Accessible Incontinence Control Device

GROUP 8
Maroun Bousleiman, Erica Kramer,
Yamalia Roberts, Zack Smith Roberts

Sponsored by RERC Sponsored by RERC-AMI National Student Design AMI National Student Design Competition Competition

Dr. John D. Enderle
Biomedical Engineering, University of Connecticut
Email: jenderle@bme.uconn.edu
Phone: (860) 486 Phone: (860) 486 – 5521
Summary

Introduction
Previous Work
Design
Budget
Conclusion

Team 8
Introduction

Clients
Background
Project goals

Team 8
Clients

Three clients benefiting from the use of an accessible incontinence control device:

- Keisha, 84, female: stroke victim with hemiplegia on the right side of her body.

- Jerry, 82, male: Parkinson’s patient.

- Jamie, 44, female: suffered a T11 spinal cord injury. Confined to a manual wheelchair and wants better urinary control when playing basketball.
Background
Project goals

- Accessible to both male and female patients.
- Assist patients with dysfunctional bladders by controlling flow and urinary release time.
- Discrete, light weight, cost efficient, environmentally and user friendly.
- Accurate readings and display of bladder’s status.
- Inform patients about bladder’s emptying.
Project goals

• The implantable device:
  - no adverse effect
  - no toxicity to cells
  - no proteins absorption
  - biocompatible with body fluid, pH, and
  - remains in the human body for at least 30 days
Previous work done by others

Products
Student design projects
Patent

Previous work done :: Products
Team 8
Previous work: Products

Previous work done :: Products
Previous work: Student design project

• AssureFlow -2007- Australia Student Design Competition

• Micturition Alarm -1990- NSF
Patents


- US Patent #4800900: January 31, 1989. It is an external cloth strap that is useable by male incontinence patients.

- US Patent #5823972: October 20, 1998. It is a two part device that can measure bladder pressure and urine flow. The first part of the device is an inflatable cuff that is mounted to the penis. The second part is a catheter that has a pressure transducer on the end of it.

- US Patent #7128707: October 31, 2006. It is an artificial sphincter cuff which can be implanted around the beginning of the urethra. The cuff is made of electroactive polymer which can be expanded or contracted by an external electrical actuation device.

- US Patent #6319208: November 20, 2001. The device is a small floating recorder floats in the bladder and telemetrically relays information to an external receiver regarding urinary tract pressure.
Design

Bladder Status Indicator

Bladder not full

Patient or care-taker keeps device engaged to prevent urine flow.

Bladder full

Patient or care-taker disengages device to empty bladder.

Bladder empties

Patient care-taker reengages device to prevent urine flow.

Design :: Functions Flow Chart

Team 8
Design Overview

- **Subunits**
  - Remote Control
  - Microprocessor
  - Wireless Transmission
  - Pressure Transducer
    - Signal Amplification
    - Volume Calculation
  - Artificial Sphincter
  - Micro Pump
  - Power Supply
  - Device Housing
Remote Control

Design :: Remote Control  Team 8
Microprocessor

- Converts pressure from pressure transducer input to volume with the output displayed on the LCD
- Controls the artificial sphincter via the pump
- Controls the speaker and vibrating alarm
- Allows user input
Wireless Transmission

- ZL70101 Medical Implant RF Transceiver
- Can be configured as implant or base
- 402-405 MHz, 433-434 MHz
Pressure Transducer

Design :: Pressure Transducer

Team 8
Pressure Transducer – Volume Calculation

- Laboratory experiment using pressure transducer directly
- Ultrasound scan using following equation:
  \[ V = (\text{Height} \times \text{Width} \times \text{Depth}) \times 0.625 \, \text{m} \]
- Threshold volume between 150 mL and 300mL
Artificial Sphincter

Design :: Artificial Sphincter

Team 8
Micro Pump

- Control fluid transfer between reservoir and cuff of artificial sphincter
- Low power consumption
- Low heat generation

TCS Micro Pump M100-S

Design :: Micro Pump  
Team 8
Power Supply

Wireless Transceiver -> Amplifier -> Pressure Transducer

Battery 6 volts

Ground

Micro Pump

Design :: Power Supply

Team 8
Device Housing

- Thin Cell Batteries back to back and connected in series
- Micro Pump
- Fluid Reservoir
- Wireless Transceiver
- Amplifier
- Tube to Cuff
- Connection to Pressure Transducer

Dimensions:
- Depth: 30 mm
- Height: 72 mm
- Width: 70 mm
- Length: 55.4 mm
- 14 mm
- 19 mm

90 mm (3.54 inches)

Design :: Device Housing

Team 8
# Budget

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>MODEL/PART NUMBER</th>
<th>QUANTITY</th>
<th>ITEM COST</th>
<th>SHIPPING COST</th>
<th>TOTAL COST</th>
<th>SUPPLIER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro Pump</td>
<td>M100-S</td>
<td>2</td>
<td>$89.83</td>
<td>$9.29</td>
<td>$128.95</td>
<td><a href="http://www.micropumps.co.uk/">http://www.micropumps.co.uk/</a></td>
</tr>
<tr>
<td>Artificial Sphincter</td>
<td>AMS-800</td>
<td>1</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td><a href="http://amsinrance.com/home.html">http://amsinrance.com/home.html</a></td>
</tr>
<tr>
<td>Tygon Tubin (3/32&quot;)</td>
<td>57361</td>
<td>10</td>
<td>$0.80</td>
<td>$5.90</td>
<td>$13.80</td>
<td><a href="http://www.usplastic.com/catalog/default.asp">http://www.usplastic.com/catalog/default.asp</a></td>
</tr>
<tr>
<td>Thin Cell Battery</td>
<td>UBC502030</td>
<td>4</td>
<td>$9.00</td>
<td>$36.00</td>
<td>$45.00</td>
<td><a href="http://www.ultralifebatteries.com">www.ultralifebatteries.com</a></td>
</tr>
<tr>
<td>Speaker</td>
<td>273-073</td>
<td>1</td>
<td>$1.99</td>
<td>NA</td>
<td>$1.99</td>
<td>RadioShack.com</td>
</tr>
<tr>
<td>Low Voltage Amplifier</td>
<td>2062598</td>
<td>3</td>
<td>$1.49</td>
<td>NA</td>
<td>$4.47</td>
<td>RadioShack.com</td>
</tr>
<tr>
<td>5 Pack 1 Ohm Resistors</td>
<td>271-1335</td>
<td>1</td>
<td>$0.99</td>
<td>NA</td>
<td>$0.99</td>
<td>RadioShack.com</td>
</tr>
<tr>
<td>5 Pack 100 Ohm Resistors</td>
<td>271-1347</td>
<td>1</td>
<td>$0.99</td>
<td>NA</td>
<td>$0.99</td>
<td>RadioShack.com</td>
</tr>
<tr>
<td>CuTouch</td>
<td>U05003</td>
<td>1</td>
<td>$402.00</td>
<td>$10.00</td>
<td>$412.00</td>
<td><a href="http://www.comfiletech.com">www.comfiletech.com</a></td>
</tr>
<tr>
<td>CB220</td>
<td>U01002</td>
<td>1</td>
<td>$34.00</td>
<td>$34.00</td>
<td>$34.00</td>
<td><a href="http://www.comfiletech.com">www.comfiletech.com</a></td>
</tr>
<tr>
<td>ACODE-300</td>
<td>B01001</td>
<td>2</td>
<td>$59.00</td>
<td>$118.00</td>
<td>$177.00</td>
<td><a href="http://www.comfiletech.com">www.comfiletech.com</a></td>
</tr>
<tr>
<td>ACODE300 IF</td>
<td>B02001</td>
<td>1</td>
<td>$19.00</td>
<td>$19.00</td>
<td>$19.00</td>
<td><a href="http://www.comfiletech.com">www.comfiletech.com</a></td>
</tr>
<tr>
<td>ACODE PROTO</td>
<td>U02003</td>
<td>1</td>
<td>$5.00</td>
<td>$5.00</td>
<td>$5.00</td>
<td><a href="http://www.comfiletech.com">www.comfiletech.com</a></td>
</tr>
<tr>
<td>Adapter</td>
<td>E01065</td>
<td>1</td>
<td>$22.00</td>
<td>$22.00</td>
<td>$22.00</td>
<td><a href="http://www.comfiletech.com">www.comfiletech.com</a></td>
</tr>
</tbody>
</table>

**TOTAL COST** $809.09

---

Team 8
Conclusion

Our device:

• **Cost effective**
• **Better** than current device because of the continuous and easy to understand status indicator
• **Easy** to operate
• **Discrete**
• **Accessible** to patients with disabilities
Acknowledgments

• Dr. J. Enderle
• Dave Price
• Sponsor : RERC-AMI

Thank You !
Questions ?