Backpack Lever Arm System & Shampoo/Conditioner Identification Device

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Overview

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• Previous Work
  • Similar NSF projects
  • Available products
  • Patents
• Methods
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• 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
Purpose of the project

• Design and develop an instrument that allows Mrs. Smith to differentiate between shampoo and conditioner bottles while in the shower.

• Attempted options:
  • Shapes
  • Colors
  • Large Letters

• A touch-sensitive device, which upon triggering will cause a sound signal to be produced.
Previous work

• Similar NSF projects:
  • Shampoo and Conditioner Voice Device for People with Vision Problems in the Shower (Spring 07):
    • Weight
    • Client need
  • “talking calculator” - Cynthia Henderson (Department of Agricultural and Biological Engineering of Mississippi State University)
    • user inputs from a calculator
    • a BASIC Stamp II microprocessor
    • an ISD1000A voice chip plays the information corresponding to the mathematical expression.
  • GPS voice output device - Kurt Peterson and Neil Peterson (Department of Electrical Engineering of North Dakota State University)
    • GPS receiver and a PIC16F876 microcontroller to collect position, speed, and heading information every 1 to 5 seconds.
    • V8600A Speech Synthesizer: generate voice outputs when users press on the keypad.
Products

• Verbal indication devices are also used in many children interactive learning toys. When user presses on the items, appropriate voice outputs help them to identify the objects, colors, shapes and learn phrases.

Fisher Price - Laugh & Learn Learning Table
Jumbo Talking Elmo
Patents

• **U.S. Patent No. 6,449,887** – Water Globe with Touch Sensitive Activation

• **U.S. Patent No. 4,748,756** – Touch Activated Enhanced Picture Frame

• **U.S. Patent No. 7,264,377** - Sensor-Activated Audible Story Lamp

• **U.S. Patent No. 7,269,484** - Vehicular touch switches with adaptive tactile and audible feedback
Methods

- Primary Requirements
  - Increase Independence of Client
  - Maintain Safety
Increase Independence

• Client Input, Mechanical Stimulus
  • Touch-Sensitive Pressure Sensors

• Auditory Output
  • Small Accessory Speakers

• Eliminates Need for High Visual Acuity

• Eliminates Need for Long-Term Memory to Differentiate
Mechanical Stimulus

• Tactile Sensitivity – Large Touch-Pad (Use of Piezoelectric Concepts)

• Wraps Around the Entire Bottle (makes the specific depression of a button unnecessary).
Visual Representation

- Touch Sensitive belt
- Shampoo!!
- Built-in speaker

- Touch Sensitive belt
- Conditioner!!
- Built-in speaker

- Touch Sensitive belt
- Shampoo

- Touch Sensitive belt
- Conditioner
Logic System
Factors Taken Into Account

• Safety
  • Due to Environment – Wet

• Device Properties
  • Shock-proof
  • Corrosion Resistant

• Unique Needs of Client
  • Small
  • Lightweight
  • Customizable

• Device Features
  • Small Speakers
  • Small Battery
Limitations

• Incorporating a small power source, and speakers into a belt without making the device cumbersome, overweight, or even minutely difficult to carry.

• Choosing the appropriate materials for the belt to ensure safety of the client, and not exceeding the limit in terms of weight or volume.

• Small Element of Dependence – Removing the belt and attaching it to another bottle, once the shampoo/conditioner is finished. Client may require the help of a family member in carrying out this task, which we presume will be occasional.
**Budget**

- The cost of products in the market with similar components ranges from $30 - $80. The budget allotted for this project is $750,
- The following is a rough estimate.

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<th>Part List</th>
<th>Quantity</th>
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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.
Cerebral Palsy

• All humans suffering from Cerebral Palsy share have limited fine motor control some body parts.

• Other symptoms may include significant impairment of balance, posture, verbal articulation, involuntary movements, and sometimes mental impairment.

• Athetoid: Lack of ability to have effective control of some areas of the body.

• Quadriplegia: Lack of muscle control that encompasses all four limbs and the trunk.
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.
Previous Work

• Backpack Transfer Device — Thomas Cabell and Brian Deuter
  the Department of Agricultural and Biological Engineering of Mississippi State University

  • An aluminum track with a 90 degree curve in the middle.
  • Transfers, supports and stores backpacks to facilitate independence for a student with cerebral palsy.
  • Attached to the wheel chair in two places.
  • Can be easily configured to another any wheelchair.
Products Available

• **Magic Arm made by Beneficial Designs Inc.**
  - a 90 degree pivoting end.
  - a 360 degree rotating elbow.
  - a 360 degree rotating end.
  - Both ends have studs that are tapped and fit any standard 5/8 inch socket.
Patent Research

• U.S. Patent No. 5,180,181
  • Motorized Movable Storage Bag for Use on a Wheelchair

• U.S. Patent No. 20050001405
  • Pivoting Wheelchair Backpack Holder

• U.S. Patent No. 4,919,443
  • Swing-Out Backpack for Wheelchairs
Objectives

• Design a device that will transport Mason’s backpack to a usable position when it is required and also keep it safely stowed away when it isn’t.

• The device needs to be:
  • Light weight.
  • Reliable.
  • Efficient.
  • Manageable.
  • Inexpensive.
Visual Representation
Methods

Switch 1 (on) → Arm unfolds and rotates 90 degrees to the front → Switch 1 (off) → Switch 2 (on) → Wheel rolls along the arm and brings the attached backpack to the end of the arm → Switch 2 (off) → Switch 2 (on) → Activates the motor that is attached to the wheel

Switch 2 (on) → Activates the motor that is attached to the wheel → Wheel rolls along the arm and brings the attached backpack to the back of the wheelchair → Switch 2 (off) → Switch 1 (off) → Arm rotates 90 degrees and folds back to the left side → Switch 1 (on)
Budget

- Similar project discussed before cost significantly more than our design.
- The device Mississippi State University developed costs an estimated $1300.
- Three-dimensional moving robotic arm by Zap Dynamics cost roughly $30,000.

<table>
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<tr>
<th>Part List</th>
<th>Price ($)</th>
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<td>Supports</td>
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<td>Quickdraw Clamp</td>
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<tr>
<td>Misc. Electrical Components</td>
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<tr>
<td><strong>Total Expense</strong></td>
<td><strong>230.42</strong></td>
</tr>
</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

- ABLEDATA. http://www.abledata.com/
Acknowledgments

• Sponsor: NSF
• Dr. John Enderle
• Dave Price
QUESTIONS??