Backpack Lever Arm System & Shampoo/Conditioner Identification Device

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Overview

- Introduction
- Purpose of the Project
- Previous Work
  - Similar NSF projects
  - Available products
  - Patents
- Subunits
- Budget
- Project Highlight
Shampoo and Conditioner Identification Device
Introduction

• Client Background:
  • Reduced visual acuity
  • Mild-to-moderate progressive cognitive impairment

• Client Need:
  • Independence
  • Distinguish between shampoo and conditioner bottles
Device Belt

• Requirements:
  • Waterproof
  • Corrosion Resistant, Durable
  • Lightweight
  • Capable of incorporating other components

• Appropriate Material:
  • ‘Roll-A-Hose’ Flat Hose
  • 12mm in Diameter
Device Belt Cont’d

• Belt Increases Diameter of The Shampoo Bottle by Merely 2.4cm (Easy to Carry)

• Made of Rubber, Soft PVC

• Small Plastic Casing - Attached to Incorporate Voice Recorder / Playback Circuit

• Small 8 Ohm Speaker - Attached

• Buttons – Evenly Spaced

• All Wiring Runs Internally (Inside Hose)
“Talking Belt”
Pushbutton Switch

- 6 Buttons
- ‘Normally – Open, Soft-Touch Momentary Switches’.
- Small - Will fit into a circular hole that is 9.5 mm in diameter.
- Insulation - Hot glue to fill any space in between. Allow the formation of a water tight area.
Speakers

- Compact and light
- Compatible with the message recording circuit
- 4 ohm 8 watts speakers from Skycraftsurplus
- 3 and 5/16” in diameter
- 8 watts up to 15 watts
- Only require up to 4 volts of power
Voltage controller

- Voltage controller used is the **7805**
- Suitable for C-MOS and TTL
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limiting
- Output current of 500mA
- Max voltage rating of 5.2 Volts
- Typical voltage is 5.0 Volts.
- Two layouts to choose from.
Microcontroller

- **ISD2540**
  - CMOS type devices
  - Allows for recording and playback of messages up to 40 seconds long
  - EEPROM memory allows for storage up to 100 years without power
Power Source

• Voice recording circuit requires 6V

• Powersonic PS-605 F1 6V 0.5ah
  - 500mAh
  - 6 V
  - Dimensions: 2.24” x .55” x 1.97”.
  - Weight: .25 lb
Visual Representation

Buttons

Speaker

Voice Recording Kit

Buttons
## Budget

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>5V Fixed-Voltage Regulator 7805</td>
<td>$1.59</td>
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<tr>
<td>Microcontroller</td>
<td>$7.20</td>
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<td>Flat Garden Hose</td>
<td>$16.95</td>
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<td>Momentary Switches</td>
<td>$21</td>
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<td>4 Ohm Speaker (2x)</td>
<td>$6</td>
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<tr>
<td>PS-605 Powersonic 6V Power Supply</td>
<td>$15.94</td>
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<td>Voice Recorder/ Player Kit (2x)</td>
<td>$55.90</td>
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<td>Plastic Casing</td>
<td>$7</td>
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<tr>
<td>Insulation Materials (Hot Glue, Tape)</td>
<td>$21</td>
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<tr>
<td><strong>Total Expense</strong></td>
<td><strong>$152.58</strong></td>
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Project Highlights

- Significant Potential to Make a Difference
  - Alzheimer’s Disease
  - Post-Ophthalmic Surgery Patients

- Product Utility and Uniqueness
  - Integration of technology to produce a healthcare device of this kind.
  - Small Niche Market

- Product Features and Benefits
  - Small, Lightweight, Customizable, Portable.
  - Client Satisfaction – Independence, Self-reliance

- Novel Concept - Goals and Potential
  - Potential for Diversification
    - (i.e. Kitchen: Juice Bottles in the Refrigerator)
Backpack Lever Arm System
Introduction

• For individuals with cerebral palsy, manipulation of common objects can be quite difficult.

• The need to constantly ask others for help causes a loss of independence and has a negative affect on a person’s self image.

• Our particular client, Mason, is an eight-year old boy with cerebral palsy, who has good motor control of his right shoulder/arm/hand.
Purpose of the Project

• Strong desire to be independent and wishes for the capability to access his possessions without outside assistance.

• As Mason grows older he will need to be more self-sufficient and the development of this novel tool would facilitate this necessity.

• Mason would greatly benefit from a device that would allow him to access his belonging from his backpack without needing to ask for others to aid him.
Visual Representation

Low-Carbon Steel Support Bar

Vertical Adjustment Holes (Sides of Wheelchair)

12-14 Inches (Adjustable)

9 Inches

20 Inches

6 Inches

Armrest
Movements of the Arm

1. Turn the Switch
2. Limb Two rotates 180 degrees counter clockwise
3. Limb Three rotates 90 degrees clockwise
4. Limb Two rotates 90 degrees counter clockwise

Wheelchair

Back

Limb One

Limb Two

Limb Three
Movements of the Arm Cont’d
Three Segments of the Arm

• Dimensions:
  • Length: Limb One = 14 in. Limb Two = 20 in. Limb Three = 9 in.
  • Width: 7/8 in

• Material:
  • Low Carbon Steel: light, malleable and inexpensive
Hinge

- Rotates 270 degrees both counter clock and clock wise.
- Shear strength of brass: 200-400 MPa.
- Dimensions:
  - 1-9/16” tall, 1” deep, and 1-3/8” long
Voltage controllers

- Voltage controllers used are the 7805 and the 7812
- Suitable for C-MOS and TTL
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limiting
- Output current of 500mA
- Two layouts to choose from.

7805
- Max voltage rating of 5.2 Volts
- Typical voltage is 5.0 Volts.

7812
- Max voltage rating of 12.5 Volts
- Typical voltage is 12.0 Volts.
Stepper Motor

- 10A-TTL-3SW by Excitron
- 0.9 degrees per step.
- 55oz/ft of torque
- 12 Volts
Microcontroller

- PIC16C84
- CMOS type devices
- Allows for programming through PIC-C software
Stepper Motor Controller

- Output from the microcontroller are connected to the stepper motor coils through a hex buffer chip and then a TIP120 transistor.

- Sample code shows how to make the motor function continuously through microcontroller programming.

---listing 1---

```plaintext
' First stepper motor controller program  
' Rotates motor at set speed forever
Symbol delay = B0  ' use b0 as the delay variable
delay = 25  ' set the delay to 25 ms

loop: high 0  ' turn on Q1
    pause delay  ' wait 25 ms
    low 0  ' turn off Q1
    high 1  ' turn on Q2
    pause delay  ' wait 25 ms
    low 1  ' turn off Q2
    high 2  ' turn on Q3
    pause delay  ' wait 25 ms
    low 2  ' turn off Q3
    high 3  ' turn on Q4
    pause delay  ' wait 25 ms
    low 3  ' turn off Q4
    goto loop  ' forever
```
Attachment of Device to Wheelchair

• Incorporate a horizontal bar support at the back of the client’s wheelchair.

• The Quickie Z-500’s seat width is (12-14 in.), so the horizontal support bar will be adjustable to accommodate sizes in between (by inserting rods of varying lengths into the vertical adjustment slots).

• The bar will be locked on both sides to the vertical adjustment pieces, generally used to adjust the height of armrest clamps.

• Limb 1 will also contain slots that can accommodate the rods (made out of 304 Stainless Steel, selected on the basis of its properties).
Visual Representation of the Attachment Mechanism

Limb 1 (Attached to Back of Wheelchair)

Horizontal Support Rods

Vertical Holes On Bars That Run Parallel On Either Side Of The Wheelchair
Attachment of Backpack to Device

• The H.B. Clipper Quickdraw will be attached to Limb 3, which is the segment that comes closest to the client’s midline.

• One clipper will be used to attach the backpack whereas the other will be used to attach to the limb.

• Clippers are made of stainless steel, which is corrosion-resistant. This will improve the safety and product life of the device.

• The two clippers are connected by a strong, 13 cm nylon string.
## Budget

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
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<tbody>
<tr>
<td>Step Motor (10A-TTL-3SW-42 )</td>
<td>$179</td>
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<td>Microcontroller (16F84)</td>
<td>$7.20</td>
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<td>Hinge (2)</td>
<td>$32</td>
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<tr>
<td>H.B. Clipper Quickdraw</td>
<td>$7.93</td>
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<tr>
<td>Low carbon steel bars</td>
<td>$10</td>
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<tr>
<td><strong>Total Expense</strong></td>
<td><strong>$236</strong></td>
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</tbody>
</table>
Project Highlights

- **Versatility:** Can be used by anyone that has trouble with awkward postures.
  - Including individuals with progressed forms of muscular dystrophy or multiple sclerosis.
  - Device does necessarily have to be used in a school setting, but can also be used in the professional field or social settings.

- Promotes independence for disabled people.

- Folding technology has not been adapted to a device of this sort.
  - Folding allows: Safe storage and transfer to closer proximity.

- The low cost of our project makes it attainable by a much wider range of users.
References

- http://www.tranzistoare.ro/datasheets/400/249955_DS.pdf
- www.flat-hoses.com
- http://www.radioshack.com
- http://www.techexpressusa.com/mm5/merchant.mvc
- http://www.newark.com/jsp/Power+Products/Battery+Accessories
- http://www.techstreet.com/cgi-bin/detail?product_id=24975
- http://prostores2.carrierzone.com/servlet/excitroncom/
- http://www.climbhighoutlet.com/
- http://www.techstreet.com/cgi-bin/detail?product_id=24975
- http://prostores2.carrierzone.com/servlet/excitroncom/
- http://prostores2.carrierzone.com/servlet/excitroncom/
- http://www.techstreet.com/cgi-bin/detail?product_id=24975
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QUESTIONS??