Project for Steven Macary

Team 22

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The Client

- Steven Macary
- 11 years old
- Suffers from Cerebral Palsy
- Loves Barney!
- Lives in Storrs, CT
Disability Limitations

- Lacks speech and language capabilities
- Inadequate motor skills
  - Lacks muscle control and coordination to do ordinary things like write with a pen/pencil, use a keyboard, open and close door knobs, put adequate pressure on feet
- Walks with hesitation – tries to hold onto objects or people to maintain balance
- Slow reactions to external stimuli
Purpose of Project

- Create 3 devices to give Steven more independence
  - Portable Electronic Communication Device
  - Modified All-Terrain Vehicle or Quad
  - Automatic Doorknob Opener

- Provide more convenience for Steven and his parents

- Improve Steven’s access to a better quality of life
Product Objective – Communication Device

- Steven currently uses PECS system (Proxtalker)
  - Inconvenient to travel with
  - Limited communication
- Design electronic portable communication device
  - Convenient for travelling
  - More expansive communication
  - Give Steven a verbal identity
Project Objective – Modified All-Terrain Vehicle

- Steven’s enjoys riding his ATV, BUT
  - He can’t ride it independently
  - Lacks sufficient motor skill to steer/accelerate
  - Parent cannot always be there to help him ride it

- Modify ATV to accommodate the following:
  - Easier steering and navigating using hand controls
  - Better seating to support his trunk and upper body
  - Safety restraints and foot placements
  - Visually appealing – Barney-esque

- Safer and easier to use ATV
Project Objective – Automatic Doorknob Opener

- Steven cannot turn knobs to open doors
  - Mother worries about him locking himself
- Create and automatic button-operated doorknob opener
  - Steven loves pressing buttons
  - Allow Steven to move in and out of rooms without help of others – more independence
  - No more worries for his mother
Hardware

- 3 main parts:
  - Touch screen
    - Easy to navigate for Steven instead of keyboard/mouse
  - Single Board Computer
    - Will run all software and store files on 16GB compact flash (CF) memory card
    - 512MB RAM, 532MHz
  - Battery
    - Lithium ion high capacity battery
    - 7.4V, 8800 mAh
Software

- Operating System – Debian Linux (open-source)
- All other programs – Linux compatible
  - Mozilla IceWeasel – instead of Firefox
  - m–player plugin for music files
  - X Windows GUI
- Scripting Languages to design appearance and interaction of communication program
  - PHP
  - JavaScript
Program will replicate PECS on electronic platform
  ◦ Pictures will be associated with words/phrases
  ◦ Multiple images may be chosen to form sentences
  ◦ Button on touch screen will vocalize images

Built-in speakers will transmit sound

Picture library and other multimedia databases may be enhanced via USB, Ethernet or WiFi – stored on CF memory card

Options to change voice settings and volume settings will be provided
Methods – Modified ATV

- Adapted steering system to meet Steven’s needs
  - Steven doesn’t have muscle strength to push down pedal with leg
  - Joystick – passes electric signals through potentiometers, which will determine joystick position and steer in that direction
    - i.e. – pushing joystick forward will cause acceleration, pulling it back will activate brakes
- Speed control mechanism to limit speed for safety
Methods – Modified ATV (contd.)

- Modified seat with trunk support and safety harness
- Foot holders to prevent involuntary leg movement
- ATV will be visually appealing to Steven
  - Barney colors – purple/green
  - Barney-shaped seat, if possible
- Remote control for parents to control the ATV if needed, as a safety measure
Methods—Automatic Doorknob Opener

- Turning a doorknob rotates an axel inside that moves the catch that holds the door locked
- Automatic doorknob opener
  - Steven loves pressing buttons
  - So, this device will be operated by a big red button
    - Upon depression button will send electrical signal to a micromotor to retract catch and open door
- Powered by 12V DC power source
## Budget – Communication Device

<table>
<thead>
<tr>
<th>Portable Communication Device</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part Name</strong></td>
<td><strong>Value</strong></td>
</tr>
<tr>
<td>Touch Screen/LCD</td>
<td>350</td>
</tr>
<tr>
<td>Single Board Computer (SBC)– 512MB, 532 MHz</td>
<td>500</td>
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<tr>
<td>Compact Flash Memory Card – 16GB</td>
<td>50</td>
</tr>
<tr>
<td>Lithium ion battery – 7.4V, 8800 mAh</td>
<td>80</td>
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<tr>
<td>External Casing</td>
<td>75</td>
</tr>
<tr>
<td>Speakers, 2 Watts</td>
<td>65</td>
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<tr>
<td>Wire</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1145</td>
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<tr>
<td><strong>35% of Total</strong></td>
<td>400.75</td>
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</tbody>
</table>
## Budget – Modified ATV

<table>
<thead>
<tr>
<th>Modified All-Terrain Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Name</td>
</tr>
<tr>
<td>DC Motor</td>
</tr>
<tr>
<td>Motor Controller</td>
</tr>
<tr>
<td>Speed Controller</td>
</tr>
<tr>
<td>Remote Control</td>
</tr>
<tr>
<td>Remote Control Receiver</td>
</tr>
<tr>
<td>Adapted Seat</td>
</tr>
<tr>
<td>Safety Harness</td>
</tr>
<tr>
<td>Joystick</td>
</tr>
<tr>
<td>Wire</td>
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<tr>
<td><strong>Total</strong></td>
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35% of Total: 458.5
# Budget – Automatic Doorknob Opener

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Value</th>
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<tbody>
<tr>
<td>DC 12V Micro Motor</td>
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<tr>
<td>Plywood – 20 sq. ft.</td>
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<tr>
<td>12 Volt Battery</td>
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<tr>
<td>Remote Control Receiver</td>
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<tr>
<td>Remote Control Transmitter</td>
<td>20</td>
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<tr>
<td>2 Relays</td>
<td>20</td>
</tr>
<tr>
<td>2 Limit switches</td>
<td>160</td>
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<tr>
<td>2 Hinges</td>
<td>10</td>
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<tr>
<td>Screws</td>
<td>5</td>
</tr>
<tr>
<td>Wire</td>
<td>10</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>415</strong></td>
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<tr>
<td><strong>35% of Total</strong></td>
<td><strong>145.25</strong></td>
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</table>
Similar Previous Work Done By Others

- Communication Device
  - ProxTalker – $2500 on market

- Modified ATV
  - Argo 8x8 Hdi – $18,373 on market
  - Electric ATV ZAP Dude Mobility Vehicle – $4,985

- Automatic Doorknob Opener
  - Otodor Automatic swing door opener – $207
Communication Device – $1145 (prototype), $400 (market value)
  ◦ ProxTalker – $2500 on market

Modified ATV – $1310 (prototype), $460 (market value)
  ◦ Argo 8x8 Hdi – $18,373 on market
  ◦ Electric ATV ZAP Dude Mobility Vehicle – $4,985

Automatic Doorknob Opener – $415 (prototype), $150 (market value)
  ◦ Otodor Automatic swing door opener – $207
Conclusion

- These products enhance Steven’s sense of freedom and independence
  - Communication will be easier, more expansive, and convenient
  - Riding his ATV will be more enjoyable and safer than before
  - Navigating himself through his own house will be a lot easier with the automatic door opener

- Main goal – to improve his quality of life and access to normal childhood activities, while being safe and meeting the client’s needs and wants.
QUESTIONS?