

Wink: Capstone Final Report

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Introduction

Wink is a mobile iOS app that reminds users to record their sleep and mood, then presents the user with data to help them better understand their mental health. The idea for Wink came from EECS 442: Mobile App Development. In this class, we were tasked with designing a minimal viable product of an idea that we came up with that would be beneficial to some group of people. While in EECS 442, I worked together with Ian Bertram and Katie Knister to come up with the idea for Wink and an initial prototype before continuing work individually on the app as part of my Engineering Honors Program Capstone project.

One of the early, significant challenges we faced was deciding what we wanted to build. Brainstorming and generating ideas was a major focus of EECS 442 as the professor, Elliot Soloway, believed it was one of the, if not the most important stage of the design process. Our team spent a week generating ideas, many of which were ridiculous and unfeasible before we settled on the idea to build an app that managed lines for virtual career fairs. As we started working on this idea and planning out the app's design, we soon realized that none of us were too excited about the app. At this point, we decided we needed to pivot. Even though we had done a couple weeks of work on our virtual career fair idea, we wanted to build something we were passionate and excited about, we just didn't know what.

While our team was busy trying to come up with a new idea we could pursue, a team member of ours had a conversation with a roommate who has bipolar disorder and regularly sees a therapist. This individual expressed their frustration with the difficulty of tracking the mood and sleep information their therapist would ask them for each week. The person would try to record how much they slept and how well their day was in a journal but often forgot. Furthermore, even when they remembered to record the information, the individual had a hard time manually parsing from their notebook how their sleep affected their mood when the therapist would ask. Our team member relayed this story to our team and presented as a project we could solve with an app. This piqued everyone's interest and we decided to pursue the idea. This was largely because we were excited about building something to help people with their mental health which we saw to be a very important cause.

We decided we would build an app that reminds users to enter the number of hours they slept in the morning, and a rating for how good their mood or mental health was in the evening. The app would then be able to conveniently store this data in such a way that it could compute statistics that would help the user see the correlation between their sleep and mood, rather than having to manually parse or calculate it themselves.

Questions Addressed

As we set out to build our sleep and mood tracking app, there were two main questions that drove us. The first of which was, “Will the app be quick and easy for people to use?” In order for people to use our app, we recognized that it must be convenient. Even if we could produce valuable statistics and insights with the app, people would not use it if it was cumbersome or clumsy to enter the necessary data each day. This question of convenience also goes back to our teammember’s roommate’s motivating anecdote about forgetting to write their sleep and mood in a notebook each day. By focusing on simplicity and ease of use, we believed we could minimize the rate at which people forget to record their data.

The second question we wanted to address was “Will seeing the correlation between sleep and mood provide users with valuable information?” Even if our app was able to address the first question by being extremely convenient, people would not use our app if it did not provide value. We saw the value of our app as its ability to store the users data and efficiently compute statistics that would be cumbersome to do by hand even once, let alone on a regular basis. Since we believed the answer to both of these questions had to be yes for our app to be useful, we used them to drive our development decisions and obtain user feedback.

In addition to these two main questions, a third question that we took very seriously was, “Will users’ sleep and mood data be private and secure.” Since our app requires users to enter potentially sensitive data, we wanted to minimize its ability to be leaked or

exposed. For that reason, we decided to store all data client-side on the users' own device. By not using a server, the users' information would not have to travel over the network where it could potentially be monitored or intercepted and there would be no backend server containing the entire user base's information. Instead, by storing it on the user's iPhone we could rely on Apple's built in security system which is much stronger than anything we would be able to produce.

Methods and Results

The general method we used was an iterative design process. We would begin a cycle with idea generation, move into design and implementation, and finish with evaluation and user feedback. There were many benefits to this design model which and described in the discussion section of the report below. In total, our app Wink went through three complete design iterations, each of which will be discussed individually.

Design Iteration 1

In our first iteration we set out to build a functional minimal viable product. While we wanted to ensure it addressed our two main questions of convenience and usefulness discussed above in the questions addressed section, we were not concerned with including every feature we would eventually want in it. We decided the most important features were the ability to enter sleep data, the ability to enter mood data, and the calculation of a correlation between them. Screenshots from our app after the first iteration are shown below in Figure 1.

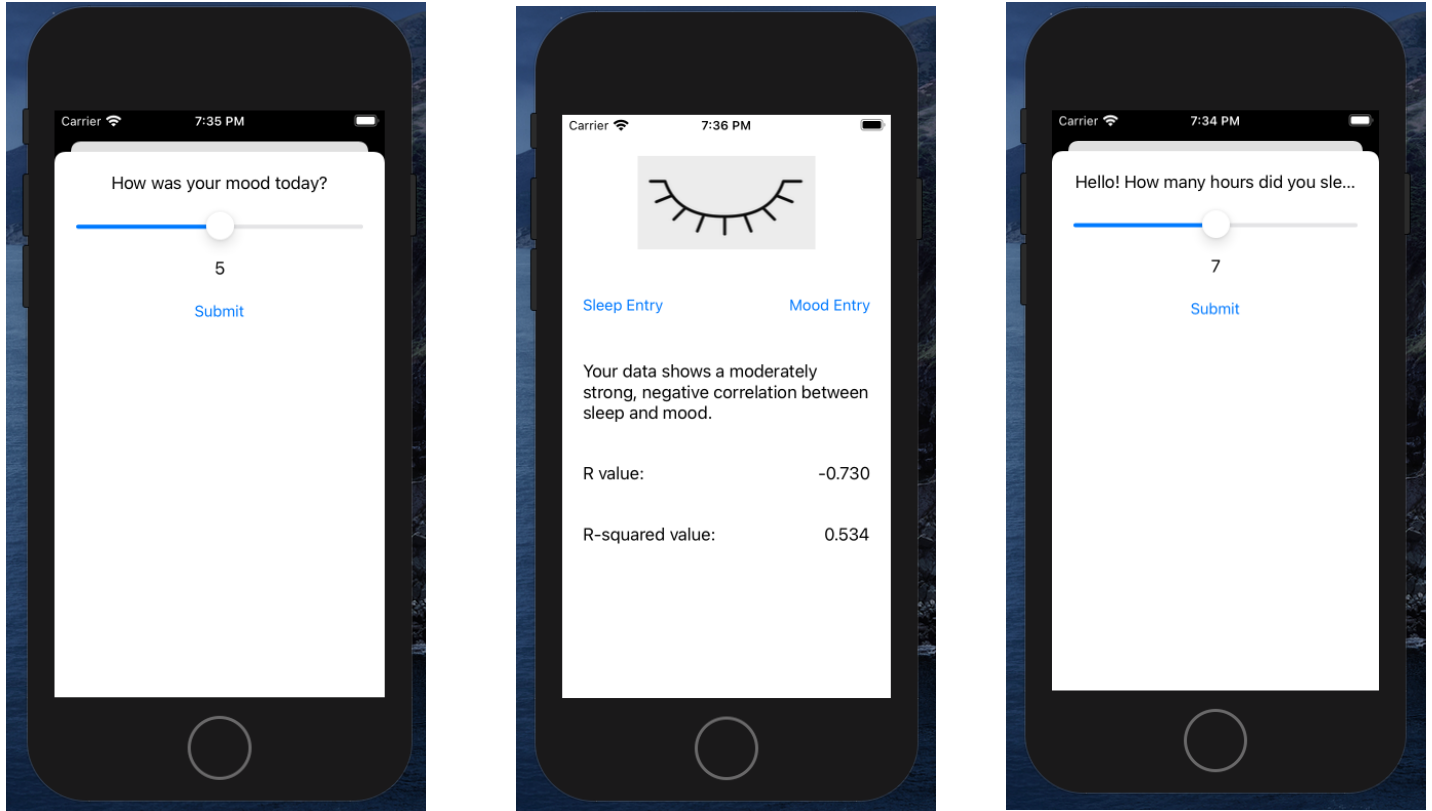


Figure 1: Screenshots from the first iteration

Additionally, our first iteration included reminder notification in the morning for the user to enter their sleep data and in the evening for the user to enter their mood data. The goal of this was to make the app more convenient and help prevent users from forgetting to enter their data.

After completing our first functional prototype, we began evaluating our app with user testing. This proved to be more challenging than we thought for a couple reasons. First, we were developing our app under Apple's university developer program which only allowed us to download our app on a limited number of devices. Second, since we were

working on this project during the COVID-19 pandemic, we were largely limited to the people we were living with to use as testers. Despite these limitations, we were able to recruit six testers to use our app for one week.

At the end of their trial with the app, we asked testers to rank the importance and their satisfaction with various features on a scale of 1-5. These features included the summary statement of the correlation, the r/r^2 values presented, the data input slides, and the reminders. A table summarizing these results with the testers average scores is presented below in Figure 2.

	Importance (1-5)	Satisfaction (1-5)
Summary statement	4.4	3.2
r and r² value	3.0	2.6
Data input sliders	4.2	3.8
Reminders	3.6	3.4

Figure 2: Summary of user feedback from six testers of first iteration

Looking at this data, we were able to make a couple key observations. First, the summary statement is very important, however, users do not find our version very satisfying. Second, users did not like the r and r^2 values that we (as the development team) thought would be very important.

Finally, we collected several user quotes to help guide our next iteration. These include:

“The summary statement was insightful but difficult to understand”,

“I want to be able to enter data for the previous day, like if I wait until after midnight”,

“I wish that I could see all the raw data for previous days”.

This feedback directly pointed to items that needed to be addressed in the next iteration of our app.

Design Iteration 2

The first step in designing our second iteration was reviewing our feedback for the first. From it, we narrowed in on four shortcomings to address. The first of which was that our summary statement was difficult to understand. We decided to address this by providing additional explanation about what the correlation meant rather than just stating it. The second issue we wanted to address was that users couldn't enter data for previous days. This was particularly frustrating for users when they wanted to record their mood when they went to sleep after midnight. To fix this, we added a feature to allow users to select any previous date when inputting data. The third problem was that users had no way to view the raw data of their previous entries. To fix this, we added a table that contains all the data ever inputted. Lastly, many users commented that there was not enough granularity in the sleep slider which we fixed by switching to 15 minute increments.

These changes, along with an additional statistics view, are shown below in Figure 3.

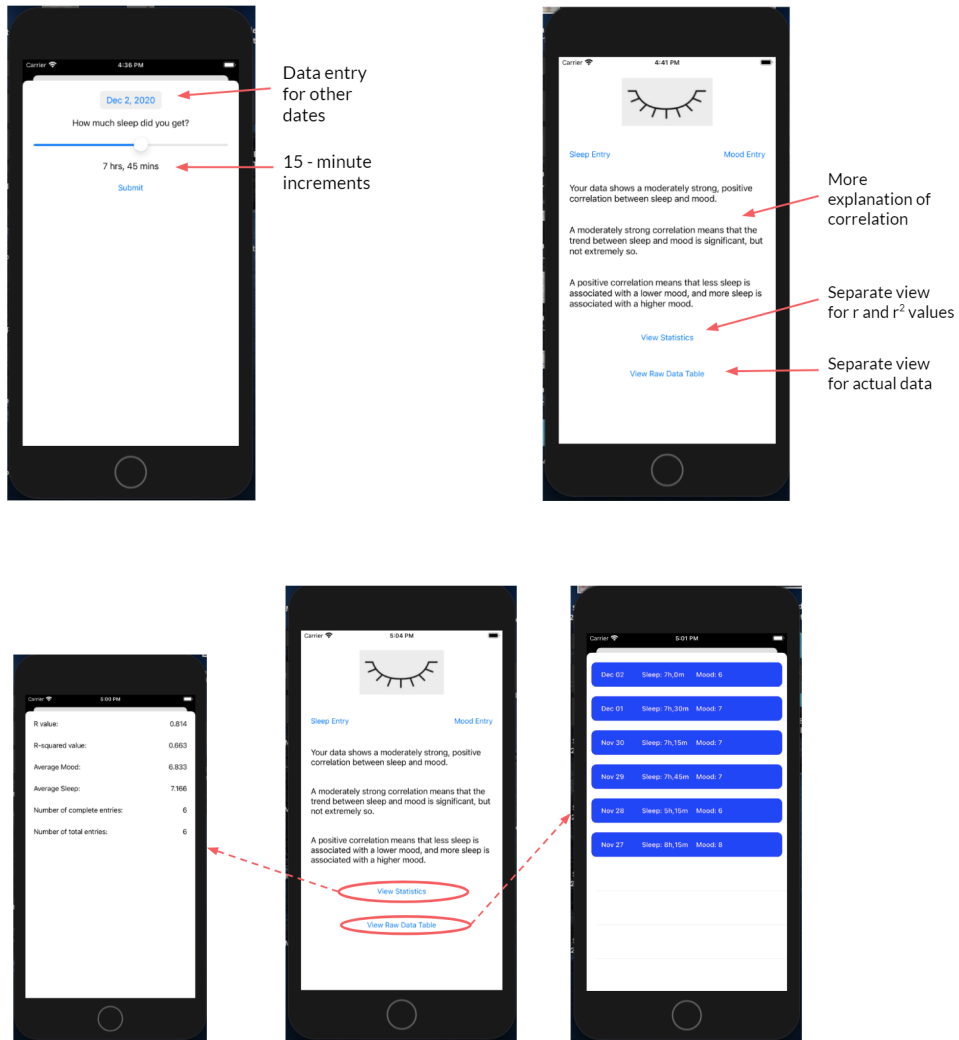


Figure 3. Screenshots from the second iteration

After completing our second iteration, we downloaded the new version of our app onto our original testers' phones and asked them to use it for another week. Once the trial was complete, we asked them to rate the various features of the app. Most of these features had a direct analog to a feature we asked them about in the previous iteration. For example, instead of r/r^2 value we asked about statistics since our new version contained statistics besides r/r^2 while our first did not. Figure 4 below shows average

ratings of each feature for importance and satisfaction while Figure 5 below shows how these ratings changed from our first iteration.

	Importance (1-5)	Satisfaction (1-5)
Statistics	4.6	4.4
Summary Statement	4.6	4.2
Data Input	4.8	4.6
Raw Data Table	4.6	4.4
Overall Product	4.2	4.4

Figure 4. Summary of user feedback from six testers of second iteration

	Increase in Importance	Increase in Satisfaction
Statistics	+ 1.6	+ 1.8
Summary Statement	+ 0.2	+ 1.0
Data Input	+ 0.6	+ 0.8
Raw Data Table	N/A	N/A
Overall Product	+ 0.4	+ 1.2

Figure 5. Summary of the change in feature ratings from iteration 1 to iteration 2

These results showed that our user ratings went up for every category from iteration 1 to iteration 2. In particular switching from stating the r/r^2 value to having a separate statistics view resulted in a 56% improvement in satisfaction. All of our feedback wasn't possible, however, as multiple users who did not have the latest iPhone versions often experienced a bug where the statistics page would sometimes display NaN (not a number) for values in the statistics page. Additionally, many users expressed interest in being able to see trends over time in their data.

Design Iteration 3

The feedback from our second iteration led to changes in our final iteration. The first issue addressed was the NaN bug with different versions. This proved to be rather challenging to debug as none of our team members had experience working in Swift (the programming language used for making iOS apps). After a substantial amount of research and experimentation, we were able to make our app compatible with all models of iPhone. The second change we made was to make a separate page, similar to the raw data page, which displays a user's weekly average for sleep, mood, and r (correlation) value. Figure 6 below shows a screenshot of this feature for a user with two full weeks of user data inputted.

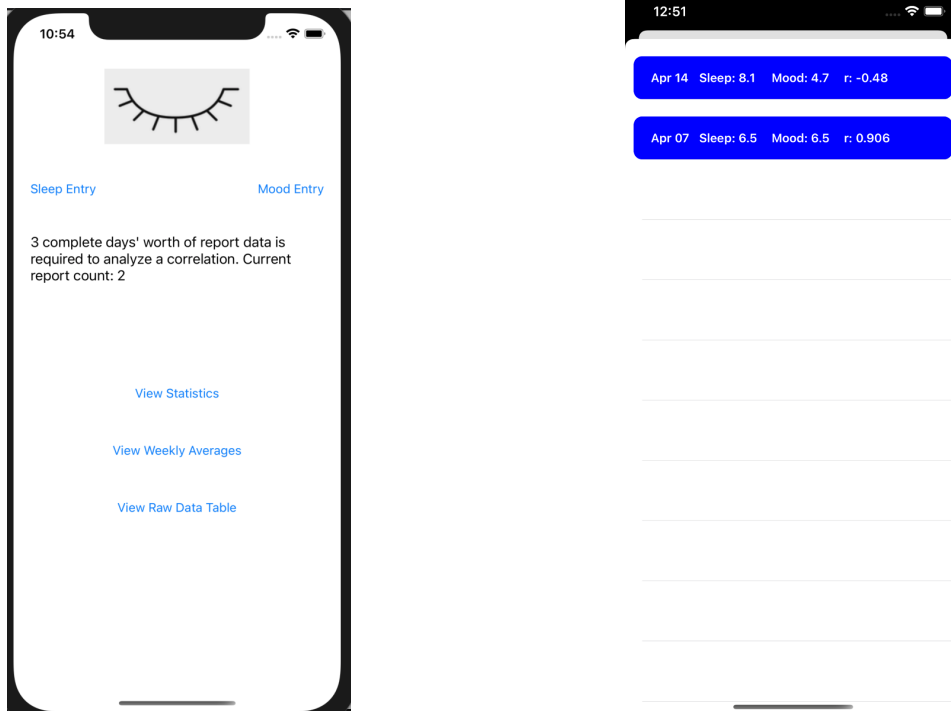


Figure 6. Screenshot of Weekly Average Feature

Discussion

We believe that our two main questions posed above in the Questions Addressed section were both answered to be yes. Based on the user feedback we received, particularly for our second and third iteration, users of our app found it to be easy to use and also found the statistics to be insightful which was the fundamental goal of our app.

While we are satisfied with our current product, there is still room for improvement in future iterations. Much of the feedback from our final iteration suggested that the functionality of our app was good but it was not very aesthetically pleasing. As such, in a future iteration we would work with a graphic designer to spruce up our while also

adding more visual components such as graphs. Another area to explore for a future version is more data inputs. While sleep can be a key indicator of mood, there are many other factors users may want to consider such as diet and exercise. A future version of the app could track these variables in addition to sleep.

Over the course of this project, our team learned a lot. From a technical standpoint, none of us had built an app prior to this project and had no experience with Swift or XCode (Apple's development software). This presented a pretty sharp learning curve for us as many things like persistence storage proved to be much more difficult than we expected. Beyond just learning these tools and programming languages, we got experience working in new environments which is an important skill for any engineer. Additionally, we gained experience using many different collaboration platforms as the COVID-19 pandemic meant that we were unable to meet in person.

Conclusion

Overall, our team found this project to be an extremely rewarding experience. It was satisfying to see a project through several iterations of the design process which is something that is often not possible in a single semester course. We also learned a lot, getting experience developing apps for the first time, which is something that will likely be valuable in our future careers as software developers. Finally, now that we are posting the app to the Apple App Store, we are excited to share this project with our friends and family.