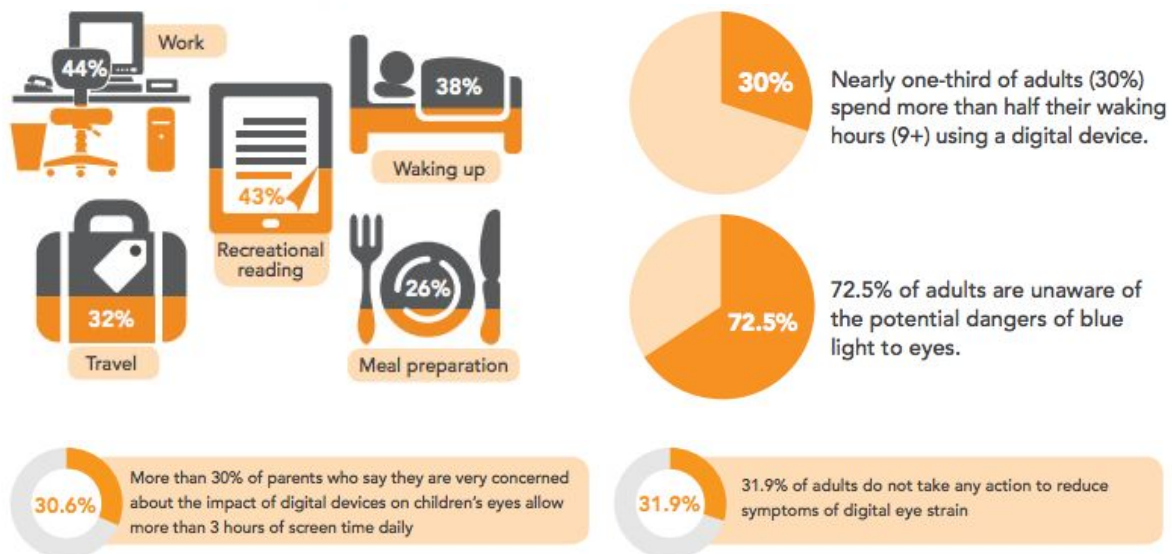# mirage

Team

Alexis Anand - Lead Researcher
Katrina Ezis - Project Manager
Chris Ma - UX Designer
Cynthia Zhang - UI Designer

Problem and Solution Overview

Everyone knows the pain from spending a day staring at a screen, the blurry eyes or headache that break your focus. Nowadays, over 70% of American adults own a smartphone, 95% own a cellular device, 45% own a tablet, and 73% own a laptop or desktop[1]. Emerging research has also linked age-related macular degeneration to long-term screen usage.[2] This infographic put together by The Vision Council sums this problem up perfectly.

Activities Associated with Digital Device Use:

Work 44%
Waking up 38%
Recreational reading 43%
Travel 32%
Meal preparation 26%

30% Nearly one-third of adults (30%) spend more than half their waking hours (9+) using a digital device.

72.5% 72.5% of adults are unaware of the potential dangers of blue light to eyes.

30.6% More than 30% of parents who say they are very concerned about the impact of digital devices on children's eyes allow more than 3 hours of screen time daily

31.9% 31.9% of adults do not take any action to reduce symptoms of digital eye strain

[1] http://www.pewinternet.org/2015/10/29/technology-device-ownership-2015/

[2] https://www.thevisioncouncil.org/sites/default/files/VC_DigitalEyeStrain_Report2015.pdf

[3] https://www.thevisioncouncil.org/sites/default/files/VC_DigitalEyeStrain_Report2015.pdf

We can see that there are a lot of issues associated with prolonged screen use. Although eye strain can be easily reduced by following the 20-20-20 rule -- every 20 minutes you look at an object 20 feet away and blink slowly for 20 seconds[1]. However, we found that following this simple 20-20-20 rule is much more difficult that it looks like. From our research, we discovered that most participants do not pay much attention to their eye health. They either weren't aware of the cause of any eye-related pain that they felt, or they don't want to be interrupted from their work to take a break. To solve this problem, we hope to create something that doesn't take away from our user's focus, but instead help them improve eye health unobtrusively. In addition, we hope to give our users more incentives to improve eye health, such as by drawing correlations between eye strain symptoms and eye strain level.

After talking to an optometrist and interviewing potential users, we decided to focus on reduce harmful light exposure and reduce eye strain. Our design has two parts. The first one is a pair of smart glasses, with sensors to detect eye strain, and filters on lenses to filter out UV light and blue light. The smart glasses also have the feature to send a break reminder, without interrupting the user. Which means, when the user is not focusing and has eye strains, the right corner of a lens will displays an eye icon to indicate that the user should take a break. The color of this icon will get redder and redder as the eye strain level progresses. The other part is a smartphone app. The application serves as the interface to view the tracked data by the user. From the app, the user is able to see the amount of time he/she was exposed to harmful light, and the change of eye strains throughout the day. Users could easily relate eye-related symptoms such as headache with the eye strains.

Initial Paper Prototype

Our paper prototype features two parts. The first part is smart glasses, and the other part is a smartphone application. The smart glasses have sensors to keep track of the user's eye strains, and detect ambient light levels. While the glasses are connected to the app, the glasses will wirelessly transmit the eye data to the app. By tracking the user's eye movement and the distance at which they are focused, the lenses of glasses will display an icon, to remind the user to take a break. The app allows the user to visualize and interact with the data recorded by the glasses. Information including how much harmful light exposure and how much eye strain the user had will be displayed in the app. However, the major issue of the initial prototype is the lack of goal settings. Users are only able to view the data, but cannot do anything about it. We realized our problem during our heuristic evaluation, and added this functionality in the next iteration of our prototype.
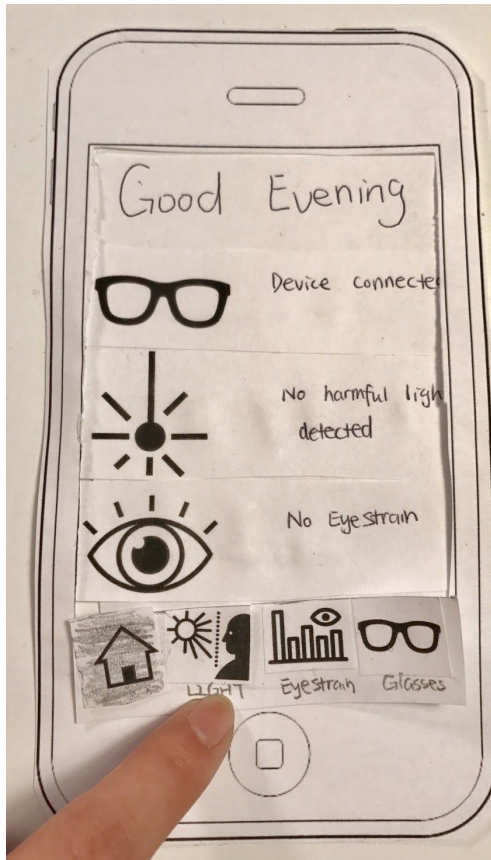
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[1] http://visionsource.com/blog/tips-for-eliminating-computer-eye-strain/
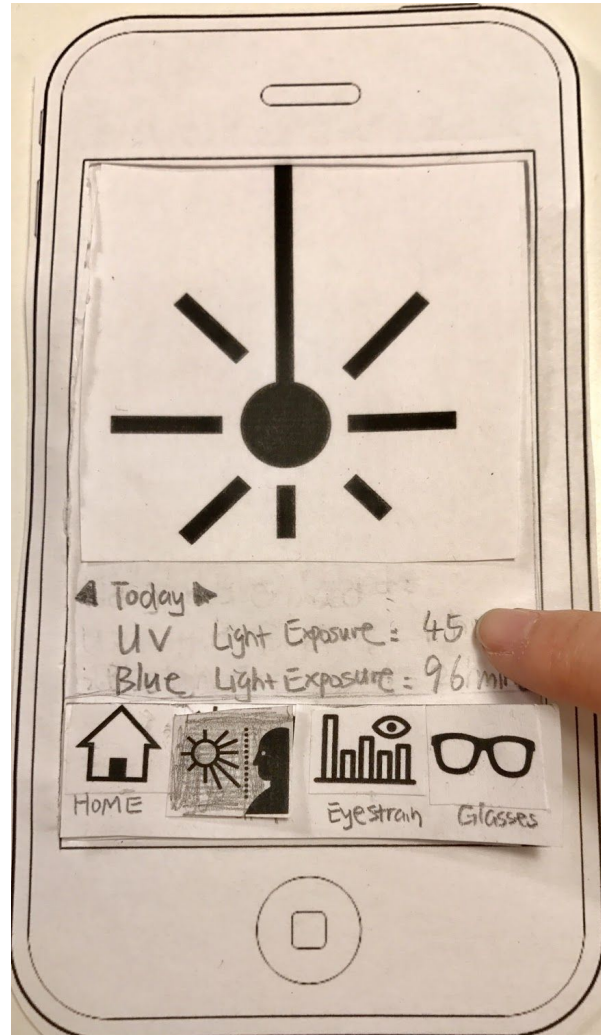
Initial prototype of smart glasses


Initial prototype of smartphone app

Task 1: Reduce Harmful Light Exposure

The homepage of this app. It displays whether the smart glasses are connected, whether the glasses detect any harmful light, and whether the user has eyestrain at this moment. After clicking the light icon, user will be taken to screen 1.2.

This page displays the duration that the user is exposed to harmful light (blue light and UV light) for the current day. After clicking on today's data, the user will be taken to a more detailed data visualization page (screen 1.3).
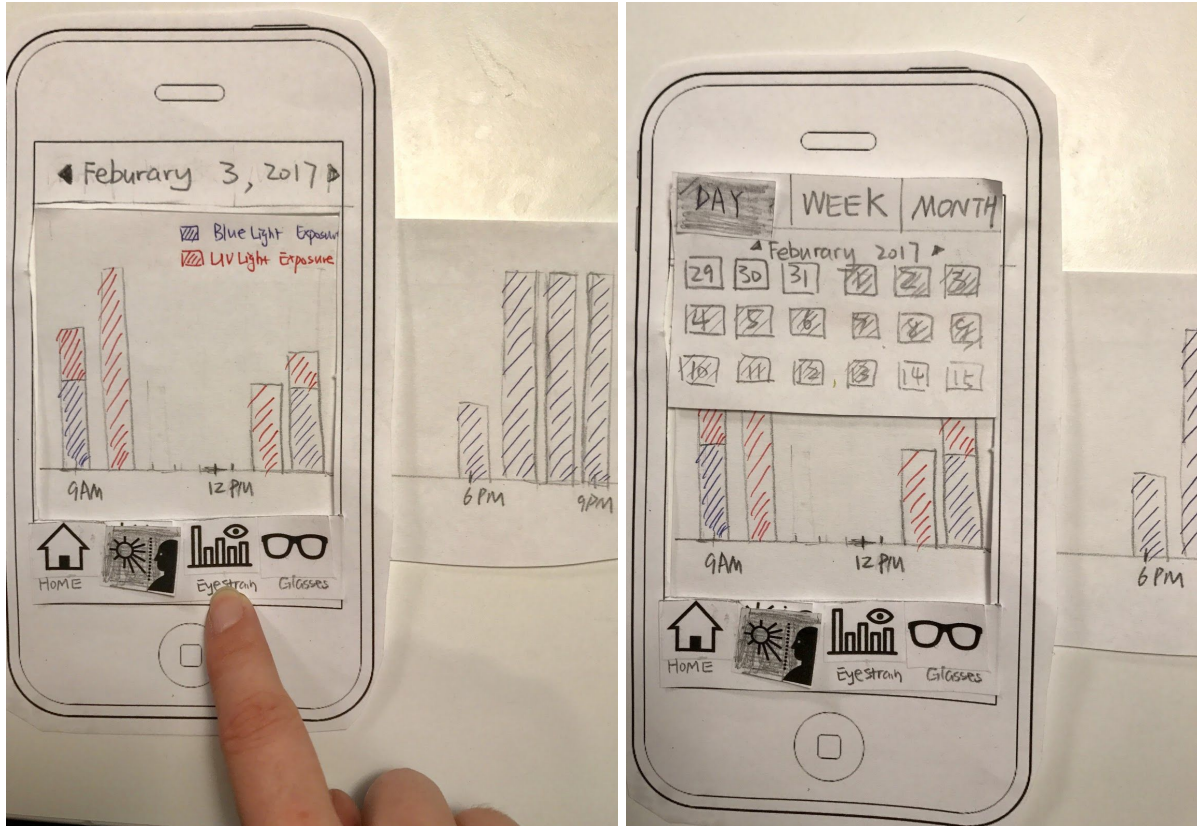
These two page displays the amount of time that the user is exposed to blue light (color coded in blue), and UV light (color coded in red). The user could click on the date at the top, and select a particular day, to visualize the data at that day (shown in screen 1.4). The user could also choose to view this data by week or by month.

Task 2: Reduce Eye Strain
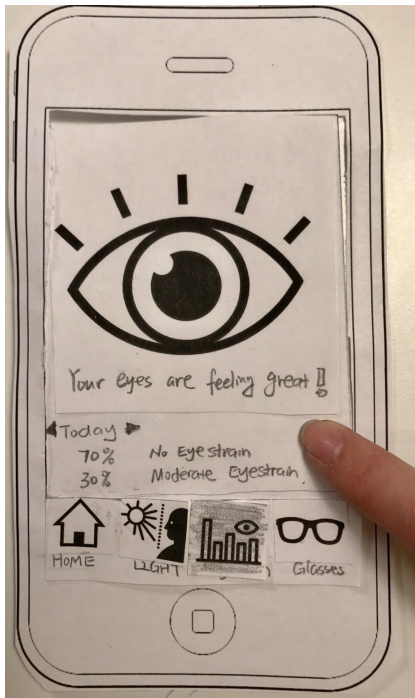
On this page, the user will be able to see the current status of his/her eyes -- whether the eyes are strained or not.

This page is the visualization page of eye strain over time. Blue indicates there's no eye strains, yellow indicates there's moderate eye strains, and red indicates there's severe eye strains. The user could scroll to see more data. Similarly, the user could change the date of interest, and see data in a different date. After clicking on the glasses icon, the user will be taken to the glasses settings page (shown in screen 2.3).
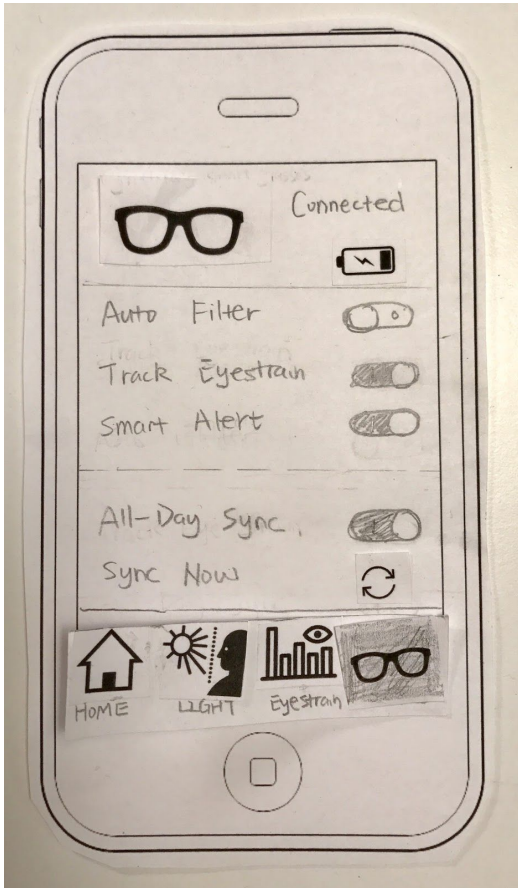
This page allows the user to change settings of his/her smart glasses. They could choose to turn off the smart alert, so that they will never be bothered by break reminders. They could also turn off the filter functions, if they are doing some color sensitive work.

Testing Process

We primarily looked for usability testing participants in the CSE computer lab as it was an accessible location to find several participants. It also allowed us to work with our target demographic, people who are particularly prone to eye strain. We tested with a total of three participants. We used a free table for each of our usability tests. We began each session by briefly introducing the product and its purpose, i.e. explaining that they will be interacting with the app for smart glasses that are designed to reduce eye strain.

We had participants complete the following tasks: set an eye strain goal, view UV light exposure data, enable/disable focus mode, and connect the smart glasses. After the first usability test, we gave the participants scenarios when explaining the tasks. For example, instead of simply asking the participant to set an eye strain goal, we asked them to imagine they were having frequent headaches, and wanted to set a goal to see if reducing eyestrain affected the headaches. We found that these scenarios helped the participants understand the tasks and feel motivated to complete them.

Test protocol we used:

1. Explain who we are, and what our project is about.
2. Explain what the participant will be doing -- the interface he/she will be interacting with.
3. Ensure the participant that our design is being tested, not the participant.
4. Tell the participant we will not answer any questions during the test.
5. Give the participant the first task.
6. Start testing process. One person acted as the facilitator, one person acted as the computer, and one person acted as the observer.
7. If the participant is stuck, reiterate the task and tell him/her to think out loud. Also, record this incident.
8. Give the participant the second task.
9. Thank the participant and debrief.
10. Fix critical issues.

Testing Results

The usability tests helped identify patterns in user interaction which meant our design needed improvement. The most obvious example of this is the flow to set a goal, which underwent several revisions as a result of our usability tests. Before we began usability testing, our system for setting a goal was very simplistic: the user was given a choice to

either maintain or improve eye health. This was inspired by Fitbit, another health tracking device, which sets goals based on reducing or maintaining weight. However, we discovered that this model didn't work as well for eye health, as people don't often have specific quantifiable goals like they might for weight. Instead, people's eye health goals are often based around specific problems they face, such as headaches, dryness, or blurry vision. As a result, users didn't know whether they should choose to maintain or improve eye health when setting a goal.

Our first attempt to remedy this was to ask different questions when setting a goal. Now, users would see three checkboxes during setup that represented specific focuses for improving eye health. These focuses were reducing eye strain (caused by focusing on nearby objects), reducing blue light exposure, and reducing ultraviolet light exposure. These all have different damaging effects on eye health, and so by selecting one or more of these factors, the user can decide where they want to focus their eye health efforts based on the symptoms they experience. Then, the app could use the user's choices to calculate goals for exposure to each of the above factors, and issue alerts at the appropriate levels.

This new design was a step in the right direction, but it seemed like the progress visualizations in the app didn't clearly match what the user chose when setting a goal. As a result, we broke down the composite "eye health progress" graph into three graphs, for eye strain and each kind of harmful light exposure. Then, when setting a goal, the app would display the specific exposure goals calculated for a user based on their choices. Afterwards, these would be displayed as goal lines on each of the three new progress graphs. In addition, the user could fine-tune those limits manually to further match their goals.

Another part of our design that evolved throughout the testing process was the home screen. Our original home screen design had three rows of information for goals and each kind of harmful light exposure. Each row had an arrow button to access the page for that item. A major issue with this design was that it was unclear what the user should do at the home screen. Is it just to provide information, or are there actions for the user to perform as well? In addition, it was unclear what the arrow buttons were for, and so users were hesitant to push them.

To try and address this, we replaced the arrow buttons with action buttons which made it clear what each button did, and also prompted the user to take action when action was required. For example, if a device wasn't connected to the app, a button would prompt the user to add a device. However, once we added a new row for goals, the

home page started to feel cluttered and confusing, and also started to feel redundant with the tabbed navigation bar at the bottom.
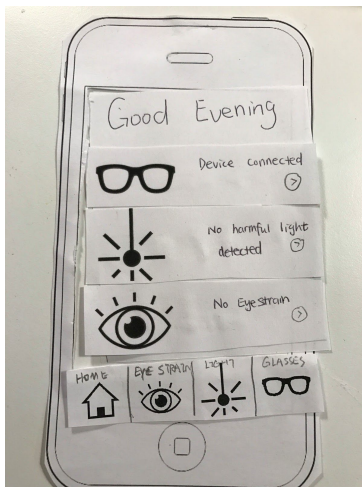
Home screen with arrow buttons
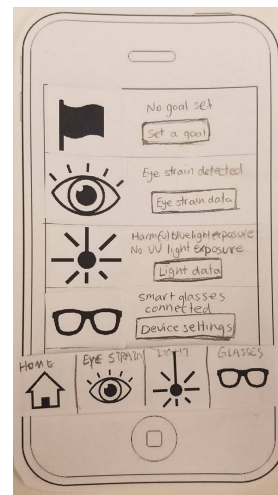
Home screen with action buttons

Our latest iteration is our digital mockup, and with it, we drastically simplified the home screen, placing a focus on the goals. Two graphs, for eye strain and harmful light exposure would be displayed on the home screen, along with the goal line. An area at the bottom is dedicated to start the process for adding a goal and setting up a device, and the tabbed navigation was removed and replaced with a hamburger menu. We felt this was a good compromise between guiding a user through the necessary setup steps, and a simple, clean homepage that puts the data the user most often needs first.

The final major change we made throughout the testing process was adding more documentation throughout the app. We did this in three main ways. The first was to provide more information on eye health. During testing, we found that many of our users did not know why blue and ultraviolet light specifically were damaging to the eyes. In response, we added tooltips to the harmful light exposure detailing their risks in terms of macular degeneration and the sleep cycle. The second way was documenting app-specific terminology. Focus alert is not a term users are familiar with from other situations, so we added an information box during device setup explaining what focus alert is and why they might want to do this. The final way we added terminology is to make the app more friendly. For example, because searching for nearby devices can take several seconds, we decided to add fun facts about eyes on the searching screen to entertain the user during the process. And when selecting a device from the list, tips are provided for if the user's device isn't showing up. This way, the user has access to help when they need it.

Final Paper Prototype

Task 1: Reduce Harmful Light Exposure

Smartglasses
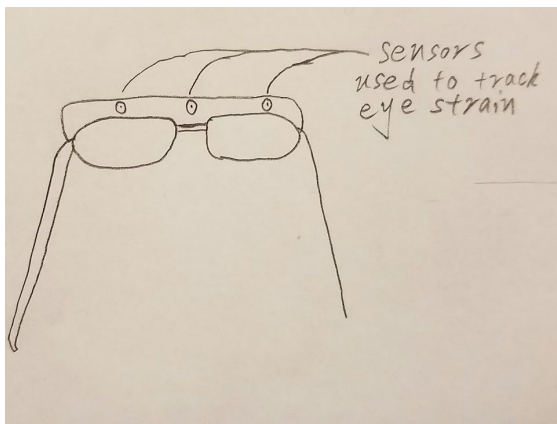
The tint of the lenses will automatically be adjusted to filter out UV light and blue light. Users could turn off this feature if they are doing color sensitive work.

Smartphone App

In order to reduce harmful light, people might want to know how much UV or blue light they are exposed to everyday. They might also want to set a goal.
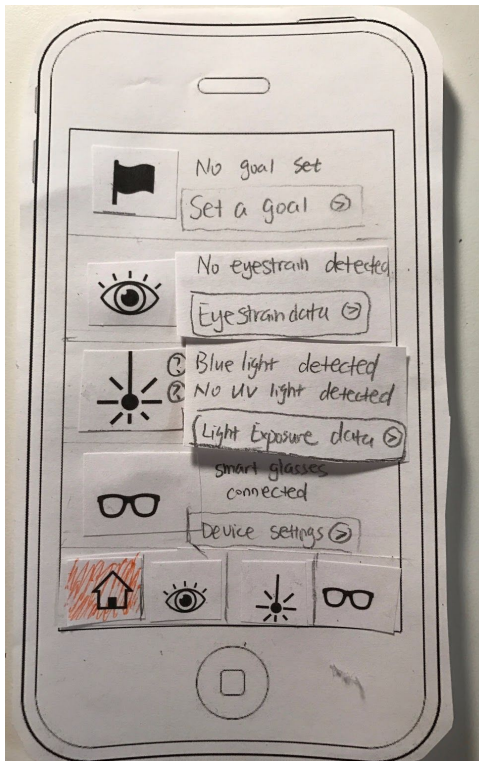
Enter the home page.
Without any goal been set, the second and third grid display whether eyestrain, blue light, UV light is currently detected.

Step 1: Click on "set a goal" button.
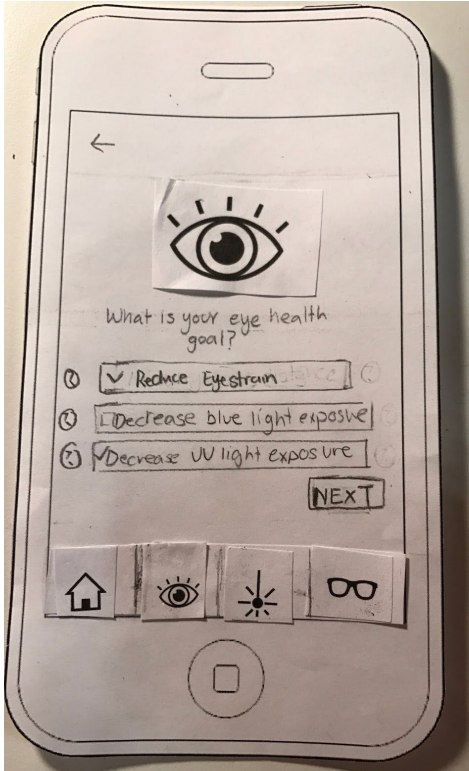
The user can choose from three eye health goals -- reduce eyestrain, reduce UV light, and reduce blue light. The user can also choose multiple of them. If the user is not sure what these terms mean, he/she can tap the question mark next to each choice.

Step 2: Click on one of the question marks.
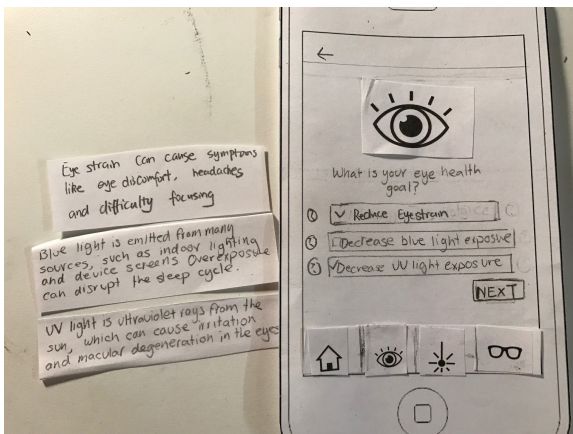
Explanations on why we should reduce eyestrain / blue light / UV light. Some common symptoms are also shown to give the user some incentives on improving eye health.

Step 3: Click on "NEXT"
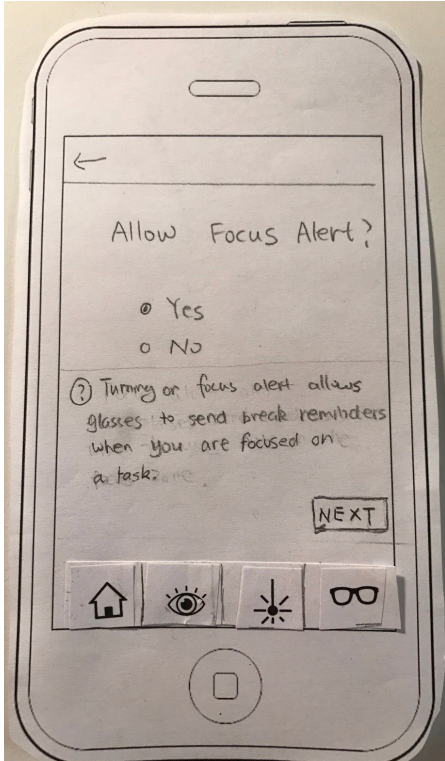
The user can set whether focus alert is allowed. (this feature focus alert will be explained in the next task). The question mark below explains what it is.

Step 4: Click on "NEXT"
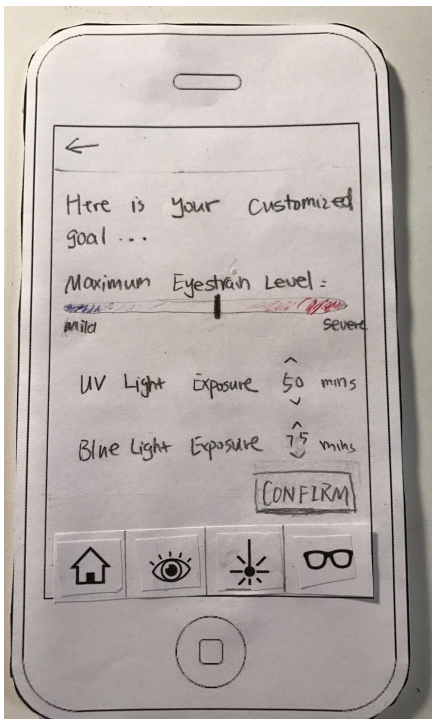
This page shows the automatically generated goal, based on the user's previous choices. The user could also modify it.

Step 5: Click on "CONFIRM"
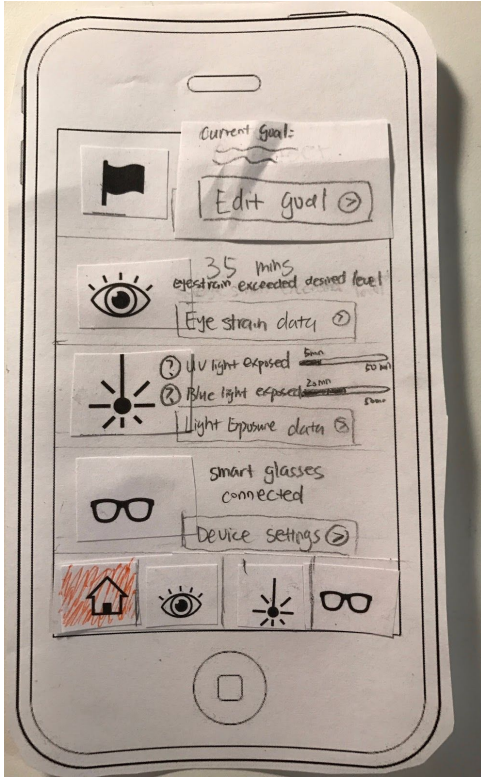
Go back to the home page. Now the second and third grid compare today's data to the user's goal.

Step 6: Click on "Light exposure data"
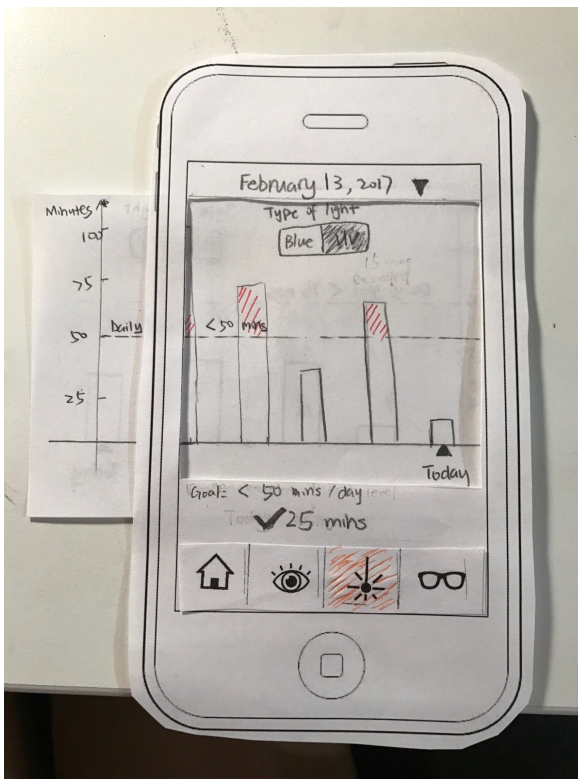
A bar graph is shown, indicating the minutes of UV light exposure this person has had on a particular day. Today's data is on the rightmost column. User's goal is also displayed. The bar graph will be red if the user has exceeded the desired amount of UV light.

At the bottom of the graph, it tells the user how much time he has been exposed to UV light today, and whether he's met the goal.

Step 7: Toggle the top switch from UV to Blue.
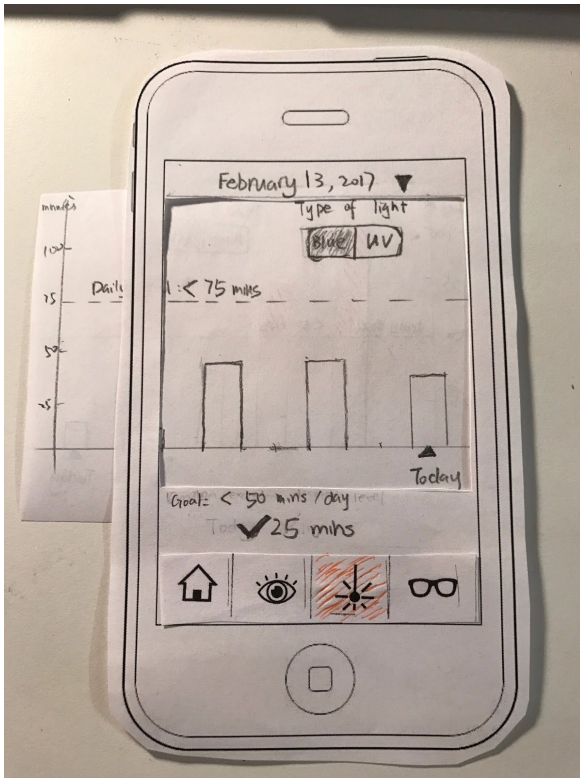
A bar graph is shown, indicating the minutes of blue light exposure this person has had. Similar color codes as the UV light graph.

At the bottom of the graph, it tells the user how much time he has been exposed to blue light today, and whether he's met the goal.

Step 8: Click on the drop down button next to the date.
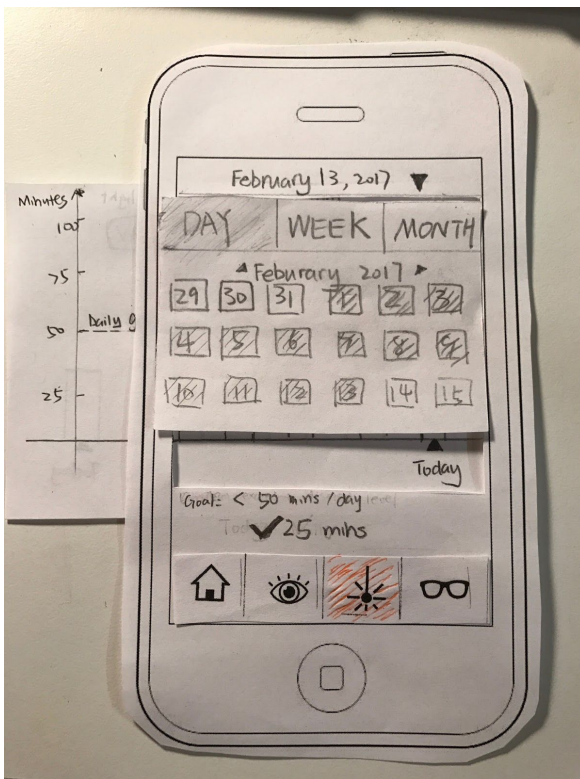
The user could also view the data on a different date, or view the data by week or by month.

Task 2: Reduce Eyestrain

Smart glasses
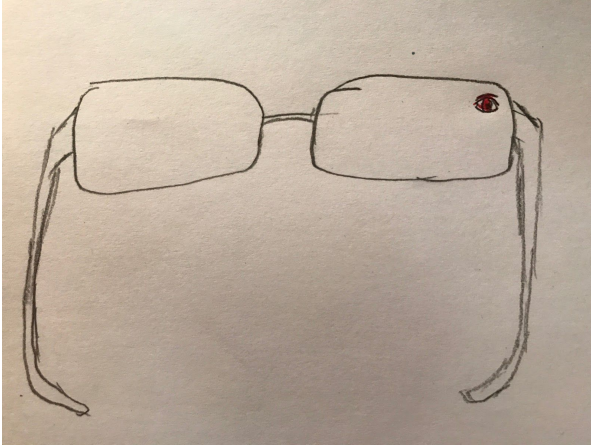
If focus alert is enabled by the user, when the user is not focusing and has eye strains, the right corner of a lens will displays an eye icon to indicate that the user should take a break. The color of this icon will get redder and redder as the eye strain level progresses.

Smartphone app
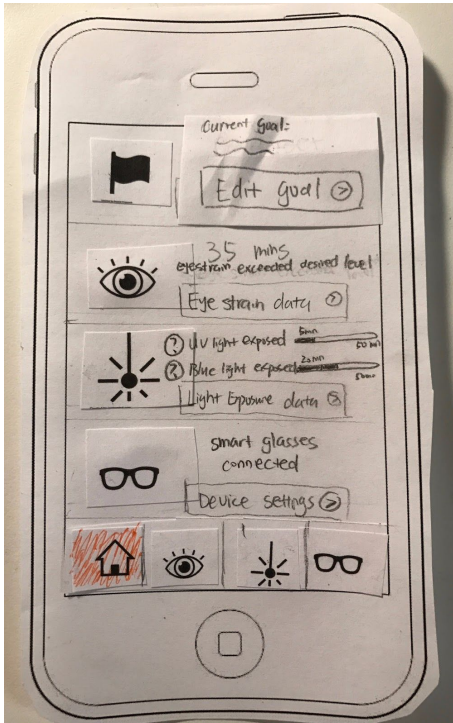
Enter the home page (this is the page when a goal has been set).

Step 1: Click on "Eye strain data"
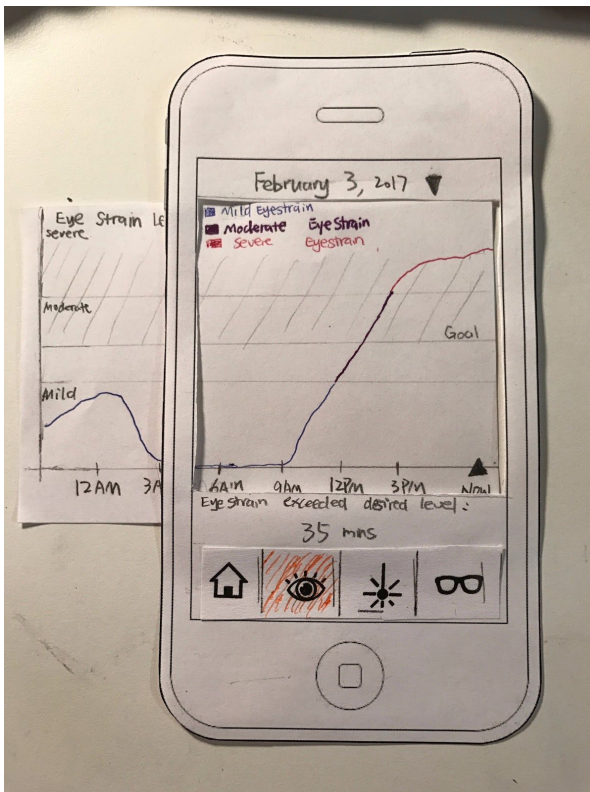
A color coded line chart is shown, presenting the eye strain level throughout the day. Blue means mild eye strain, purple means moderate eye strain, and red means severe eye strain.

At the bottom of the graph, it tells the user how much time his eye strain exceeded the desired level.

Step 2: Click on the drop down menu next the the date.
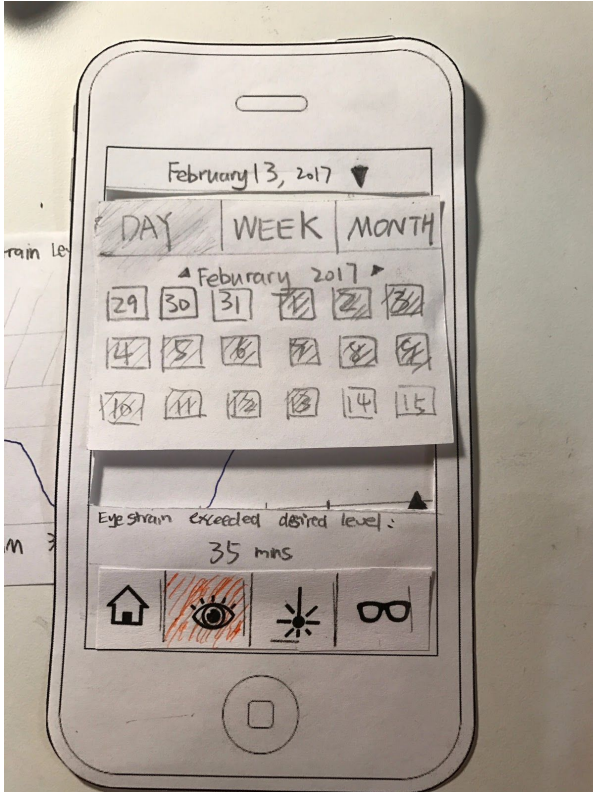
The user could also view the data on a different date, or view the data by week or by month.

Step 3: Click on the drop down button next to the date.

Implied task -- setup the device
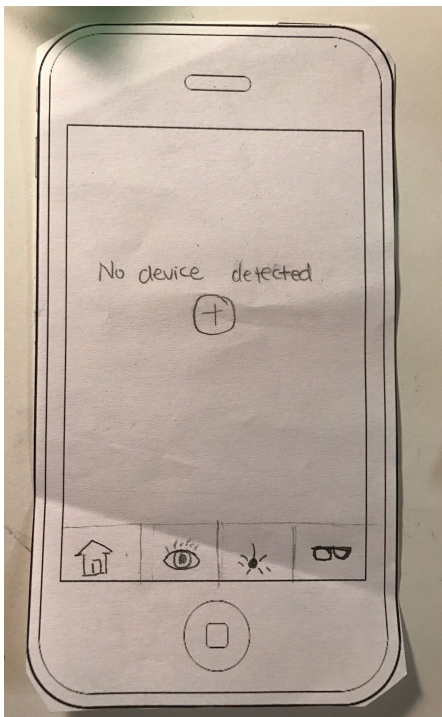
Step 1:

Click on the add button
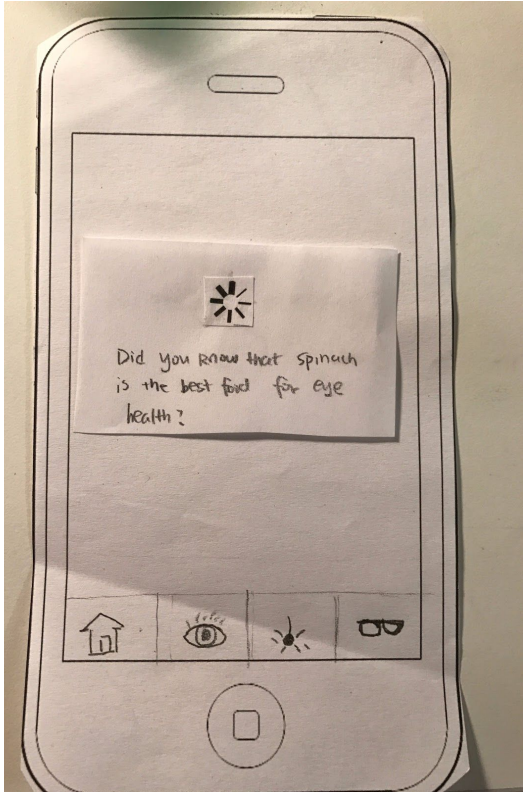
Display some eye health tips while it's searching for devices.

Step 2: loading screen

Did you know that spinach is the best food for eye health?
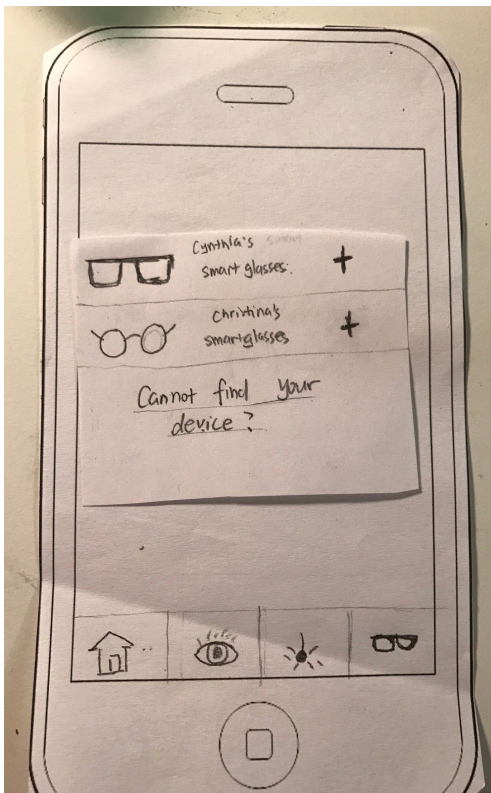
Display nearby available device. User can click on "Cannot find your device" if his/her device is not detected.

Step 3: Click on "Cannot find your device"

Cynthia's Smart glasses   +

Christina's smartglasses   +

Cannot find your device?
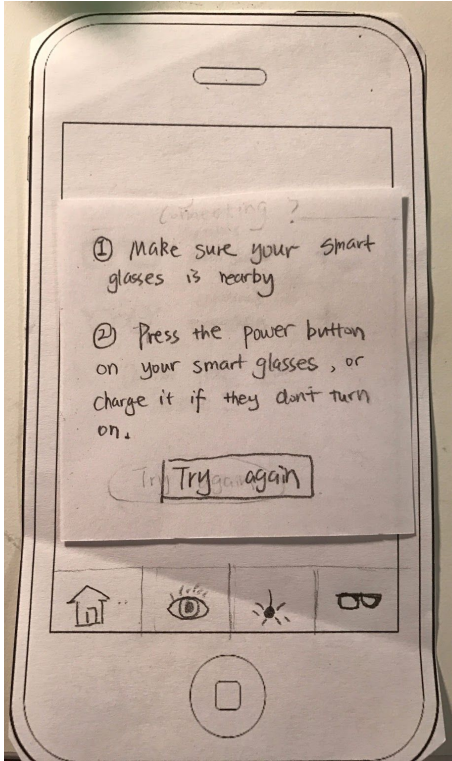
Show possible solutions if the user's device cannot be found.

Step 4: Click on "Try again"
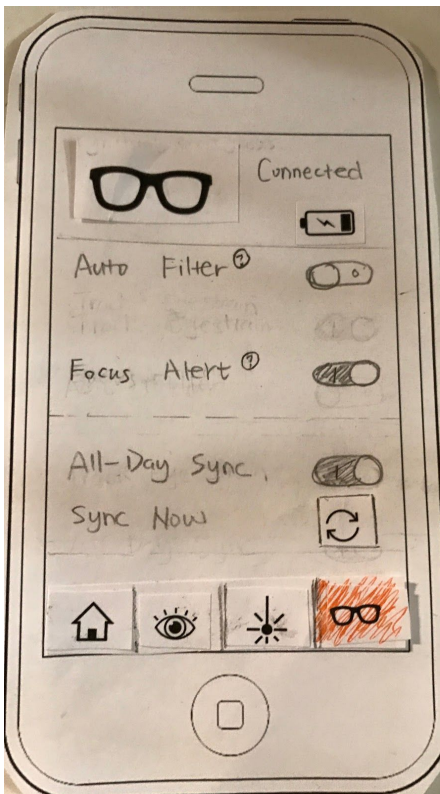
After the device is correctly connected, we will go to the settings page, in which the users could enable/disable some features of the smartglasses.

Digital Mockup

Overview
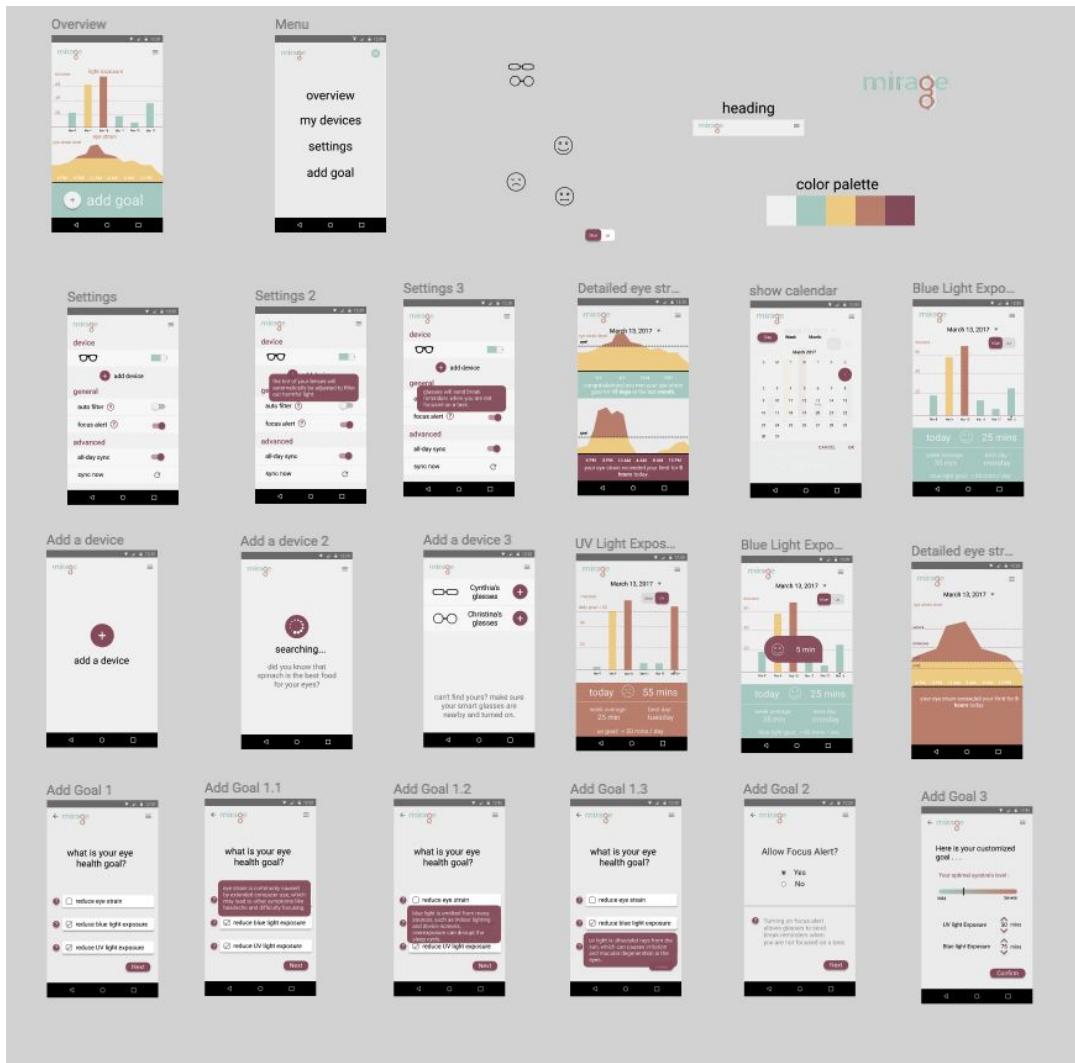
Navigation Menu:
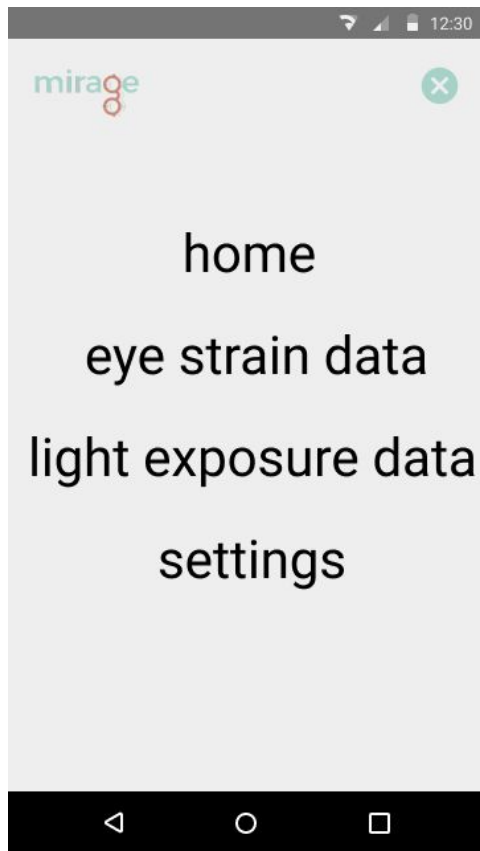
Task 1: Adding an eye health goal

   In this task users will be able to set a personal eyestrain/harmful light exposure goal for themselves. Our design ensures that users can set all types of goals in the fewest number of steps and the easiest way.
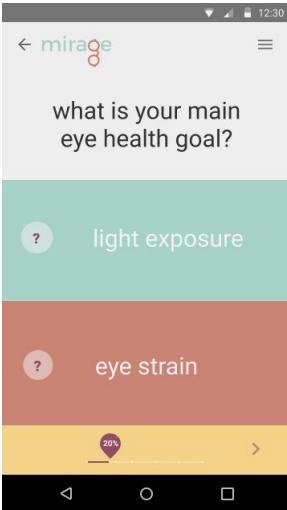
a.   User can choose a
     main health goal.
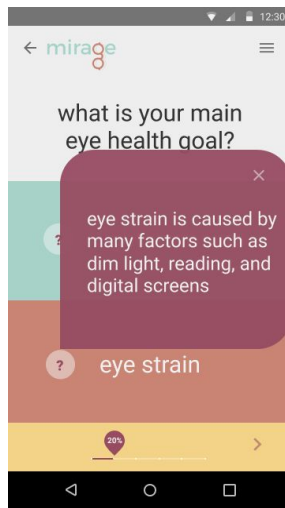
b. They can find more
information by pressing the ?.
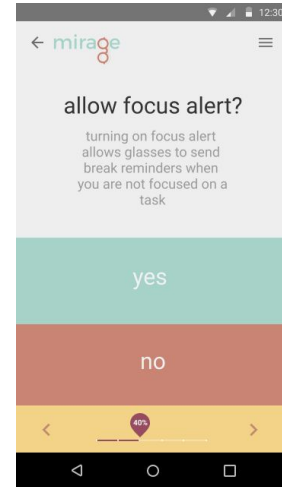
c. They can choose whether
or not to allow a focus alert.

d. User can choose how
often they want alerts. We
recommend 60 minutes, but
they can choose more or
less.
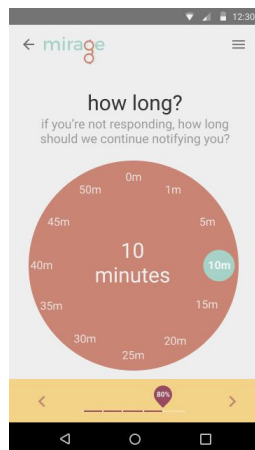
e. They then choose how
long we'll notify them to take
a break. This is similar to a
snooze function.
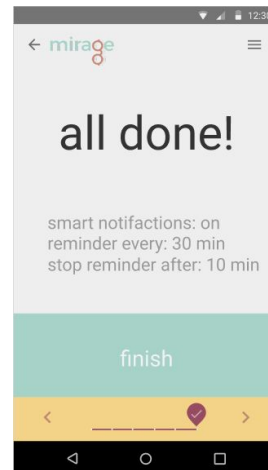
f. All done! The user can see
what they've chosen and
continue onto the main
menu.

Task 2: Monitoring & Controlling eye strain & harmful light exposure

In this task, users will be able to view their tracked eye strain compared to their personal goal and react accordingly. Our design ensures that users draws a better comparison between their goal and their actual data by making distinctive visual presentations in both color and shapes.
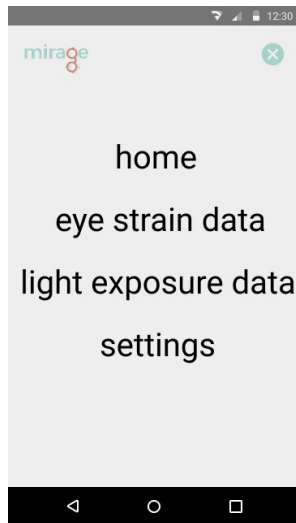
a. User can tap 'eye strain Data' or 'light exposure data' to monitor his/her personal eye strain data.
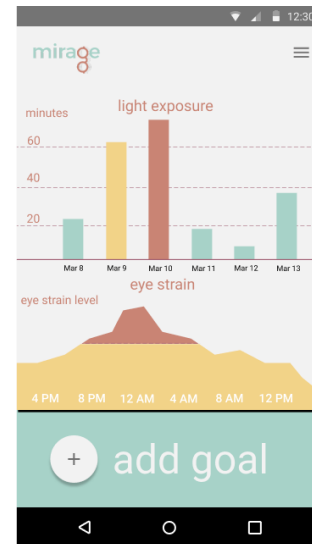
b(1). If user does not have a goal, the system would ask user to add a goal first.

Eyestrain data page   UV/Blue light data page   UV/Blue light data page
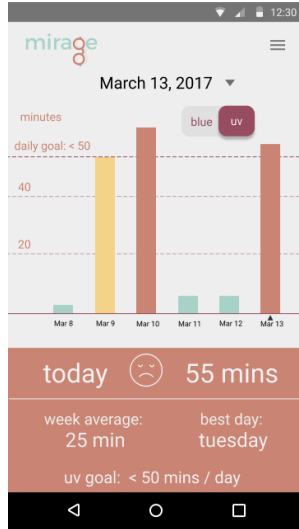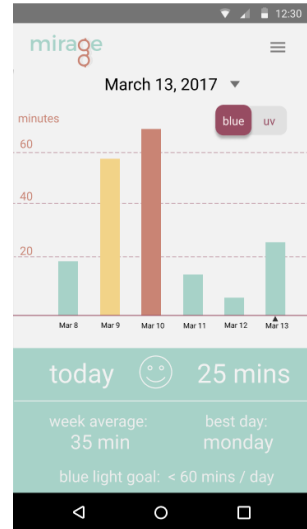
b(2): If user has already set a goal, the system would correspondingly notify user whether him/her went past the goal.

c: User can view an in-depth version of their eye strain levels. This includes a overall goal visualization, a visualization to show them how many hours out of the day they took a break, and an overview visualization that will show them how they're doing today.
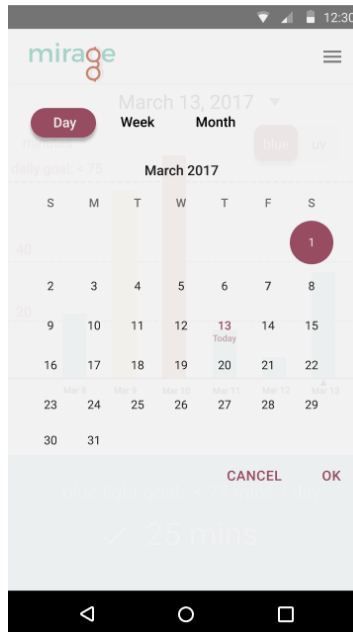
c(2). The user can change their view by looking at the calendar. This will let them change from day to month to even a year view. This will let the user understand their data over a long period of time.
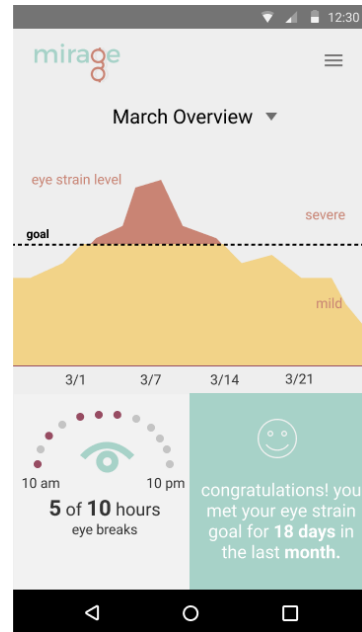
d(3). Here is an overview of the user's march data. We have similar visualizations, but they have been averaged out over the month.

Secondary Task: Add a device

    In this task, users can associate their app with (additional) glasses and modify the settings for existing glasses. Our design ensured the best user experience by making the UI minimalistic - That is to say, we only display things that are relevant to this task and nothing else.
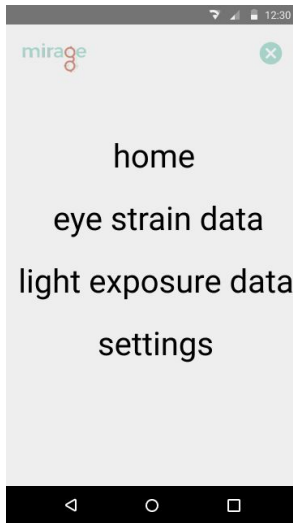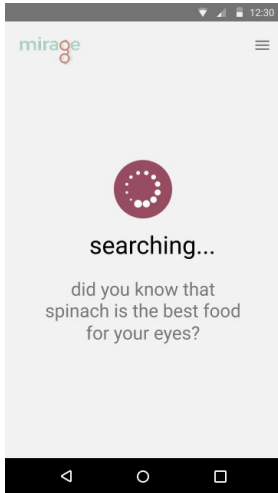

**a.** Starting from Settings, users may associate devices to the app.
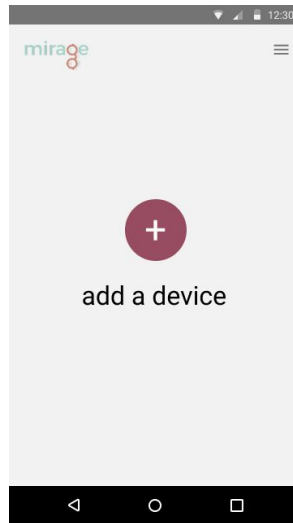
b(1). If no devices was ever connected to the app, a blank page with 'add a device' will be displayed. Tapping on the plus sign to continue.
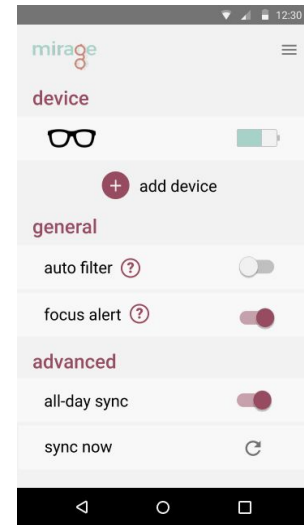
b(2). If more than one device(s) has/have already been associated with the app, an alternative page would be displayed. Tapping on the plus sign to Continue.

c. The system would then search for nearby devices to connect to.
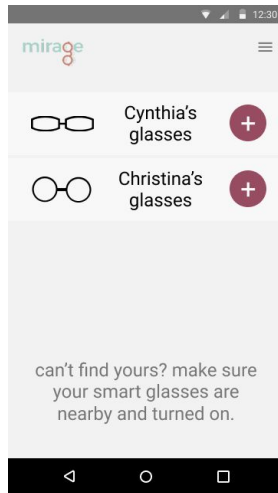
d. Once the search is completed, a list of detected devices will be displayed. Tapping on the device that the user wants to connect to continue.
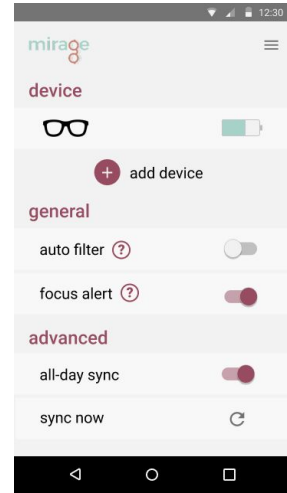
e. The associated device would then be added to the device list, and available settings for the corresponding device would also become avaiable.

Discussion

This process has been long, hard, but ultimately very rewarding. We learned that research should always influence our design choices. We can into our design assuming certain things to be true, but through usability testing and heuristic evaluations we learned that our assumptions were often incorrect. Also we learned that it is important to explore and try new things. Because our process is iterative, we're able to get quick feedback. This allows us to try new things, see if they work, and iterate again.

Our final design was hugely shaped by our overall process. From various testings and in-class feedback we constantly changed our designs, always trying to make it easier to use. Motivation is a big concern in our solution, because people don't often think of eye-strain as a pronounced concern. This caused us to ideate and try to understand how to make our design as easy and intuitive as possible. This is what lead us to taking a lot of the tracking off the user and instead use smart lense technology. Then we'll be able to inform them through a companion app and with both of these together, hopefully we'll be able to change the way a person understands eye-strain.

Our two key tasks actually didn't change much throughout our usability testing, but what changed was our design and how we approach our tasks. People wanted to learn more about eye-strain and see more visualizations of their day-to-day activities, so we simplified our design and added more information.

I think we could have used more iterations. I believe we have a good design, but with more testing (especially of our digital mockup) we could have refined our tasks, design, and idea even more. I think 3 more iterations would have put us in the sweet spot.

All-in-all we all thoroughly enjoyed this process and hope you enjoy our design as much as we enjoyed making it. Thank you for your time and consideration.

Appendix

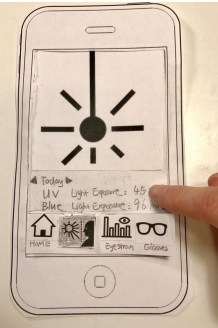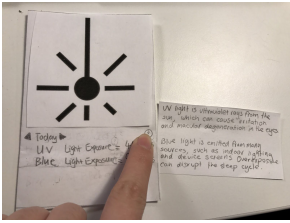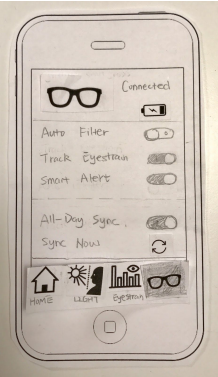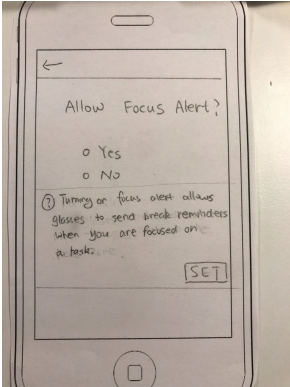Feedback notes from heuristic evaluation:
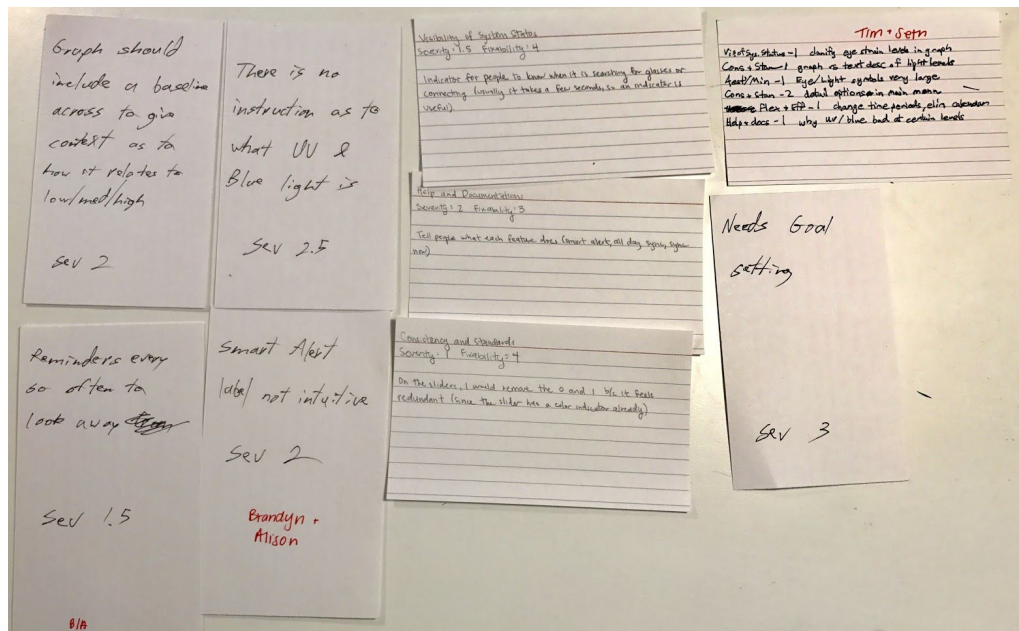
Task descriptions:
1. You just bought your smart glasses and downloaded the mirage app on your phone. You want to set up and connect your smart glasses to this app.
2. You has been having headaches lately. After you talked to your doctor, your doctor said it might be caused by eye strains. You already have an app keeps track of your headache, and now you want to use the data displayed on mirage app to learn whether there is correlation between headaches and eye strains.
3. You discovered that too much blue light is ruining your sleep, and you want to set a goal to limit the amount of time you are exposed to blue light.
4. You have a huge project due tomorrow and you need to work on it tonight. Although your eyes are really tired, and the glasses is telling you that you should take a break, you decide to ignore this alert. You want to turn off this alert.
5. You already realized the importance of eye health and you have set a goal of eye strain on this app. You want to see whether you have met your goal last week.
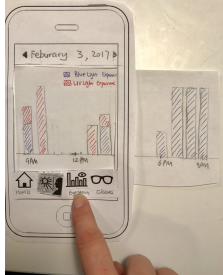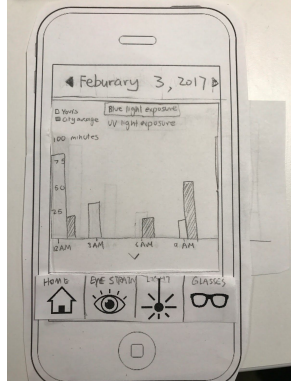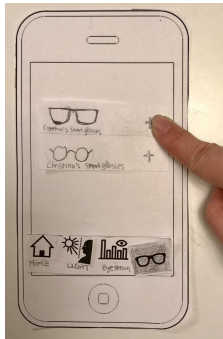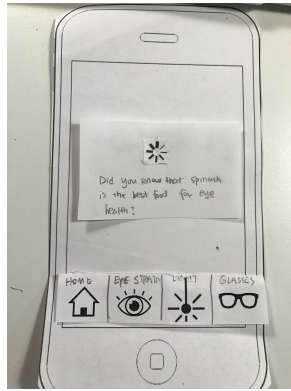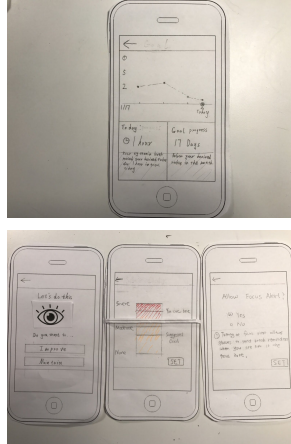
Critical incidents:
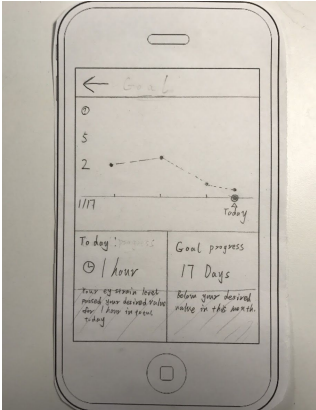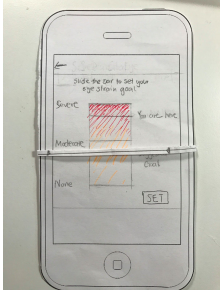1. Home page is not clear; you don't know if the items are status or calls to action

2. It's hard to learn how to set a goal on the first time using the app, or even that you are supposed to. The participant couldn't figure out how to go to the goal setting page.
3. After you click the time data of UV/blue light it's confusing what kind of light you were looking at. Lily couldn't figure out how to display UV light exposure, when she is looking at the blue light data.
4. The user thought the two bar graph one means UV light and one means blue light, but it should mean the city average exposure and the person's exposure.
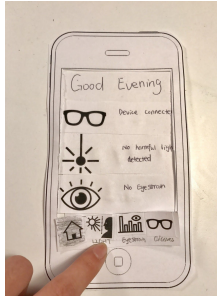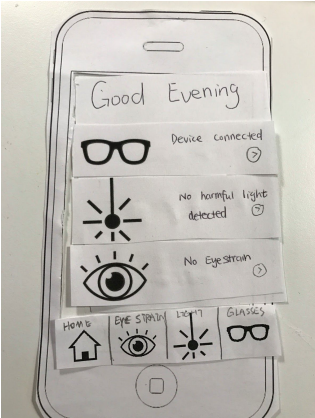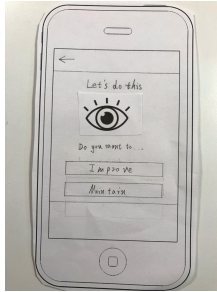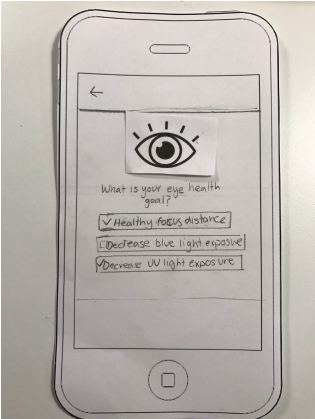
Heuristic evaluation:

Original Image	Issues	Severity (1-5)	Revised Image	Explanation
	There is no instruction as to what UV and blue light is and why they are harmful. Heuristic violated: Help and documentation	3		We put a tooltip at the upper right corner. It will automatically show up for first time users, and later on the user could also click on it to show more information.
	It does not clearly tell people what each feature does. (e.g. smart alert, all day sync, sync now...). Some labels such as smart alert are not intuitive. Heuristic violated: Help and documentation	2		Change the name of smart alert to focus alert. In addition, in the goal setting page, explain what focus alert is.

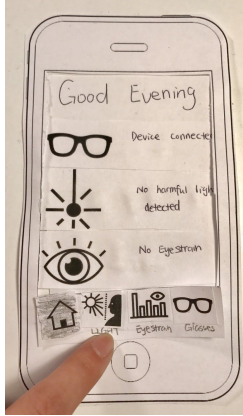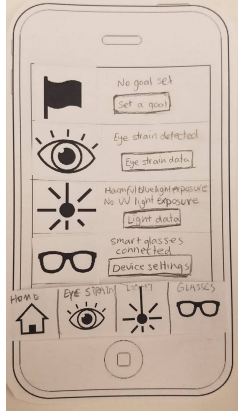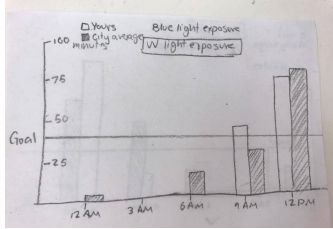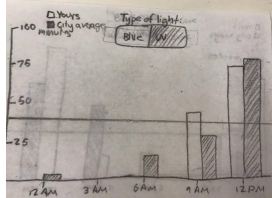|				
	Graph should include a baseline across to give context as to how it relates to low/medium/high. Heuristic violated: Match between system and the real world	2		We did some research and realized that there are not concrete recommendations on how many hours of harmful light exposure people should have. As a result, we changed the graph to show the average exposure of all users in the city along with the exposure of this user.
	Indicator for people to know when it is searching for glasses or connecting, since it usually takes a few seconds. Heuristic violated: Visibility of system status	2		Add a search loading animation, and at the same time, give the users some tips on eye health.
(no image)	There is no way for a user to see or track their progress towards improving eye health. Heuristic violated: Match between sytsem and real world	4		Add pages in the prototype to set eye strain goals and track the user's progress toward meeting them.

First usability testing:

Image	Incident Description	Severity	Revision	Explanation
(no image)	There's no feedback after the participant successfully set a goal. Heuristic violated: Visibility of system status	3		After the user successfully set a goal, we will take the user to a page that compares the history average to his/her goal.
	The participant didn't know what the slide bar means in the goal setting page. Heuristic violated: Help and documentation	2	(no image)	We added some text on that page, but later we decided to delete this page, because we don't think it is necessary to let the user choose another goal other than the suggested one.

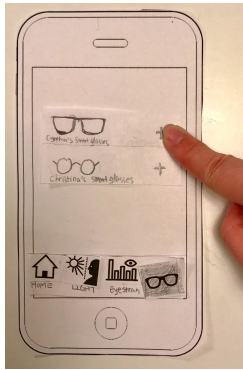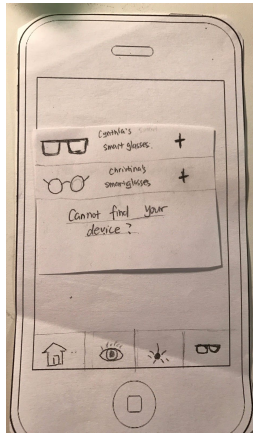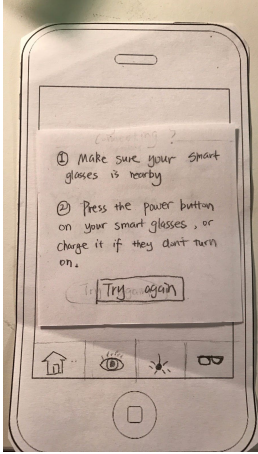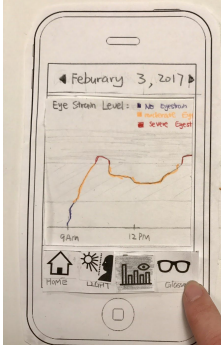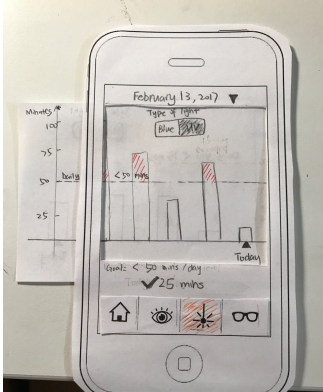| Image	Incident Description	Severity	Image	Explanation
	The participant was not sure if he could click on the icon on the home page.	1		We added arrows to indicate that clicking on this will take the user to another page. We also updated the navigation pictures to be more consistent.
	The participant were not sure about whether he wanted to maintain eye health, or improve eye health. (possibly the design should give more suggestions)	2		We changed the question to ask about eye health goals. Three choices are given: healthy focus distance, decrease blue light exposure and decrease UV light exposure. Then we can customize the settings accordingly.

Second usability testing:
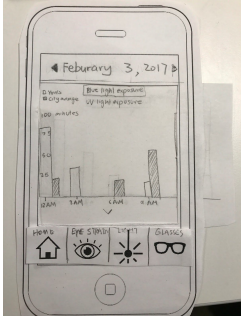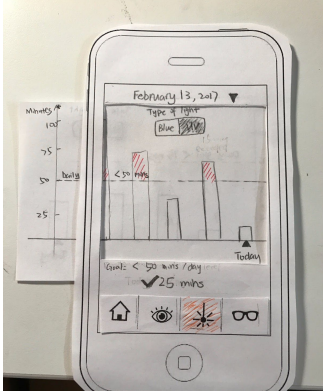
| Image	Incident Description	Severity	Revision	Explanation

	Home page is not clear; you don't know if the items are status or calls to action	3		We clearly separated the status and call-to-action items on the home page
	Goal slider is oriented incorrectly	1		We reversed the two sides of the slider. Now severe is on the right, and mild is on the left.
	Average eyestrain level -- wording is confusing	1		We changed the word 'average' to 'Maximum'. That way it makes it clearer to users that this the goal is to keep their eye strain level below this value.

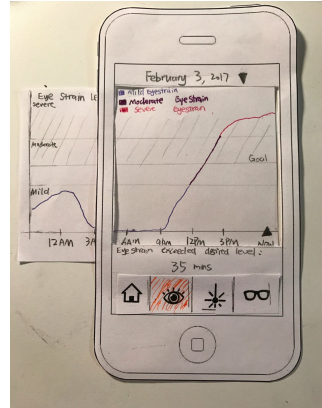| Image	Incident Description	Severity	Revision	Explanation
	It's hard to learn how to set a goal on the first time using the app, or even that you are supposed to. The participant couldn't figure out how to go to the goal setting page.	3		On the home screen, while no goal is set, the user will be prompted to create a goal
	After you click the time data of UV/blue light it's confusing what kind of light you were looking at. Lily couldn't figure out how to display UV light exposure, when she is looking at the blue light data	3		Toggle switch is made more visible and uses a more conventional design.

Third usability testing:

Image	Incident Description	Severity	Revision	Explanation
	Smart glasses had names on them but the participant wasn't named that. In addition, it's not clear what to do if the user's device is not displaying, which violates the help and documentation heuristic.	3		A new button "cannot find your device" is added, so the user could see some suggestions on what he/she should do if he/she is having trouble connecting the device.

	The user was not sure if he could click on the date to show data by week.	2		Change the two arrows to a drop down button.
	The user thought the two bar graph one means UV light and one means blue light, but it should mean the city average exposure and the person's exposure.	3		simplified the visualization page by removing the bars for city average, and comparing only to the user's goal.
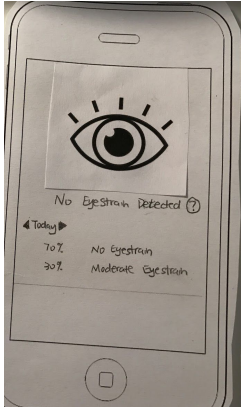
| | The user was tempted to click on the eye icon in the data visualization page. He also mentioned that this icon is too big. | 1 | | We felt like the eye icon is unnecessary, since it does not provides the user any informations. As a result, we removed the old page, and instead of the icon, a graph is now displayed. |