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CS 147
Assignment #1
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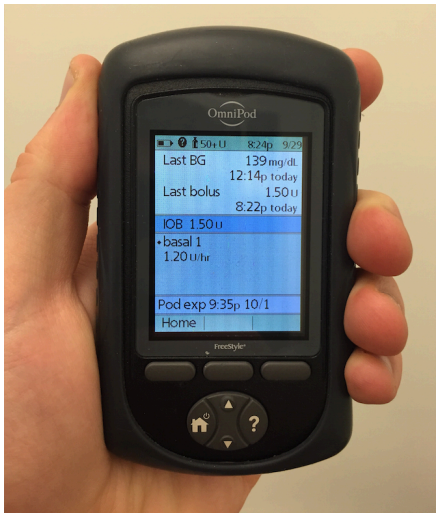
Project Proposal: Smart Phones and Diabetes Data

Problem Background

As someone who has had type-1 diabetes for nearly 10 years, I realize how much effort must go into proper personal diabetes care. A diabetic must check his blood sugar at least 4 or 5 times daily, count the carbohydrates he eats at every meal, and deliver insulin based on his blood sugar, diet, and level of activity. Furthermore, he must take all of the data aggregated over the days and weeks and make adjustments as needed in order to maximize the effectiveness of his diabetes care. However, many diabetics lack the time, tools, or capacity to most effectively manage their diabetes care on their own. Diabetics everywhere could take much better care of their disease if they were able to efficiently analyze their self-collected data and share it with their healthcare providers.

Analysis of Problem

Existing diabetic technology does a fair job of providing this, but also falls short in some ways. Take for example, my Personal Diabetes Monitor, or PDM (pictured at right). This unit allows me to test my blood sugar and adjust my insulin delivery (via a wirelessly-connected "pod" that I wear on my abdomen) based upon my pre-programmed insulin needs. One of its biggest drawbacks (besides a frustrating UI) is the way in which it displays user data such as blood glucose history and insulin delivery. Relevant statistical information is available in both list and scatter plot form, but is not provided to the user in a way that encourages her to frequently review the data and, most importantly, make adjustments to her dosages that will yield greater control. The result is that even though insulin needs can change both frequently and drastically, most diabetic patients will only make changes at their doctor's appointments every 3 or 6 months.



Suggested Solution

I propose integrating the technology of the PDM (as well as most blood glucose meters and insulin pumps) into a smartphone application. The result will not only be a much less expensive unit (less than one-hundred dollars as opposed to a thousand), but also one that would enable easy and frequent correspondence with the healthcare provider. By testing one's blood sugar using a hardware attachment for the phone and issuing commands from the phone instead of PDM, all of the same data could be collected on the phone and therefore be made easy-to-share. With better analytical tools and enhanced communication between patient and provider, the patient would be able to update his dosages far more frequently, and enjoy substantial health improvements associated with better diabetes care.

Experiment

To test the effectiveness of such a system, I would randomly assign two groups of type-1 diabetics aged 18-45 (as is standard in diabetes studies) to use either my smartphone unit or a traditional care unit like the PDM over the course of three months. (The unit used would constitute my independent variable.) At the end of the experiment, I would measure each group's relative improvement from the start of the experiment by its member's hemoglobin A1C (a test that measures roughly the average blood sugar of a person over the course of three months), as well as other data indicative of enhanced diabetes control, such as number of blood glucose measurements taken daily and number of missed mealtime boluses (the dependent variables).

I would expect to see a substantial improvement in the overall diabetes care of the group that used the smartphone application, as they would be more prone to communicate with their healthcare providers about the control of their disease and therefore receive help and advice allowing them to make improvements.