

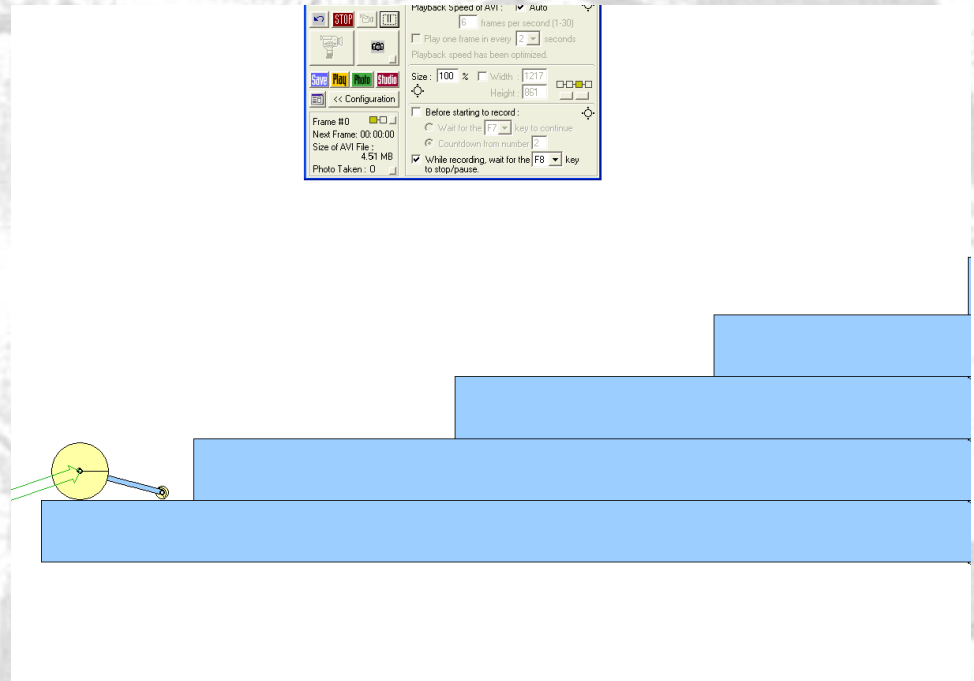
start: The Super Stair Cart



**Blue Team
Section B**

Goal

- *Start* makes it easier, safer and more comfortable to move large and small items up and down stairs

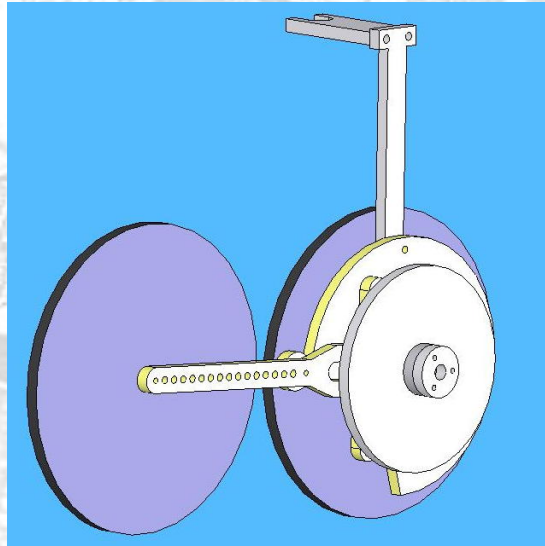


Design Parameters

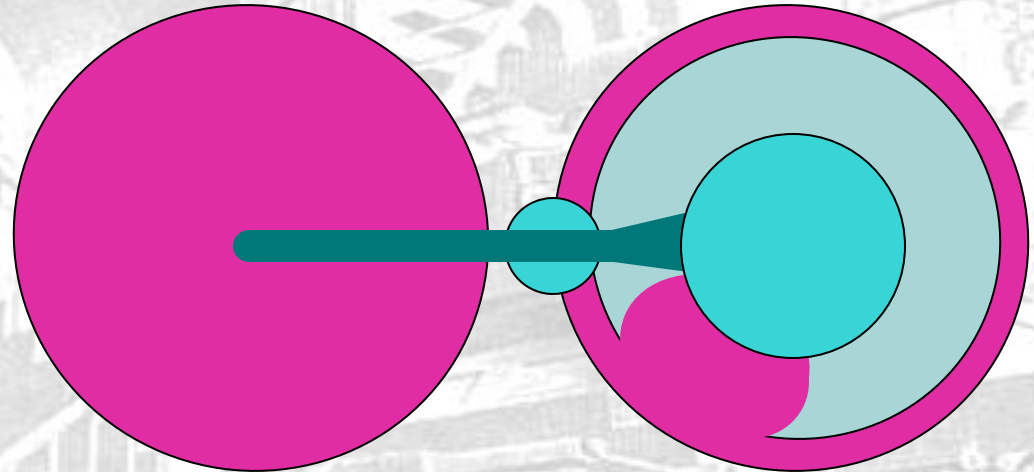
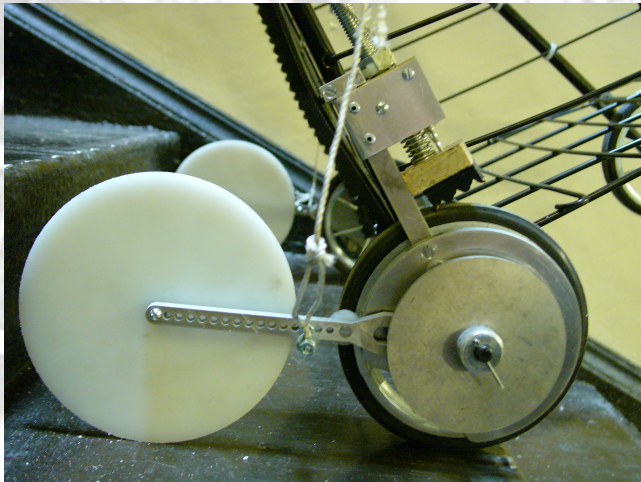
Critical Modules

- **Stair Mechanism**
 - Ascent
 - Descent
- **Safety**
 - Tipping forward
 - Tipping backwards
- **User Interface**
 - Stability
 - Ergonomic

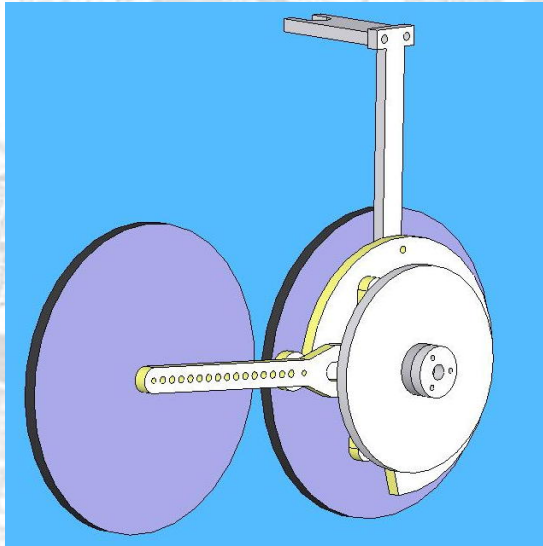
Progress: Stair Ascent



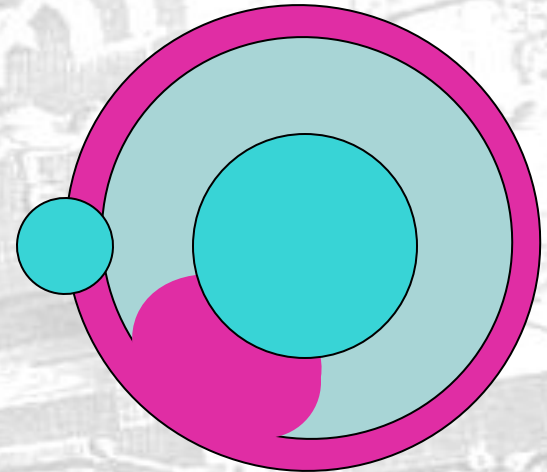
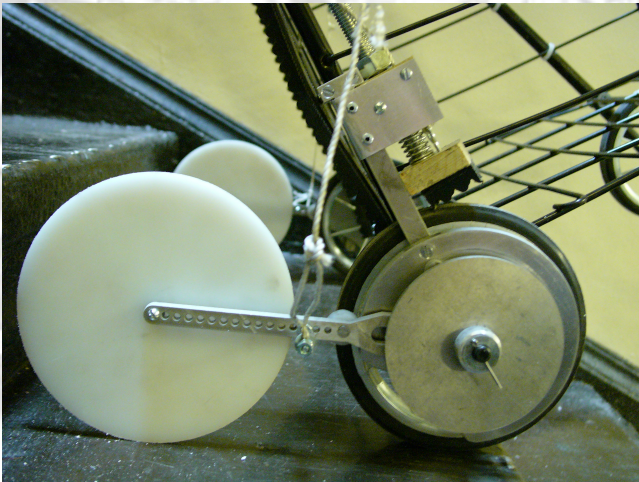
- Minimizes force required by user
- Variable radius arm
- Maintains Constant 45deg. Slope
- Roller guided along Cam



Progress: Stair Ascent



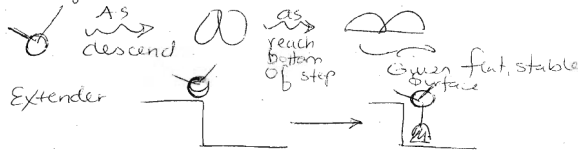
- Minimizes force required by user
- Variable radius arm
- Maintains Constant 45deg. Slope
- Roller guided along Cam



Progress: Stair Descent

Alternate Design Ideas:

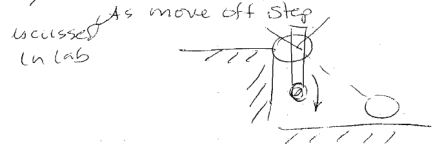
2) wheel breaks open + discussed in lab
Going up - acts as regular wheel



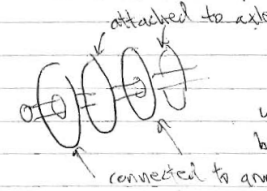
3) Foot Extender

negatives: needs to take into account variations in step heights & treads/depts

4) Damper Mechanism - potentially Rotational - Attached to cart At fixed angle - slowly releases



Rotational Viscous Damper



$$M = n \cdot \frac{\pi \mu \Omega}{2k} (b^4 - a^4)$$

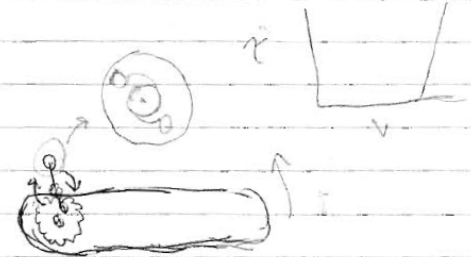
where n is the # of sets of disks between which fluid flows

Use an inclined plane to transmit torque into plate to plate motion $h_{\text{new}} = h_0 - \frac{x}{k}$

most likely options:

Centripetal

using gears or bolts ← may slip



high speed air furthest along gear pt. huge force amplification back along path ... good!

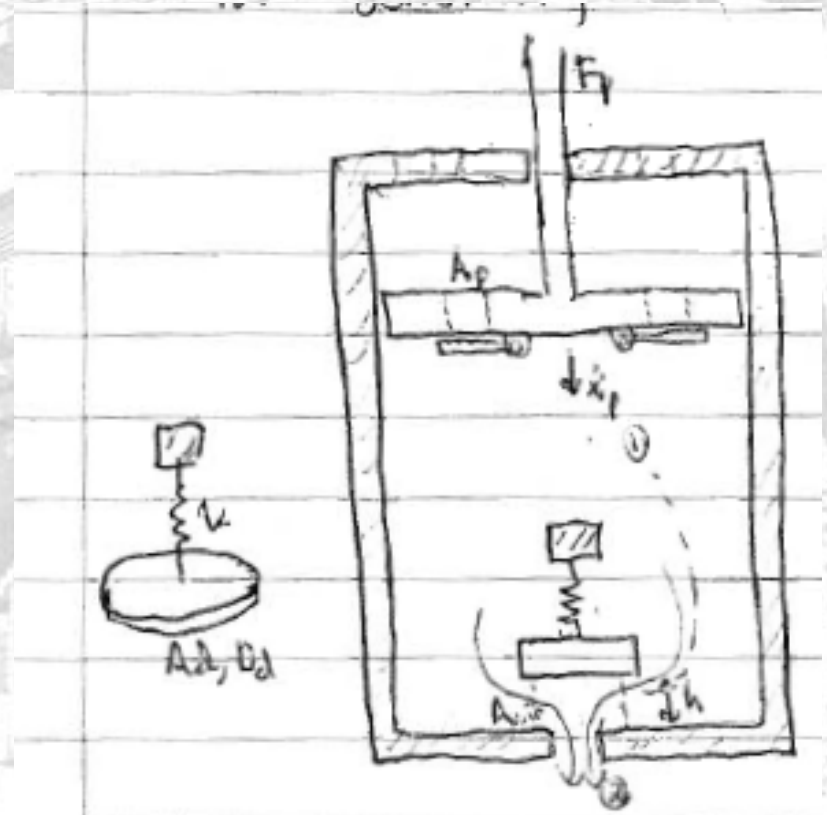
Progress: Down Mechanism

○ *Criteria*

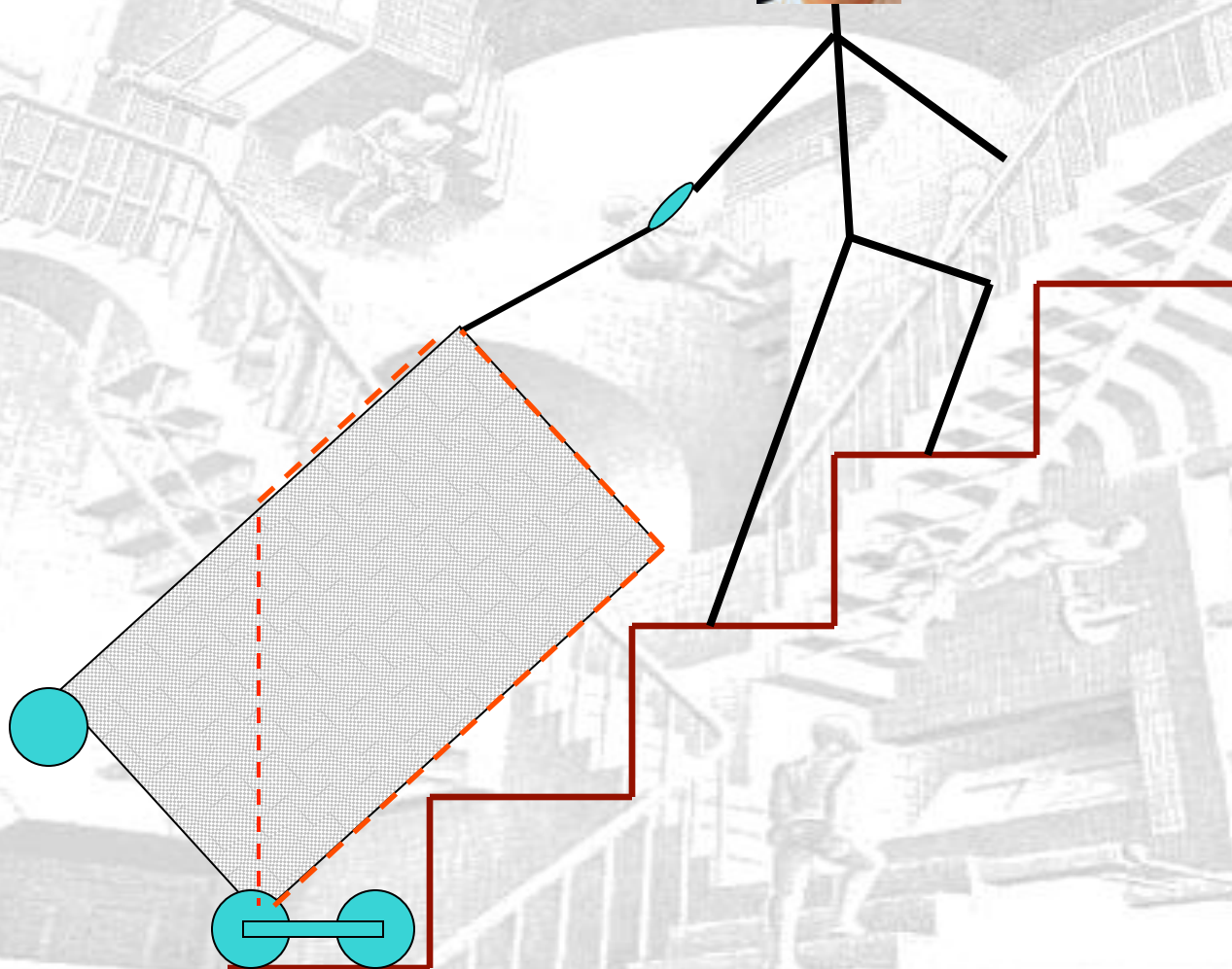
- Easy to integrate
- Ease of Use
- Maintenance

○ *Parameters*

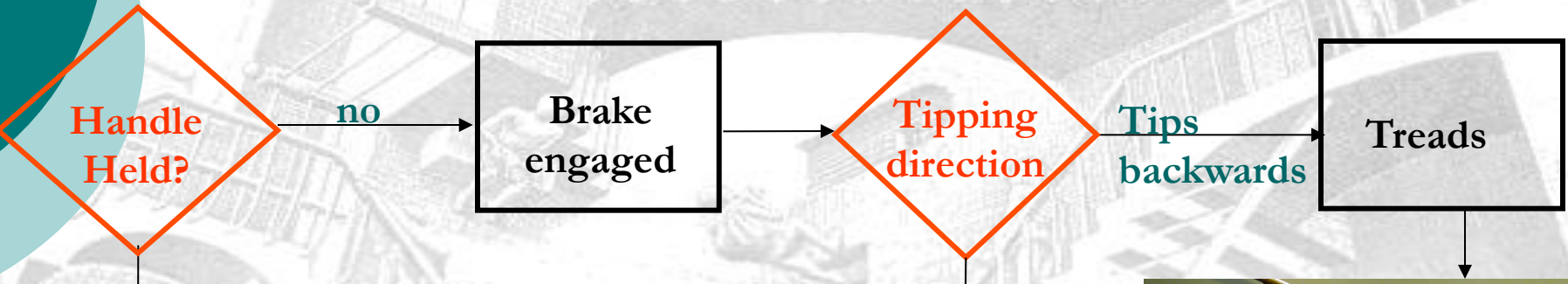
- Torque $\sim 3-30$ lb-ft
- Unidirectional
- Rotational
- Operates at constant velocity



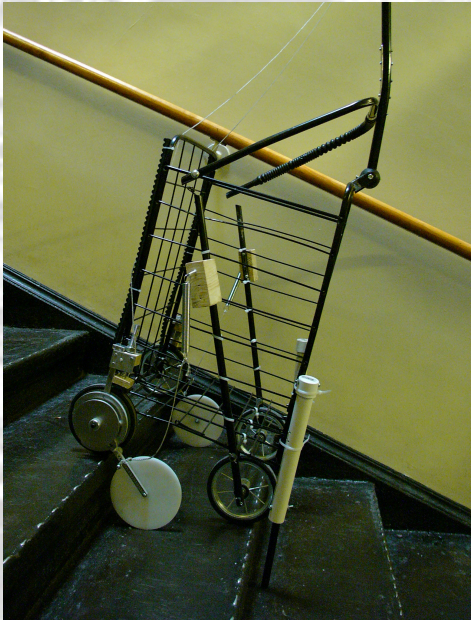
Progress: User Interface and Stability



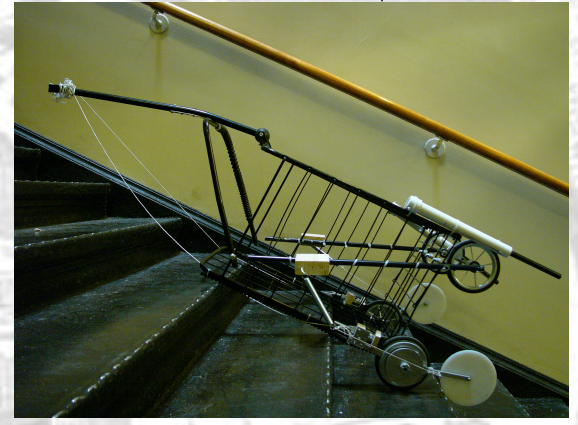
Progress: Safety



Brake disengaged



Telescoping Feet



Treads



UNIVERSITY OF CALIFORNIA
SAN DIEGO

Looking Ahead....

- **Edit Cam Design**
- **Optimization of Damper Design and manufacturability**
- **Costs**
- **User Interface**