

Background

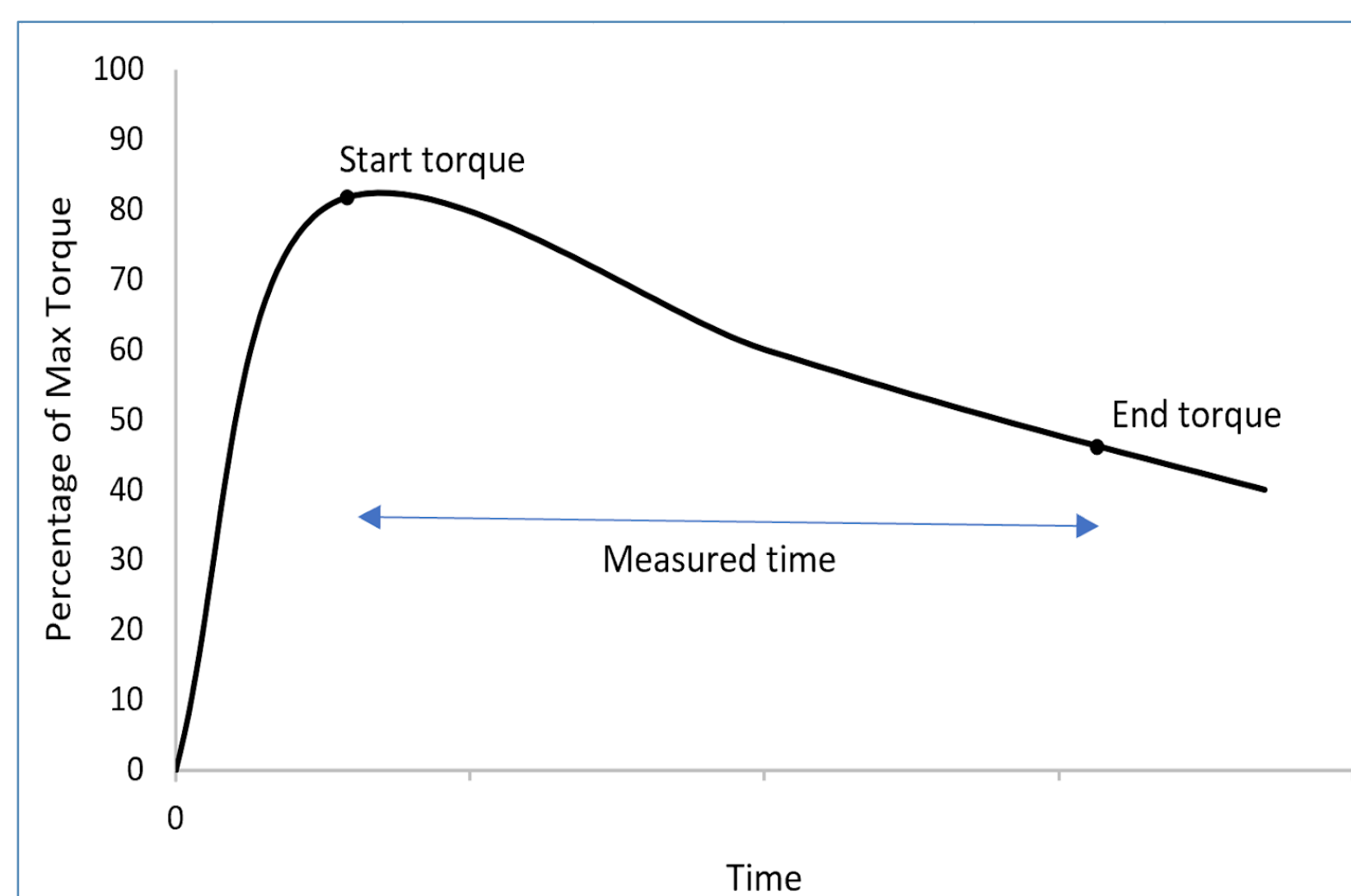
SBD-P23, under guidance of Stanley Black and Decker, designed a **test rig** that provides a **universal, comparable way** to measure the **durability and life of plier teeth**. The rig is built for testing of tongue and groove pliers.

Goal: Assess the extent to which secondary heat treatment affects the lifespan of pliers to determine whether cost and time can be saved during manufacturing while maintaining the quality of the pliers.

Requirements



- Measurable torque data
- Consistent wear
- Universal for different tongue and groove plier sizes
- Functional for 0.5"-1.5" test piece diameters
- Safe
- System runs in applicable environments
- Simple test setup



Approach to Testing

1. Select a "start" and "end" torque as a standard for all tests.
2. Mount the pliers and clamp the jaws around a test piece.
3. Start spinning the test piece and tighten the plier grip to exert the "start" torque on the test piece.
4. Continue spinning the test piece to wear down the pliers until the "end" torque is reached.
5. Use the number of test piece rotations as the metric to compare different pliers to one another.



Teeth Wear

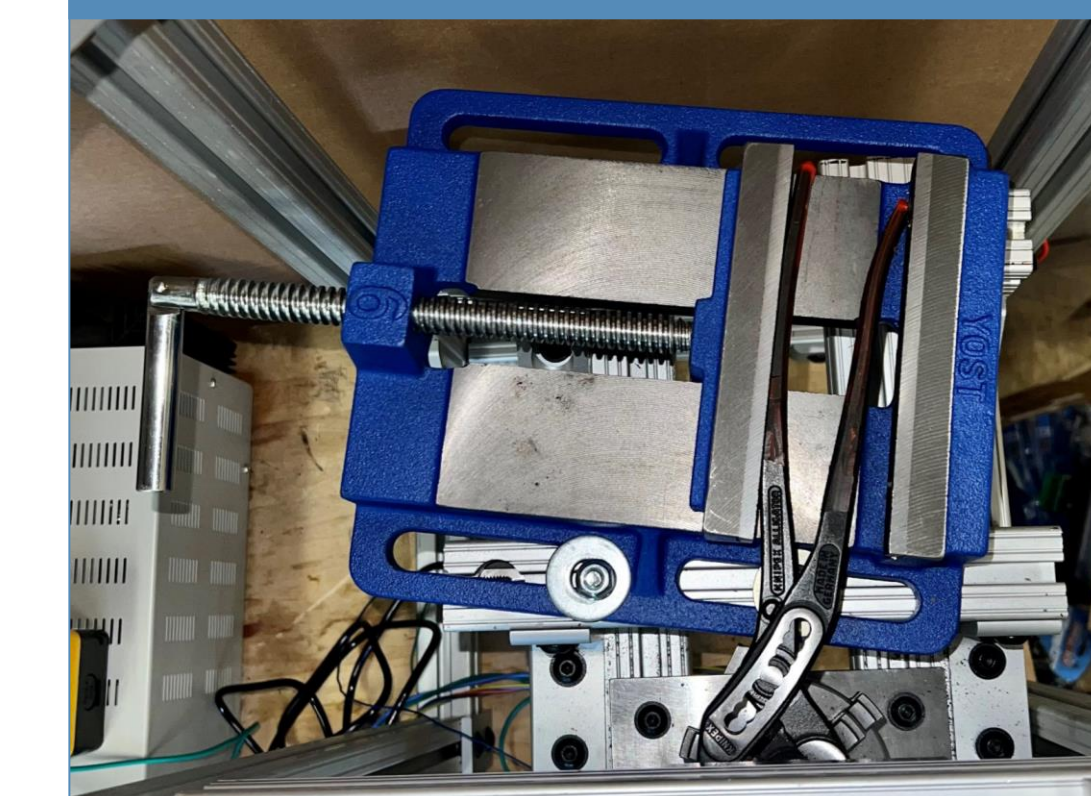


Verification

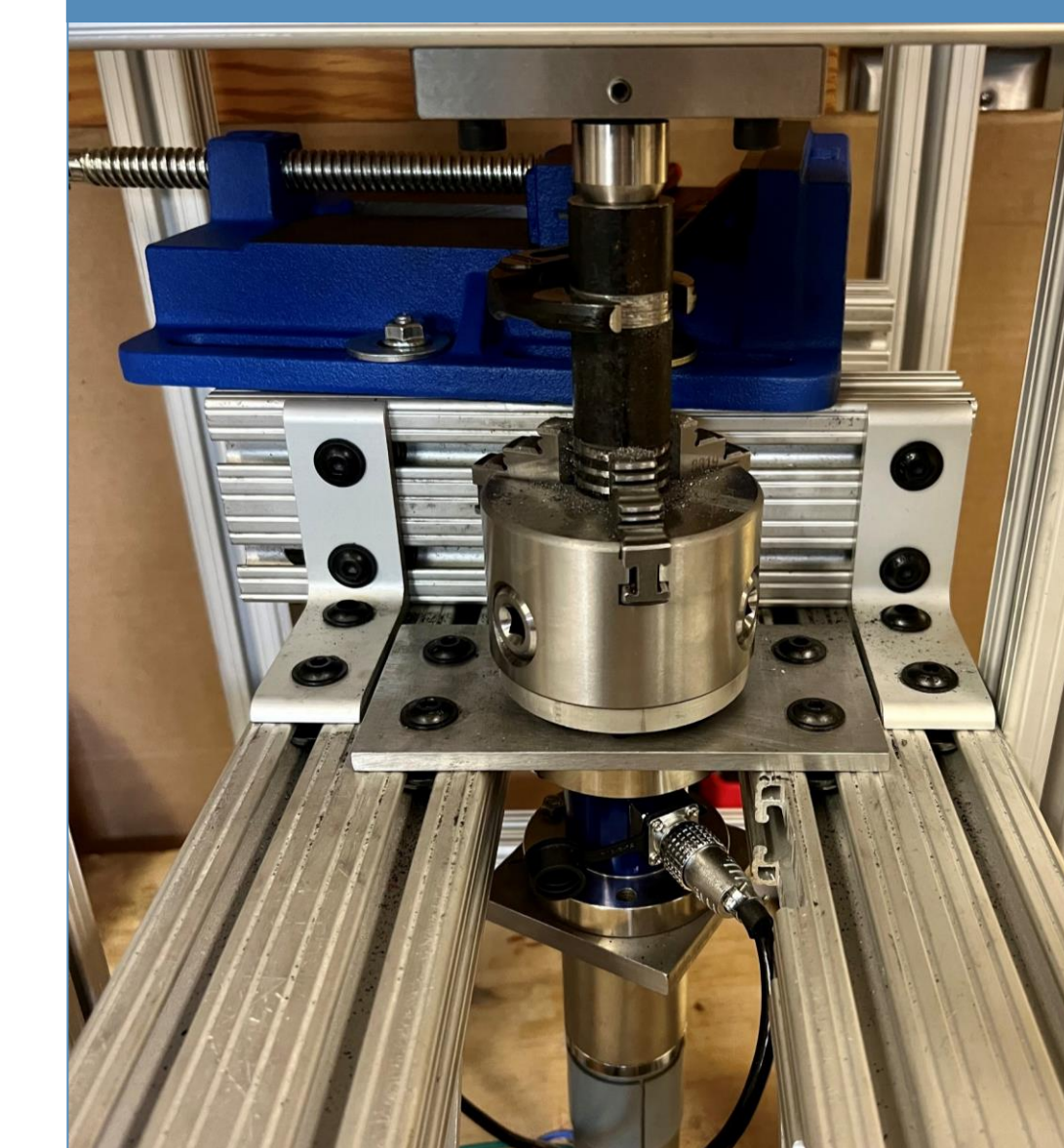
Testing was performed to ensure the testing rig met the requirements:

- **Torque Cell Calibration** – Accurate torque measurements
- **Consistent Wear** – Reproducible wear on plier teeth for same plier type
- **Plier Universality** – Ability to mount different plier types
- **Variable Test Piece Diameter** – Ability to mount different test piece diameters
- **Safety** – Physical barriers and functionality of (4) emergency stops
- **Environmental** – Ability to function for length of time under varying temperature range
- **Usability** – Ease of use

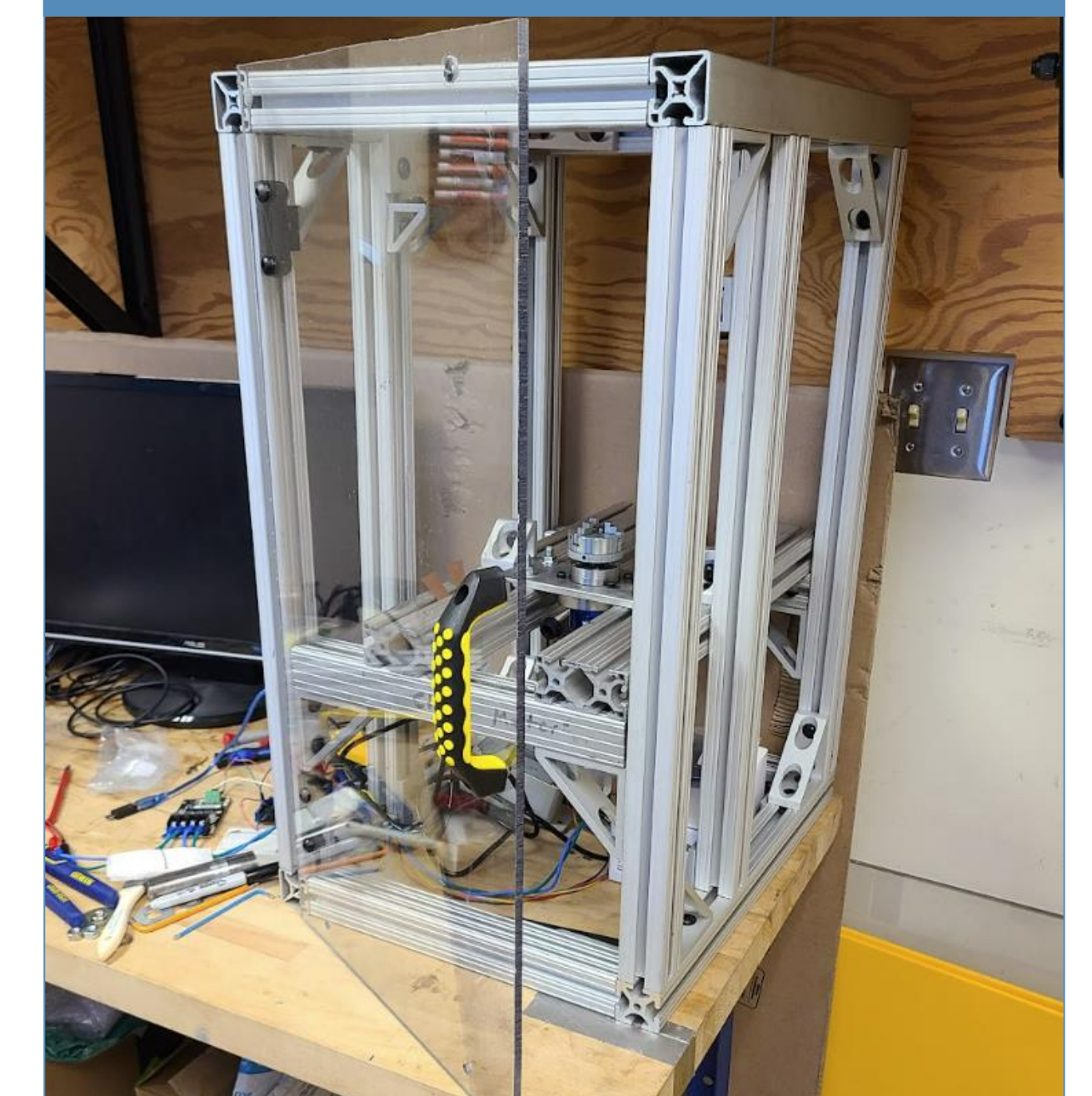
Plier Vice



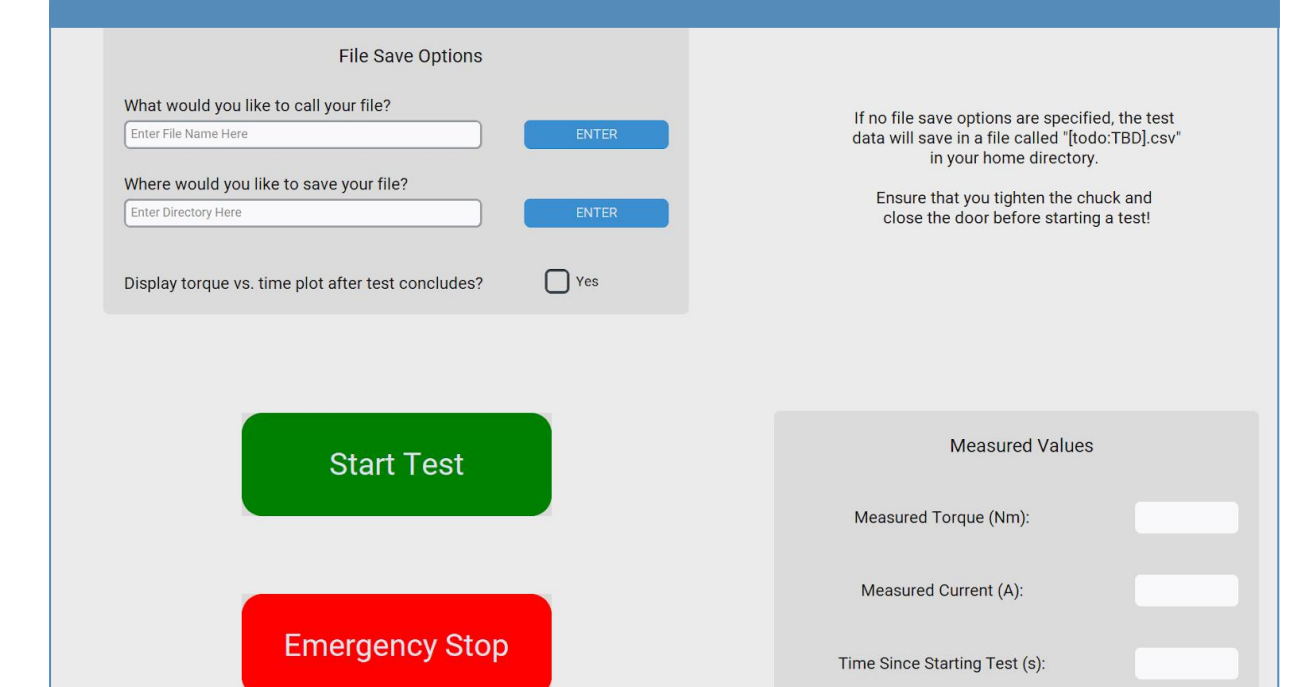
Drivetrain



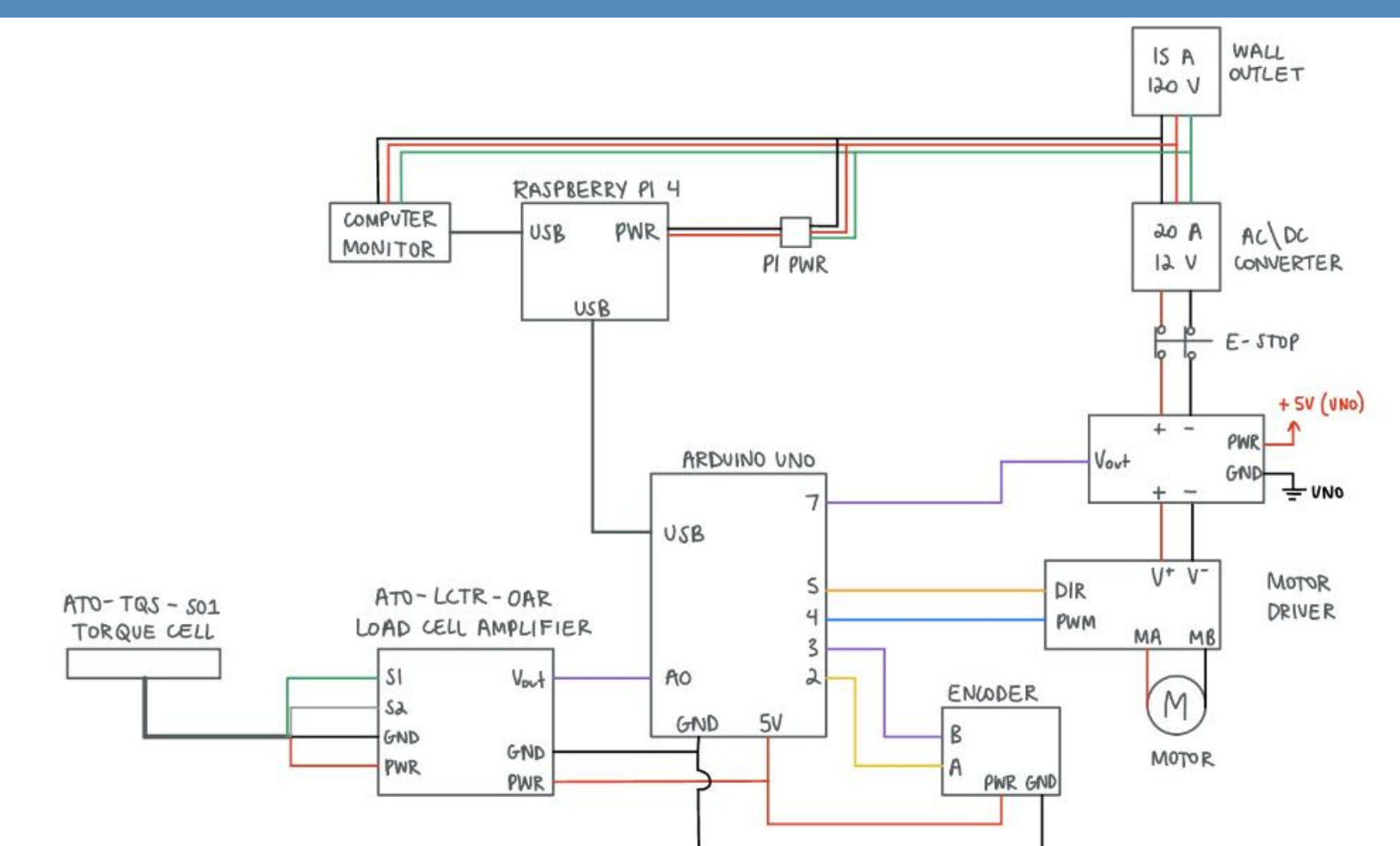
80/20 Frame



GUI View



Electronics



Conclusions

Tests were performed with a "start" torque of 5Nm and an "end" torque of 0.5Nm.

- Tests were conducted on two plier test groups of the same geometry, size, and manufacturing processes- except one test group did not have secondary heat treatment.
- When run under approximately the same torque for the same amount of time, there was no noticeable difference between the two groups on their torque output.
- Visually, non-heat-treated pliers wore down marginally more.

Areas for Improvement:

- The system makes it difficult to begin a test at a precise or accurate "start" torque because of delayed and noisy data.
- Slight wobble within the vice is one cause of noisy data.
 - Restricting the pliers completely in the vertical direction helps with this, as well as supporting the pliers on parallels.

Acknowledgments

SBD: Chris Ibrahim, Josh Tsai
JHU: Stephen Belkoff, Mark Cooper,
Yensabro Kanashiro, Jack Albin, Glennisha Fulton

