Logical Design Proposal
The Salty Sea Dogs
Team 11

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Activity Report

Abstract—This project aims to construct a cost effective tensile tester for the Chemistry Department. We have developed a design that will not only be cost effective, but also improve the base design. We plan on implementing a stepper motor, thinner string, switches/buttons, and an LCD. These improvements will yield more accurate readings and an easier to use system.

Index Terms—Uniaxial Tensiometer, System Analysis, Engineering Design

1 Background

The Chemistry Department at UAlbany desires to conduct a laboratory where students can test the strength of materials. However, tensile testers in the market are high cost. A base tensile system has been constructed, but many improvements can be made. Gaps in the given system surmise to low ease of use and lack of accuracy. Our idea is to improve accuracy and barrier of entry by supplementing the system with a motor, switches/buttons, and a LCD screen.

2 System Requirements & Constraints

Figure 1 depicts the system use cases discussed in class. This system seeks to meet the stakeholders' requirements to the best of its ability given the constraints (see constraints section (Section 2.4)) for non-functional system requirements. The most important requirements presented by the stakeholders are as follows: Accuracy, User Friendly, and Damage Prevention. Accuracy when preforming tensile tests, user friendly design making the system straight forward to use, and damage prevention to provide feedback to the user to protect system components from damage.

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2.1 Requirement #1 Accessibility

The switch and motor align to the principle of accessibility by making the system easiest to use. The user just has to press the switch to move the motor, which tests the sample. It collects a data trend for the material. Also, calibration is conducted via buttons in the bread board. An LCD displays instructions so the user knows what step they're at. Finally, wing nuts were added to the clamps to make it easier to secure material within them without significantly increasing the price.

2.2 Requirement #2 Accuracy

The motor, switch, and new sensor all aid the accuracy of the system. The motor and switch allow measurements to be set and controlled and the new sensor has the capacity to test

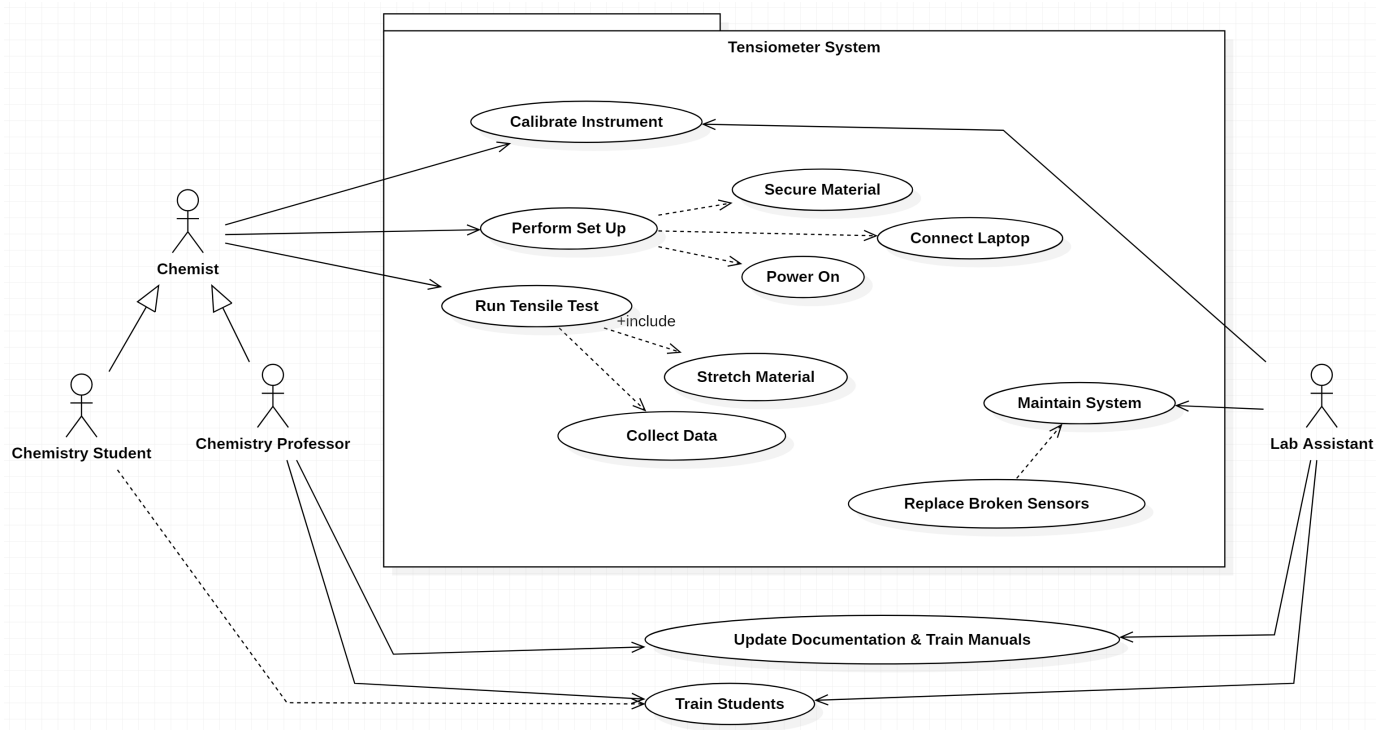

Figure 1. Use case model of the tensiometer system depicting system actors and the desire actions the system is required to support.

stronger material while having more accuracy for weaker polymers.

2.3 Requirement #3 Durability

The stepper motor will increase the accuracy of the system as well as reduce the chance of destruction by slowly increasing the force applied and halting as soon as the user lets go of the switch.

2.4 Constraints

The constraints for this project are from the chemistry department. These constraints restrict the design process and limit the potential solutions. For this project, the system constraints are as follows:

- **Time Constraint:** Completed and read to presentation/demonstrate by April 22nd
- **Budget:** Cost needs to be below $150. Going over budget will require strong justification as to the value added from the cost overrun.
- **Replication:** Relatively straight-forward process to replicate the work, such that we can build out a lab of identical tensiometers.
- **Accessibility of Parts:** Parts need to be readily accessible, ship quickly (not on back order) and available from common part suppliers (e.g., Digikey, Mouser, Adafruit, SparkFun, Amazon). Avoiding parts that are difficult to source.
- **Safety:** System must be safe to operate without significant training or supervision

3 Logical Design

Figure 2 shown above includes a hand drawn sketch of an improved system. It includes a new load sensor that can handle more load, and a switch + motor that can apply a controlled force. The LCD will also display instructions. The clamps are also improved by using wing nuts, which makes it easier for the user to open and close them when inputting the material that is to be tested.

3.1 Design Justification

This design was chosen to improve the accuracy and stability of our tensiometer. A new

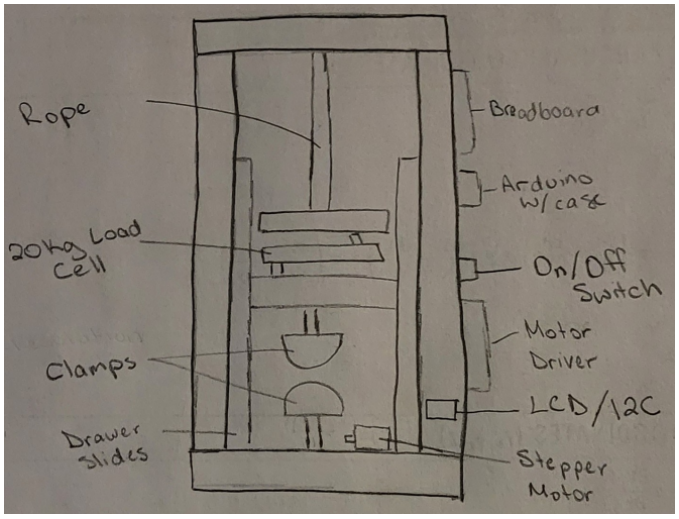

Figure 2. Here is a hand drawn sketch of the system with ideas for improvement.

load sensor is added to handle more weight and wing nuts are added to the clamps to make it easier for the user to add in the material that is to be tested. A switch + stepper motor are also added to apply a more consistent force.

REFERENCES