Fast and Furious: High Speeds at High Hopes Preschool Progress Presentation

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Problem Statement

Children who lack the freedom of independent mobility experience resulting negative cognitive effects such as poor depth perception and cause and effect reasoning. These same children also unfortunately tend to be ostracized by their peers, preventing the development of valuable social skills.

Primary Objective

Mainly, we seek to help the children gain age-appropriate individual control of their mobility. Granting them the ability to move about on their own will help them with:

- Conceptualization of cause and effect
- Depth perception
- Cognitive development
- Social development

Needs Assessment

Patient :

- Needs to accommodate children of different sizes (weighing up to 360 lbs)
- Must not startle the child during acceleration
- Needs to accommodate children that need different acceleration options

Provider:

- Must be able to easily adjust seat for child
- Must be able to easily access battery for charging
- Motor controller must be easily accessible
- Must be able to adapt car for distinct needs of child
- Must have easily switchable acceleration mechanisms
- Must be easily sanitized to prevent potential spread of germs between children

System:

- Will be a powered mobility device
- Can’t compromise original outer structure
- Additional parts for the car must not cost over $200
- Time to fully charge battery should be 8-12 hours
- Total run time will be 1-2 hours

Solution Description

A power wheels car (6-V battery powered ride-on) with modular components and attachments which will support a variety of conditions. Our car is suited for children younger than 5 years and will have:

1. Safety Features
    a. Torso harness, foam padding, postural supports, possibly a parent handle and brake
2. Plug and Play Inputs
    a. Button to accelerate, steering wheel, handle bars, pressure controls
3. Motivational Appeals
    a. Colored inputs, music, lighting

This week:

4. Safety Feature
    a. Five-point harness being used and built into seat
5. Postural Support
    a. Tracks bolted into car (tilting mechanism to be added)

Measurements/Observations to Consider

Measurement	Modification Effect
Seat is not easily adjusted by the provider external to the car	An extension of the pin mechanism to make it easily accessible for the provider
Owner's manual shows maximum weight is 77 lbs	New seat track should be able to support up to 77 lbs
Easily adjust seat harness	Cover seat in fabric and attach with buttons
Seat needs to be attached to track and not fall under weight of child	Saddle pieces support the chair and can handle 360 lbs
Width of the wheel 7.8"	Steering attachment must fit on this
Children can't support their own trunk	Seat tilted at an angle

Noteworthy Progress

- Successfully achieved complete build of preliminary functioning seat mechanism
- From compressive testing, found that one H-clip can support 360 lbs on the vertical
- New design ideas from High Hopes visit (doorbell between plexiglass)
- Quantitative data from High Hopes IRB (Powered Mobility Skills Checklist)
- Set date to bring our car to High Hopes on March 24th for study kids, do general observation March 30th

High Hopes Study- Powered Mobility Checklist

Scoring (adapted from Furumasu 2016)

0	Task no attempted
1	Maximal hands-on assistance on switch with verbal cueing (51-75% assist)
2	Moderate hands-on assistance on switch with verbal cueing (26-50% assist)
3	Minimal hands-on assistance on switch with verbal cueing (25% or less assist)
4	Direct stand-by guarding with verbal cueing with occasional minimal assist to redirect
5	Verbal cueing only
6	Age appropriate supervision

Skills

	Score
Turns switch on and off	
Demonstrates concept of cause and effect (realizes that activating switch is causing movement of car – communicating verbally, expression, or action)	
Demonstrates "Stop" and "Go" concepts; follows directions of releasing switch at verbal cue of "stop" and pushing switch with verbal cue of "go"	
Maintains contact with switch for a minimum of 5 seconds	
Pushes switch to engage car in motion for 5 seconds	
Navigates car in forward direction for 10 seconds	
Looks in the direction of movement	
Turns a 90 degree corner to the left	
Turns a 90 degree corner to the right	
Navigates towards a toy, stops to play with toy	
Navigates towards a peer, teacher, or parent; stops to interact with individual	
Stops the car on command after engaging car in forward motion	
Stops after bumping into an obstacle	
Stops spontaneously to avoid stationary objects	

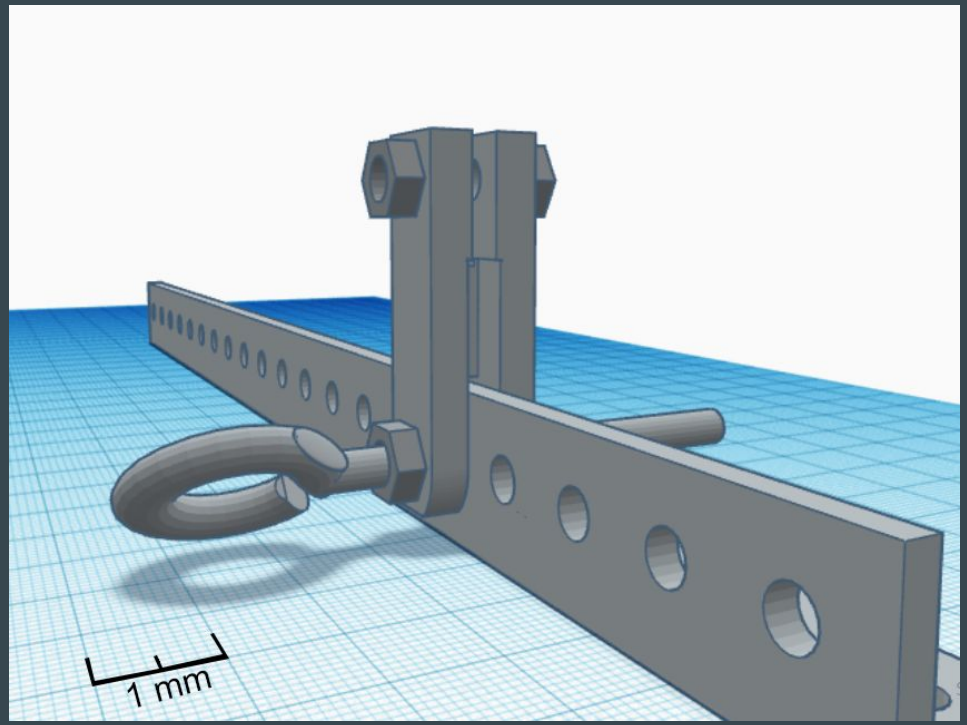
Current Goals

- Finish installing motor controller
- Design an easier way to adjust the seat angle
- Create foam molds for hip alignment, leg flair restriction, headrest
- Attach harness
- Complete steering wheel modification

Milestone	Deadline	Status
Track construction- amanda and nick	Tues Feb 07	Completed
Total seat modification- amanda and nick	Tues Feb 07 Tues Feb 21 Wed Feb 22	Completed
Leg/hip padding- amanda and taylor	Tues Feb 14 Fri Feb 24 Fri Mar 3	Not started
Steering wheel modification- taylor and nick	Fri Feb 17 Fri Mar 3	Not started
Motor operation/wiring- will and taylor	Tues Feb 21	In progress
Kill switch- will	Fri Feb 24	Not started
Headrest construction- amanda and taylor	Fri Feb 24 Fri Mar 3	Not started
Armrest construction- amanda and taylor	Tues Feb 28 Fri Mar 17	Not started
Harness attachment- will	Tues Feb 28	Not started
Acceleration options (buttons, head, handlebars)- taylor	Fri Mar 17	In progress
Car test-ready	Fri Mar 24	Not started

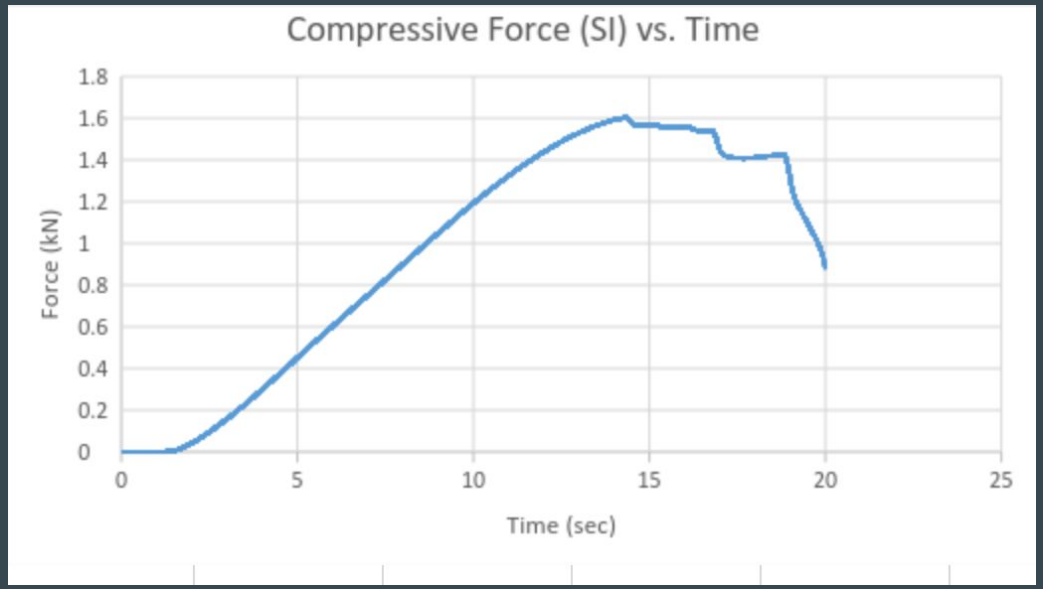
Design Updates - Seat

- 3D printed saddle piece can support 1.6kN (360 lbs) along vertical axis before mechanical failure
- Adjustable PVC peg for seat angling
- In process of devising more accessible methods of adjusting seat position
- Slight adjustment made to width of track positions on car body



Compression Testing

Pressure (N/m2) x Minimum cross area (m2) = Force (N)

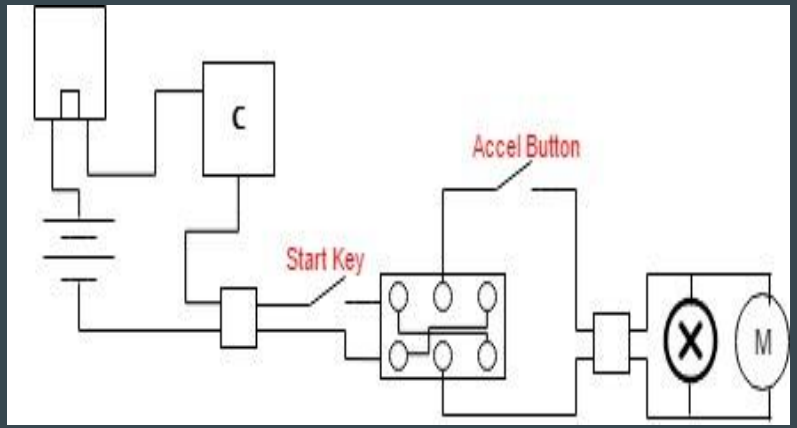


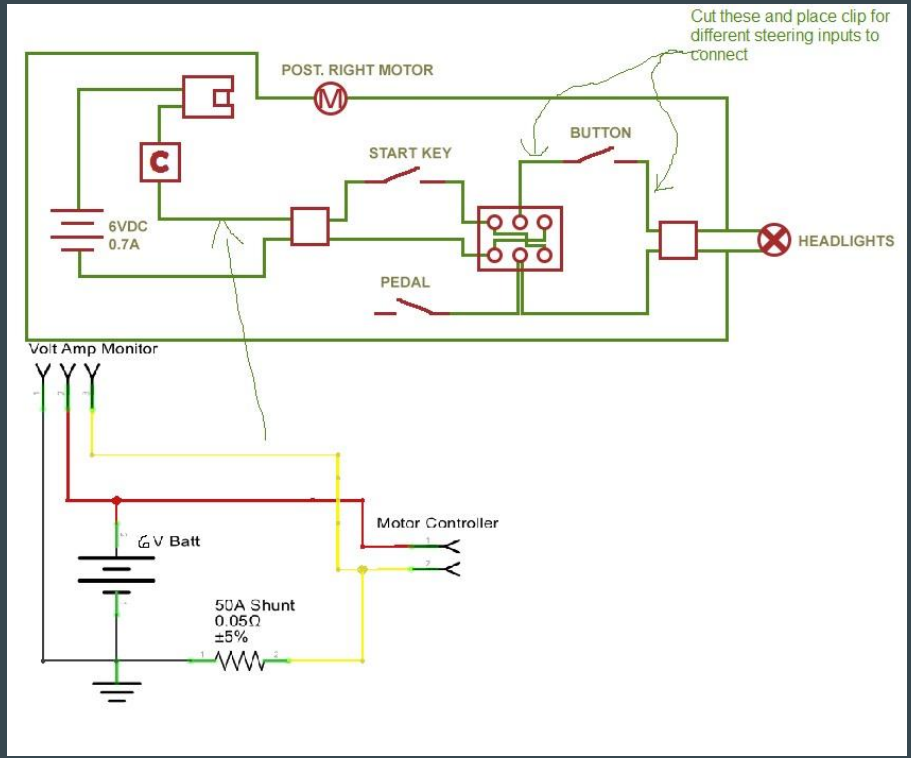
Calculated force: 2561.22 N (575.81 lbs)
Tested: 1602.25 N (360.22 lbs)

Approximate fill level for print ~62.5%

Fracture in piece follows vertical grain of 3d printed material

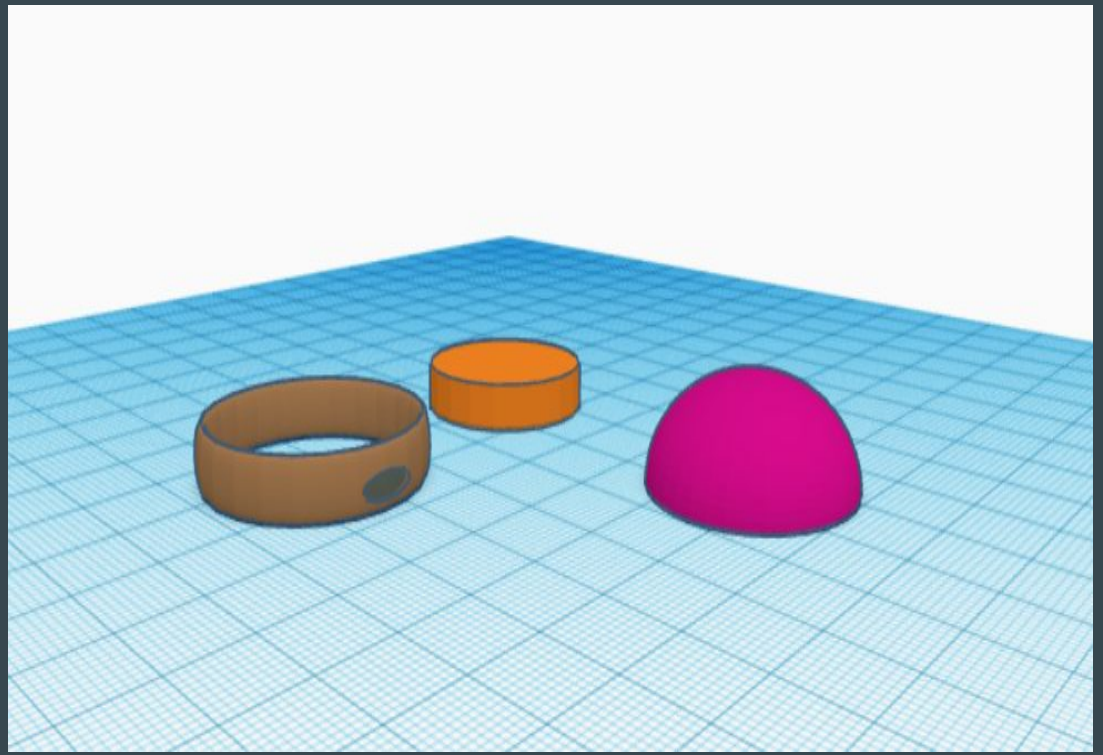
Design Updates- Circuit





Design Updates - Button

- Size of button base - 2.8”
- Color of the button will be red
- Something to think about: children with disabilities are motivated by light up toys



Future Goals

- Installation of motor controller
- Update of pending circuit diagram to account for new wiring
- Shaping and attachment of foam correction blocks for legs and hips
- Acquisition of materials necessary for steering wheel adjustment
- Installation and customisation of safety harness, headrest, and armrest
- Installation of kill switch and multiple activation methods

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Comments

- Next week we’re meeting at noon. No progress report.
- Check notes from each slide and apply