GRANULAR FLOW LABORATORY PROJECT

DESIGN CENTER COLORADO

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Mission

Why are hourglasses filled with sand, not water?

Mission: This project answers that question through a modular, transportable, and engaging display demonstrating the key differences between granular and fluid flow.

Requirements

- ✔ **Size Constraint:** Entire display must fit within client's lab window
- ✔ **Transportability:** 2-Person unit transport process
- ✔ **Weight Limit:** Max unit weight of 60 lbs
- ✔ **Flow Duration:** Must be within typical attention span
- ✔ **Visibility:** Flow must be visible, supported by LED lighting
- ✔ **User Interaction:** Users reset hourglasses to restart flow
- ✔ **Poster:** Informative poster must be within proximity of display
- ✔ **Leak-Proof:** Hourglasses must be leak-proof

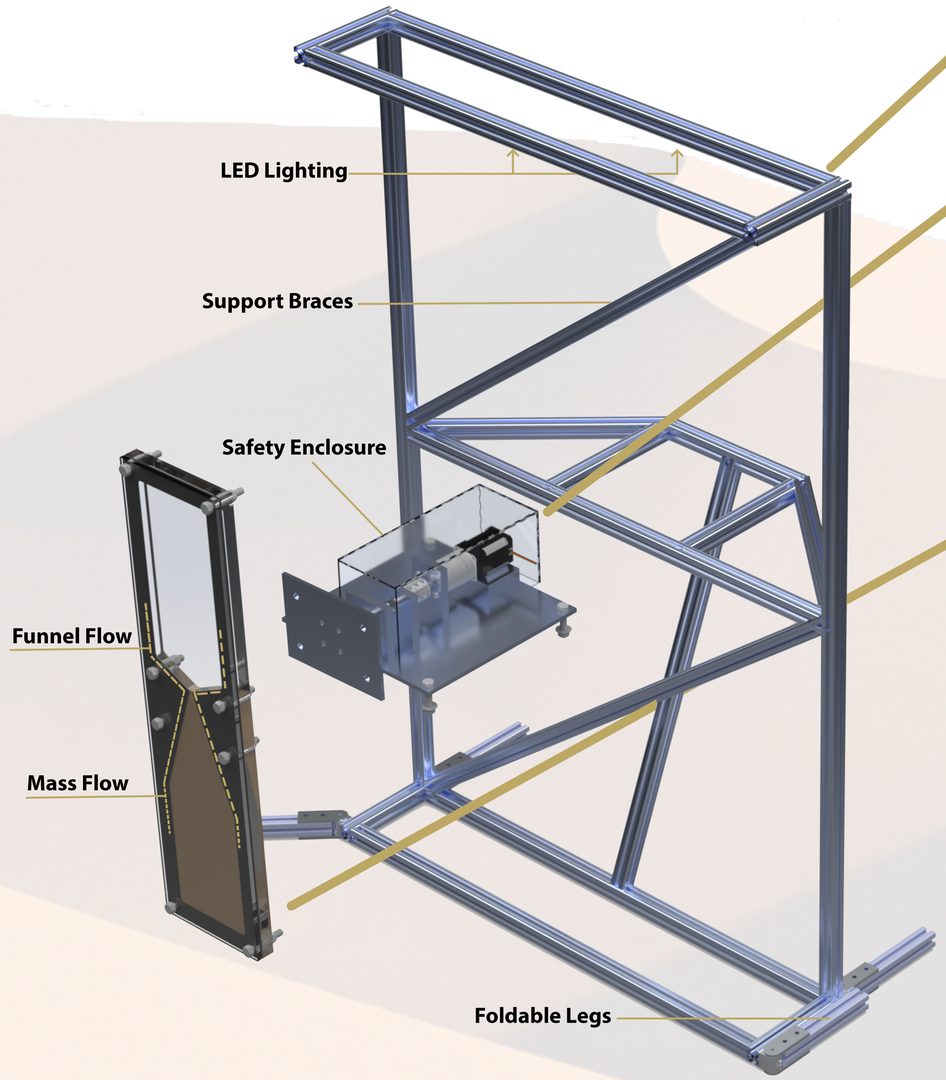
Challenges

- Weight
- Transportability
- Assembly
- Manufacturability
- Scratching
- Static
- Leak-Proof
- Hourglass Alignment

Design Overview

Each display unit features **a clear, motorized hourglass**, mounted on a lightweight **aluminum frame**. Two hourglasses are filled **with grains** and one **with water**. A **communication box** allows users to flip hourglasses individually or all at once.

Design

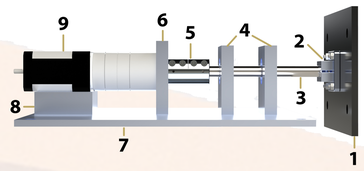


Frame

80/20 Aluminum
- Lightweight & Modular

Drivetrain

6061 Aluminum
- Lightweight & Durable

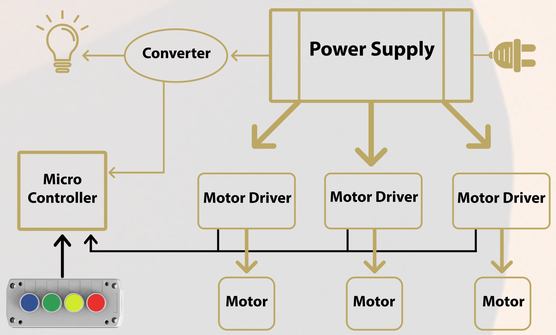


1. Connecting Plate
2. Flange Adpter
3. 12mm Shaft
4. Pillow Blocks
5. Step Up Adapter
6. Motor Mount
7. Mounting Plate
8. Motor Spacer
9. Stepper Motor

Hourglass

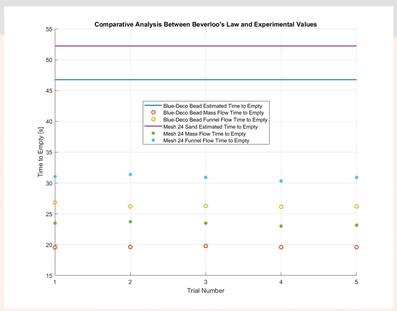
Clear Acrylic
- Better Scratch Resistance

Electronics

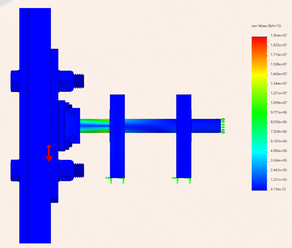


Analysis

Beverloo's Law



Drivetrain FEA



Testing & Results

Req.	Test	Result
Transportability	2-Person Transport	✔
Weight	Weigh Individual Unit	✔
Flow Time	20-30s of Flow	✔
User Interaction	Electronics Functionality	✔
Leak-Proof	Leakage Test	✔

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