Specifications

for

Syringe Auto-Loading & Usage Tracking Equipment

Date: 9/19/07

Team Members
Daniel Littleton
Scott Relation
Kathryn Tempe
Introduction and Overview

Several times each day millions of diabetes patients throughout the world must give themselves injections of insulin in order to control their blood sugar levels. The amount of insulin required depends on the progression of their disease, the level of physical activity they’ve been participating in, and the type and amount of food they’ve been having over the course of the day. Because the amount of insulin needed can vary greatly from injection to injection, a standard dosage can not be used; the amount must be calibrated precisely each time. The loading of a syringe with a specific dose of insulin can be difficult for some patients with disabilities. Those that are visually impaired may not be able to clearly read the indicator lines on the syringe, and so are unable to reliably load a precise amount of insulin. In some cases patients may have reduced hand motor skills or touch sensitively which prevent them from being able to easily and accurately prepare a syringe. The Syringe Auto-Loading & Usage Tracking Equipment is meant to assist these individuals; allowing them to properly prepare syringes with the dosage of insulin they need without requiring any supervision or intervention from others.

The device will accept insulin bottles of any size or shape and will be able to work with standard 50 unit (1/2 cc increments) or 100 unit (1 cc increments) disposable syringes. The dosage of insulin dispensed by the equipment must be accurate to within .1 unit of the user requested amount. Time-stamped records will need to be kept for any doses that are drawn, and patients will be alerted to how much insulin remains in a bottle following the loading of a syringe. A digital display will present prompts, dosage amounts, and other information in a manner and size that will make it easier for a somewhat visually impaired patient to read. All prompts, amounts, and information will be outputted audibly as well as visually. The interface for the device will have Braille labeling on all of its keys to make the device more usable by partially or completely blind patients. Key size, location, and type will be chosen to make the equipment more usable by individuals with reduced hand motor skills or touch sensitivity. Safeguards will be put in place to prevent the device from attempting to load a syringe when it is not below and vertical to the insulin bottle; (this is to prevent air from getting into the syringe inadvertently). If the user specifies a dosage amount that exceeds the amount of insulin in the bottle or if it exceeds the size of the syringe, the user will be alerted of the error and the syringe load will be cancelled. The finished device will be portable; allowing patients to be able auto-load syringes without needing to be directly plugged into an electrical outlet or a computer.

Realistic Constraints

The construction of the Syringe Auto-Loading & Usage Tracking Equipment prototype has a maximum budget of $2000 allocated for it. Its must be built, tested, revised, and ready for final client review by May 2008. Due to the limited time and budget constraints, the prototype of the device does not need to be portable, but its design should lend itself to portability. Although the eventual product should be fairly durable, light weight, and have a long battery life so as to best accommodate someone who might be away from their home for an extended period of time; the primary focus during the construction of the prototype will be on the implementation of an easy-to-use and highly accessible interface that patients can use to reliably and accurately prepare insulin dosages.
Technical Specifications

Electrical Parameters

Battery Life
Non-Rechargeable 6 months
Rechargeable Must be able to provide enough power for the device to function a minimum of 10 times over a 24 hr period.

Display
Number of Characters >= 20 per row
Number of Rows >= 2
Height >= 10 mm
Width >= 10 mm
Visibility Visible in Strong Sunlight

Voltages
The device will operate using batteries which provide a minimum of 5 volts of power.

Stability
During loading, the device should be able to maintain an upright position without being supported.

Accuracy
A syringe should be able to be loaded to within .1 unit of the user specified dosage amount.

Mechanical Parameters

Keys
Height >= 10 mm
Width >= 10 mm
Vertical Spacing >= 2 mm
Horizontal Spacing >= 2 mm
Coloring High contrast; Light Key / Dark Label or vice versa

Size
12” x 12” x 6” maximum
Ideally should be able to fit into a backpack or suitcase.

Weight
10 lbs max

Durability
Ability to survive minor impacts and drops

Minimum Operational Life
6 months to a 1 year
Must be able to accurately load an average of 3 syringes a day; (provide approximately 550-1100 doses).
### Environmental

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temp</td>
<td>40°F to 100°F</td>
</tr>
<tr>
<td>Storage Temp</td>
<td>-15°F to 120°F</td>
</tr>
</tbody>
</table>

### Software

<table>
<thead>
<tr>
<th>Category</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Character Size</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>&gt;= 10 mm</td>
</tr>
<tr>
<td>Width</td>
<td>&gt;= 10 mm</td>
</tr>
<tr>
<td>Colors</td>
<td>2 minimum</td>
</tr>
<tr>
<td>Menu Level</td>
<td>3 maximum</td>
</tr>
<tr>
<td>Record Storage</td>
<td>&gt;=20 doses</td>
</tr>
<tr>
<td>Information Stored</td>
<td>Dose Amount, Date/Time</td>
</tr>
</tbody>
</table>