Power tool operation - Rat Model

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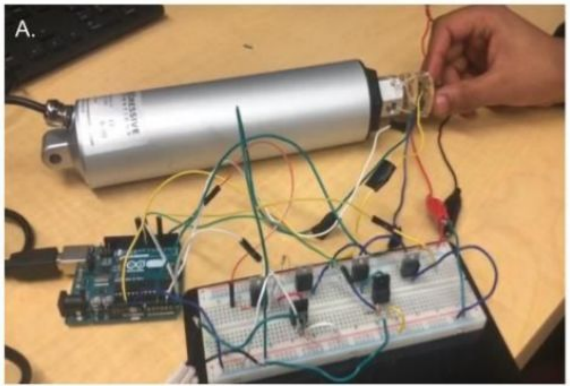
Presentation Overview

1. Problem Statement
2. Background
3. Summary of Product Design Specifications
4. Design Alternatives
5. Design Matrix
6. Future Work
7. Acknowledgements

Problem Statement

Create a device that can be used on rats to simulate repetitive power tool use in rats

- Taking the next step from project from last semester.
- Currently have a proof of concept of circuitry
- Obtain required materials and create a working model
    - Linear actuator
    - Load cell
    - Cage



Background

Power hand tool operations

- Rapidly rising impulse loads
- Overloading eccentric muscle contractions

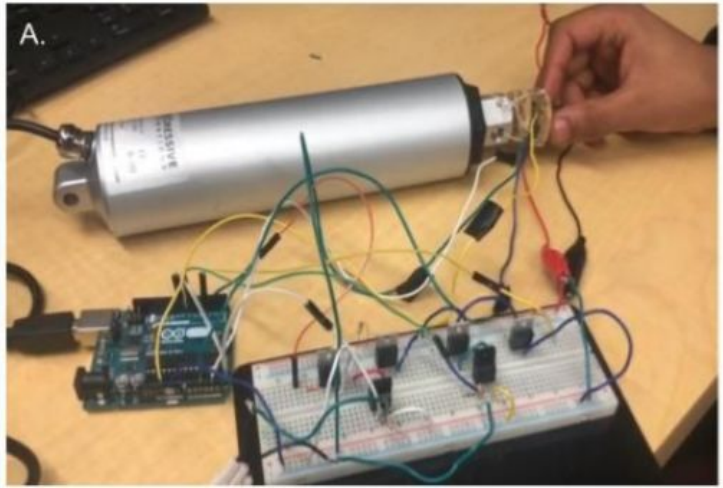
Chronic Injuries

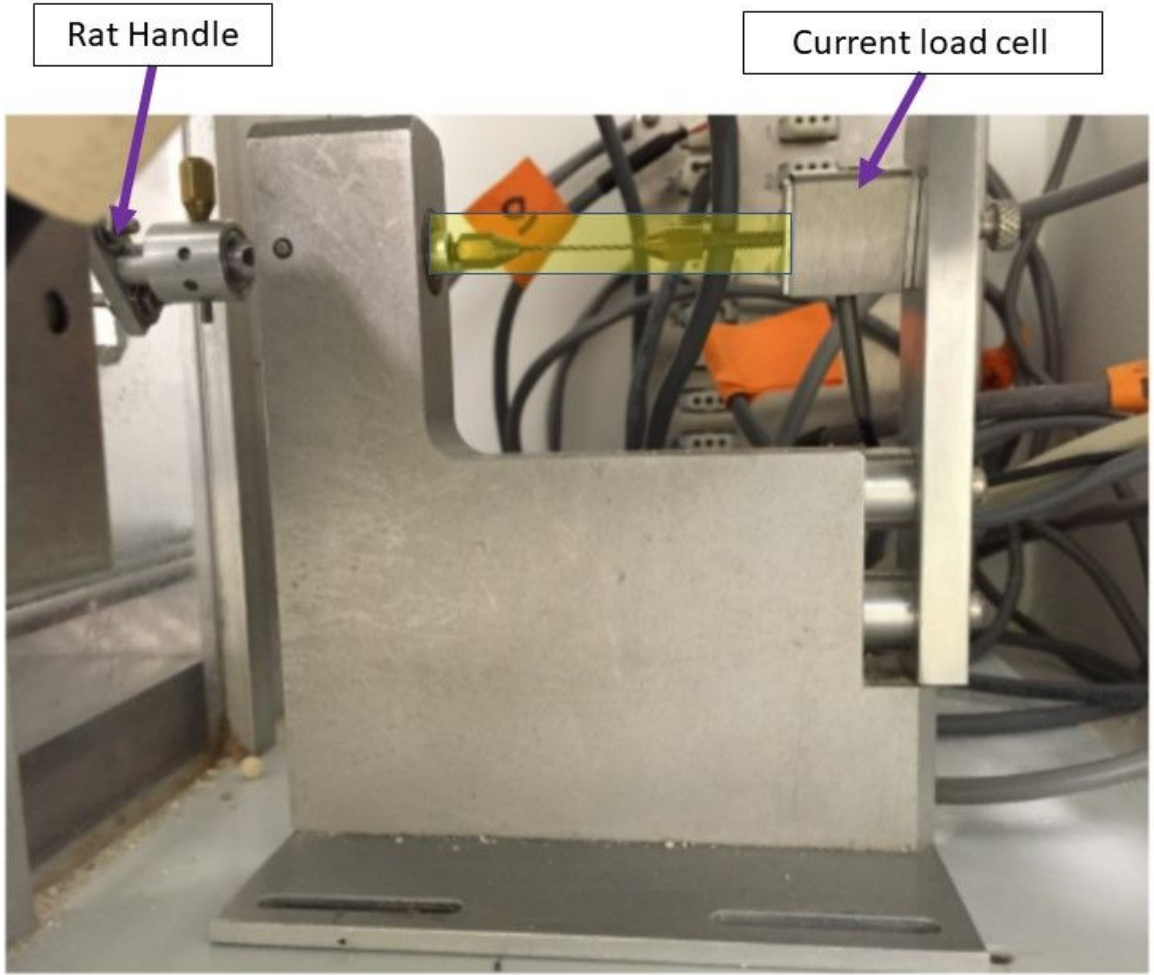
- Repetitive loading
- Stretched muscle fibers and tendons

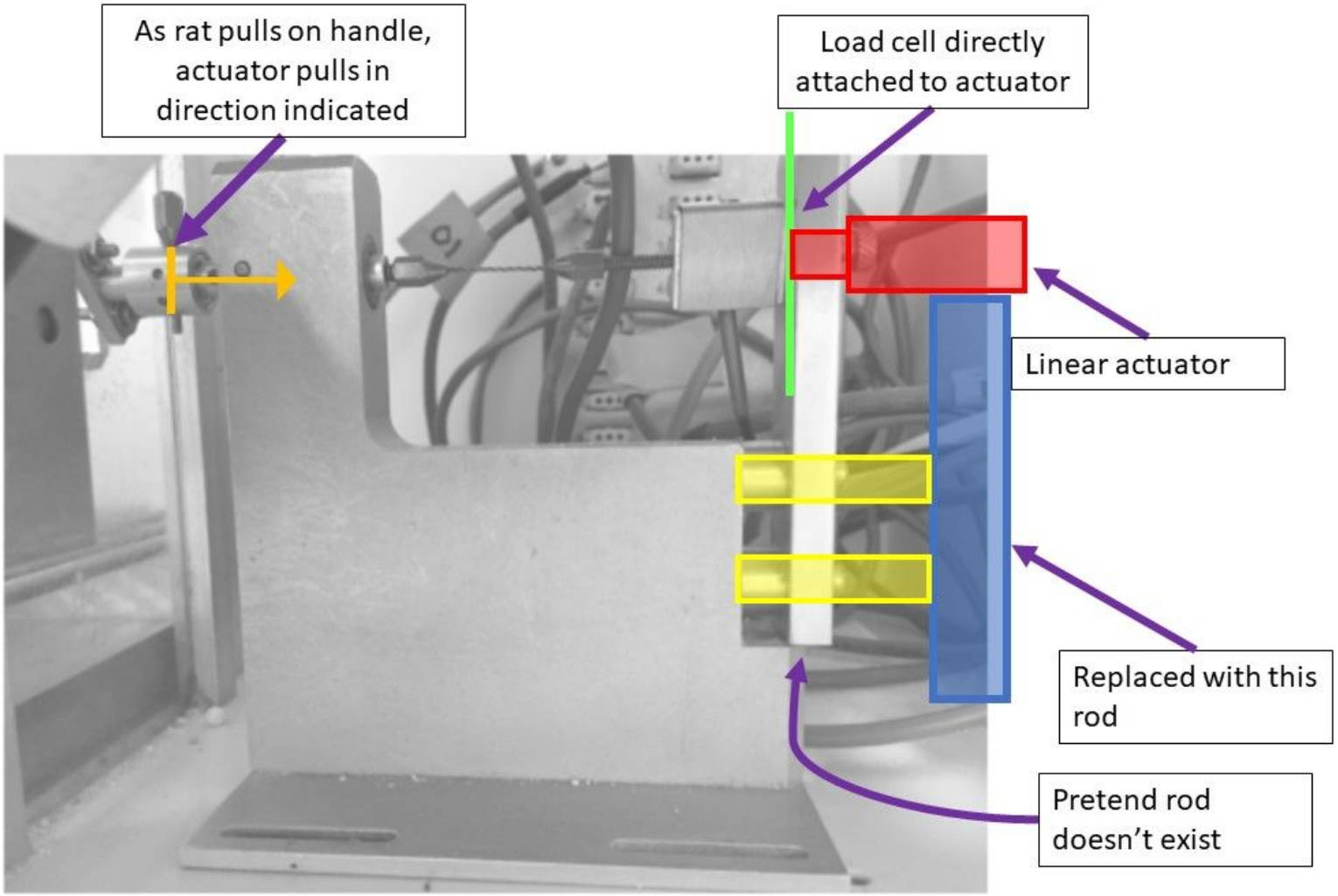
[1] Compliments of Hilti.com

Summary PDS

- Simulate repetitive power tool operation injury
- User input force and grasp duration thresholds
- Seamless integration onto existing chambers

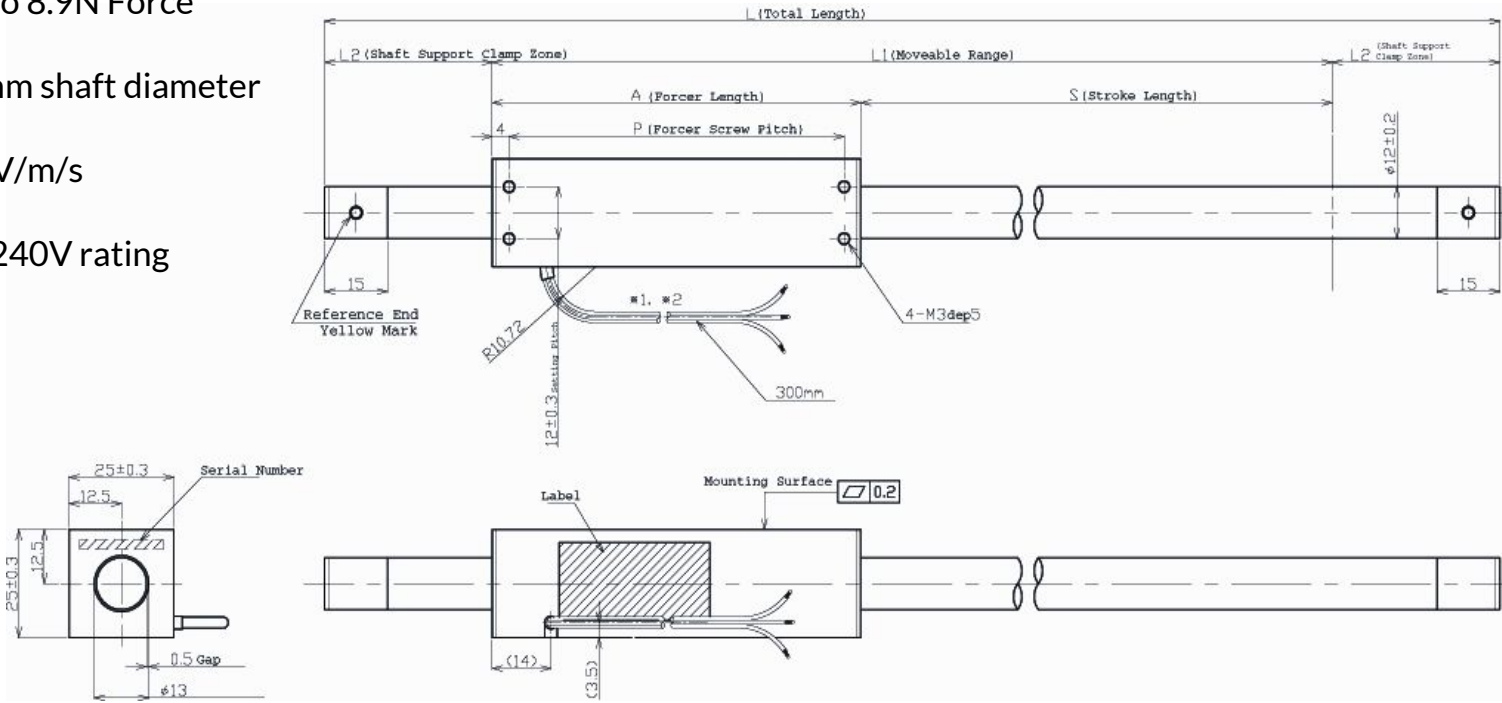



Rat Handle
Current load cell


As rat pulls on handle, actuator pulls in direction indicated
Load cell directly attached to actuator
Linear actuator
Replaced with this rod
Pretend rod doesn't exist

Option 1: S120Q Nipton Pulse Linear Shaft Motor

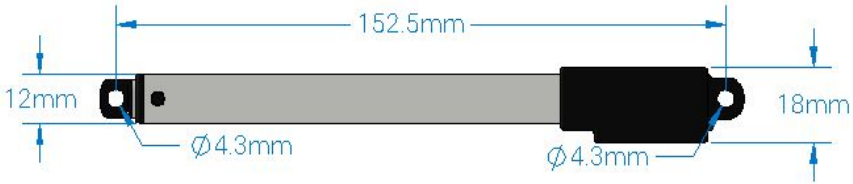
- Up to 8.9N Force
- 12mm shaft diameter
- 7.4 V/m/s
- 10-240V rating

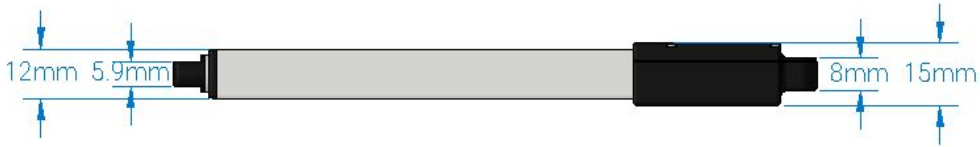


http://www.nipponpulse.com/catalog/parts/search/motors-linear-servo/part_id:20

Option 2: AMD L12 100 mm Stroke 4 lb Thrust Light Duty Linear Servo

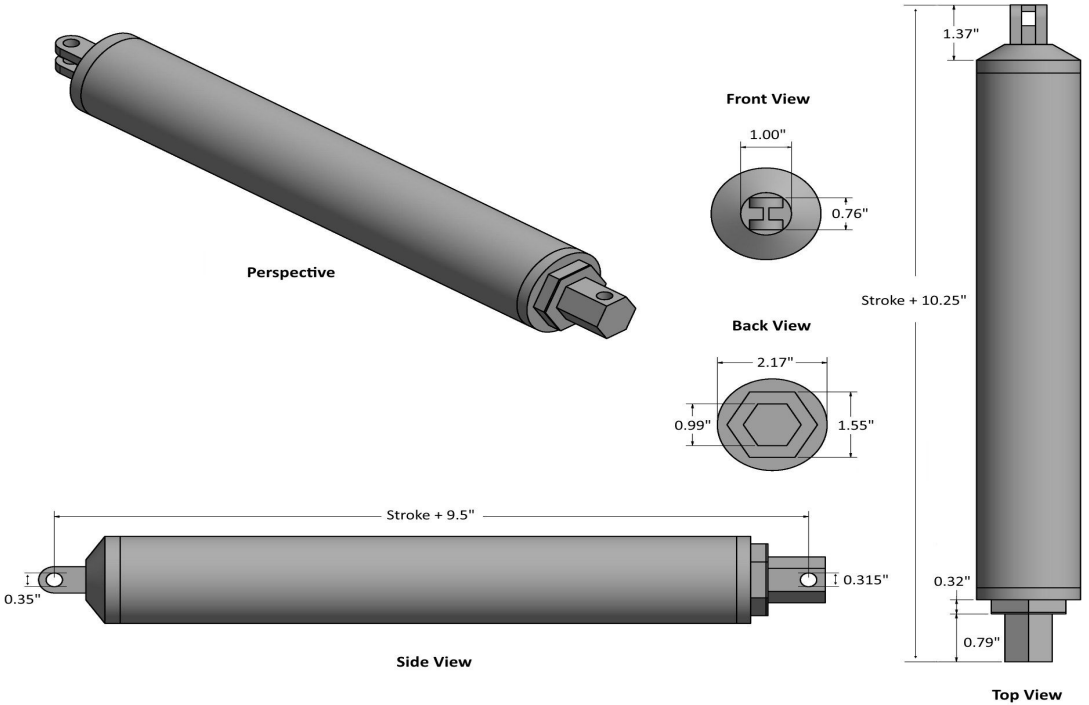
- Provides equal force in tension and compression (22N)
- Maximum speed of 25 mm/s
- Voltage requirement 4.5-7.5V
- Compressed length of 15.25 cm





Option 3: High Speed Linear Actuator

- Can provide upto 97 N of force
- Maximum speed of about 230 mm/s
- Requires 12V power source
- Compressed length is 26 cm



FA-RA-22-12-X

Actuator:	S120Q Nipton Pulse		AMD L12 Actuator		Firgelli High Speed Actuator	
Adjustability(30)	3/5	18	4/5	24	2/5	12
Cost(25)	3/5	15	4/5	20	2/5	10
Size(25)	5/5	25	4/5	20	2/5	10
Speed(20)	2/5	8	2/5	8	5/5	20
Total 100	**66**		**72**		**52**	

*While Consistency and safety were considered they are not included on the matrix as they were redundant due to the fact that all the actuators were objectively equal in their safety and consistency

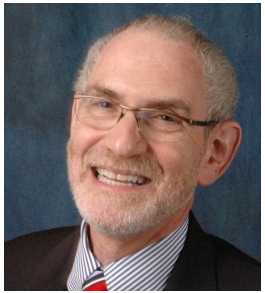
http://bmedesign.engr.wisc.edu/course/files/matrix/DesignMatrixRequirements.pdf

Future Work

- Present suggestions to client
- Code to handle user input
- Calibrate load cell
- Integrate actuator + load cell with code
- Testing
  - User input
  - Model rat arm with spring of known k
- Create housing for device

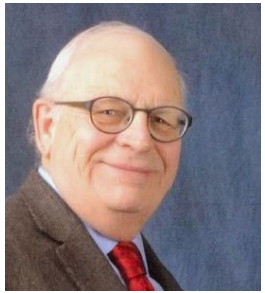
Acknowledgements

Prof. Witzenburg



Prof. Radwin

Prof. Barbe



Prof. Tompkins

Previous team: Janavi Kotamarthi, Naman Patel, Carson Gehl

References

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