



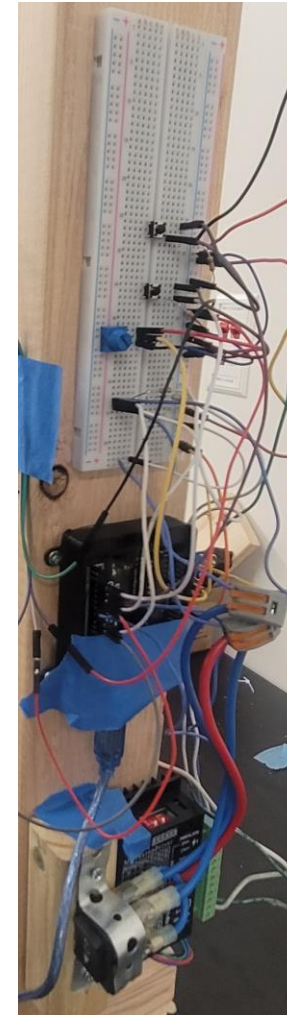
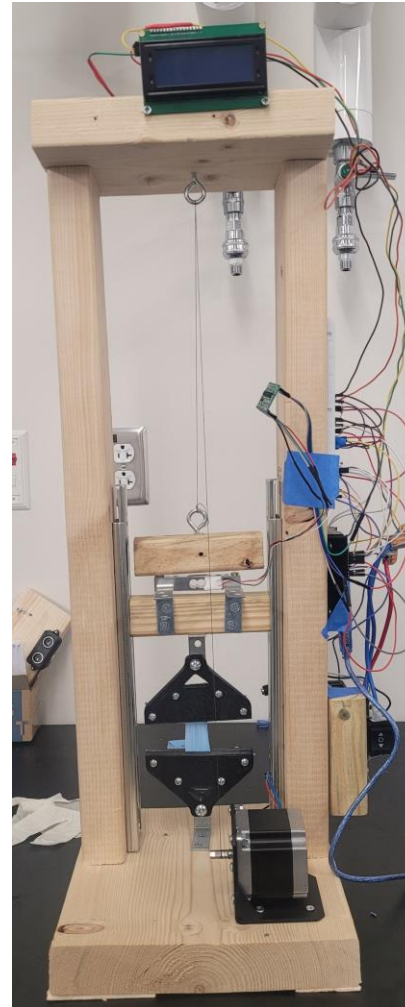
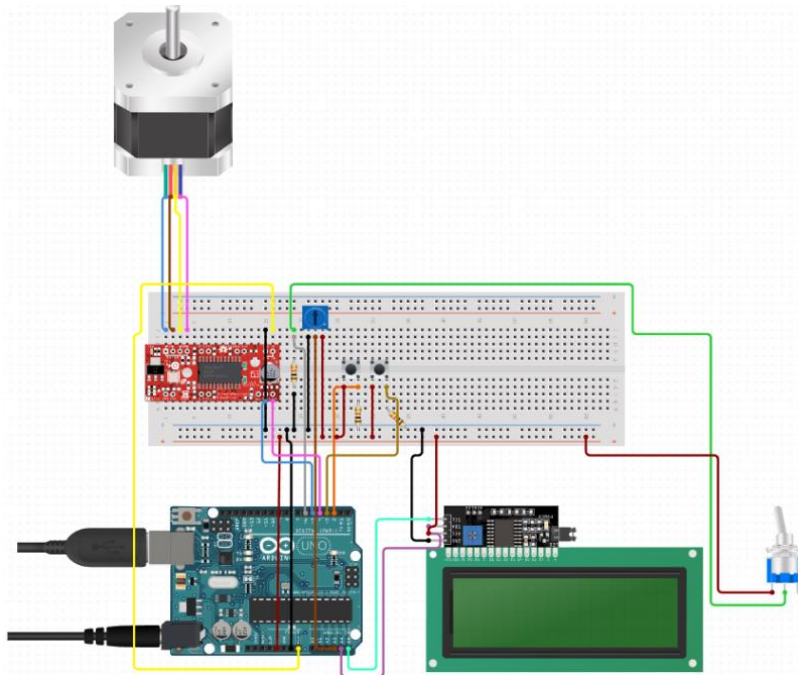
TENSILE TESTER

Kaleb Bogardus, Mariela
Monterroso, Elijah
Lallemand, Kareem
Abdeltawab

GOALS

- Accuracy + Precision
- Ease of use

SYSTEM DESIGN



KEY FEATURES

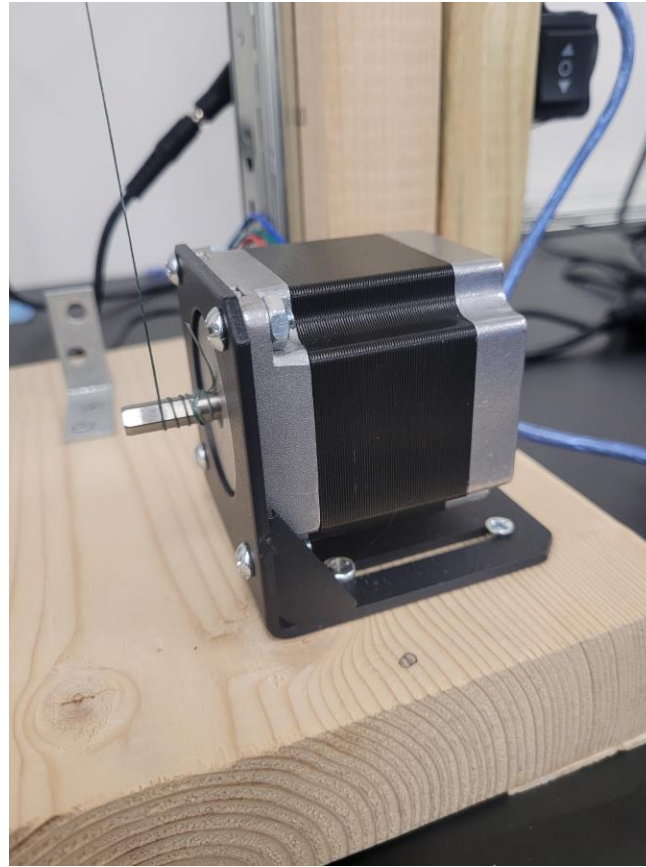
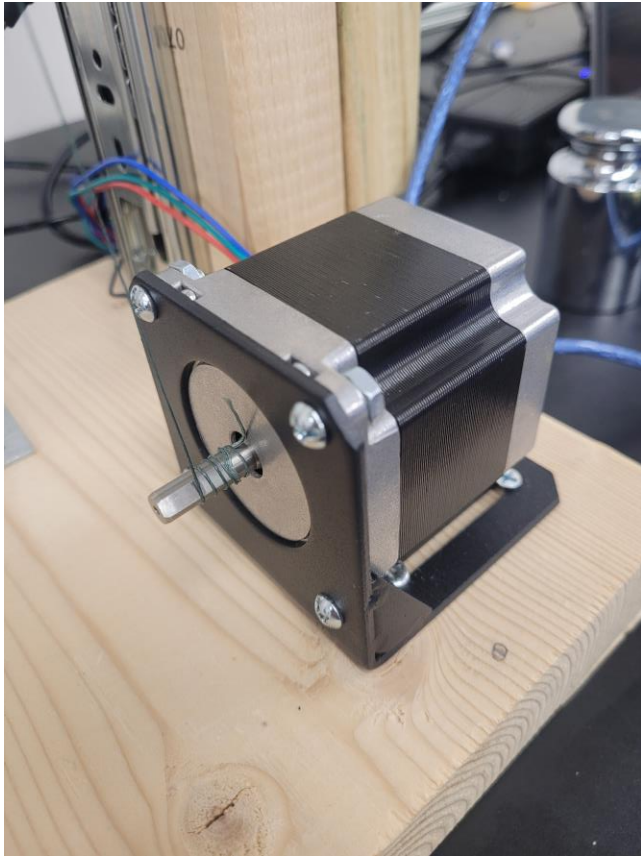
ACCURACY:

- Stepper Motor
- 20 kg load cell
- Thinner string

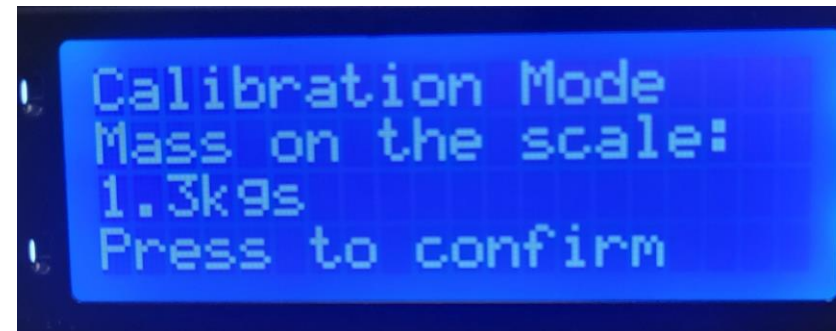
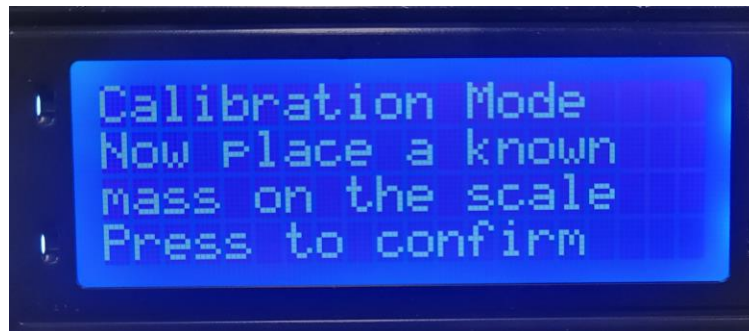
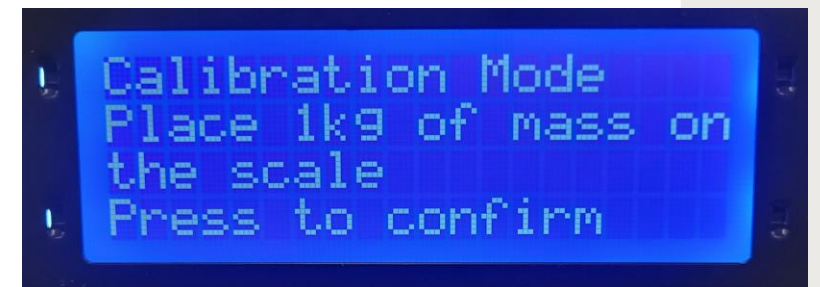
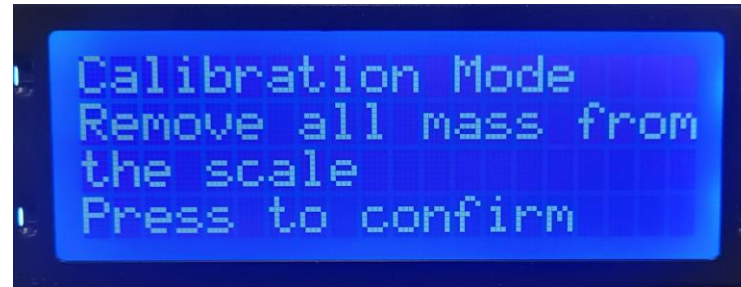
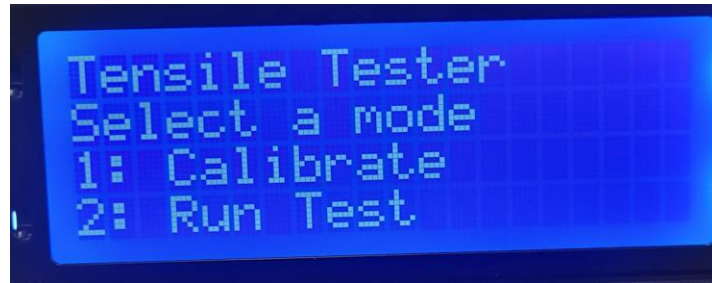
EASE OF USE:

- LCD
- Wing nuts
- Switch

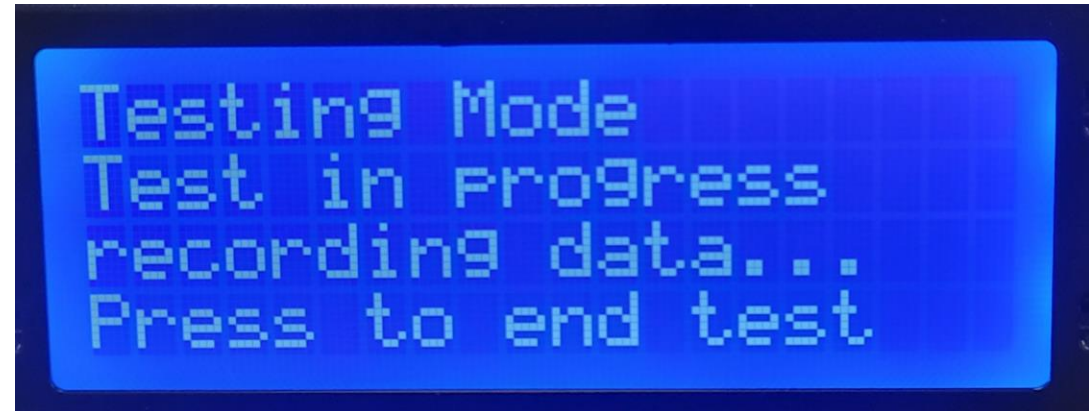
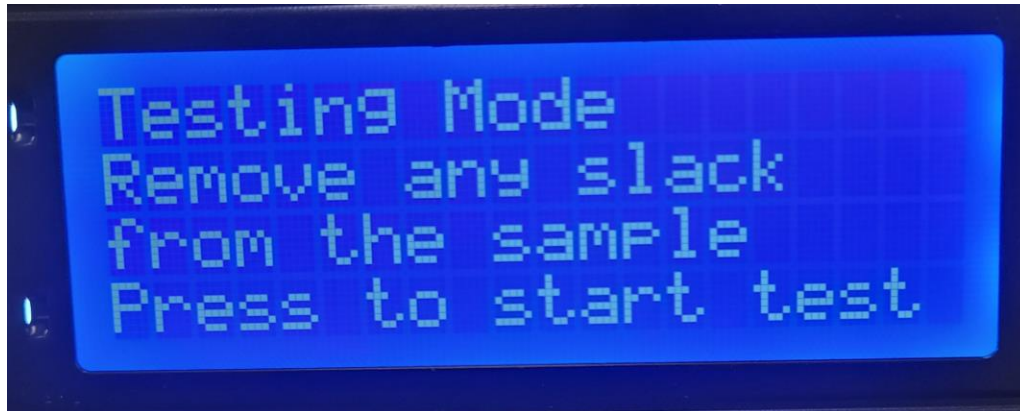
STEPPER MOTOR



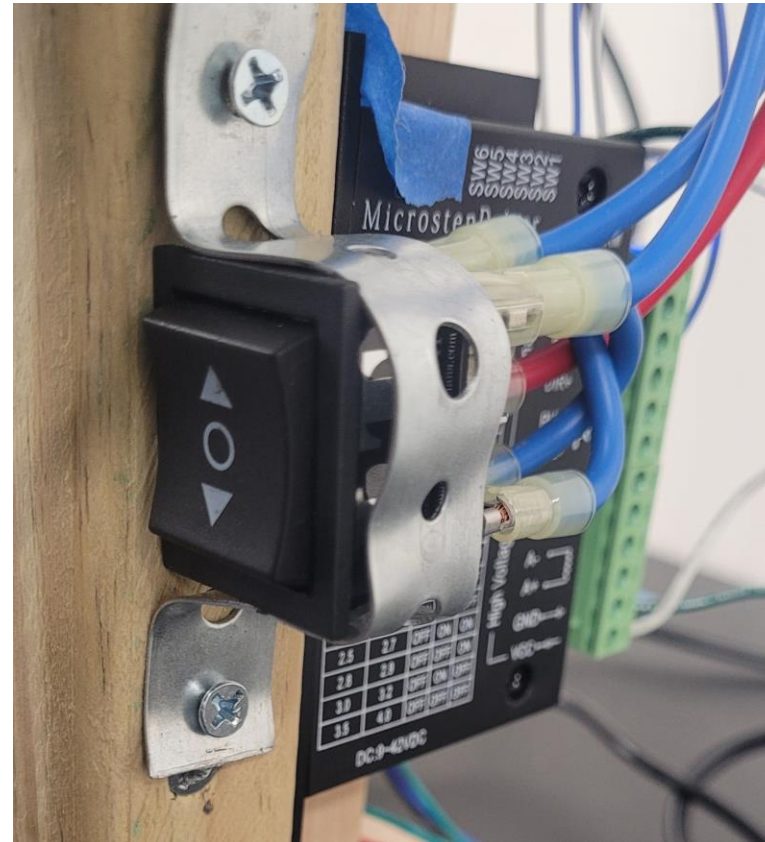
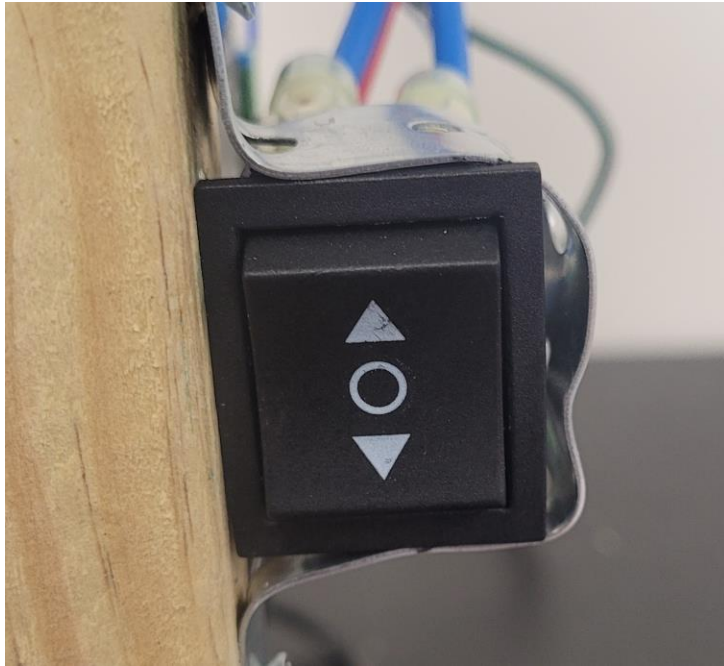
LCD SCREEN- CALIBRATION



LCD SCREEN - TESTING



SWITCH

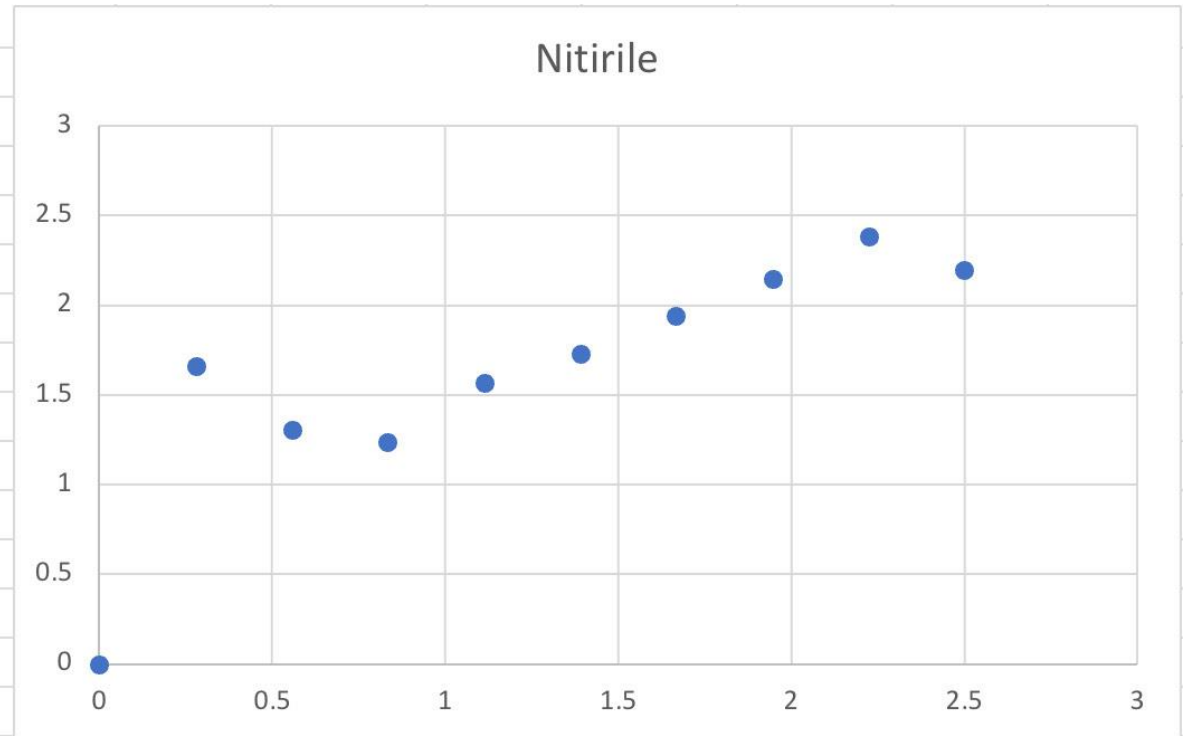


COST

<u>Part</u>	<u>Cost</u>	<u>Notes</u>
Stepper Motor	\$23.99	24-48V; 2.8A Motor -- Measures Distance
Motor Power Supply	\$16.79	Output: 24V, 4A -> 96W -- Provides necessary power
Motor Controller	\$10.99	9-42V; Model TB6600 -- Controls System
20 kg Load Cell with Amplifier Board	\$9.49	20 kg -- Measures Force
LCD/(I2C protocol controller)	\$12.99	20x4 -- Displays Instructions
Switch	\$8.99	3 way momentary switch
String	\$2.99	Thinner string for system
Wing Nuts	\$5.99	8 Wing Nuts to reinforce the clamps.
Total Cost:	\$83.24	
Max Budget:	\$150.00	
Budget Remaining:	\$66.76	

RESULTS

• Strain	Stress		
0	0		
0.28	1.658357143		
0.5566667	1.308		
0.8333333	1.237928571		
1.1133333	1.564928571		
1.39	1.728428571		
1.6666667	1.938642857		
1.9466667	2.148857143		
2.2233333	2.382428571		
2.5	2.195571429		
		UTS	Young's Mod
		2.382428571	5.922704082

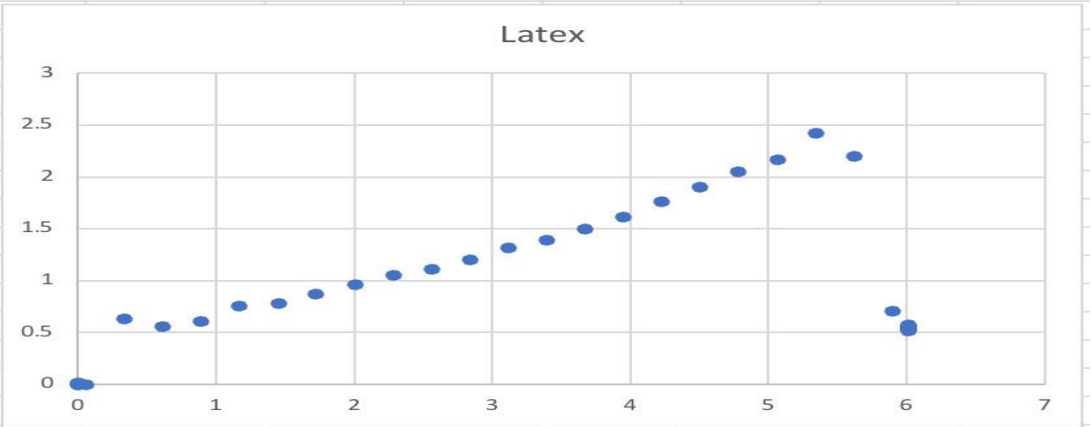


Metric	Sample	# Trials	Our System	Known Value	Error (Percent)
Young's Modulus	Latex Glove	1	1.8917 MPa	740 ± 10 kPa	155
..	Nitrile Glove	1	5.92	2.4 ± 0.2 MPa	146.66
Ultimate Tensile Strength	Latex Glove	1	2.422	3.3 ± 0.1 MPa	24
..	Nitrile Glove	1	2.38	4.4 ± 0.1 MPa	45.9

RESULTS

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Low strain	New stress
0	0.0148636
0	0
0	0.0148636
0	0
0.0533333	0
0.33	0.6391364
0.61	0.5648182
0.89	0.6094091
1.1666667	0.7580455
1.4466667	0.7877727
1.72	0.8769545
2	0.9661364
2.28	1.0553182
2.5566667	1.1147727
2.8366667	1.2039545
3.1133333	1.3228636
3.39	1.3971818
3.67	1.5012273
3.9466667	1.6201364
4.2266667	1.7687727
4.5033333	1.9025455
4.78	2.0511818
5.06	2.1700909
5.34	2.4227727
5.6166667	2.1998182
5.8933333	0.7134545
6.0066667	0.5796818
6.0066667	0.5202273
6.0066667	0.5350909
6.0066667	0.5350909
6.0066667	0.5499545
6.0066667	0.5499545



Young's Mod	UTS
1.89173554	2.422773

One explanation for higher inaccuracy of the Young's Modulus compared to our Ultimate Tensile Strength results is the lack of linear data points in the beginning of both curves, which is what we used to calculate

IMPROVEMENTS

- New clamps
- More testing
- Rails
- Clean wiring