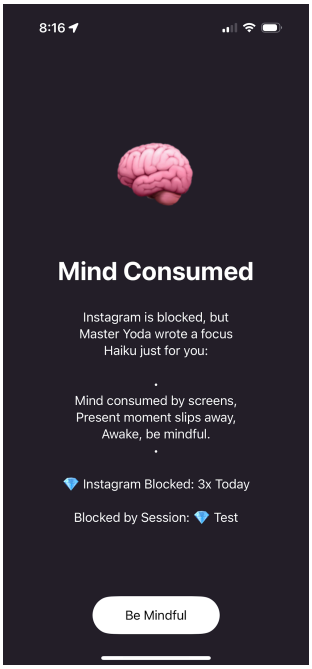

Figure 2: **Opening a distracting app during one of *Opal*'s schedules results in an `App Shield` being displayed [Clicking the button closes the app, and users can request breaks by returning to the *Opal* app]**

3 Approach

UBlock's design process started with customer discovery. Interviews with 26 individuals resulted in the software's requirements, with the two major one's being:

1. needs to limit access to distracting applications in a way that is not easily bypassed
2. redirects users to productive alternatives from distracting applications instead of simply blocking said distractions

In order to encourage user base growth, ideation also resulted in a leaderboard feature that encourages users to compare their screen times with friends. This functionality would be a primary aspect of the application, and thus would only function when a user had friends that also used the application. In theory, this would encourage a user to invite their friends to also download and use the app, encouraging the overall user base to grow.

Using these customer interviews and software requirements as a guide, drafts of the software's UI were created to help further guide the physical implementation of the software (Figure 3 and 4).

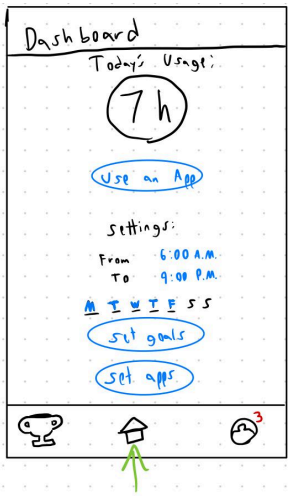

Figure 3: **This draft of the Home screen displays the user's aggregate screen time, allows them to set productive goals, set distracting apps, and manage a schedule during which the distracting apps are blocked. [Other screens were proposed to be accessible via the tabs at the bottom of the UI]**

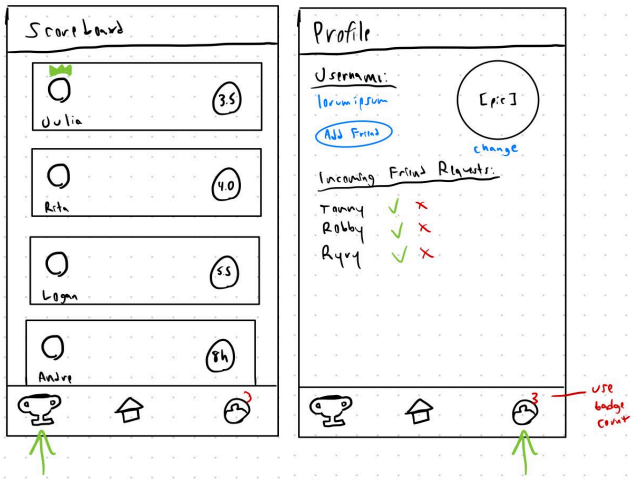

Figure 4: **Proposed Leaderboard and Profile screens [users would be able to customize profiles, add friends, and view their friends' screen times]**

Apple represents 57.93% of the U.S. Mobile Vendor Market Share [10]. Thus, in order to develop a mobile app that is accessible to a majority of the smartphone market, *XCode* was selected as the IDE of choice to develop a mobile application for Apple's iOS. As for programming the app, *Swift* and *SwiftUI* are the new standard languages used for

programming in *XCode*. Firebase was also initially selected as a "Back-end As A Service" to provide the cloud functionality necessary to create user profiles and add friends within the app.

In order to use Apple's *Screen Time* API functionality, the following frameworks were also imported and configured into the *XCode* Project: Family Controls, Managed Settings, and Device Activity. These frameworks provide projects with the ability to set restrictions and run code in the background based on timed triggers or device activity thresholds.

`SwiftData` was used to provide data persistence within the project, so that selected apps, written goals, and chosen schedules were not erased once the application was closed and reopened.

4 Challenges

In programming the application, it became quickly apparent that the leaderboard functionality would be difficult to implement. Apple runs most of its Device Activity features in a sandbox environment that does not let developers obtain access to an iPhone's usage data. Developers can customize Device Activity Reports, thus changing how usage data is displayed to the user, but the data itself is protected by Apple.

As such, it is not immediately obvious through the available documentation how an iOS developer can export a user's usage data to a cloud database where it can be used to share with others, so for the sake of completing this project within the allotted time (a semester), the profile and leaderboard screens and their associated functionality were scrapped.

It was also initially intended to display the user's input goals back to them via the Managed Settings `App Shield`, so that opening blocked apps immediately encouraged the user to pursue other activities. However, the `App Shield` runs in a sandbox environment, and its configuration cannot be adjusted outside of the title text/color, subtitle text/color, icon, and button text/color.

5 Result

The resulting application is a minimum viable product that allows users to select apps they consider distracting, create a list of productive alternatives they'd rather commit their time to, and set a schedule during which the distracting apps are blocked via the *Screen Time* API's `App Shield`.

The app's functionality is centered around one main screen (Figure 5) where the user can view their personal configurations and choose whether or not to edit them. The screen is divided into three sections: "Distracting Apps", "Productive Alternatives", and "Schedule".

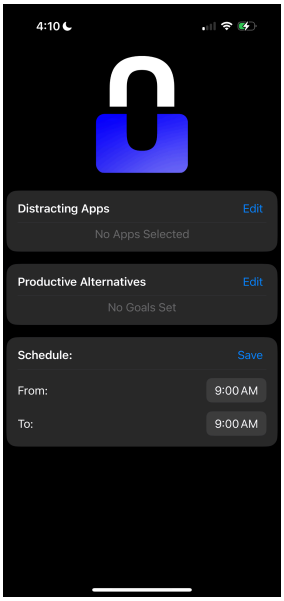

Figure 5: **UBlock's main screen, where selections are displayed [by default, the selections are empty and the schedule is set from 9:00AM to 9:00 AM]**

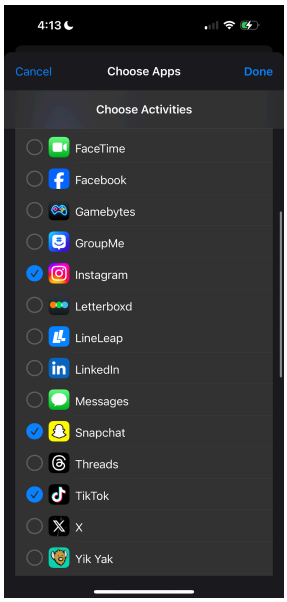

Figure 6: **Upon hitting "Edit" next to "Distracting Apps", the "Choose Apps" sheet is displayed [here, users can select apps they deem distracting, organized by category (e.g. Social, Gaming, etc.)]**

The “Distracting Apps” section displays the selected apps back to the user. Tapping “Edit” brings up a sheet (Figure 6) where users can select which apps they consider distracting, and this selection is later used to block said apps via an `App Shield`. The selection functionality is provided by the `Family Activity Picker`, a predefined view provided by the Family Controls framework.

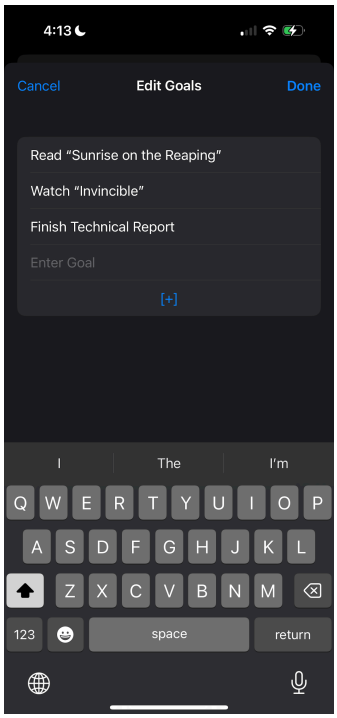

Figure 7: **Upon hitting “Edit” next to “Productive Alternatives”, the “Edit Goals” sheet is displayed [here, users can add goals via the [+] button and give them names by typing into their respective text fields]**

The “Productive Alternatives” section displays the list of user defined goals. Tapping “Edit” brings up a sheet (Figure 7) where users can add goals via the [+] button, write a text description for each goal, and save them to memory.

Hitting “Cancel” on either the “Choose Apps” or “Edit Goals” sheet reverts any changes, while tapping “Done” saves all changes to memory.

The “Schedules” section provides two `DatePicker` wheels that allow the user to set “From” and “To” times, during which the selected distracting apps will be blocked. For example, setting 9:00 AM and 5:00 PM respectively will block the apps from 9AM to 5PM. Hitting “Save” starts the Device Activity Monitor extension, which then blocks the selected distracting apps during the selected times.

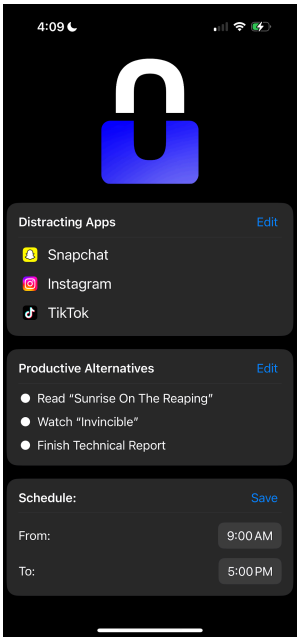

Figure 8: **UBlock’s main screen, now populated with sample data [distracting apps have been chosen, goals have been set, and a schedule has been saved]**

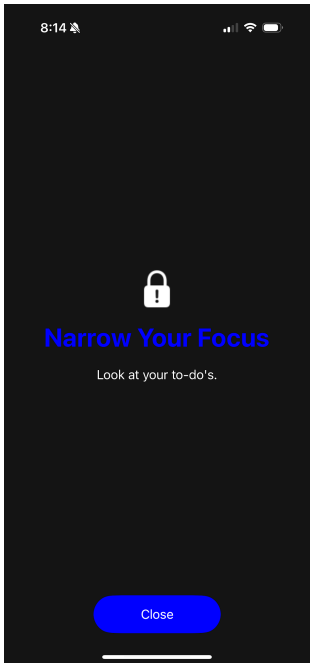

Figure 9: **UBlock’s `App Shield`, encouraging users to check their personalized goals [this is displayed whenever the user tries opening one of the selected distracting apps during the saved schedule]**

5 Planned Features

While the MVP is functional and meets the defined user requirements, more can be done to make it an effective tool used to reduce a user's screen time.

Currently, once a user opens a blocked app and views the "Narrow Your Focus" `App Shield`, they must close the app and reopen UBlock in order to view their list of productive alternatives. In order to redirect users towards viewing their productive alternatives directly, Apple's *Shortcuts* functionality can be utilized to UBlock instead immediately when a distracting app is opened. *one sec*'s utilization of this functionality proves that doing so is possible.

The leaderboard functionality is still a promising way of encouraging a growing user base, but also a feature that would encourage users to build a supportive community focused on reducing individual screen times. While it is not immediately obvious how a leaderboard like this can be physically implemented, *Opal*'s leaderboard feature suggests that it is possible and that further research is required in order to figure out how to do so.

Although potentially problematic, social media can still provide benefits that users of UBlock may want to experience in healthy doses. As such, a way to bypass the blocking functionality UBlock provides via short intervals would be an effective way to discourage problematic usage without forcing users to lose access to apps entirely during set times. Adding a bypass feature that allows users to take breaks up to 10 minutes could be an effective way to allow some leniency, but then disallowing users from bypassing the blocking functionality for double the selected time afterwards would be an interesting way to discourage users from bypassing the `App Shield`.

As well as allowing users to bypass blocking schedules in select cases, it would also be important to keep users focused on their intended tasks to protect them from getting distracted during such bypasses. This can be achieved by forcing the user to type in a task they want to complete during the bypass into a text box, select the desired time of the bypass (up to 10 minutes), and then display this text back to the user during the bypass using Apple's `Dynamic Islands`. `Dynamic Islands` are an iOS overlay that surround the front facing camera on Apple's latest iPhones, and this overlay persists even when using different applications. Thus, by displaying the user's goal back to them, this could potentially keep users focused on specific tasks even while using apps that are designed to distract them and keep them engaged.

Ultimately, this capstone project serves as an important step towards a much larger and more sophisticated tool. However, it still offers promising functionality in its minimum viable product state, and can already be used by others to help them reduce their screen time on distracting apps.

ACKNOWLEDGMENTS

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