Lightweight Portable Power Chair

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Client

- Susan Lucek
- Annalee Hughes
  - 10 years old
  - Weight 55 lbs
  - Height 56”
  - Cerebral Palsy
Cerebral Palsy

- Non-curable disease caused by abnormal development of motor control center of the brain.
- Motor control center responsible for muscle tone and motor activity.
- Effects the body’s movement, balance, and posture.
- Major symptom is spasticity, continuous messages from the CNS to tighten and contract muscles rendering them unable to regulate themselves.
- Baclofen pump placed in abdomen to reduce symptoms but poor trunk strength.
Effect on Client

- Permanently confined to a wheelchair.
- Tendency to lean forward due to baclofen pump
- Needs supportive braces and straps to maintain upright position in chair.
- Has slightly more muscle control of right side of the body allowing her to control her own wheelchair.
- Legs and feet remain twisted without support structures.
Objective

- Provide a design that is lightweight and easily transported.
- Accommodate for growth of the client.
- Ensure health and safety needs.
- Allow independent movement in social environment other than home.
- Durability, and Maintainability.
Previous Designs

NSF Senior Design Project designed by students at the University of Massachusetts at Lowell
• Joystick controlled
• Disassemble into four main parts for portability
• Adjustable height
• Wheelbase - 23” by 21”
• Two 12 voltage batteries, 24 volt source, PWM controller.
• Total cost $1500.
Previous Designs

Product Spinlife.com
- (2) 12 volt batteries powered by a 24V, 420W motor
- Battery life - 15 miles
- Weighs 130 lbs, capacity 300lbs
- Turn radius 30”
- Total cost $1299
Patent Results

Patent for any motorized wheelchair that is lightweight foldable, and portable

- December 11, 2001
- Oong Choi and Fred E. Ingle
Features & Design

• Portability (80-110 lbs)
  - Limited disassembly
  - Collapsible

• Adjustability for growth
  - straps, braces, footrest

• Tilted seat (90° - 105°)

• Restraints, padding and supports
Features & Design

- **Power operated (motor and motor)**
  - Two pole motor – electricity enters at two points. Low priced, half the torque of 4-pole motor, burn out fast, faster than 4-pole motor
  - Four pole motor – for heavy duty wheelchairs. Twice the torque of 2-pole, heat evenly distributed, half the torque of 2-pole
  - Gearless, brushless motor – new innovation. Most durable, drive wheels directly connected to motor rotors, brakes connected to rotor, magnetic trapezoidal wave function controls microprocessor
  - Belt operated – very quiet but require lots of maintenance

- **24V/200W x 2 Power with 12V 24AH (x2) batteries (rechargeable)**
  - Last 2-3 hours
Features & Design

• Rear wheel drive
  – Possibility of mid wheel drive
• Joystick controlled
  - donation of Invacare, MIKVI
Features and Design

- **Frame**
  - Donation of a manual wheelchair
- **Seat**
  - Seat may be bought or designed from wood cutouts and cushioning.
- **Electrical**
  - **Microcontroller**
    - decode the signals coming from the joystick
    - PWM to create an on/off signal
    - Will result in the turning of the wheelchair due to one wheel being turned on while the other is off.
## Budget

<table>
<thead>
<tr>
<th>Items</th>
<th>Price</th>
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<tbody>
<tr>
<td>Motors (2)</td>
<td>$600.00</td>
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<tr>
<td>Batteries (2 rechargeable)</td>
<td>$90.00</td>
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<tr>
<td>Battery charger</td>
<td>$70.00</td>
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<tr>
<td>Wheels</td>
<td>$120</td>
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<tr>
<td>Joystick</td>
<td>$70</td>
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<tr>
<td>Seat</td>
<td>$150</td>
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<tr>
<td>Microprocessor</td>
<td>$100</td>
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<tr>
<td>Miscellaneous (Safety Supports, etc.)</td>
<td>$200</td>
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<tr>
<td>Frame</td>
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<tr>
<td><strong>Total Cost</strong></td>
<td><strong>$1,550</strong></td>
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</table>
Conclusion

• Primary: Provide adequate support
• Will be lightweight and portable for short social events.
• Annalee will have more independence and mobility and will not be weighed down as with her other chairs.
• Maintainable for parents.
Acknowledgements

• Orlando Echevarria
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• James Astoria
QUESTIONS?