Team 23: Adjustable Physical Therapy Table

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Advisor: Dr. Reffeor

Problem Statement

The MAT Table Excellence in Rehabilitation Company has requested our help to design and prototype a safe and reliable lift/tilt mechanism and sliding brake mechanism that will be integrated with the current table design for increased reliability and stability.

Background

The MAT Table is a versatile rehabilitation treatment aimed towards physical/occupational therapists working in outpatient and inpatient clinical settings. The device combines 5 different types of rehabilitative and exercise techniques into a single device, enabling clinicians to provide a comprehensive and personalized treatment approach while optimizing the total recovery time. The device also lowers the risk of injury to the to the clinician and the patient by reducing the number transfers required to and from the device.



Critical Functions

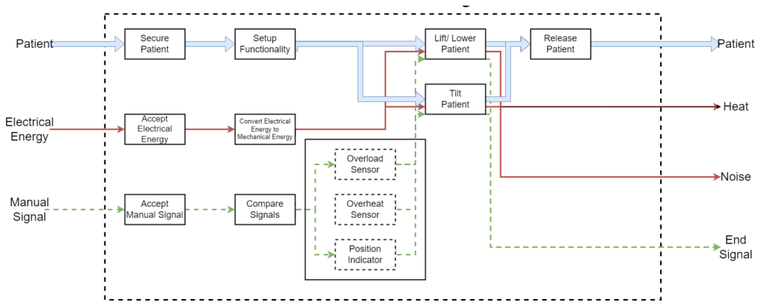
The critical functions of the MAT Table our design focused were defined as the following:

1. Generate motion
2. Lift mechanism
3. Table mobility
4. Control
5. Tabletop brake

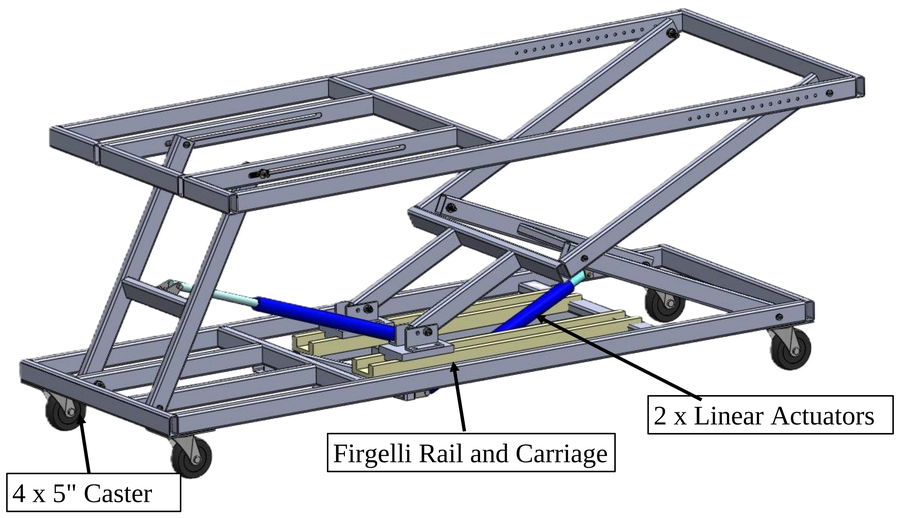
Key Specifications

Specification	Value	Units
Table Strength	1100	Pounds
Lift Strength	500	Pounds
Maximum Vertical Height	33	Inches
Minimum Vertical Height	19	Inches
Maximum Horizontal Rotation	38	Degrees
Minimum Horizontal Rotation	-8	Degrees
Maximum Deflection	2	Inches

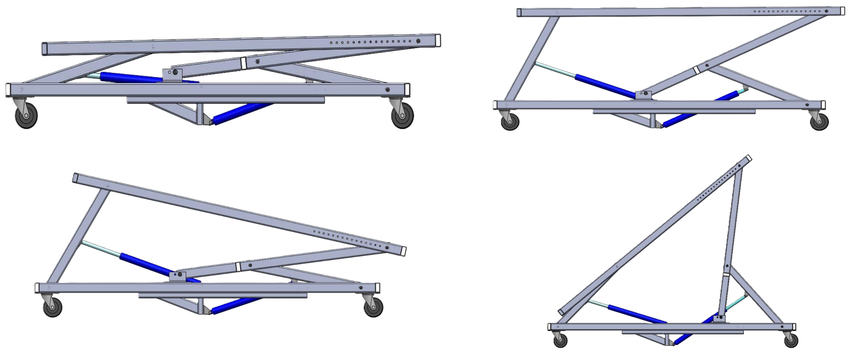
Function Structure Diagram



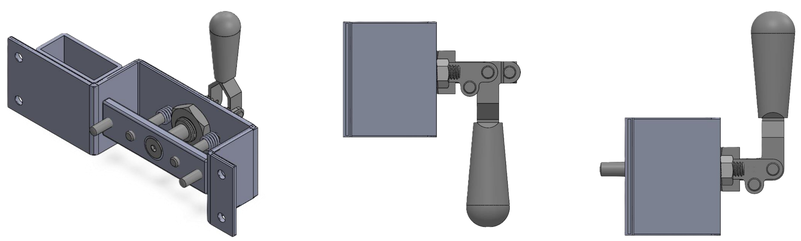
Mechanical Design



LIFT/TILT MECHANISM



BRAKE MECHANISM

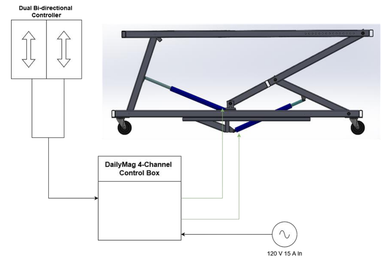


Next Recommended Steps

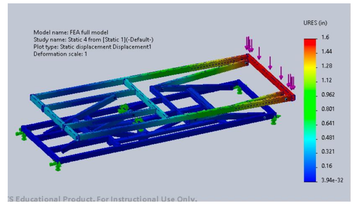
- Linear actuators with position feedback and self-locking capability to enhance control and simplify machine design
- Implement secondary braking mechanism on linear slides to improve stability
- Design for manufacturing
- Tolerance stack up analysis

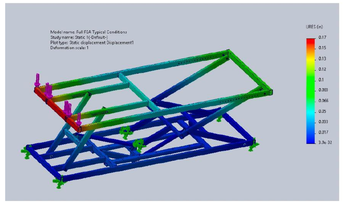
Engineering Analysis

- FEA Analysis
- Fatigue Analysis
- Kinematic Analysis
- Power Calculations
- Buckling Analysis



Simulation Results



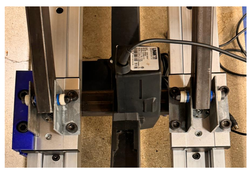


Parameter	Maximum Allowable Value	Actual Value
Deflection (inches)	2.00	1.80
Actuator Forces (pounds)	1348	1228
Shear on Fasteners (pounds)	6283	< 2000
Bearings	740 pounds	9700 hours
Brake Pin Load (pounds)	1038.60/pin	< 500
Power (watts)	1800	216

Final Prototype







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- Lab Supervisor Roy Visser