Project Proposal

Assistive Devices for Joey Toce
Sponsor: National Science Foundation

Design Team 8:
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Alanna Ocampo–Bioinformatics

BME 4900
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Three assistive devices will be designed to aid 6-year-old Joey Toce, who suffers from a muscular disorder, known as Cerebral Palsy, in order to allow him to experience more independence & increase his ease of participation in everyday activities.

Main physical and cognitive deficits of client: poor muscle tone in arms and legs, global apraxia, strabismus, speech difficulties

The three projects to be designed, at the suggestion of the client’s mother, Katrina Toce, who is the team’s main contact for the duration of the project, are the following:

1) Adapted Hungry, Hungry Hippos Game
2) Adapted Sled
3) Device Control Panel

Overview of presentation:

1) Objectives & Implementation of Projects
2) Pre-existing Devices and Comparisons
3) Budget
1) Adapted Hungry, Hungry Hippos Game

Objectives:
- The Purpose of this project will be to take an existing H.H.H. board game and modify it so that the client will have full control of the game.
- Device must provide force required to push on levers without much effort from client.

Implementation:
- Design assistive device as separate unit that attaches to board game.
- Implement motorized control system to exert necessary force (must have motor selectivity (balance between power and battery life)).
- Use push button (jellybean style) which will allow independent control of game (large surface area).
- The device will be battery operated.

Figure 1: Design setup for game
2) Adapted Sled

Objectives:
- Provide a safe and secure way for the client to be pulled around in a snow sled
- Support head and trunk and secure client to sled with harness

Implementation:
- Plastic seat will have full supportive harness (across the shoulders, not just across the waist), which will be attached to plastic snow sled.
- Seat’s back support will be tall enough to support head; will also be small adductor coming out from lower half of the seat, which will sit between client’s legs to further prevent him from slipping out while sled is in motion
- Full Support Swing Seat will be bolted to the sled through a piece of quarter inch plywood, which will provide a level base on which the seat will be mounted on
3) Device Control Panel

Objectives:
- Remotely control DVD & CD player, and turtle light in his room with portable, easy-to-use control panel
- Touch sensitive buttons (jelly-bean style)

Implementation:

Figure 4: Control panel

Figure 5: RF Receiver–Transmitter System
1) Adapted Hungry, Hungry Hippos Game

- **Pre-existing Devices:**
  - One such product exists titled Hungry Hippo, manufactured by Enabling Devices & Toys for Special Children.
  - Employs large push paddles.
  - Priced at $110.00

- **Proposed Design**
  - Meets specifications!
  - Touch-sensitive buttons
  - Simple, customized setup
  - Supplies necessary force on hippo levers at the touch of a button for the client

  **Lower marketing price point!**
  - At 35% of prototype cost, can market device for ~$50.00

Figure 6: Existing adapted game

**Problems:**
**DOES NOT meet specifications!**
- Required force on paddle is still too large for client
2) Adapted Sled

- Pre-existing Devices:
  - Many toddler/baby sleds exist with large range of prices
  - Ex: Walmart Pelican Baby Sled ($15) & patent-pending Bambino Grande Pull Sled ($150)

- Problems:
  - DOES NOT meet specifications!
  - No harness and/or back & head support are missing

- Proposed Design
  - Meets specifications!
  - Full support harness provided
  - Full head and back support
  - Reasonable marketing price point!
  - At 35% of prototype cost, can market device for ~$31.00
Pre-existing Devices:

- Universal remote controls ($30–$250 or more)
- Control panels for disabled people at www.enablingdevices.com (+accessories $250)

Problems:

DO NOT meet specifications!

- Buttons too small
- System too complex for client’s use
- Must lift and point universal remotes (IR)

Proposed Design

Meets specifications!

- Touch-sensitive buttons
- Simple, customized setup with bright colors and pictures which facilitate Joey’s ability to learn tasks
- Don’t have to lift and point remote (RF)
- BONUS: Extra range in comparison to IR remotes

Comparable marketing price!

- At 35% of prototype cost, can market device for ~$238
## Proposed Budget

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Approximate Cost (US Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project I: Adapted Hungry, Hungry Hippos Game</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jumbo Pancake Switch (jelly-bean style)</td>
<td>Very sensitive to touch 6”D x 0.5”H</td>
<td>$28</td>
</tr>
<tr>
<td>Electric DC motor</td>
<td>Small electric hobbyist motor that will operate with small voltage</td>
<td>$10</td>
</tr>
<tr>
<td>Batteries, swing arm, possible microcontroller</td>
<td>Battery will probably be between 7V &amp; 9V; PIC or Stamp microcontroller for controlling speed and torque angle of motor</td>
<td>$85</td>
</tr>
<tr>
<td>Sheet Metal</td>
<td>Metal to create box to contain parts of device</td>
<td>$20</td>
</tr>
<tr>
<td><strong>Total approximate cost of actual product</strong></td>
<td></td>
<td><strong>$143</strong></td>
</tr>
<tr>
<td><strong>Total approximate cost including testing supplies</strong></td>
<td></td>
<td><strong>$266</strong></td>
</tr>
<tr>
<td>(Extra battery (1), swing arm (1), microcontroller (1), motor (1), and switch(1))</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Price of product at 35% of prototype value</strong></td>
<td></td>
<td><strong>$50.05</strong></td>
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</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Approximate Cost (US Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project II: Adapted Sled</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic Sled</td>
<td>No cost—supplied by parents</td>
<td></td>
</tr>
<tr>
<td>Full Support Swing Seat (child size)</td>
<td>Head and side support, harness support, and in between legs support</td>
<td>$75</td>
</tr>
<tr>
<td>Quarter inch ply wood</td>
<td>1 panel</td>
<td>$6</td>
</tr>
<tr>
<td>Stainless steel bolts</td>
<td>Quantity: 4 @ $2/each</td>
<td>$8</td>
</tr>
<tr>
<td>Stainless steel nuts</td>
<td>Quantity: 4 @ $0.25 each</td>
<td>$1</td>
</tr>
<tr>
<td><strong>Total approximate cost of actual product</strong></td>
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<td><strong>$90</strong></td>
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<tr>
<td><strong>Total approximate cost including testing supplies</strong></td>
<td></td>
<td><strong>$175</strong></td>
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<tr>
<td>(Extra bolts (30), nuts(30), and plywood (1 panel))</td>
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<tr>
<td><strong>Price of product at 35% of prototype value</strong></td>
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<td><strong>$31.50</strong></td>
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## Table 1: Proposed budget

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity/Description</th>
<th>Cost</th>
</tr>
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<tbody>
<tr>
<td><strong>Project III: Device Control Panel</strong></td>
<td></td>
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<tr>
<td>Receiver-Transmitter</td>
<td></td>
<td>$120</td>
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<tr>
<td>Microcontroller</td>
<td>2 @ ~$32/each PIC or Stamp</td>
<td>$65</td>
</tr>
<tr>
<td>Breadboard</td>
<td>Can be cut</td>
<td>$15</td>
</tr>
<tr>
<td></td>
<td>Quantity: 3 packages@ $5/each</td>
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<tr>
<td>RF-IR extender</td>
<td></td>
<td>$60</td>
</tr>
<tr>
<td>Button Click Switch (jellybean style)</td>
<td>10 @ $31.95/each</td>
<td>$320</td>
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<tr>
<td>Plastic material to construct housing for device</td>
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<td>$100</td>
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<tr>
<td><strong>Total approximate cost of actual product</strong></td>
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<td>$680</td>
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<tr>
<td><strong>Total approximate cost including testing supplies</strong></td>
<td></td>
<td>$944</td>
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<tr>
<td>(Extra transmitter-receiver (1), microcontrollers (2), switches (2), and breadboard (3))</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Price of product at 35% of prototype value</strong></td>
<td></td>
<td>$238</td>
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<tr>
<td><strong>Total approximate cost of all three actual products</strong></td>
<td></td>
<td>$913</td>
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<tr>
<td><strong>Total approximate cost for all three products including testing supplies</strong></td>
<td></td>
<td>$1385</td>
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Questions?