The ATPC-X42
All-Terrain Power Chair

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Overview

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Introduction

- Client: Annalee Hughes
  - Age: 10
  - Height: 56”
  - Weight: 62 lbs
  - Bright and Adventurous
  - Has Cerebral Palsy
  - Has very poor trunk strength and leans forward while sitting
What is Cerebral Palsy?

- Neuromuscular disorder often caused at birth
- No known cure
- Characterized by involuntary muscle movements
- Motor control drastically reduced
- Causes muscle deficiencies such as in the trunk
- Mental disabilities may be apparent
Objective

- Design an all-terrain power chair with a low center of gravity that allows Annalee to travel on her property without her or her family having to be concerned with her safety.

- Annalee has tipped her current power chair and does not have the strength to get herself back up.
Specifications

- The chair will have:
  - A low center of gravity
  - Sufficient ground clearance
  - Large wheels to handle rough terrain
  - A right-handed joystick controller
  - A seat belt and five-point harness
  - A tilt sensor with alarm system
  - An auto-actuating seat that complements the slope
  - Portability for access through doorways
Division of Labor

- **Niaz Khan**
  - Electrical Design
    - Build Tilt Sensor with Alarm System
    - Seat Auto-Actuation
    - New Circuit Integration

- **Selome Mandefro**
  - Software Design
    - Tilt Sensor Code
    - Integration of Tilt Sensor with Auto-Actuator
    - Reprogramming of Joystick Controller
Division of Labor, cont.

- Alex Mann
  - Part Fabrication
    - Spacers, Seat Mount, Back Mount, Footrest, Casters
  - Part Integration with Chassis

- Vikram Shenoy
  - Mechanical Design
    - Design of New Components (Spacers, seat Mount, Back Mount, Footrest, Front Casters)
    - Part Analysis and Simulation
Mechanical Design

- Existing Components
  - chassis of Quickie S626 Power Chair
  - battery cage
  - arm rests
  - anti-tip wheels
Mechanical Design, cont.

- **New/Modified Components**
  - seat mount – accommodate a wider seat
  - seat base plate
  - front casters – hold wider front tires
  - larger front and rear tires – increase chair stability
  - larger seat and seat back – allow Annalee to grow into chair
  - footrest – enable easy access into the chair

- Autodesk Inventor is being used for design and analysis
Completed Work:

- Majority of CAD in Autodesk Inventor
- Design of spacers, front casters, seat base plate
- Fabrication of spacers
Mechanical Design, cont.

- **Work in Progress:**
  - Design of seat back mount
  - Design of footrest

- **Next Steps**
  - Finite element analysis of each part
  - Center of gravity analysis
  - Simulations of different scenarios
  - Fabrication of remaining parts
  - Reassembly of power chair
Electrical Design

- Components
  - Joystick controller
  - Two 12V batteries
  - Charger
  - Kill switch
  - Seat actuator
  - Tilt Sensor
New Additions:

- Implementation of a tilt sensor with alarm system
  - Warn Annalee when approaching slopes too steep
  - Increases safety of the device
- Automatic seat actuation complementary to tilt sensor feedback
  - Will auto-adjust seat positioning relative to the hill
  - Helps maintain proper posture while the chair is in operation
Software Design

- Components
  - Joystick controller
  - Power Module
  - Tilt Sensor
  - Auto-Actuator
Software Design, cont.

- Work completed so far:
  - Code worked on for tilt sensor

- Work to be completed:
  - Integrate tilt sensor with auto-actuator
  - Reprogram the joystick and power module to account for modifications in the device
Budget Overview

- Total Budget: $1300
- Total Spent, Fall 2009: $450
- Expected Costs, Spring 2010: $330
- Total Expected Cost: $780
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