PORTABLE, COMPACTABLE POWER WHEELCHAIR
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Division Of Labor

- Nathan Storie
  - Transmission
- Kristie Astoria
  - Frame Design
- Farrukh Rhaman
  - Seat Design
Client

- Susan Lucek
- Annalee Hughes
  - 10 years old
  - Weight
  - Height 56”
  - Cerebral Palsy
    - Caused by abnormal motor cortex development.
    - Effects the body by movement, balance, and posture.
    - Baclofen pump placed in abdomen to reduce spasticity causes poor trunk strength.
Effect on Client

- Permanently confined to a wheel chair.
- 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 won wheelchair.
- Legs and feet remain twisted without support structures.
Project 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 Work

- **At’m Power Wheelchair manufactured by Invacare**
  - Joystick Controlled
  - Dissemble into three parts – battery, seat, and frame
  - Traction motor – rubs against tire for rotation of wheel
  - Foldable chair unit
  - Total Cost $1749

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

- **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 for any motorized wheelchair that is lightweight foldable, and portable
– December 11, 2001
– Oong Choiand and Fred E. Ingle
# Specifications

**Physical:**
- Aluminum 6061-T6 Piping

**Mechanical:**
- **Seat Width**: 15”
- **Seat Depth**: 16”
- **Back Height**: 21”
- **Seat-To-Floor**: 20”
- **Ground Clearance**: 2”
- **Total Size**: 24”x25.5”x41” (L X W X H)
- **Weight Capacity**: 230 (lbs)
- **Weight**: 90 (lbs)
- **Speed**: 4 m/s

**Electrical:**
- **Motor**: Invacare Motor 1255 RPMS
- **Joystick**: Invacare (At’m Power Wheelchair)
- **Control System**: Invacare (At’m Power Wheelchair)
- **Battery (2)**: PE 12 V 12SLA
- **Battery Life**: 2-3 hours (12 miles)

**Environment:**
- **Operating Environment**: Indoor/Outdoor (avoid wet conditions)
- **Storage Capacity**: -20 to 150 (degrees Celsius)
- **Operating Temperature**: 20 to 100 (degrees Celsius)

**Note:** The software and electrical system have been completed. The entire electrical system from an At’m power wheelchair manufactured by Invacare will be used.
Modification will be done to the At’m Power Wheelchair manufactured by Invacare.

- Alteration to the frame will be due to altering the design into a direct drive motor.
  - Side pipe will be increased by 3 inches to ensure motor attachment is located in the appropriate location.
- The width will be reduced to better fit Annalee small body.
  - 15 inches instead of 18 inches.

Modification will done to motor mount to ensure the safety of the client when the mount is under direct pressure.
- There will be two mounts on each motor to ensure that all stress applied to the mount is distributed evenly.
Seat Design

- At’m Chair frame will also be modified to fit Annalee.
  - The sit will be 15 inches instead of 18 inches.

- Modifications due to position of motors.
  - Locks that were connected to base frame will be shorted by 3 inches vertically and 1.6 inches horizontally.
Seat Ergonomics

- Seat cushion connected to base via Velcro
  - portability and storage options
  - Possibility for growth in width for new cushion insertion (not likely but option available)
- Seat cushion
  - Air foam similar to product Varilite evolution
    - Polyurethane foam
    - Light weight
  - Gel
    - Heavier
    - Less maintenance required.
Seat Ergonomics cont.

- Back support: similar design to seat cushion except differences lie in the material.
  - Memory foam to contour to client’s back, tilted forward 45 degrees to fit to her posture.
Transmission

- Transmission will create the torque needed by the wheels.
- With no load a 9:1 gear reduction will be required.
  - Max speed of 5mph, with no load.
  - Designed with multiple gears to reach required ratio.
- Will be housed in gear box for safety reasons.
Future Work

- Obtaining sample materials from Varillite, Jay cushions.
- Meet with Physical Therapist with presentation of seat design.
  - Use PT’ advice to come up with new features/ideas improving the seat interface with client.
Future Work

- **Timeline**
  - Complete by Jan. 19, 2010

- **Transmission Design**
  - Completion by Jan. 19, 2010

- **Seat Design**
  - Completion by Jan. 19, 2010

- **Aluminum Piping**
  - Has been ordered for base frame and seat, fabrication will be initiated as shown as stress analysis and redesign are made.
The chair though behind is coming along
- Issues sorted out
- Working through break

Welding done through break

Sample materials for seat and back support.
- Make our own air foam cushion.

The portable chair
- Will come apart for easy storage
- Will be something her parents can singlehandedly carry/use.
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Questions!