

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
Temperature / Humidity Sensor	Measures Temperature / Humidity used to calibrate distance sensor	\$10.29
LCD screen with I2C	Displays instructions / data	\$10.99
Kevlar rope / pulley	Smoothen pulling process	\$24.98
Push/Pull Clamps	Stronger / efficient clamps	\$52
TOTAL		\$98.26

Project Partners

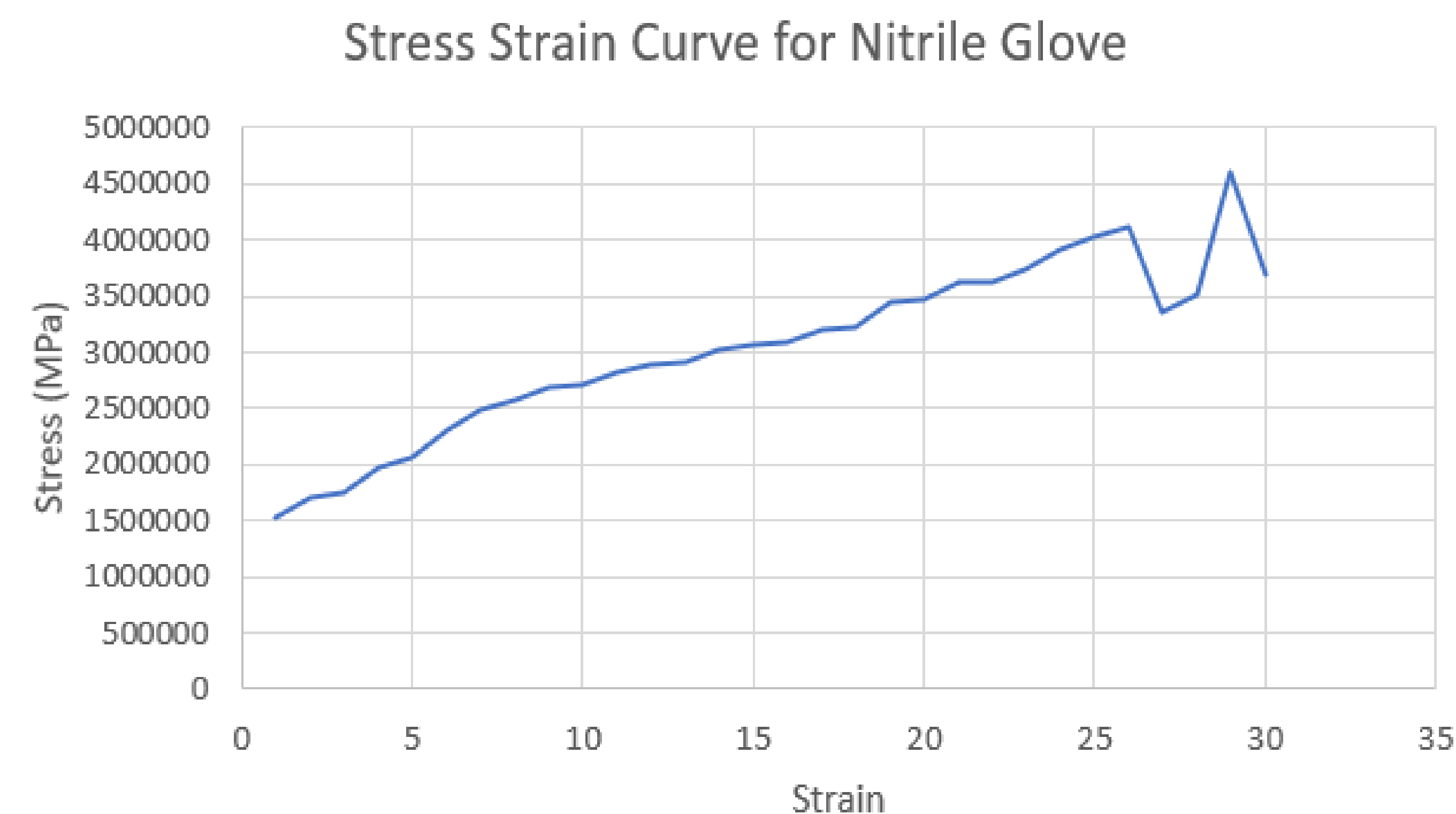
- Special thanks for Professor Chen, Feldblyun, Yeung, and the University at Albany's Chemistry Department for sponsoring this project.
- This project was developed in ECE442: *Systems Analysis & Design* in the Electrical & Computer Engineering Department.

Experimental Results

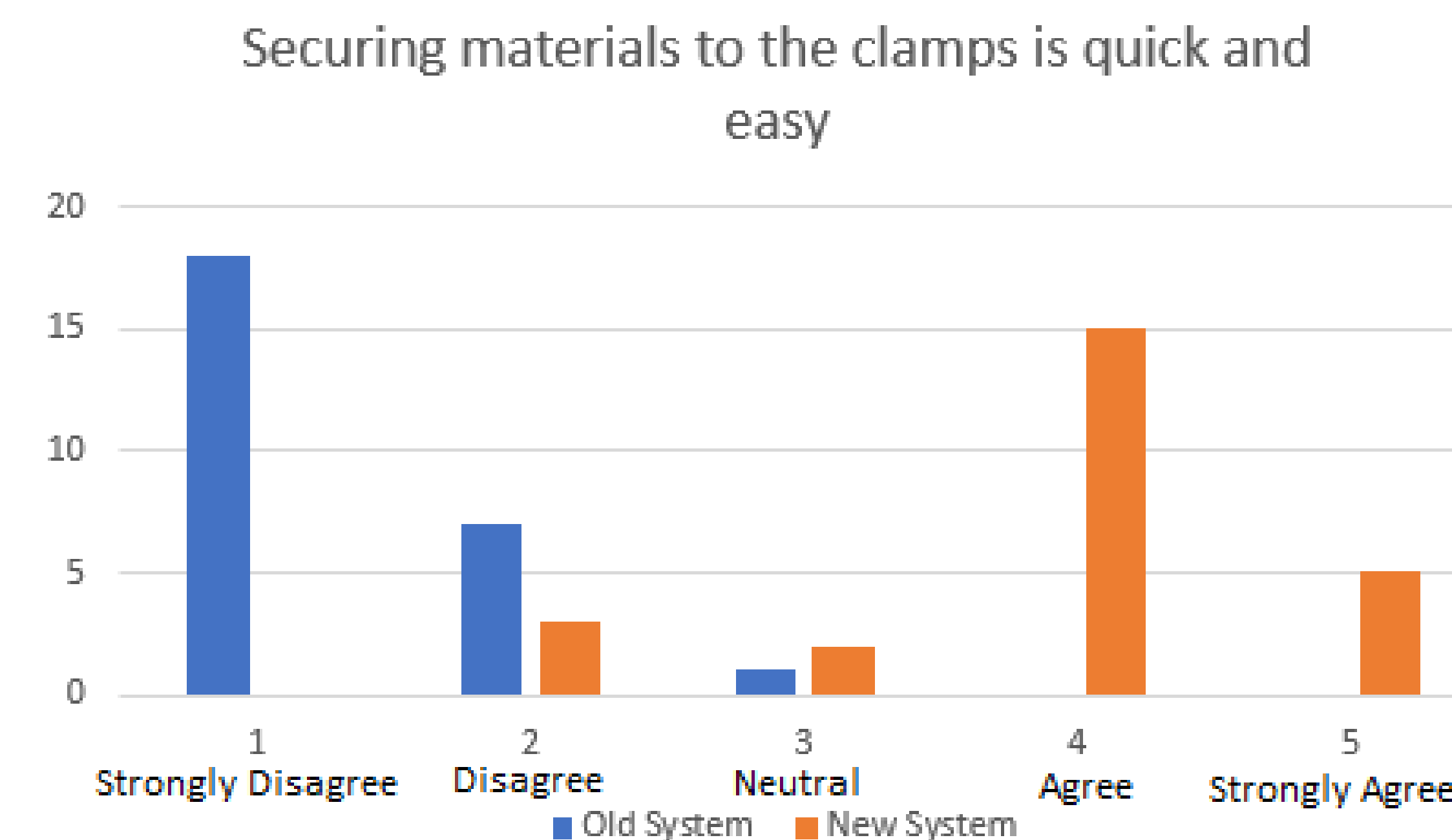
System Accuracy

Metric	Sample	Our System	Known Value	Error
Young's Modulus	Latex	743 kPa	740 ± 10 kPa	0.406 %
...	Nitrile	2 MPa	2.4 ± 0.2 MPa	-16.7 %
Ult. Tensile Strength	Latex	3.4 MPa	3.3 ± 0.1 MPa	3 %
...	Nitrile	4.6 MPa	4.4 ± 0.1 MPa	4.5 %

Our values compared to the known values are accurate



Stress Strain Curve generated from our system



Clamps on the new system are easier to use compared to the old system

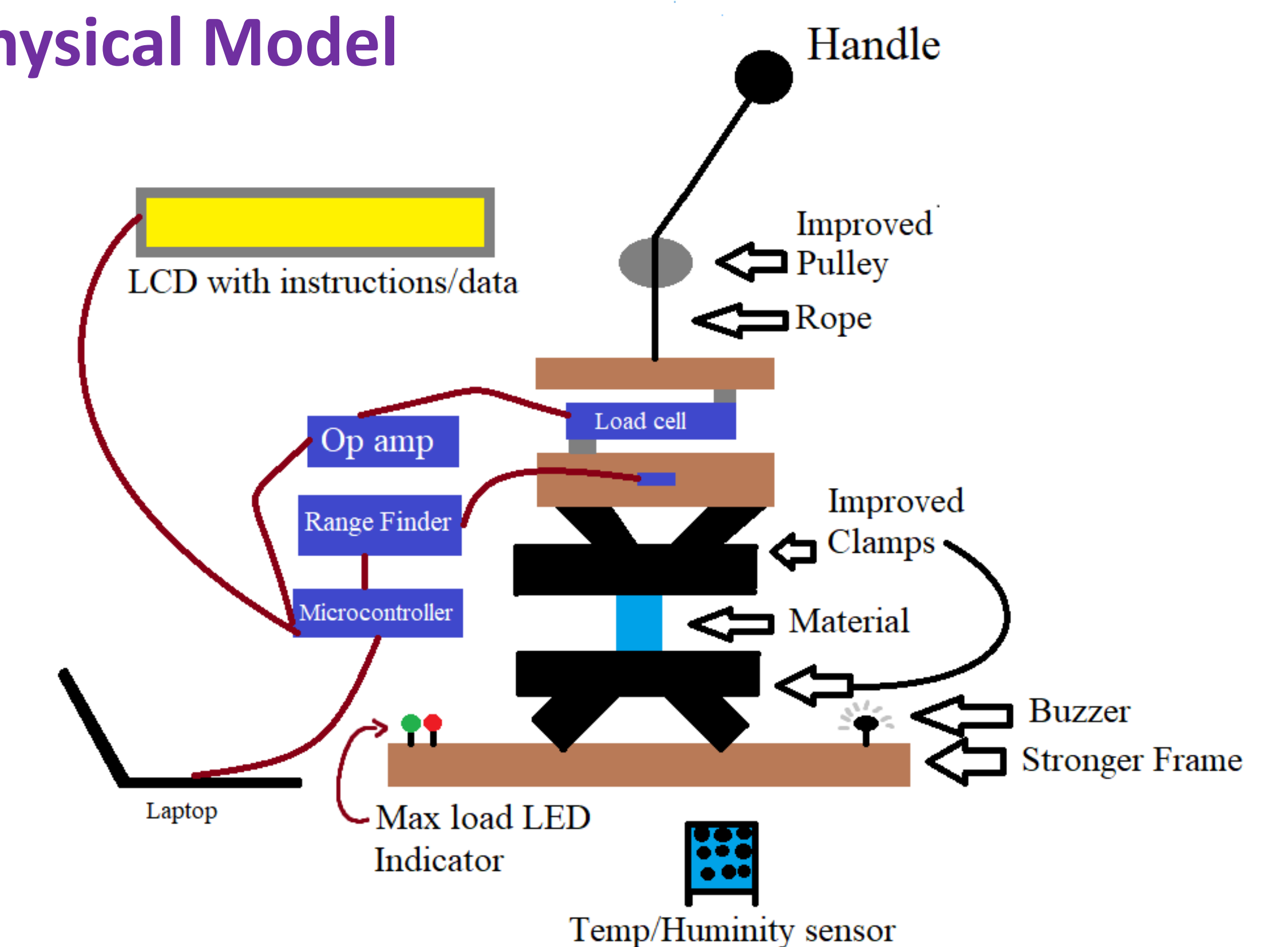
System Design

Key System Features

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

- Push Pull Force Clamps:** Stronger and easier to use Clamps
- Kevlar Rope / Pulley:** Smoother data collection
- Temp / Humidity Sensor:** More accurate calibration of distance
- LCD screen:** Instructions and data display
- CoolWin Application:** Quick download and easy to use software that allows for data collection and interaction with the system

Physical Model



Circuit Schematic

