**Insulin Pump User Interface Project**

Team EERC

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**Abstract** An insulin pump used by a diabetic patient can often be confusing or difficult to use. For this reason we designed a user interface for a phone app connected to an automated insulin pump system. Our goal was to create a simple, good-looking interface which presented important information to the user in a clear way. Additional functions which we wanted to include are a list of previous readings, a manual operation mode in which the user can administer a dose of insulin when they need one, a way for users to schedule future doses, and notifications of events which can affect how the pump or app will function. We created diagrams and interface mockups to assist us in achieving all of these goals.

1. **Introduction**

The need for a better solution to insulin monitoring and dosing for diabetic patients has also led to the need for a user interface for the new device. Currently, diabetics monitor their own blood sugar and inject insulin as needed throughout the day. This leads to spikes in both blood sugar and insulin as food is eaten and insulin doses are given. An automated insulin monitoring system which can connect to a phone app can keep track of insulin levels continuously throughout the day, injecting insulin doses as needed to maintain a constant blood sugar level. This will eliminate the large swings that patients currently experience, increasing the quality of life of the individual dramatically.

The health of the patient will also be improved, as reducing the variation in blood sugar levels can eliminate the long term negative impacts of diabetes, as well as the short term negative impacts by maintaining a level of blood sugar closer, or identical to, the levels of a person without diabetes.

1. **Background**

Diabetes is a disease in which the body either cannot produce enough insulin (type 2 diabetes), or cannot produce insulin at all (type 1 diabetes). Insulin is a hormone in the body used to process and break down sugars and starches to move them out of the bloodstream, and into nearby cells.

When a patient without diabetes consumes food, the sugars and starches are introduced into the body and insulin is then produced and released by the pancreas. As a result of the insulin processing the food, blood sugar levels will lower to a normal level and the patient will feel no adverse effects. For patients with diabetes, the insulin produced may not be enough to lower the blood sugar to a safe level, or the patient may have taken a dose which is too small for their level of blood sugar. This leads to a condition called hyperglycemia, which is characterized by high blood sugar, high sugar levels in urine, increased frequency of urination, and increased thirst. This can lead to another condition called ketoacidosis, which can be life threatening.

Hypoglycemia is the opposite of hyperglycemia; it is when a patient has abnormally low blood sugar and is caused by not consuming enough sugars or carbohydrates. This condition is often characterized by shaking, blurred vision, confusion, dizziness, and weakness. While very serious, this condition can be treated simply by eating or drinking something containing sugar or carbohydrates. In severe or untreated cases, this can lead to seizures, unconsciousness, comas, or even death. In these severe cases, a hormone called glucagon, a hormone which stimulates the liver into releasing stored sugars, can be injected into the patient.

Using a self-contained insulin pump and blood sugar monitor, patients can avoid both hypoglycemia and hyperglycemia. Maintaining a normal level of blood sugar also allows the patient to live a more normal life, spending less time checking their blood sugar and reacting to the reading. The more often a patient experiences levels of low and high blood sugar, the more susceptible they are to the long term effects, such as high blood pressure, higher risk of heart attack and stroke, blurred vision or blindness, and numbness or tingling in the hands and feet.

1. **The Project**

The goal of our project was to design an interface for an insulin pump and blood sugar monitor unit. We wanted to make information very clear and easy to read, and accomplished this by making the current blood sugar reading the prominent feature on the main form. This information is the most important to the user, as this will determine how urgent their current situation is. The other important information displayed on the main form is when the next dose will be given, so the patient can determine whether they will need a higher or lower dose.

Here is the main page: ![A screenshot of a cell phone

Description generated with very high confidence]() As with what was stated above we wanted a very simple design for this, the only things on the page is the latest reading, the next reading time, and buttons to go to the other pages. Here is the reading history page: ![A screenshot of a cell phone

Description generated with very high confidence]() This page is also very simple in that it only is a page to display the records of what the insulin pump took. The other pages like the settings page just contains a couple of textboxes, and the schedule dosage page has a couple of fields, so you can set a time for a dosage and a button to confirm this is want you want.

The biggest problem with this project was we were planning to make the project with some third-party software and visual studio that would very closely imitate an android phone. But just before our presentation date we had to scrap that idea because we didn’t have enough time to figure out exactly how long it would take to learn how to use the software and be able to make this insulin pump. So we ended up deciding to use WinForms instead and were able to get into most of the functionality we wanted to have for the presentation.

1. **Conclusion**

We learned how to do some basic C# programming, and we learn how to work in a group of two and split work up evenly. We also learned how to do some designing in WinForms. The one thing we both agree one that could have been improved is that we could have spent a lot more time working on just the visual aspect instead of the coding of functions on each page.

1. **References**

American Diabetes Association, *Type 1 Diabetes*, http://www.diabetes.org/diabetes-basics/type-1/

American Diabetes Association, *Type 2 Diabetes*, http://www.diabetes.org/diabetes-basics/type-2/

American Diabetes Association, *Hyperglycemia*, http://www.diabetes.org/living-with-diabetes/treatment-and-care/blood-glucose-control/hyperglycemia.html

American Diabetes Association, *Hypoglycemia*, http://www.diabetes.org/living-with-diabetes/treatment-and-care/blood-glucose-control/hypoglycemia-low-blood.html

American Diabetes Association, *Insulin & Other Injectables*, http://www.diabetes.org/living-with-diabetes/treatment-and-care/medication/insulin/

1. **Appendix**