

Problem Statement

- The University at Albany's chemistry department, as part of their educational mission, intends to build a laboratory for undergraduate students where they can gain hands on experience testing various material properties (including tensile strength). However, due to the extremely high cost of commercial products they have been unable to equip such a laboratory.
- The goal of this project is to build an accurate, low cost, easy to use uniaxial tensile strength tester to support this educational mission.

System Requirements

- System Accuracy:** The system should be able to accurately measure the stress-strain curve, such that Young's Modulus and Ultimate Tensile Strength can be calculated to within two significant figures.
- System Ease-of-Use:** The system should be easy to calibrate and operate by undergraduate students without requiring knowledge of electronics or software programming.

System Components & Budget

Part	Purpose	Cost
VL51L1X	Measures Distance	\$15
Load Cell 20kg	Measures Force	\$10
4X4 Keypad	Reads inputs	\$13
TFT LCD display	Displays the Data plot	\$24
SD card /SD reader	Exports Data	\$18
TOTAL		\$152

Project Partners

- Special thanks for Professor Chen, Feldblyun, Yeung, and the University at Albany's Chemistry Department for sponsoring this project.
- This project was developed in ECE442: *Systems Analysis & Design* in the Electrical & Computer Engineering Department.

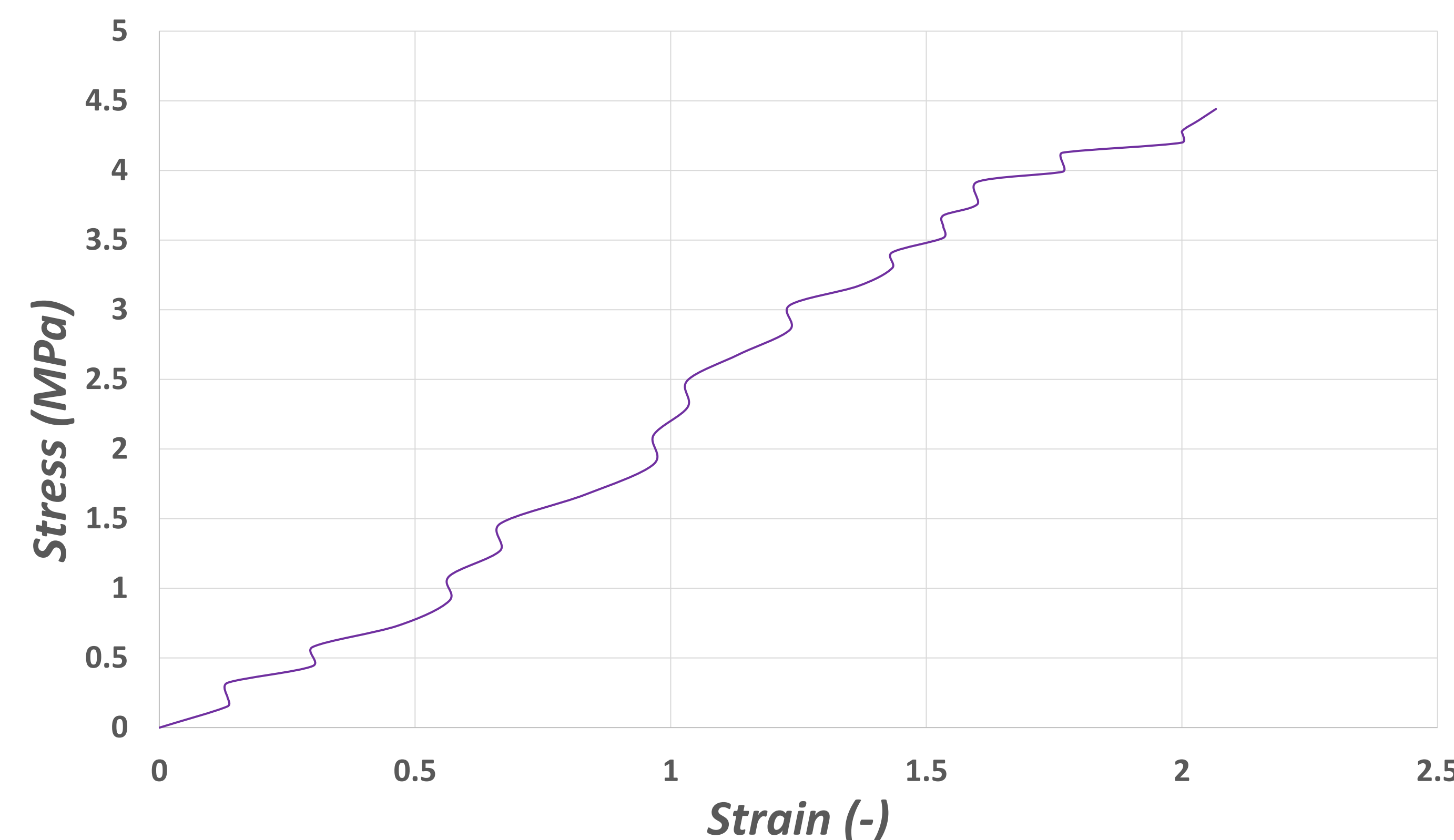
Experimental Results

System Accuracy

Metric	Sample	Our System	Known Value	Error
Young's Modulus	Latex		740 ± 10 kPa	
...	Nitrile		2.4 ± 0.2 MPa	
Ult. Tensile Strength	Latex		3.3 ± 0.1 MPa	
...	Nitrile		4.4 ± 0.1 MPa	

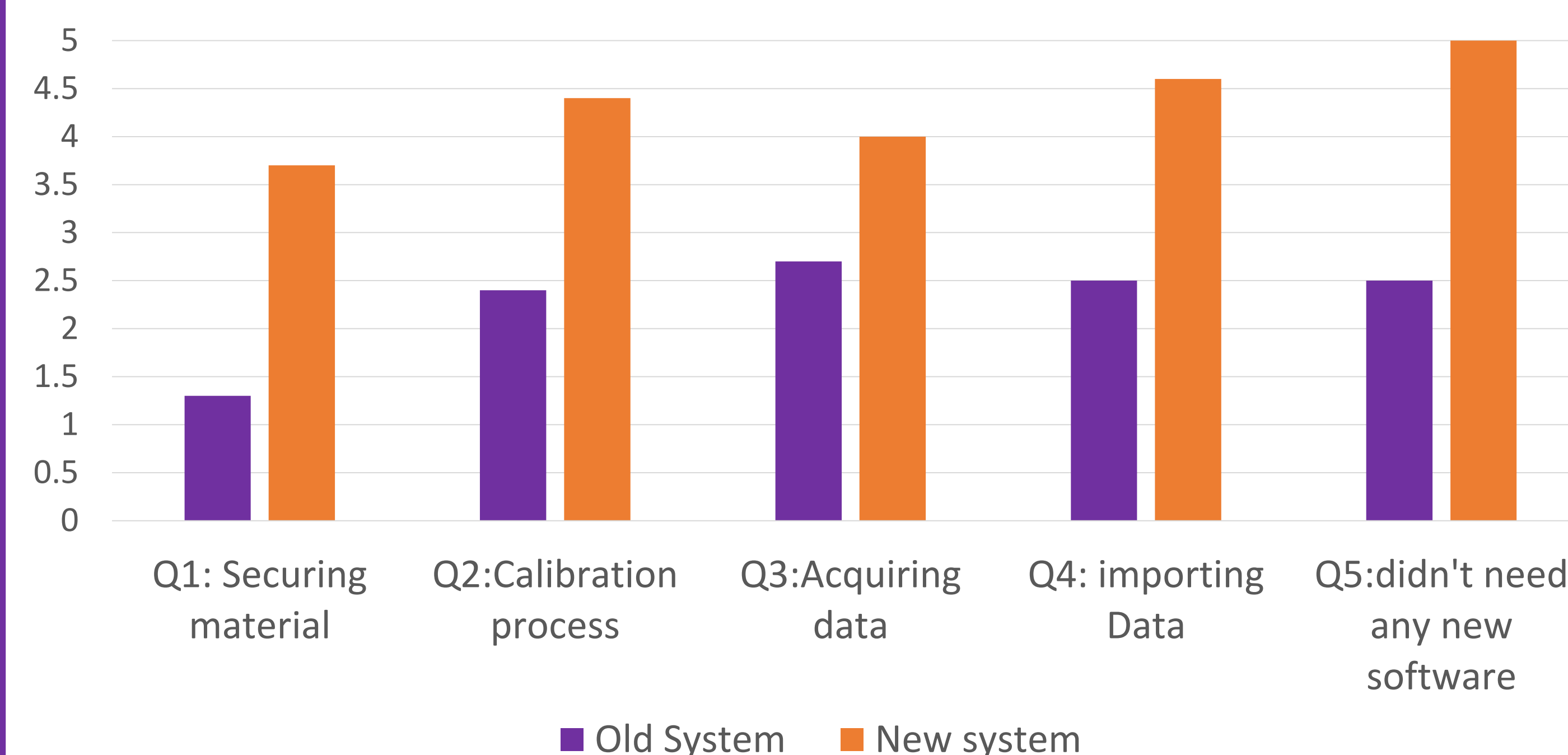
Stress-Strain Curve

Stress-Strain Curve for Nitrile Gloves



The stress-Strain curve has significantly smoothed out after the implementation of the improvements

Ease of use



The improvements have been shown to have a favorable increase in how easy the system is to use

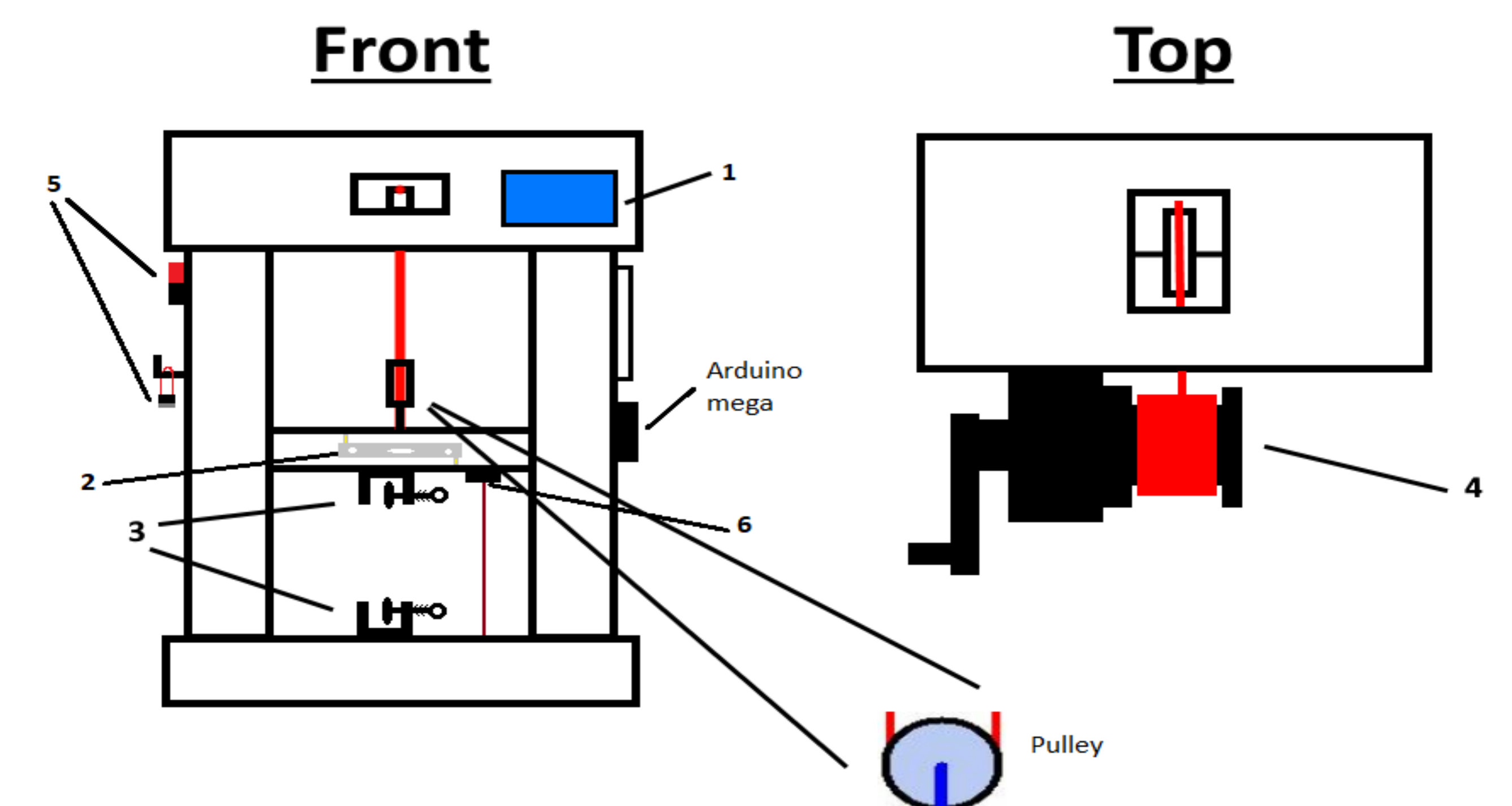
System Design

Key System Features

To satisfy system requirements, we incorporated the following design modifications:

- Item #1:** TFT Screen : Displays the live data plot
- Item #2:** 20 Kg loadcell : Increases the max load limit
- Item #3:** C Clamps: Holds the material more securely
- Item #4:** 4x4 Keypad: Used to control without a laptop
- Item #5:** VL51L1X: Increased range sensor accuracy
- Item #6:** SD Reader/ Writer: Easy transferring of data

Physical Model



The changes to the physical design can be seen from both the top and side view of the system in the above models

Circuit Schematic

