TRACKSCRIPTION

Team Members and Responsibilities

- David Phillips: Team coordination, design, write-up, user research, presenting
- Jorge Coira Fernandez: User research, write-up, presentation
- Svetlana Grabar: User research, write-up, presentation
- Zoe Brants: Designer, user research, write-up, presenting

Problem and Solution Overview

Managing prescription medications represents a challenge for many adults, especially the elderly. Some of the most frequent issues are missing a dose of the medications, obtaining information regarding new prescriptions, and keeping track of possible interactions between the patient's current medications and new prescriptions. Currently, there exist tools for keeping track of medication intake, but there isn't a successful medication management system that automates the whole process of taking medication, storing information about medications, and logging medication usage. In response to this problem, our team is designing a solution that uses a phone application and smart pill capsules to address some of the issues that patients are having. This solution combines the advantages of using personal informatics to store and manage medication information with the advantages of using a smart pill capsule to remind the patient to take their medication. The capsule can automatically keep track of whether or not the patient has taken the medicine, giving patients medication logs without constant user input.

Initial Paper Prototype

Our paper prototype consists of multiple phone screens that allow the user to walk through the two main tasks we designated to be our main focus points for our solution. Included as well are other screens that allow supporting tasks to our main tasks to be completed as well. This allows the experience to be more complete for user testing and heuristic testing. The prototype also consists of a mock-up pill capsule to allow for user interactions necessary for our main tasks.

Task 1 "Medication Reminders"

1. Time for user to take medication has reached its designated timeframe. (left)
2. Capsule is illuminated green and phone application gives notification. (right)
3. User given choice to snooze notification (left)
   a. Snooze
   b. Take medication
4. Notification disappears after taking the medication (right)
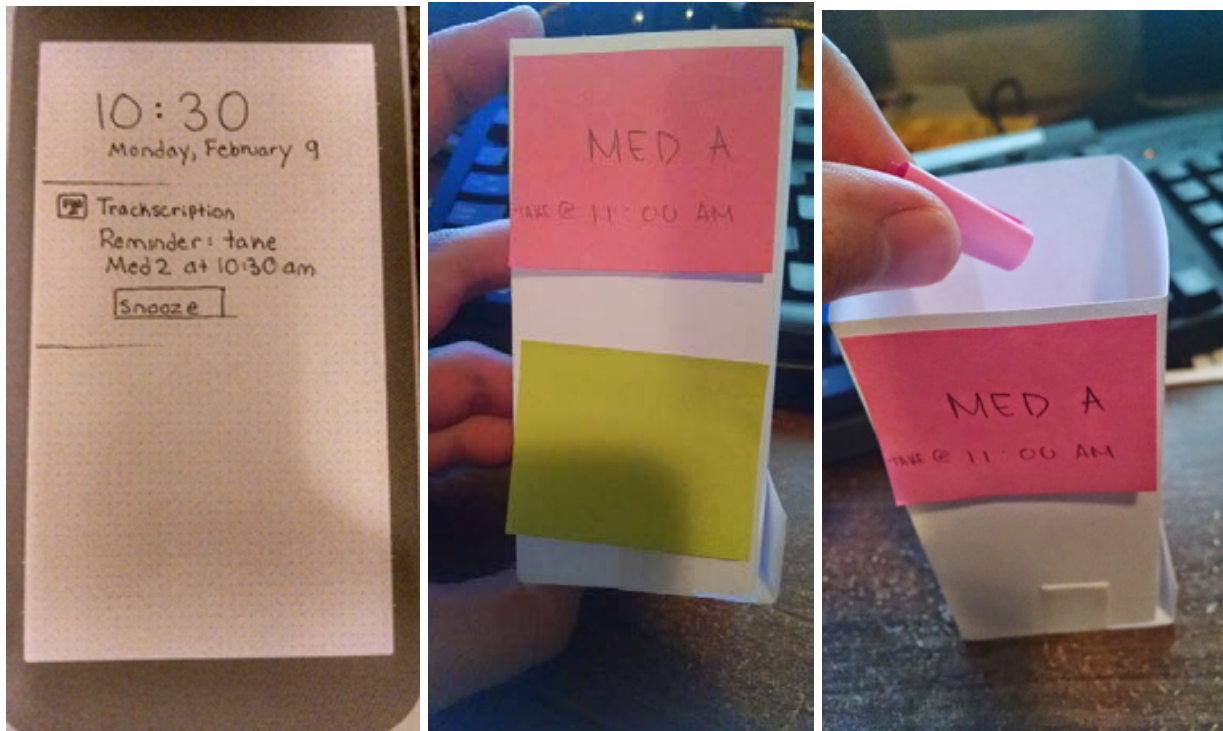
Task 2 "Mistake handling for missed medication or overdose"

1. Designated amount of time passes without user interacting with app of pill capsule
2. Application displays warning notification (left)
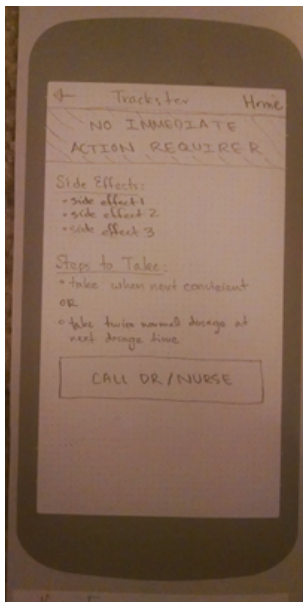3. Upon clicking notification warning message is displayed (right)
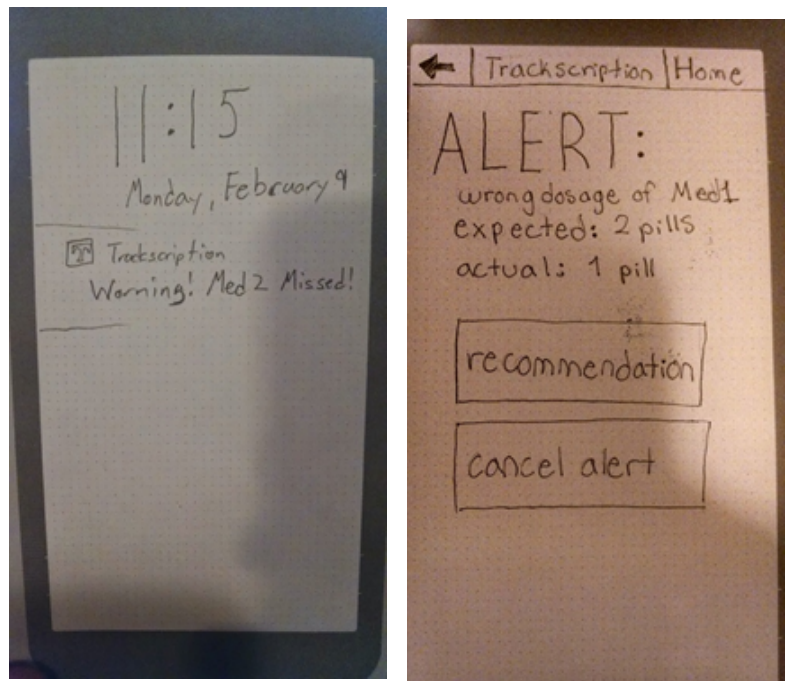
4. Message displayed dependent on severity of mistake
5. User takes action based on information given.
   a. Severe Emergency/Situation
      i. Call 911
      ii. Call emergency contact
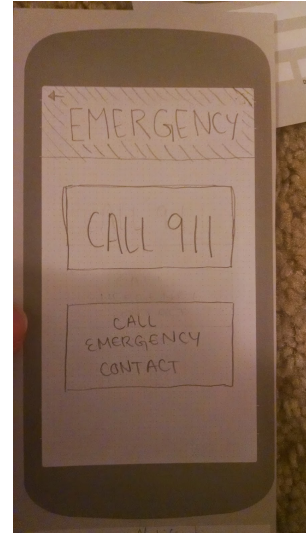
   b. Non-Severe
      i. Given information about possible actions user can take
      ii. Given information about possible side effects
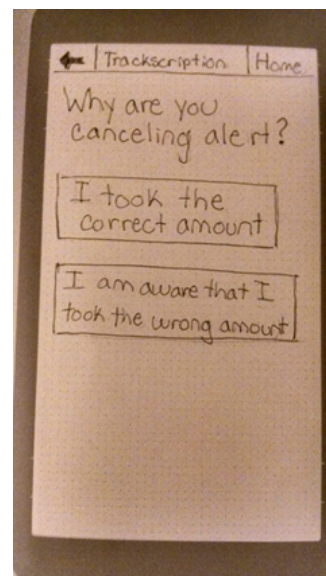
   c. Ignore
      i. User error
         1. Accidentally lost medication
         2. Needed another pill for other reasons
         3. Etc.
      ii. Application Error
         1. Miss-read
         2. Smart Pill Capsule miss-read

Testing Process

In order to improve our design we followed an iterative testing process that involved two major phases. A first phase where we conducted two heuristic evaluations of our paper prototype, and a second phase where we conducted three usability tests.

Our heuristic evaluations were done during the CSE 440 regular lecture. Our initial inspection based method and usability test provided useful information regarding the design of our prototype. Our users were college students very familiar with new technologies and smart phones .The users were able to present problems navigating through our design, and features that could be improved to ease the navigation. While this feedback was helpful, it was given by casual users of our design who are not likely to truly require a medication management tool to handle multiple prescriptions.

We conducted our three usability tests at different times and places, in order to increase the variability in the user response and experience. Our first usability test was done with a female UW Student at a computer lab on campus named Rama. We choose this participant because they are familiar with technology and we were mainly looking for logic issues in our use flows of the application. David gave the context and ran the application as Jorge and Svetlana observed and asked questions at the end of the usability test. For the remainder of the usability tests, we wanted our users to explore both the navigation and the functionality of the tasks and features implemented in our design, and possibly identify potential problems when scaling the application. Initially we planned to focus in patients currently taking multiple medications, with special attention to the elderly. However, due to time constraints, including a long weekend with no open businesses we were forced to center our attention in other UW students.

Our second participant was named Chaz, a male UW student we tested at Mary Gates. We chose this participant because he is was available and willing to help us. David and Jorge introduced the user to the product, gave them their tasks, and asked questions at the end, Zoe was the 'computer' and took notes. We made some slight changes after this test, by adding an automatic countdown on our emergency response screen and putting more info on the smart capsule. The results from this test were so significant that we implemented some of them before running our final test. Our last participant was named Jen, a female UW student we tested at Mary Gates; we chose her because she was willing to help us. Like previous, David and Jorge introduced the product and gave tasks while Zoe was computer and note taker. The

participant confessed to struggle with technology, an aspect that provided unique insight when analyzing the easiness in the interaction with our tool.

Testing Results

There were 4 major changes and revisions to our design, product of the inspection, critique, and posterior user tests. These changes are grouped into 4 categories that identify the core design concept being changed. Each of these changes also prompted further minor changes in our design. Below are the 4 core modifications to our paper prototype.

Smart Pill Box
The first major revision to our prototype involves expanding the functionality of our smart pill box. Initially, the smart pill box was able to send medication reminders to the user through color signals. No other information was relayed to the user through the smart pill box. During our critique and user tests, it was very clear that interacting with the smart pill box was significantly easier than interacting with the phone app. Therefore we decided to move some of the functionality of the phone app to the smart pill box when possible. From the critique and first user test, we decided to add the possibility of introducing a new medication into the app system by simply dropping the pills into the box. This simplifies the act of adding a new medication and only requires scanning QR code from the pill capsule afterwards. From the second and third user tests, we decided to add more feedback to the user using the smart pill box. The smart pill box not only sends a color signal prompting for an user action, but it also displays the current medication being managed by the box, and the next scheduled intake of the medication. This allows for the user to plan the next intake without needing to rely on the phone application. All these changes aim at easing the process of managing medications, and are especially important when considering our focus group, non-tech savvy elder patients currently taking multiple medications.

Home Screen
The second major revision to our prototype also aims at simplifying the process of introducing a new medication into the system using the phone app. During all our user tests, the user struggled to initiate this task. It simply was not clear enough how to initiate the process of introducing a new medication into the system. Direct feedback from the second user gave us the idea of adding a new button to the home screen. This new button labeled "add medication" fully resolved this issue. This also prompted a change in the other buttons from the app home screen. Our old "meds" button was split in "add medication" and "medication info". The "log" button was also replaced by a "medication history button". These changed removed all the

existing ambiguity of the home screen. With the new changes, the process of initiating a new task through our phone app becomes more clear and intuitive.

Synching
Our initial design required using a sync button located in the smart pill box when introducing a new medication into the system. This was done in order to prevent foreseeable user errors when handling the smart pill box. However, from our critique and posterior user tests, it became more and more clear that our main goal during the design of the app was to simplify and ease all the interaction with our design. This involved fully dropping the sync button, and instead aim for a design that allows for error detection. There is currently no need to sync the box with the phone app manually. Instead, it is the box that initiates the syncing once pills have been added into the box. We have also worked on the logic behind the error detection. Some of the errors our smart box will handle involve pouring out all the medication from the box, adding medication to the wrong box, etc··· All these edge cases will be handled using the pressure or weight sensor and a notification system.
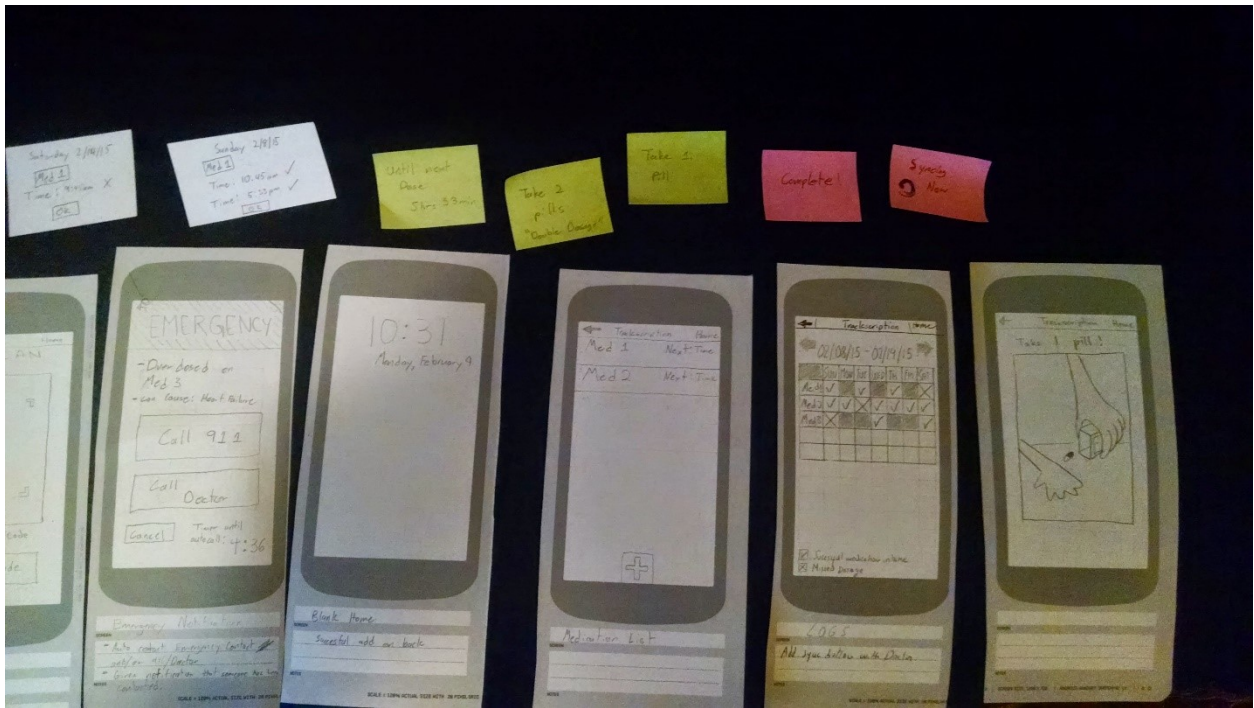
Visual notifications
The last major revision to our prototype involved changing the way we provide feedback to our users. We have eliminated all the transition screens that were not absolutely necessary in order to perform a task. We noticed we were providing too much medication info when this was not specifically requested. This was confusing some of our users when trying to perform a task. We have also put more strength on visual feedback. We now show an image on the phone when introducing a new medication or when taking a new medication that shows how this process is done using the smart pill box. This screen can be cleared once the user follows the on screen visual instructions. This is done to prevent some users from mindlessly clicking buttons to move on through screens. The medication reminders sent to the users are also more clear and descriptive. We removed our general notification message followed by a detailed medication info screen for a simple medication reminder that display the amount, the time and the name of the medication to be taken. This is also done when handling missed medications and overdoses. As described during the first core design change "smart pill box", we are also providing feedback to the user through the smart pill box. This removes the need of using the app for taking medications. The phone app becomes a tool to expand the functionality of the smart pill box, not a mandatory interface.
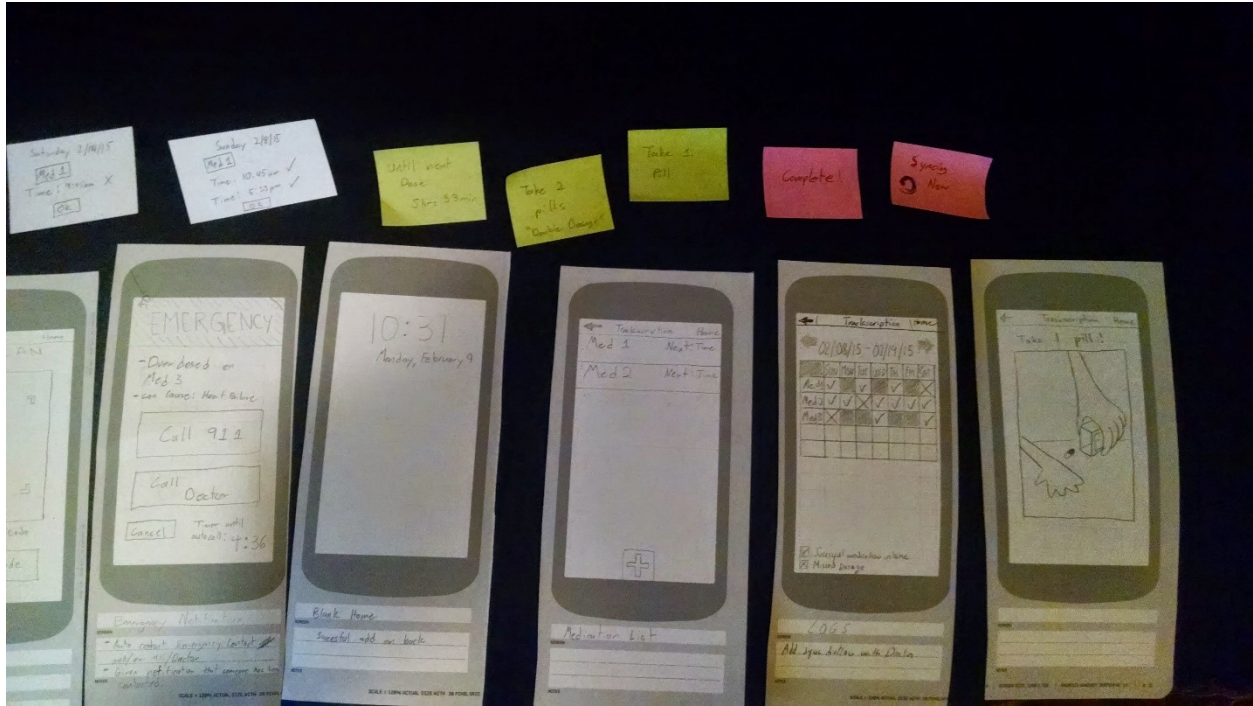
Final Paper Prototype

Overview:
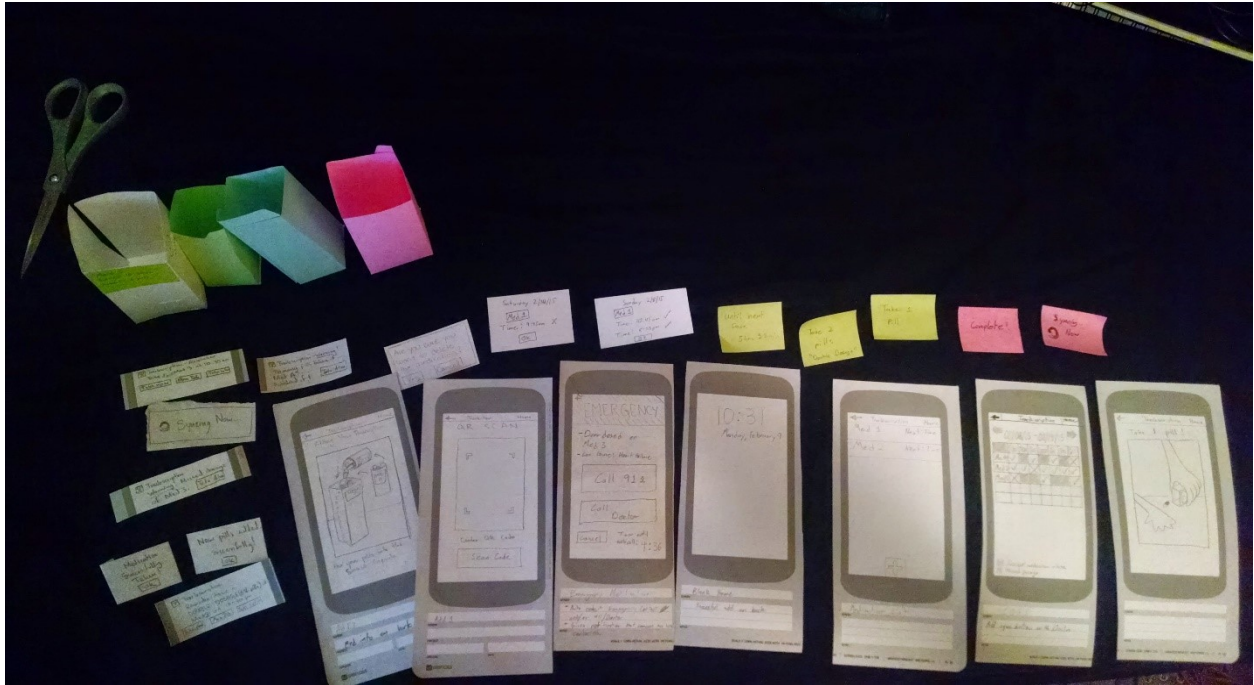
Whole view of prototype
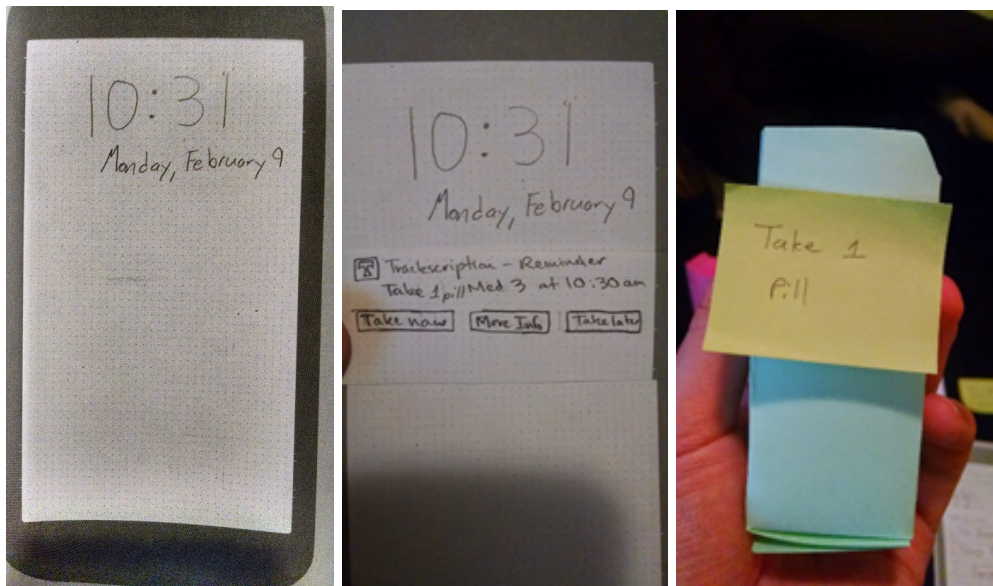

Closer image of modals and screen sets

Another set of modals and more screen sets

Task 1: Reminder to Take Medication

- ● User gets a notification on their phone to take medication. (far left)
- ● Notification gives user several options to take for medication. (left)
- ● Smart Capsule lights up green and screen let's user know how many pills to take (right)

- when users decides to take the medication this screen is shown. (Left)
- After medication is taken users gets a modal confirming that they have successfully taken the medication and also takes them back to home screen. (Right)

## Task 2: Handling Missed or Wrong Amount of Medication Cases
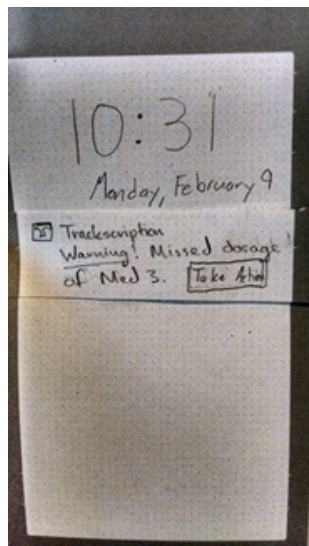
- User gets a notification saying that they missed their medication and a call to take action. (Left)
- Upon clicking on the notification or the button they are taken to the next screen where they are present with more information and course of action they can take. (Bottom-Right)
- In more vital situations users will be presented with this screen instead of the more passive screen above. This is dependent on the severity of the medication consequences that they have an error with. (Bottom-Left)
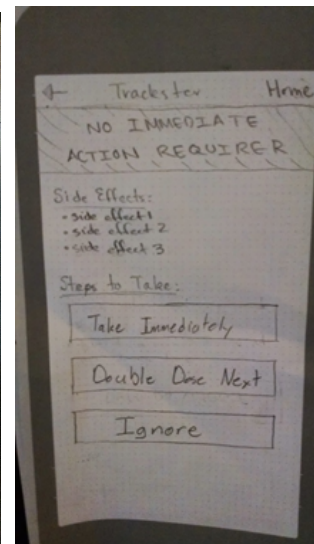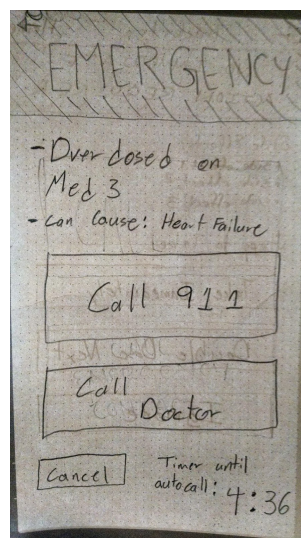
Digital Mock Up

Overview:

Our digital mock up focused a lot on not logic based changes but more aesthetic changes and terminology used in the designed solution. The biggest change we had to focus on when going from paper to our digital mock up was making the final decision on what platform it was designed for and then following through with that design language through our mock up. On our first critique that was really obvious that we need work on typography and color choices. By focusing more on the design language set out by Android Lollipop and Material Design we were able to focus our design more and give it more consistency for the final solution.

Screen 1
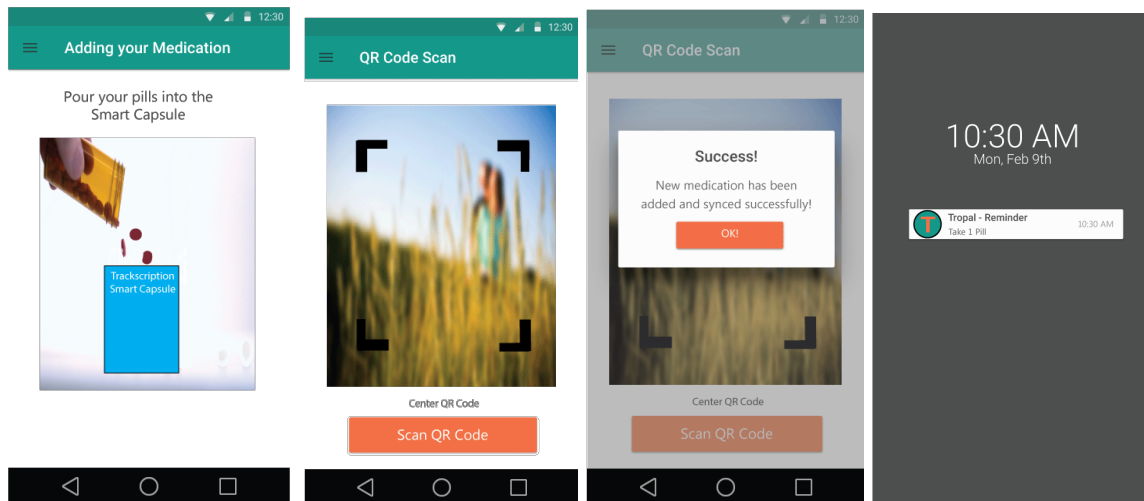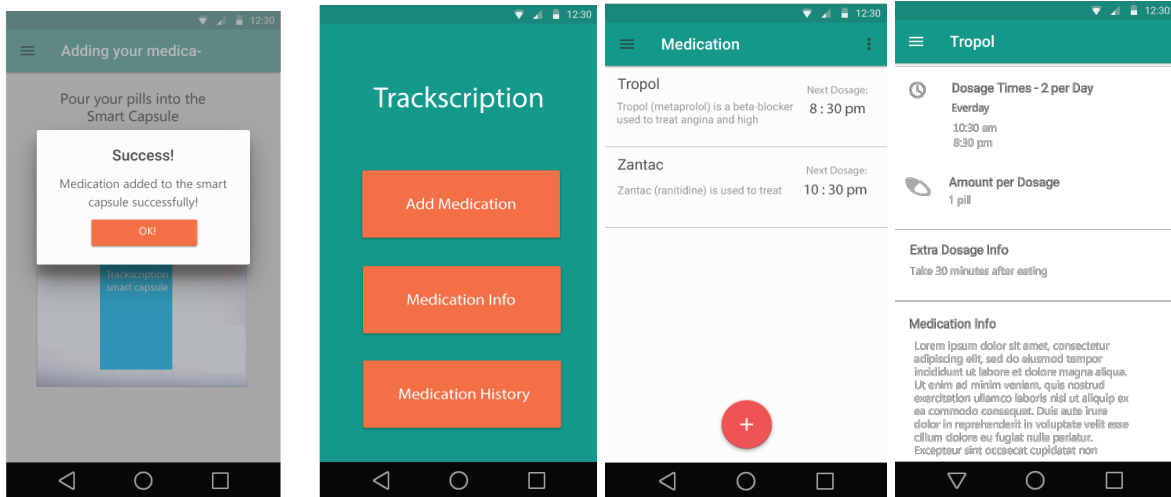
≡ Taking Medication

Take 1 pill of Tropol

Dosage Info
Take with food

Take Later

More Info

Screen 2

≡ Taking Medication

Take 1 pill of Tropol

Success!

Correct dosage of medication
successfully taken!

OK!

Dosage Info
Take with food

Take Later

More Info

Screen 3
8:30 PM
Mon, Feb 9th

Tropal - Reminder   8:30 PM
Take 2 Pills (Double Dosage)

Screen 4

≡ Taking Medication

Take 2 pills of Tropol

Dosage Info
Take with food
(Double Dosage)

Take Later

More Info

Screen 5
11:02 PM
Mon, Feb 9th

Tropal Medication   10:30 AM
Missed medication!

Screen 6

←   ⋮

No Immediate
Action Required

Side Effects
- Mild Dizziness
- Headache
- Drowsiness

Steps to Take

Take Now

Take Later

Ignore

Screen 7

←   ⋮

EMERGENCY

Overdose on Tropol
Can cause: Heart Failure

Call 911

Call Your Doctor

Automatic 911 Countdown
5 : 2 3 : 1 0 ms
Ignore

Cancel Countdown

Screen 8
10:35 AM
Mon, Feb 9th

Tropal - Warning   10:30 AM
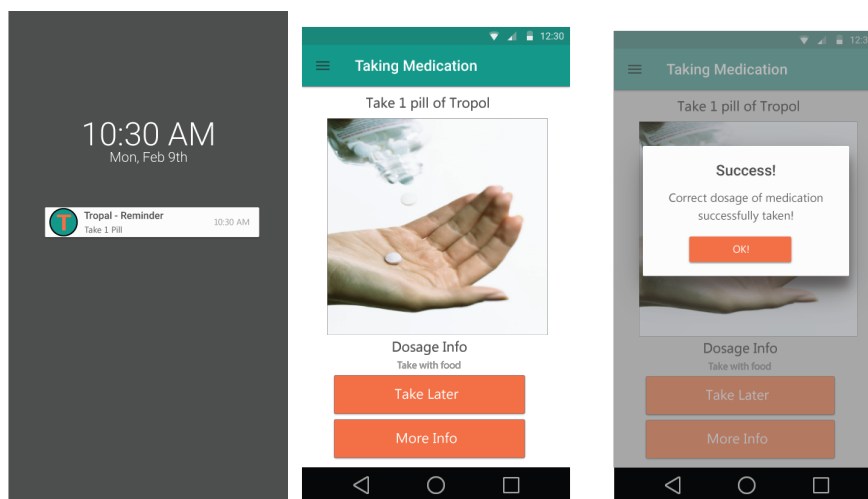Medication Overdose!

Tasks:

Remembering to take medicine

The user is reminded to take medicine through a notification telling them exactly what and how much medicine they should take at what time, providing any additional information about taking it with food, before sleeping, etc. This information is stored in the system through the initial setup of scanning the QR code containing all drug and prescription data for the user. The user can choose to take the medicine later, which will cause another notification to appear after 5 minutes. Lastly the user and choose to see more info about the medicine which they should take.

Assisting in the case of missed medication or overdose

Should the user go too long without taking their medication or take the wrong dosage, a warning notification will appear alerting them to their error and the fact that they may be in danger. To assess this, the user can click to take action, transferring them to an information screen. The first screen will tell them there is no immediate threat, list possible side effects and give a list of options to respond, taking it now, taking a double dose next time, or ignoring this warning completely (in the case of a dropped medicine interpreted as an overdose, etc). The other option for this screen informs the user they are in immediate danger, explains why, and gives them the option to call 911 or their doctor. If no action is taken in 10 minutes, a call to 911 is automatically made from the phone. If the user has stored emergency contacts, a text is automatically sent to them alerting them that the user may be in danger and should be checked-in on.
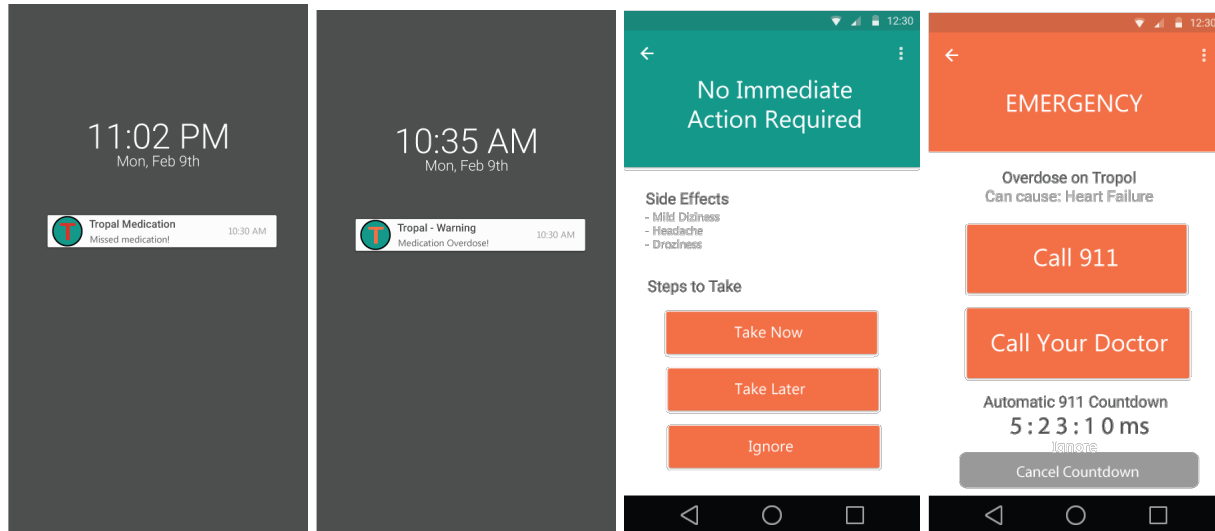
Discussion

From these design iterations, we learned that making the app more understandable to users needed to be our main focus. We had several features in mind, but once we started looking at our design more closely, it was obvious that these features needed to take a back seat and we needed the app's core to work well. We also learned that consistency was very important. We needed to look at our design as a whole and needed to make the design look fluid.

The process gave us a large insight into the usability of our product. Our main goal was to make the app and the capsules very intuitive for many different types of users. While evaluating audiences and doing user research, we were able to change our initial ideas to match the needs of the future users. By looking at our audience in the beginning, we realized that we needed the reminders and alerts to be very straightforward and to include clear pictures, so that everybody could understand what to do. This was proved to be true in the user research. Our users were able to set up the capsules much better once we added visual guides on how to do it. In addition, receiving critique from other designers was an important part of our process as we discovered some inconsistencies in our design. We originally attempted to make our app work for many different cell phone platforms, which caused some issues. After reflecting on this, we decided to aim for a design that flows well with Android phones. This changed how we made our notification system. Instead of being limited to small notifications, we could customize them to take up the phone's whole screen, which was important for the alert part of our design.

While our tasks have remained similar, we also realized that it was very important for our users to be able to add a new medication to our design. In the end, it seems as though we realistically have more than two main tasks. Our users need to know how to respond to alerts and reminders, as we planned in the beginning, but it's almost more important for them to be able to add a new medication to the system. While we spent time thinking about reminders, we didn't take into account that the set-up for the app and capsule is the most intricate. Once we realized this through our usability tests, we were able to focus more on the intuitiveness of this task.

More iterations and more user testing will always lead to a design's improvement. At this point, it will be helpful to have one or two more iterations to fix any holes or last-minute design issues, since we just fixed a few large issues in the last iteration. However, the iterations that we had were enough to reach a reasonable design that feels intuitive and tested.