AUTOMATED RETRACTING SLIDE COASTER

ARC SLIDE

Final Design
Team #7
Sarmad Ahmad
Hillary Doucette
Stephen Kustra
Client Background

- Joey Toce
- 6 years old
- Weight: 35 lbs
- Height: 42"
- Cerebral Palsy: unknown reason, damage to cerebellum.
  - Joey does not have full control of the muscles in his torso and limbs.
  - Needs additional support for his trunk to maintain an upright position.
Related Products and Patents

- Very little in outdoor playground equipment for the disabled.

Self operable transfer system for the disabled. Requires upper body control and strength.
• Recreational Device for physically disabled user.

• Heavily rely upon a supervisor.

• Very large, expensive, and requires wheel chair(s).

Wooden wheel chair ramp.
Objective

- Successfully design an adaptable slide for a user with weak trunk muscles and decreased motor control.

- The slide must include:
  - Winch to retract the coaster car.
  - Status Lights during operation.
  - A lift motor to tilt the upper platform and initiate descent of the car.

- The coaster car must include:
  - Trunk restraints, head support, lower limb restraints.
  - Adaptability of segments to user growth.
Additional Features

- Custom Built Car with necessary harnesses.
  - Trunk
  - Leg
  - Hip
- Wolmanized wood track with upper rest platform.
  - Photoelectric sensor to sense car position.
- Lift motor to tilt upper platform.
- RF controls to operate system remotely.
The entire slide will be built in 2 sections: the platform and the track.

Platform will hold the two motors and will be the starting point of the cart.

The frame will be made of wolmanized wood.

Polyethylene covering for recreational equipment appearance for car.
The Track

- Wolmanized wood.
- Approximately 26” wide and 141” long.
- Platform will be 35” high at starting point and the bottom will be 136” from the platform.
- Slide length 11.7 feet.
- Two 2” barriers will be installed on the side of the slide to control car descent on ramp.
- 26” clearance between the safety rails, which will leave a comfortable yet secure spacing for the 24” wide car.
End of slide will be flared outward to avoid misalignment of the car during retraction.

4”x4” wolmanized wooden posts will be used to stabilize the platform base of the slide.

Lift motor will be positioned 35” off of the ground.
  - Raise platform to begin descent.

Winch motor will be installed on the rear of the central platform.
Lift Motor and Winch Motor
Car Retraction and Release

- Mechanism is completely mechanical with movable parts that will allow the release of the winch hook.
- Reduces cost of expensive electrical components.
- Series of moveable parts.
- First component of this mechanism is a 1 x 1 inch square, ‘block’, protruding upwards from the platform.
- Arrows represent movement of parts. This “domino” effect will allow the winch hook to be disengaged.
Release Mechanism: Parts

- The hinges are planned to be spring loaded to enable the parts to move back to their starting positions.
- Made of stainless steel.
- The parts are solid one piece parts that have holes drilled in them where the hinges will be placed.
- The stopper acts as a barrier restricting reverse motion of part D.
Safety Rails

- The rails will be ADA (Americans with Disability Act) compliant.
- Aluminum will be used for its strength, durability and resistance to corrosion.
- Slip-on fittings: easily installed or removed.
Coaster Car

- Seat equipped with four point harness for trunk support and hip restraint.
- Velcro leg restraints to hold lower limbs in place during use.
- Car covering will be made of polyethylene sheeting and will have the appearance of a traditional wooden roller coaster train car.
## Electrical Motors

<table>
<thead>
<tr>
<th>WINCH MOTOR</th>
<th>LIFT MOTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed behind upper platform</td>
<td>Installed below upper platform</td>
</tr>
<tr>
<td>Will pull car to the top of the slide</td>
<td>Will tilt upper platform to a 20 degree angle as a means to send the car down the track</td>
</tr>
<tr>
<td>Requires 12V DC supply voltage</td>
<td>H Bridge circuit will mediate forward and reverse motion</td>
</tr>
<tr>
<td>Will be triggered to operate through 40 pin microcontroller</td>
<td>Will be wirelessly controlled</td>
</tr>
</tbody>
</table>
PHOTOELECTRIC SENSOR

- Consists of electric eyes mounted in parallel configuration
- Will be installed on the upper platform
- Indicates when car has reached top of slide
  - Will send a signal to microcontroller when infrared light beam is blocked by car

TOWER LIGHT

- 24V Tower light will be installed at top of slide
- Lights will illuminate from an amplified signal sent from microcontroller

Status light indications:

- Red - indicate winch motor is in use
- Yellow – indicate lift motor is in use
- Green – indicate car has reached top of slide
Division of Labor

- Sarmad Ahmad
  - Mechanical release mechanism, safety rails, track design, track materials.

- Hillary Doucette
  - Winch and Lift Motor control circuitry, Status Light Controls, power circuits, sensor implementation and microcontrollers.

- Stephen Kustra
  - Coaster car design, wireless control circuitry, electrical housing unit.
<table>
<thead>
<tr>
<th>ARC Slide Components</th>
<th>Quantity</th>
<th>Cost</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Car</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheels</td>
<td>4</td>
<td>8.00</td>
<td>32.00</td>
</tr>
<tr>
<td>Shaft</td>
<td>2</td>
<td>30.00</td>
<td>60.00</td>
</tr>
<tr>
<td>Nuts, Bolts, Pins</td>
<td>1</td>
<td>30.00</td>
<td>30.00</td>
</tr>
<tr>
<td>Seat and Restraints (nylon)</td>
<td>1</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>Track and Platform</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frame (Walmanized Wood)</td>
<td>1</td>
<td>350.00</td>
<td>350.00</td>
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<tr>
<td>Polyethene Covering</td>
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<td>60.00</td>
<td>60.00</td>
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<tr>
<td>U- Channels (polyethylene)</td>
<td>2</td>
<td>20.00</td>
<td>40.00</td>
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<tr>
<td>Bolts and Accessories</td>
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<td>75.00</td>
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<tr>
<td>Photoelectric Sensors</td>
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<tr>
<td>Winch Motor</td>
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<td>135.00</td>
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<tr>
<td>Battery</td>
<td>1</td>
<td>80.00</td>
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<tr>
<td>Wiring</td>
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<tr>
<td>Controls (RF)</td>
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<tr>
<td>Lift Motor</td>
<td>1</td>
<td>50.00</td>
<td>50.00</td>
</tr>
<tr>
<td>Status Tower Lights</td>
<td>1</td>
<td>65.00</td>
<td>65.00</td>
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<tr>
<td>Control Box</td>
<td>1</td>
<td>15.00</td>
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<td>Shielding Resin</td>
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<td><strong>Aesthetics</strong></td>
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<td>Shipping and Handling</td>
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<tr>
<td><strong>Total Cost</strong></td>
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<td>US$ 1382.00</td>
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## Purchases

- **Purchases as of 12/11/09**

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>Price US$</th>
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</thead>
<tbody>
<tr>
<td>Winch Motor</td>
<td>1</td>
<td>125.99</td>
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<tr>
<td>Status Tower Light</td>
<td>1</td>
<td>120.00</td>
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<tr>
<td>Seat and Restraints</td>
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<td>50.00</td>
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<tr>
<td>Car Frame</td>
<td>1</td>
<td>50.00</td>
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<tr>
<td>Battery</td>
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<td>68.00</td>
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<tr>
<td>Car Wheels</td>
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<tr>
<td>Battery Box</td>
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<tr>
<td>Battery Charger</td>
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</table>

**Total** 433.99

**Total Budget** 1382.00

**Remaining** $948.01

- **To be purchased:**
  - Wolmanized lumber
  - Photoelectric Sensor
  - Manufactured Printed Circuit Boards
  - Bolts and fasteners
At the completion of the ARC Slide, we will have custom built device that is safe, easy to use, and fun for Joey Toce. It will be an excellent means for recreational activity.

Safety is the number one concern when designing the track and coaster car for the ARC slide. All electrical and mechanical components will be thoroughly tested to ensure proper function before project closure.