FunPod: High Fidelity Prototype Write-Up

Team

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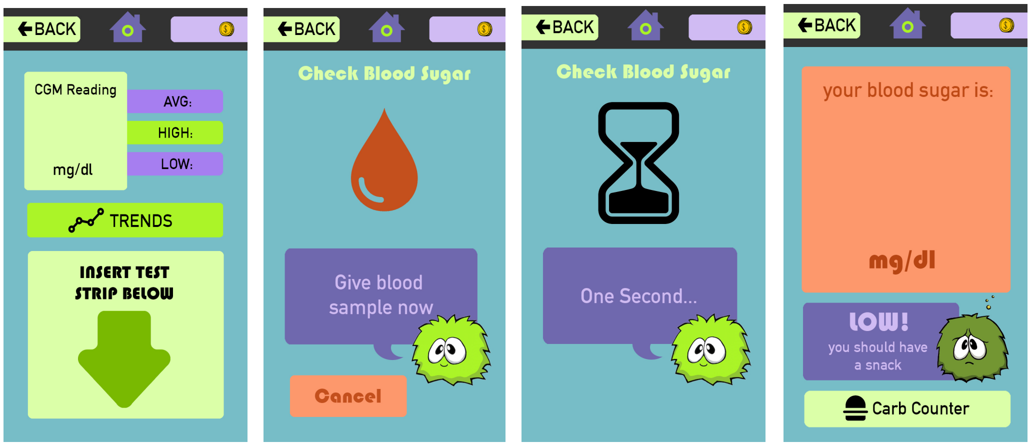
Problem and Solution Overview

For many children with diabetes, managing their condition is very scary and daunting. Diabetes care can be a flurry of self-administering insulin shots, pricking and testing blood, visiting the doctor, etc. Our hope is that by minimizing these fears and simplifying these processes, children can be more relaxed and learn how to manage their health better. Currently, many children manage their diabetes through a Personal Diabetes Manager (PDM), which is a device that tests blood glucose, communicates to an insulin reservoir, and visualizes blood glucose data. Currently PDMs are not user-friendly, and definitely not kid-friendly as the interface is not intuitive. We are improving the Personal Diabetes Manager by designing a kid-friendly interface that integrates reminders, metrics, educational games, and positive reinforcement.

Tasks & Final Interface Scenarios

1. Checking blood glucose (simple)

   This is a simple task that takes less than a minute for people who have had diabetes for several years. It is also done very frequently (7-8 times a day), usually before meals, before bed, and whenever one feels ill. Our app assumes that the user has a Continuous Glucose Monitor System, which would constantly measure blood glucose. However, users do need to double-check their blood glucose level at least 1-2 times a day. Our app has a quick way of allowing for this, assuming our device has the hardware of existing PDMs.



Give blood sample now

One Second...

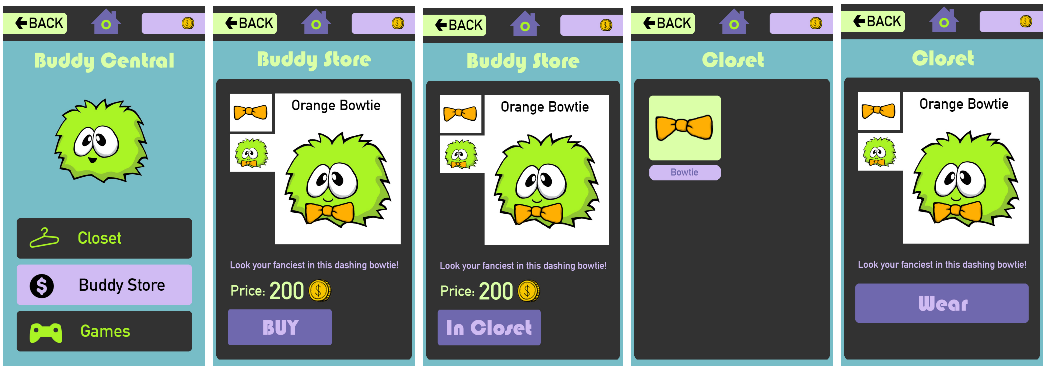
your blood sugar is:

mg/dl

LOW! you should have a snack

2. Using coins earned to buy something in the Buddy Store (moderate)

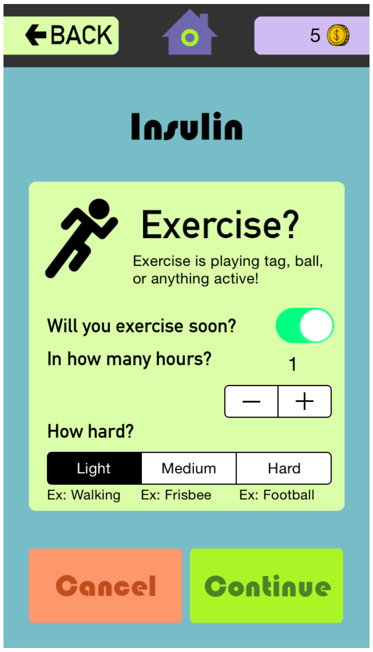
This is a new task we added to test out the reward system that is in place in the app. We felt this task was important after considering the feedback we got that the Buddy needed to be more completely integrated into the application. The user is supposed to go to the Buddy Store, find something to buy with the number of coins they have, and then wear whatever they just bought.



Look your fanciest in this dashing bowtie!

3. Administering insulin (complex)

Administering insulin is complicated because you have to consider a variety of questions such as: “What have you eaten?”, “What was your blood glucose previously?”, “What activities will you be doing later?”, and finally “What amount of insulin do you need?”. This task also incorporates the carb counting portion of our application in the event that the user would like to enter food they are about to eat to get an estimate for insulin. Our application asks the user questions that they can answer to get an estimate of how much insulin they need. In the event the user has eaten something, this tasks links in with the second task because the user can choose to use the carb count from the carb counter to get an estimate for a bolus.



Insulin

Exercise?

Exercise is playing tag, ball, or anything active!

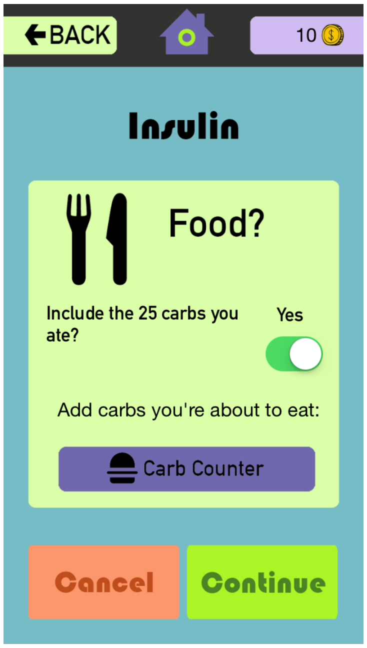
Will you exercise soon? ●

In how many hours? 1

− +

How hard?

[✓ Light]	Medium	Hard
Ex: Walking	Ex: Frisbee	Ex: Football

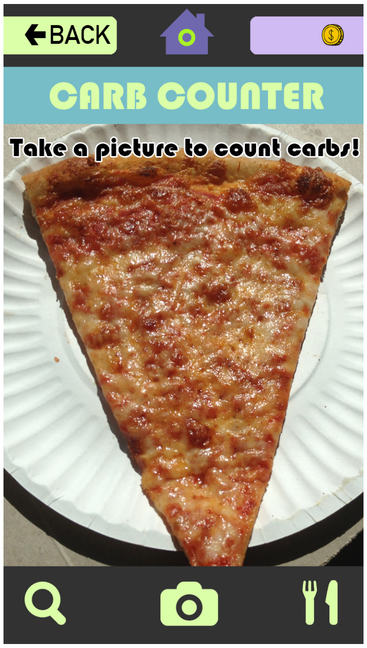


Insulin

Food?

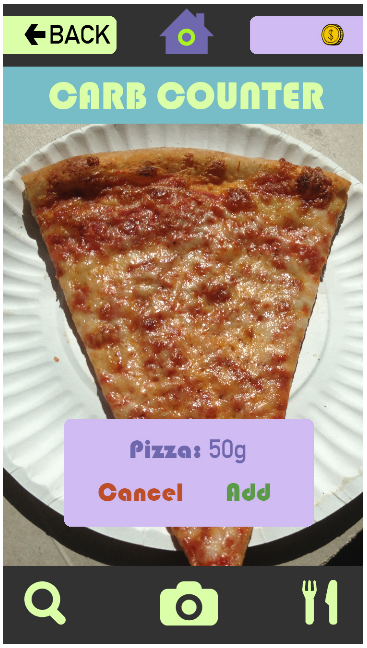
Include the 25 carbs you ate? Yes ●

Add carbs you're about to eat:



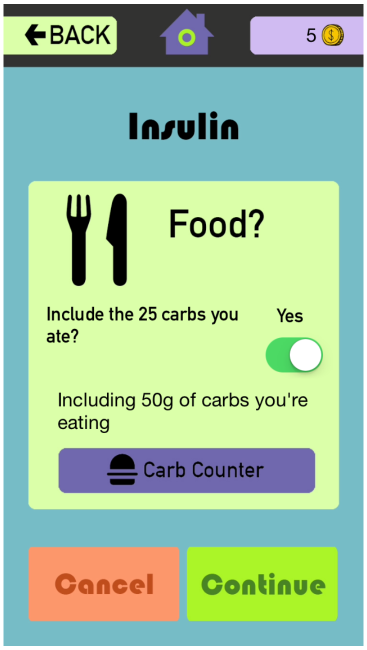
CARB COUNTER

Take a picture to count carbs!



CARB COUNTER

Pizza: 50g

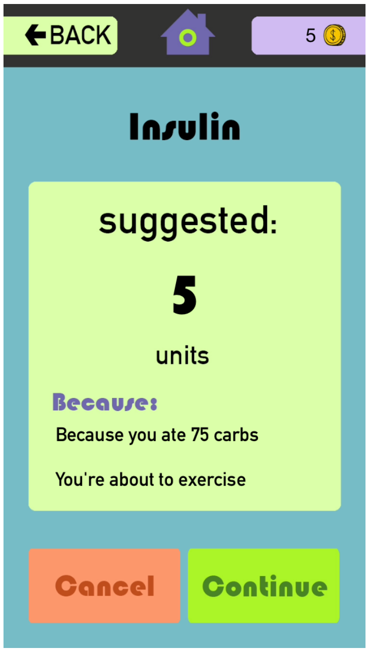


Insulin

Food?

Include the 25 carbs you ate? Yes ●

Including 50g of carbs you're eating



Insulin

suggested:

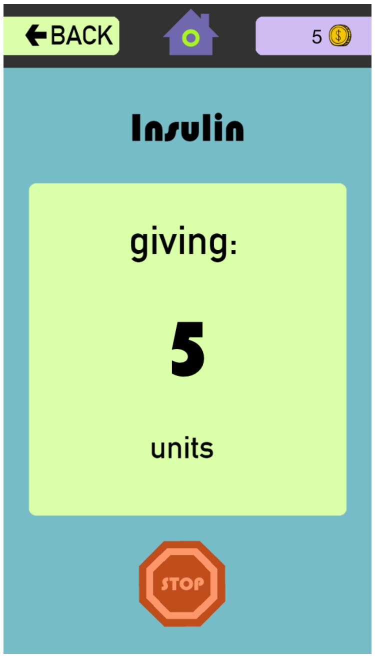
5

units

Because:

Because you ate 75 carbs

You're about to exercise

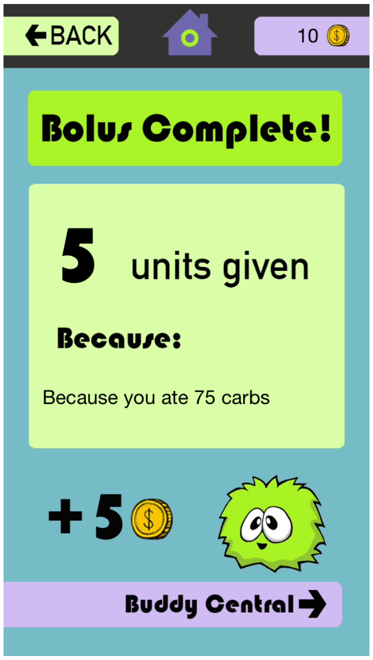


Insulin

giving:

5

units



Bolus Complete!

5 units given

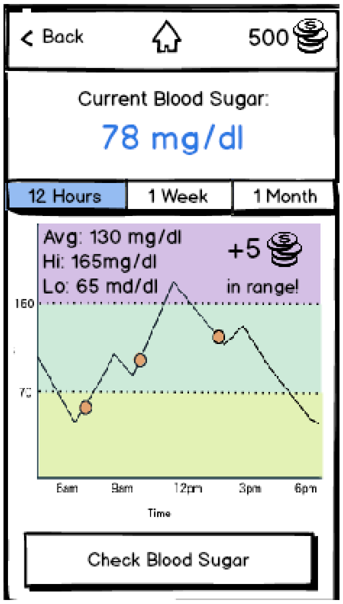
Because:

Because you ate 75 carbs

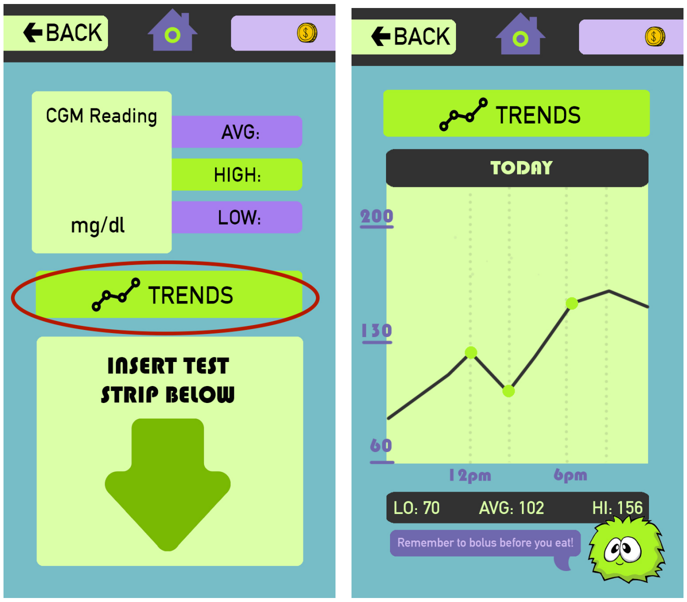
Major Usability Problems Addressed

1. [H2-2. Match between system and the real world] [Severity 3] [T,K,A]
   The phrase "Current Blood Sugar" is used on both the first screen and in the "Check Blood Sugar" screen. The "Current Blood Sugar" value is obtained from a Continuous Glucose Monitor System, but as the specification states, some users might not have this. For users who need to manually check their blood sugar and do not have a continuous measurement, it should be clear how stale the value is so that users do not have a false sense of security. Instead of simply 73 make it 73 (4 hours ago).
   - We assumed for sake of ease that all users have a CGM system and can test their blood sugar manually if need be to get a more accurate number.

2. [H2-6. Recognition rather than recall] [Severity 3] [T,A,K]
   There is a graph view of the blood sugar history, which is very helpful and informative to someone living with diabetes. However, to only way to access this screen is to tap "Check Blood Sugar" on the home screen, which is not an obvious place to look for this functionality due to the misleading label. Instead, there should be a dedicated button with a label like "Blood Sugar History"
   - Checking blood sugar history is not one of the three required tasks so we decided at least for now it is not essential to the function of the PDM and to not implement it. We did however add a button on the Check Blood Sugar page that takes the user to trends, which as of now, just has a static graph.



Medium-Fi with trends on same page

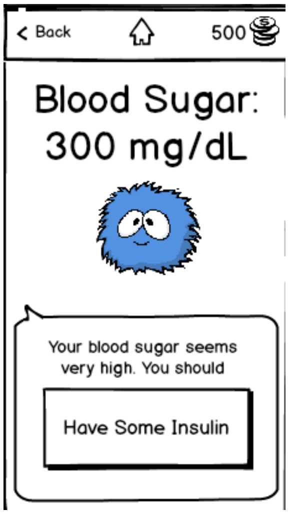


Remember to bolus before you eat!

New design with separate trends page

3. [H2-1. Visibility of system status] [Severity 3] [K]
   I have no way of visualizing my history of insulin shots. Or is that the yellow dots on the "Check Blood Sugar" page? It seems like perhaps the yellow dots represent meals, maybe you should pick a different logo for that and make them tapable, and add logos representing the insulin shots that you could tap to view time and number of shots.
   - For the sake of ease, we did not implement history of insulin shots and meals since it was not directly related to the three tasks.
   - However, in future iterations the "Trends" page is likely where users would be able to see when they gave themselves insulin and how much.

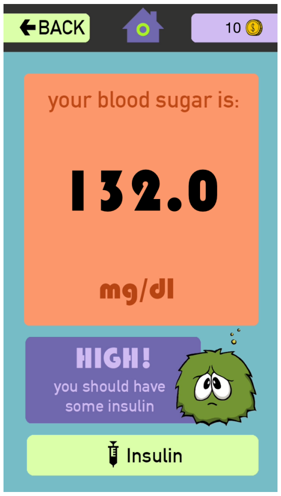
4. [H2-1. Visibility of system status] [Severity 4] [T,A]
   One of the screens informs the user that their blood sugar is 300 mg/dL, which is considered "severe" and may require immediate intervention. However, the text that indicates the level is very high is in small print and in the same color as everything else. The character is also onscreen with a smile. This gives the user a false impression that nothing is wrong, especially if they do not understand the number or if they don't bother to read the explanation. To fix this, the explanatory text should be in red or some other highly visible color, and the font size should be increase. Alternatively, the 'buddy' itself could be an indicator of blood sugar levels (changing color and facial expression when blood sugar levels reach critical levels)
   - We indicated in red if the user's blood sugar was out of range.
   - The buddy became sad too.



Blood Sugar:
300 mg/dL

Your blood sugar seems very high. You should

Medium-Fi design with little visual indication of high blood sugar



your blood sugar is:

132.0

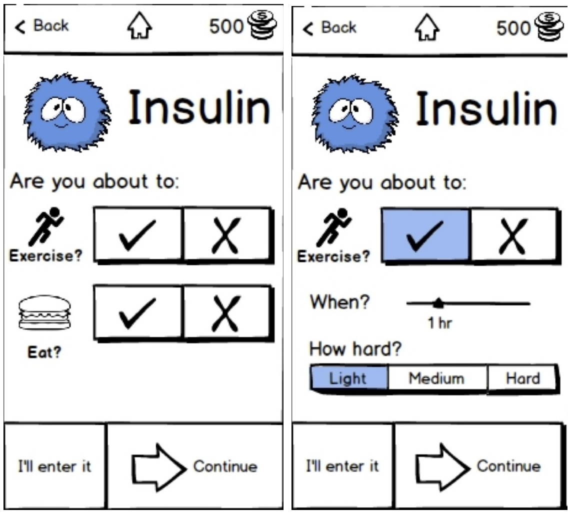
mg/dl

HIGH!
you should have some insulin

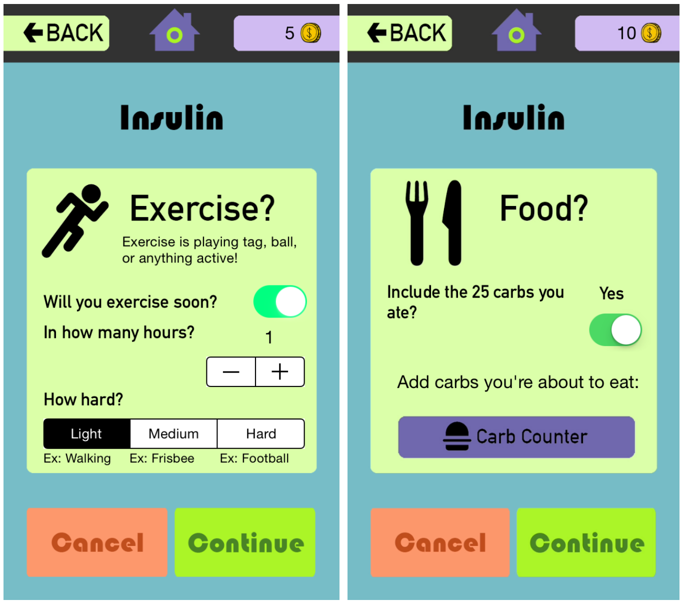
New design with red box as well as sad buddy to indicate high blood sugar

5. [H2-1. Visibility of system status] [Severity 4] [T,K]
   When using the “Insulin” feature, after choosing “Yes” to Exercise, there is no way to go back and adjust the value for Eat. Clicking “Continue” immediately brings the user to a page where the amount of insulin is given, but there is no way to adjust how much food will be eaten. To address this, have the back button bring the user back to the “Exercise”/“Eat” page so that both values can be adjusted before continuing.
   - When user changes “Insulin”, we ask if they are exercising and then if they are eating on separate pages. We then take them to the carb counting

page if they want to count carbs they are about to eat. At any point the user can hit back to return to one of the previous pages.



Medium-Fi design with options to enter exercise and food on the same page



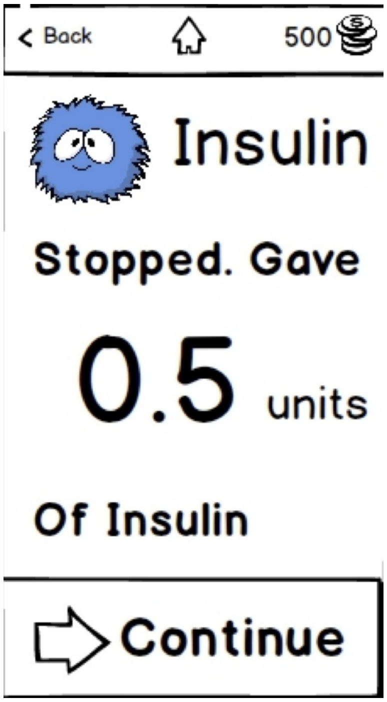
New design with exercise and food entry on separate pages

6. [H2-9. Help users recognize, diagnose, and recover from errors] [Severity 3] [T,K,A]
The confirmation page has a change button, which most people would expect to perform the same action as going back so that the user can make changes to

their inputs. However, it brings up a manual entry screen instead. This is confusing and unexpected. To fix this, the change button could be renamed “I’ll enter it” like the other screens.

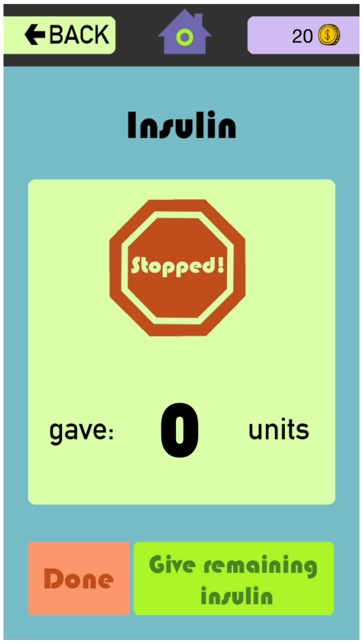
- We have done away with manual entry for insulin now, trusting that the device will give the best estimate possible for insulin dosage.
- In future iterations, we hope to have a change button and “I’ll enter it” button on the confirmation page.

7. [H2-9. Help users recognize, diagnose, and recover from errors] [Severity 4] [T] It is very easy to accidentally hit the “Stop” button while receiving insulin. However, it is not easy to undo this action. The continue button navigates the user away from that page, instead of continuing to dispense insulin. To fix this, there should be a button that allows the user to receive the rest of the specified dose of insulin.
    - We changed it according to suggestion, by having a button that allows user to get remaining insulin instead of just a “Continue button”



Stopped. Gave 0.5 units Of Insulin

Old screen with ambiguous Continue button



New screen with “Give remaining insulin” and “Done” buttons

8. [H2-4. Consistency and standards] [Severity 3] [T, A]
   It isn’t clear how to proceed from the manual entry page when using the Carb Counter. It is also not obvious whether or not the data from the camera capture is included in the insulin calculation after using the manual entry. Finally, the manual entry does not seem to actually provide a carb count, so the name of that feature is misleading. To fix this, the manual mode should be clearly separated from the automatic mode, or the automatic mode should lead into the manual mode, where the user can proceed and adjust values. In addition, the manual mode should list the carb counts for all of the chosen food products.
   - We have not implemented the manual entry for carb counting yet.
   - We hope that future iterations that the user can manually enter in a food item and the appropriate carb count for that.

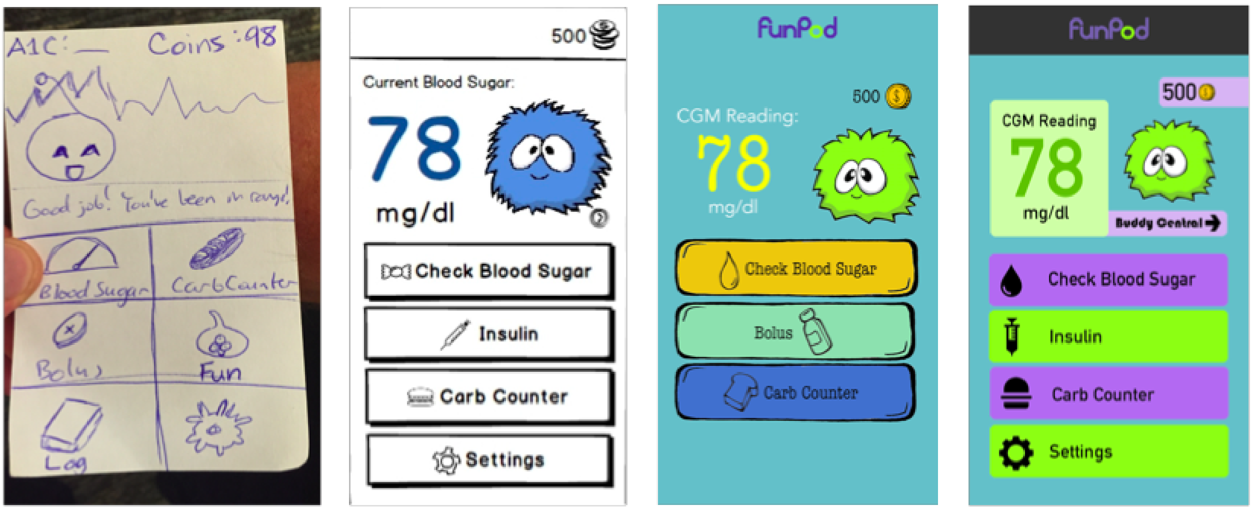
9. [H2-7. Flexibility and efficiency of use.] [Severity 3] [M]
   The carb counter screens are really cool and make it easy for users to add carbs by taking pictures. For the manual entry, it helps to be able to search for the food you ate. But it would take quite a while. I’d suggest remembering what foods people have selected recently, like a food/carb history, because people generally tend to eat the same foods. The user would be able to select from among the other foods they’ve eaten recently, instead of having to enter the same foods in again. You could also, like Foursquare, recognize when the user is in a food place (restaurant, grocery store, etc) and prompt the user to enter their food in

the moment, so they don't have to remember later. In that prompt, you could even suggest healthy food at the restaurant for the user to consider eating.

- For the sake of ease, we have not fully implemented the database yet. So far we have the functionality to add just pizza to the plate and calculate insulin units for that.
- Healthy food recommendations would be nice, but not necessarily a specific requirement for our app. This is because a diabetic person can enjoy precisely the same diet as a non-diabetic person so long as they cover appropriately with insulin dosages.

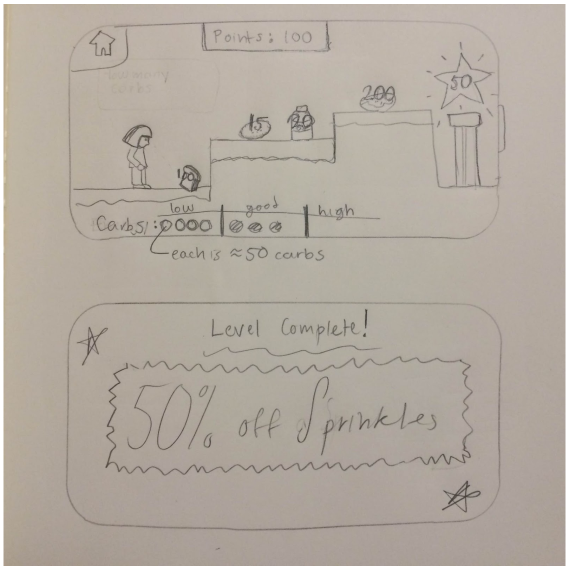
10. [H2--7. Flexibility and efficiency of use] [Severity 4] [A]
Given that insulin dosage often needs to on scale of 1-100 units. an up down arrow layout might be less than optimal. Perhaps allow the typing in of units with the keypad.
    - We have gotten rid of manual entry now for sake of ease, trusting that the device would give the best possible estimates for , but we would change it back to the dial-up/dial-down to prevent users from accidentally entering in lethal dosages.
    - Studies have shown that having such a type of manual entry feature would enable users to get a better idea of how big or small of a dose they are getting themselves

Design Evolution

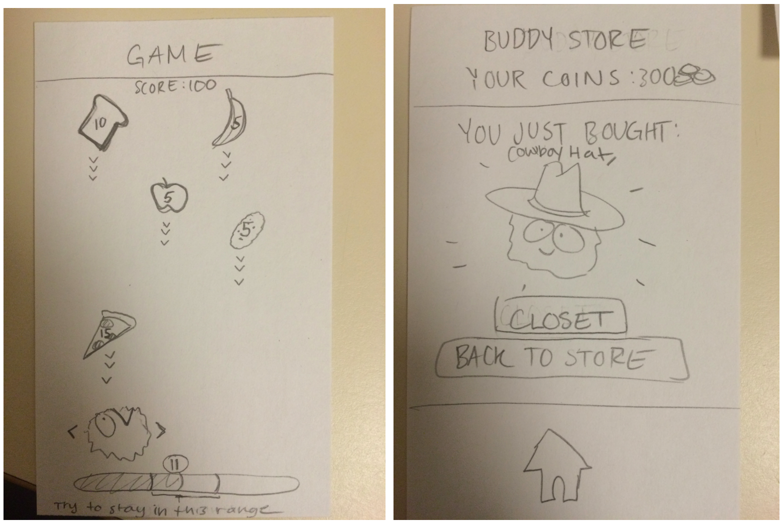


The series of images above show how the main screen of the application has changed with each iteration of the design. In general, we have tried to simplify and polish up the elements on the screen as well as make the color scheme more cohesive.

The biggest decision we made going from our sketches to our paper prototype was changing the app from a Mario Brothers-style game to a “care for your pet” game. We made this decision because it makes more sense as far as integration with the diabetes management side goes.



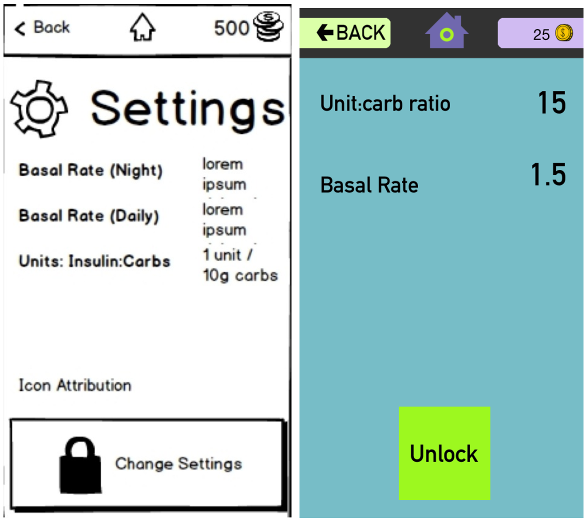
Initial sketch for the Mario Brothers-style game



Paper prototype screens for an arcade game and store centered around a pet

The changes we made from the paper prototype to the medium-fidelity prototype in the application were based on results from the user testing we did with type 1 diabetics.

Some of these changes included making the app more kid-friendly by changing buttons from “Bolus” to “Insulin” (a less technical term) and by making it so parents can set certain rates and restraints on the settings page (which requires a passcode to make changes). One participant also suggested that we give coins for more than just bolusing. To do this, we now award coins whenever the user tests their blood sugar and it is in range. Another participant suggested that we include averages on the trends page, so we added those statistics to Trends page in both the Medium-Fi and Hi-Fi prototypes.



Settings

Basal Rate (Night) lorem ipsum

Basal Rate (Daily) lorem ipsum

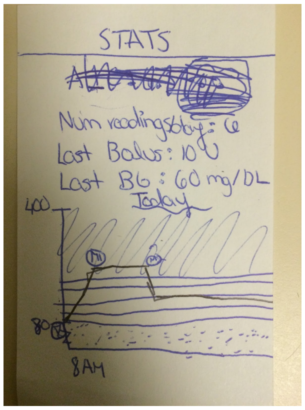
Units: Insulin:Carbs 1 unit / 10g carbs

Icon Attribution

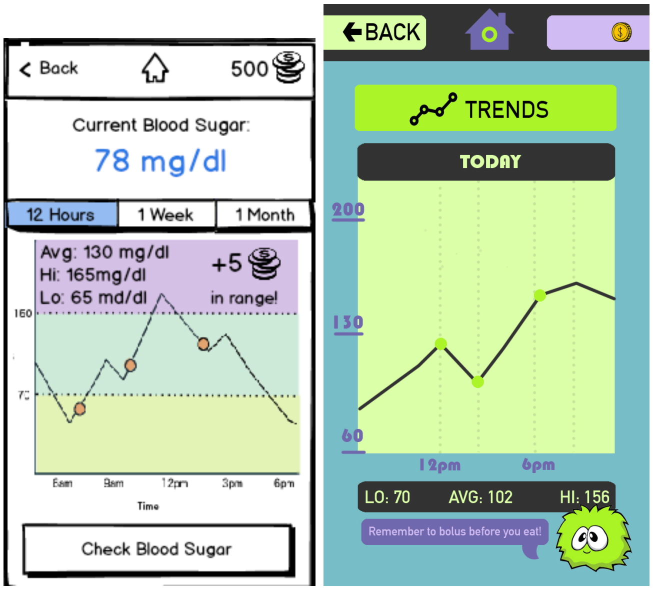
Unit:carb ratio 15

Basal Rate 1.5

Medium and Hi-Fi settings pages with options to Unlock/Lock for parents



First sketch of the stats/trends page



Medium-Fi and Hi-Fi trends pages with averages as well as lows and highs for blood sugar

Many of the changes we made from the Medium-Fi prototype to Hi-Fi #1 prototype were based off of feedback we got in the our heuristic evaluation as well as from feedback from our CA (for images of specific changes, please see the above section on “Major Usability Problems Addressed**”).** One of the biggest issues we tried to fix was unclear labeling for buttons. This was especially an issue for some of the bolus screens where it was unclear what “Continue”, Change”, or “Cancel” meant exactly. We tried to fix this by putting more descriptive labels “Give remaining insulin” and “Done.” We also got a lot of feedback suggesting that we further integrate the buddy into the diabetes management portion of the app. We did this by having the Buddy be sad when the user’s blood sugar is out of range and by having the buddy on every screen where the user is awarded coins. Some of the instructions in the application also now appear in speech bubbles to give the buddy more of a voice.

The final changes we made going from Hi-Fi #1 to Hi-Fi #2 were mainly aesthetic. Some of our classmates mentioned in studio that the buttons in the Hi-Fi #1 prototype seemed unpolished, so we decided to go for simpler, cleaner buttons. We also got some feedback saying that the original Hi-Fi prototype had a few too many colors, which could be visually distracting. We remedied this by deciding to use mostly purple and green to give the app a more cohesive aesthetic.

Prototype Implementation

Our Hi-fi prototype is an iOS app that was build in Xcode and deployed via diawi to run as a native app on an iPhone. Xcode was generally easy to use, but the interface builder was frustrating to use. The dimensions that were used on the interface builder were not compatible with iPhone 5. Instead of just using whole screens, we add to individually add all the assets Diawi was straight forward to use because it just requires one to upload 2 files and share a link to the device on which the app is to be downloaded.

We had a few Wizard of Oz elements in our demo. People testing our app had to press a button to “test blood sugar” and had to imagine that there was an attachment that one could plug into the phone to test blood sugar. Such an attachment currently would not be feasible to obtain since it is not out on the market yet. In addition, to insure that they had enough coins to buy something in the Buddy Store, we created a secret button in the FunPod logo that would increase the number of coins. This way, people did not have perform tasks over and over again to earn the coins necessary to purchase a bowtie. Lastly, we told people that we did not have a real carb counter that can recognize foods from taking pictures, but we assured them that this technology is feasible since other apps exist that can do this. We had people add a picture of pizza to count as something they ate, to take them to the insulin page and aspects of the app.

We also had to use dummy data for blood sugar numbers because we had no way to test people’s blood sugar, due to lack of the iPhone attachment. In addition, even if this was possible, we would have to prick people and draw blood, which would be way too invasive and risky considering this is a quick demo.

Our current app performs the three basic tasks of testing blood sugar, counting carbs, and administering insulin. However, for future iterations, we would like to implement manual entry for carbs, dial-up/dial-down manual entry for insulin dosage, the database of carb counts, and data analysis of blood sugar history. Furthermore we would like to do user testing on actual children with our current prototype before we move forward on implementing the new features. We hope to obtain IRB approval before we engage in such testing.