INNOVATION

Accessible Infusion Pump User-Interface

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Rehabilitation Education Research Center on Accessible Medical Instrumentation

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With current infusion pumps, there is no appropriate feedback to the input controls of the unit. This gives an opportunity for erroneous entries without any warning.

For patients with physical limitations, infusion pumps can be difficult to operate correctly.

Disabilities increase the risk of patient error in device operation.

At least one patient from our client list suffers from some form of a vision problem, a hearing impairment or an ailment that restricts motor function.

- Carpal tunnel syndrome
- Parkinson’s disease
- Arthritis
- Partial paralysis

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Project Objectives

- Design a portable, steadfast, low-cost user interface to allow easy operation of a medical infusion pump
  - Reduce input errors
    1. Auditory Output
    2. Distinguishable Confirmation Buttons
    3. Visual Display
  - Increase Independence
    1. Simple Operation with Short Learning Curve
    2. Small and Portable with Infusion Pump
    3. Promote Privacy
  - Cost-Effective
    1. Budget < $2,000
A research team from the University of Texas Health Science Center at Houston studied and prototyped an interface for an infusion pump. They accomplished this through the usability Engineering Lifecycle to develop ideas and create solutions to design errors.

A group from Chalmers University of Technology Department of Human Factors Engineering in Göteborg, Sweden also researched infusion pump interfacing. To create a baseline, they used the facilities current infusion pumps and problems were recorded via video-recording, think-aloud protocols, and surveys. No prototype was created but the information was passed to the clinicians and developers to produce a better product and avoid misuse.

Doctors and researchers from Columbia University’s College of Physicians and Surgeons along with members from the University of Texas Health Science Center also did clinical research on infusion pump interfacing. This was accomplished by assigning ratings to problems and creating a catastrophic error group. However, no prototype was created but the information was given to the infusion pump field and market.
Products

- Abbott – Aim Plus, Lifecare 5000 Plum and Plum XL
  - [www.abbott.com](http://www.abbott.com)

- Baxter – Colleague - [www.baxter.com](http://www.baxter.com)

- B Braun – Outlook Safety Infusion Systems - [www.bbraunusa.com](http://www.bbraunusa.com)
Products (Cont.)

- Cardinal Health – Alaris®, Alaris® SE pump, MedSystem III® - www.cardinalhealth.com/alaris/

- Curlin Medical – PainSmart, 4000 CMS, 4000 Plus, and 2000 Plus - www.curlinmedical.com

- Sigma International – 8000 and 6000 series pumps - www.sigmapumps.com
Patent Research

- D268,206 - Medical infusion pump  
  March 8, 1983 – Kosako

  Describes the infusion pump as a complete unit including the main body with interface.

  Medrad, Inc. generic medical device interface design patent.
Patent Research (Complimentary)

- 5,664,270 - Patient interface system - September 9, 1997 - Bell, et al.
  
  Patent for interfacing a multitude of medical devices into one remote controller for ease of use and independence.

  
  This patent allows the infusion pump to be loaded with a library of drugs which could be selected from or added to by the user.

  
  This patent describes the need for a more-readily usable interface for electronics devices but it could be implemented for a medical device.
Visual Enhancement

- 7” Color LCD Monitor
- Large Characters to allow patients with limited vision to operate infusion pump
- Display LabVIEW® 8.0

Primary Infusion

Flow Rate: ___ mL/hour
Volume to be infused: ___ mL

Scroll flow rate and volume values with joystick, press “OK” when correct for each value.
Auditory Enhancement

- Ideally Use Voice Software
- Text to Voice Module
- Independent Auditory Control

Limitations:
- Speaker Size
- Power Concerns
Tactile Enhancement

- Large Distinct Buttons
- Trigger Pressure Tuning
- Intuitive Integration with SW Structure
- Minimal Number
- Single axis joystick for scrolling
Enclosures

- Glued black ABS plastic with beveled edges for larger surface area adhesion.
- Back will be screwed on to allow access to inner electronics.
- Second enclosure will be similar in construction but with only holes for the pumping assembly and brackets.
Mounting and Brackets

- Mounting block to hold majority of weight to IV pole
- Flat brackets for wiring and flexible arms
Inside the Box

- Blackfin Microcontroller
- Intuitive Prompting Software Design
Promoting Patient Safety

- Alarms and Warnings
  - Conveying Pump Warnings
  - Low-Battery Warning
Other Considerations

- Physical Interface with Pump
- Universal Compatibility
## Budget

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<thead>
<tr>
<th>Company</th>
<th>Item Description</th>
<th>Price</th>
<th>Shipping Cost</th>
<th>Total</th>
<th>Running Budget</th>
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<tbody>
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<td>MetalsDepot.com</td>
<td>1 Ft 1.5’ x 1.5’ aluminum square stock fee</td>
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Total Payment: 728.07
Timeline

- Week 1: Initial Meeting
- Week 2: Complete Reverse Engineering
- Week 6: Complete and Test Blackfin to Pumping Unit
- Week 12: Complete and Test Blackfin to User Interface
- Week 13: Complete and Test Entire Project
- Week 14: Complete Final Lab Report
- Week 15: Demonstrate Final Project
Project Highlights

- Project Uniqueness
  - Reduce Calculation Errors
    - Visual Display
    - Distinguishable Tactile Cues
    - Auditory Output
  - Navigation Ease with Reduced Learning Curve
  - Cost-effective Device for Biomedical Corporations
  - Increasing Company Credibility
  - Satisfied/Healthier Patients
Are there any Questions?

LET'S GET READY TO INFUUUUUSE

LLLTTTTT'S GET READY TO INFUUUUUSE

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