DEPARTMENT OF MECHANICAL ENGINEERING

Formula One Chair
Wheelchair Propulsion Device

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Motivation, Goal, Impact

Motivation:

Many wheelchair users face long-term shoulder damage from navigating steep and uneven terrain. The current market options are expensive and often restrict natural mobility.

Goal:

Design a lightweight, removable propulsion device that reduces strain while maintaining manual control and adapting assistance based on the user needs .

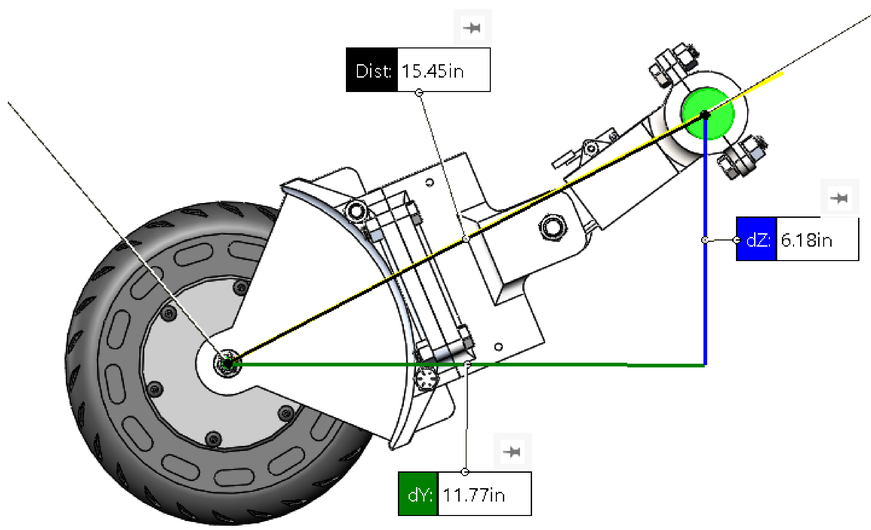
Impact:

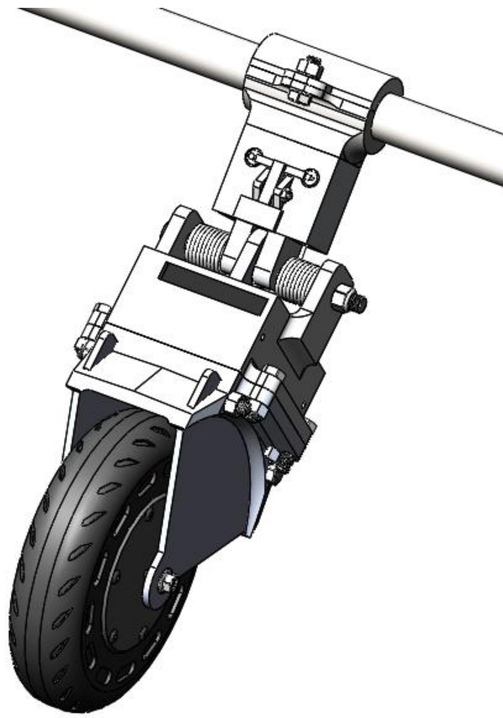
This prototype will make daily mobility safer & more accessible for wheelchair users.

Requirements

1. The device must not be a permanent fixture
2. The device must be lightweight, weighing at most 13lbs
3. The device must not significantly increase the wheelchair's profile
4. The device must provide adaptive assistance based on the user's need

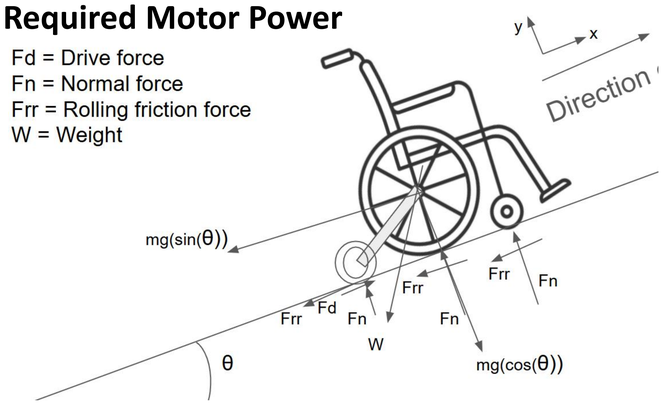
Final Design





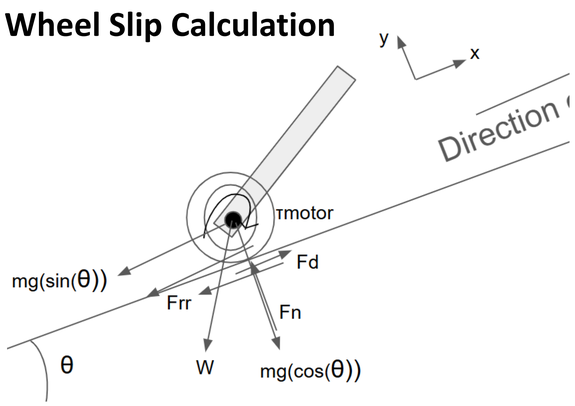
Design Calculations & Decisions

Required Motor Power



- Calculated required power from the motor hub wheel to keep a wheelchair and the user moving at a constant velocity of 3 mph (walking speed).
- Assumed parameters such as incline and a single rigid body, with the drive force coming from the attached motor hub wheel; calculations yielded a value of **169.213 W.**

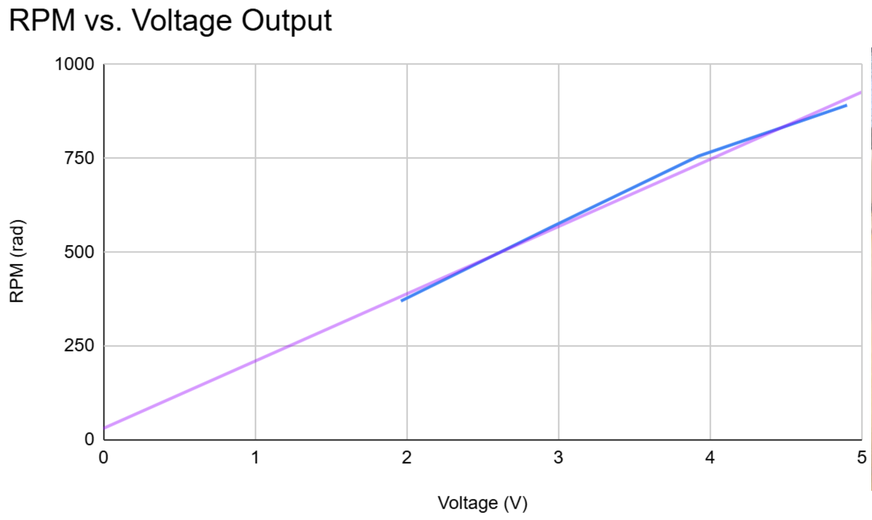
Wheel Slip Calculation

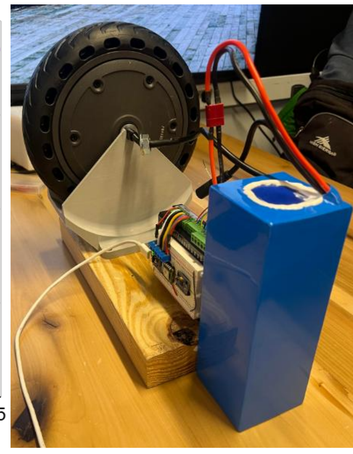


-Calculated the required force at the wheel, and compared it to the maximum friction force on the wheel. Calculations showed that it would slip.

- Added two torsional springs in parallel to increase downward force on the wheel.

Prototype & Test Results





- Graph shows voltage applied to the motor controller to get motor speed output
- Assistive operation found to be between 0.3 and 1.3 volts from testing