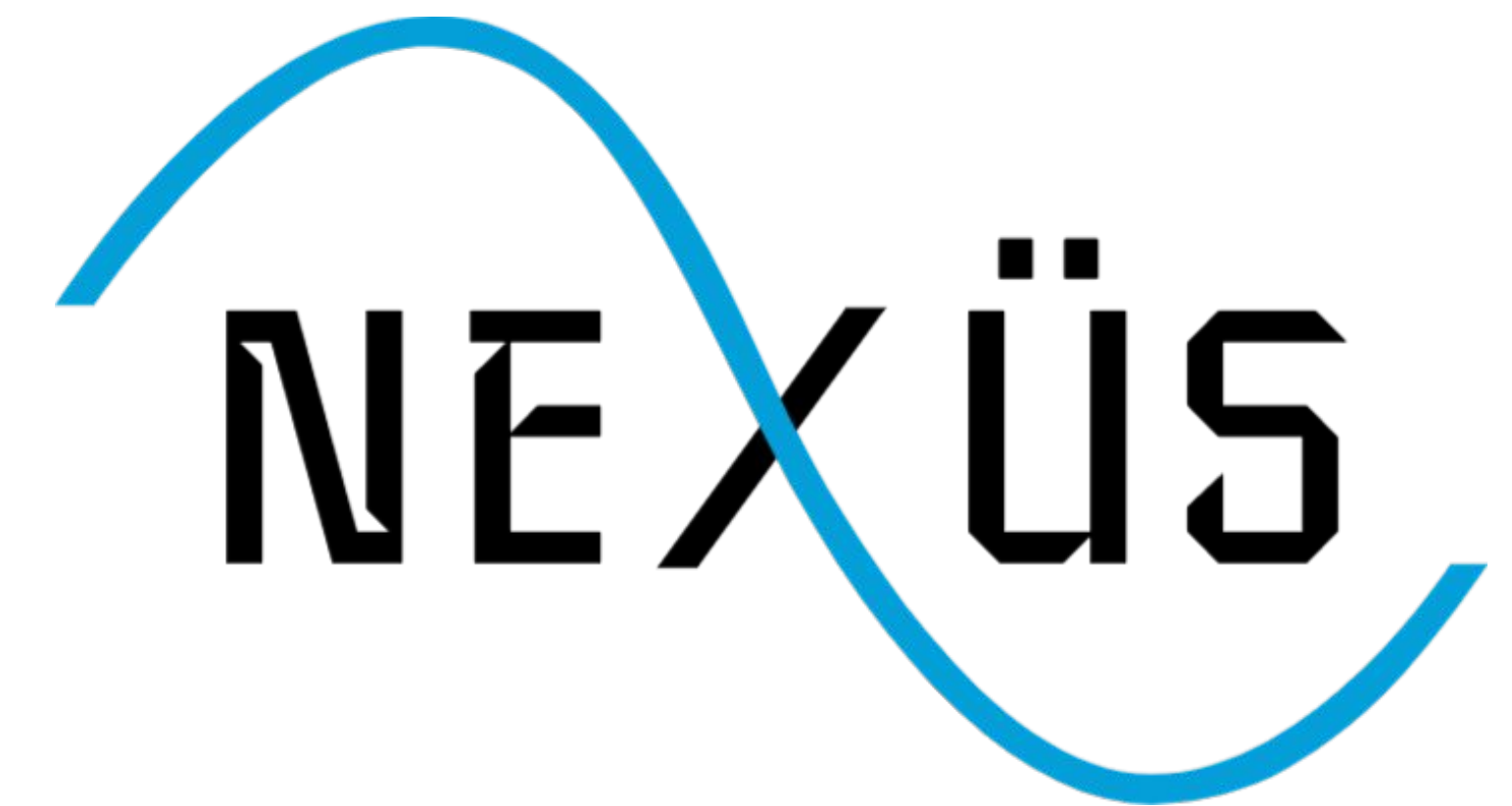


Microstraining Device for In-Situ Heating-Straining SEM

Advisors: Dr. Scott Shaffar - SDSU, Dr. Wenwu Xu - SDSU
Sponsor: SDSU Mechanical Engineering Department



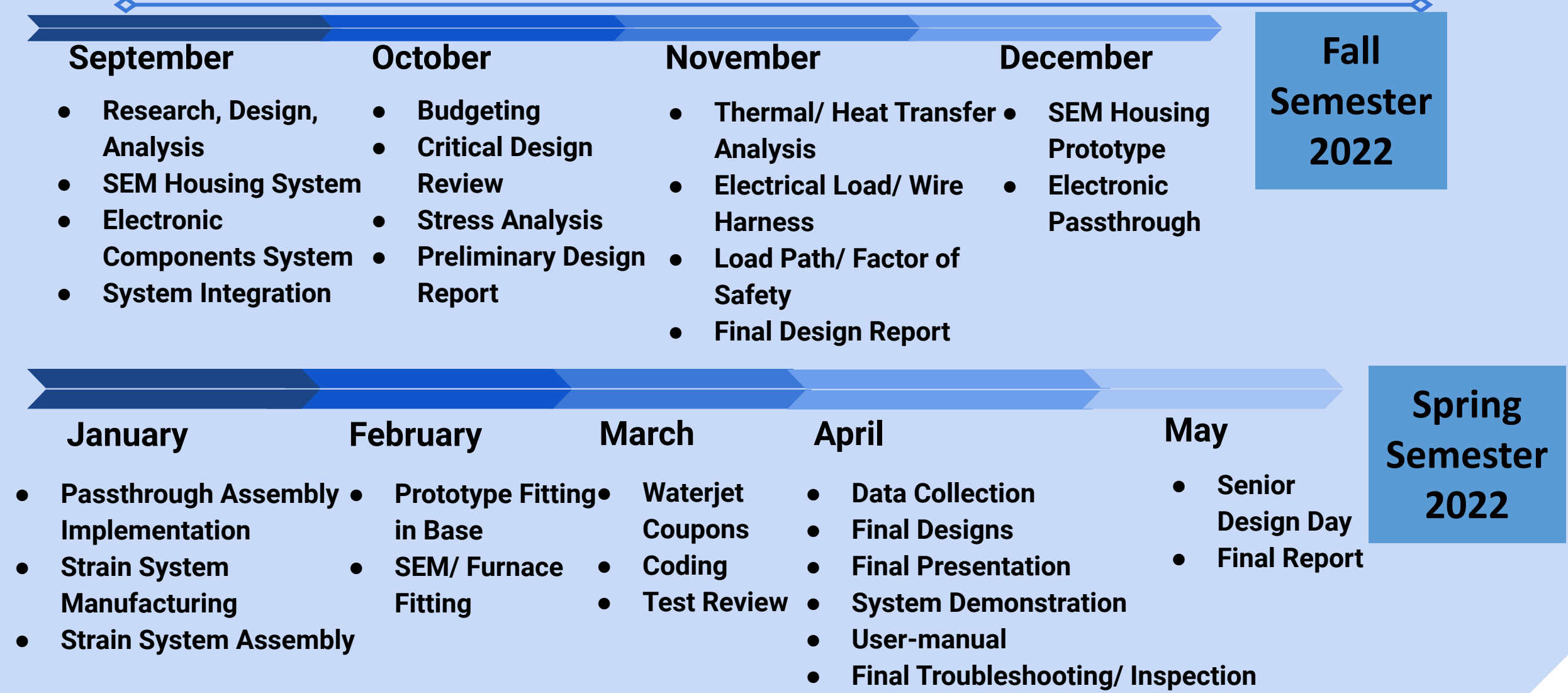
Project Objective

The main purpose of this project is to create a microstraining device to provide straining functions on a piece of sample of choice by heating it up between 200°C-600°C inside of a furnace which is placed into a scanning electron microscope (SEM).

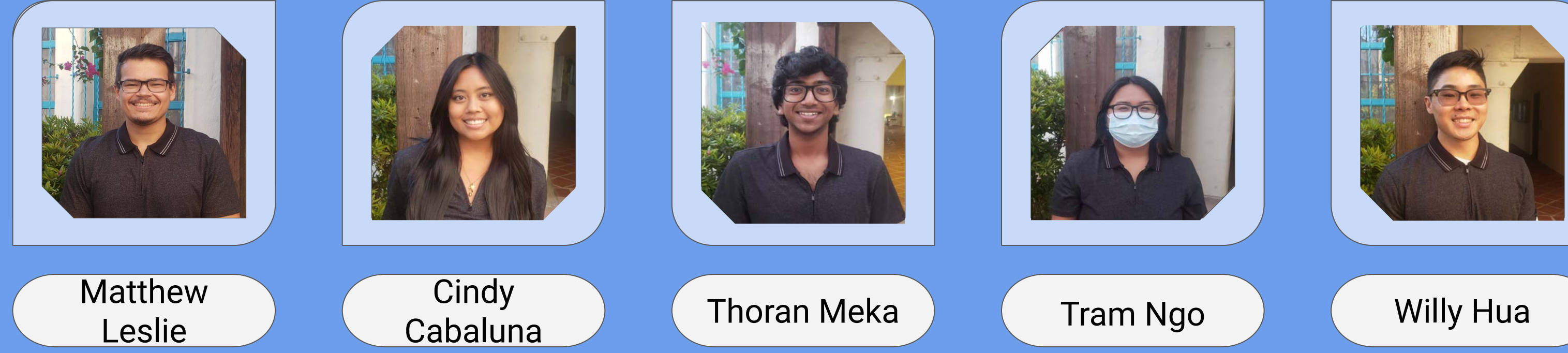
Hypothesis

The hypothesis that Dr. Wenwu Xu's has is that when an elastically deformed metal with a polycrystalline microstructure is heated up to a certain high temperature, it is possible that there could be an uneven re-distribution of the elastic energy between the grains and the grain boundaries. With this information, Dr. Wenwu Xu believes that this re-distributed energy might be able to change the structure of the grain boundary.

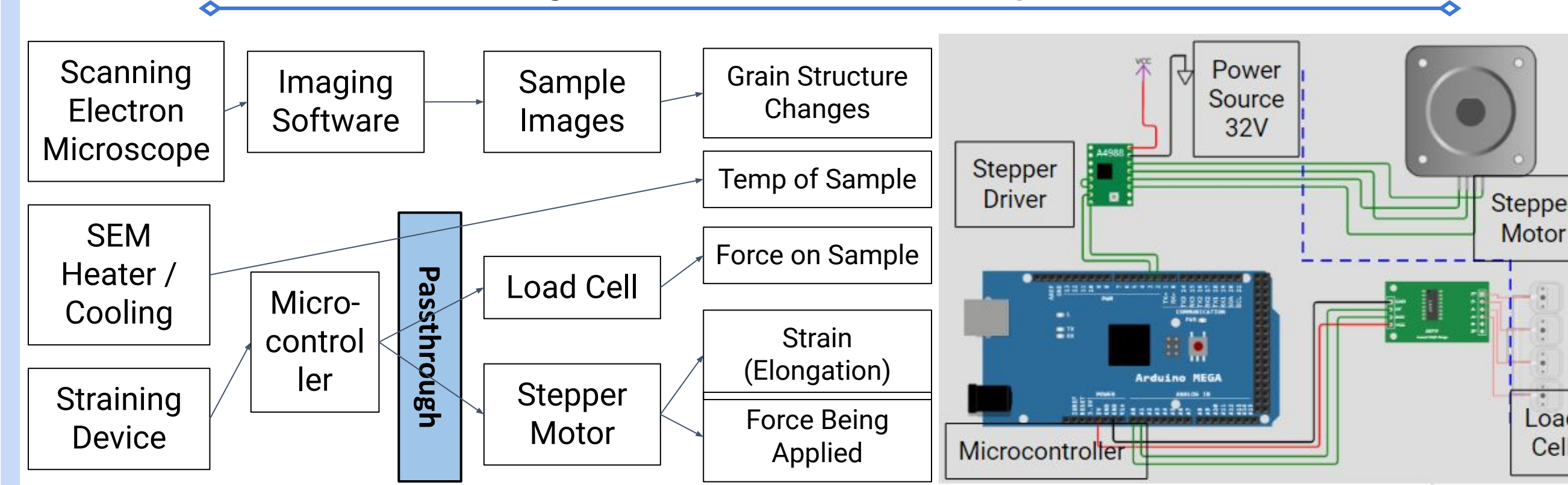
Timeline



Team Members



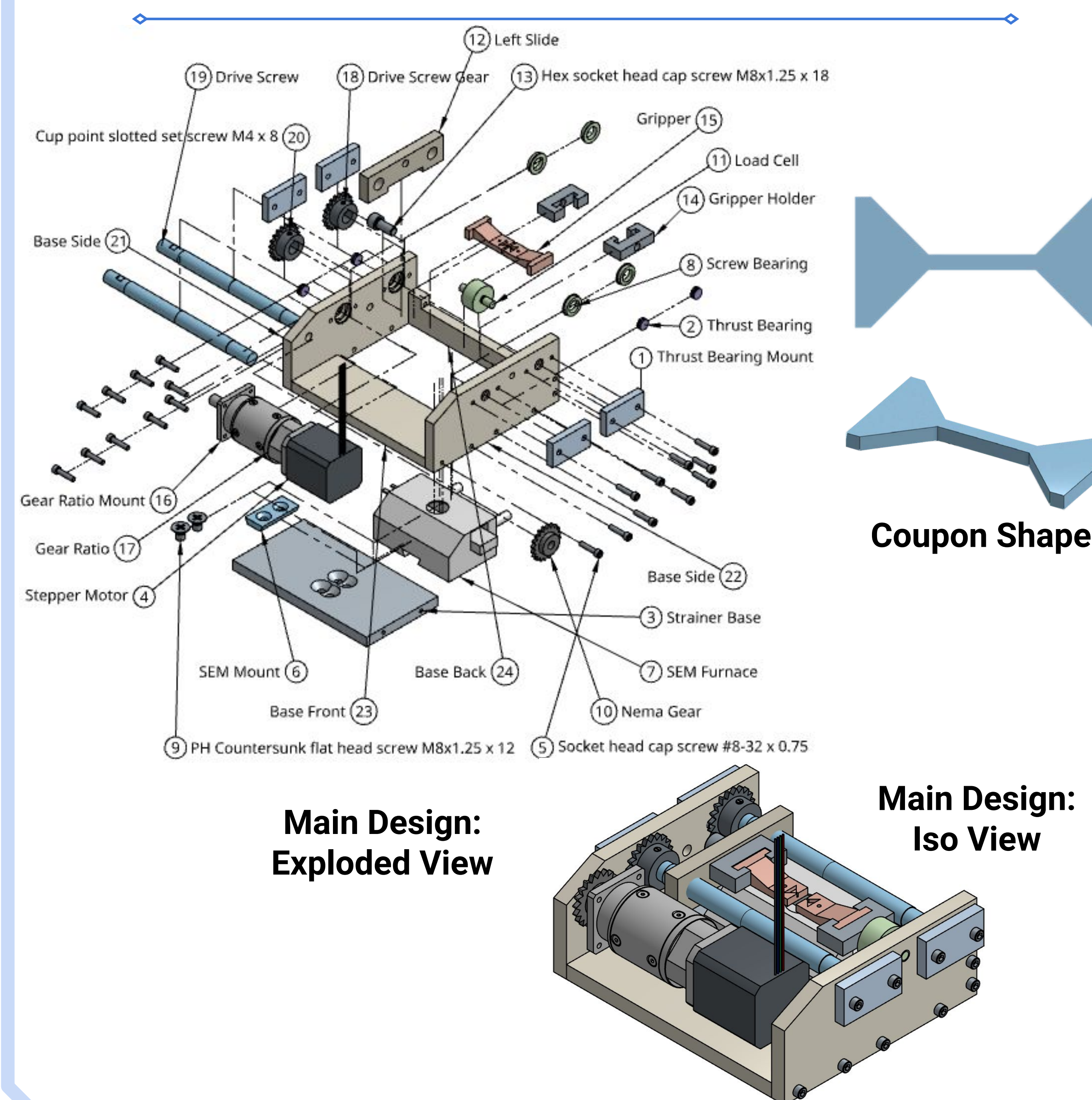
System Level Diagram



Design Changes

- Grippers will now be performing straining functions on the surface of the 8mm hole on the furnace
- Removed the interchangeable tweezers (not priority)
- Coupons are waterjetted instead of punch and die
- Original chosen screws and stepper motor were switched out
- Bearing mounts were changed to simplify manufacturing
- Stepper motor gear was exchanged to enhance performance

Final CAD Models



Overall Challenges

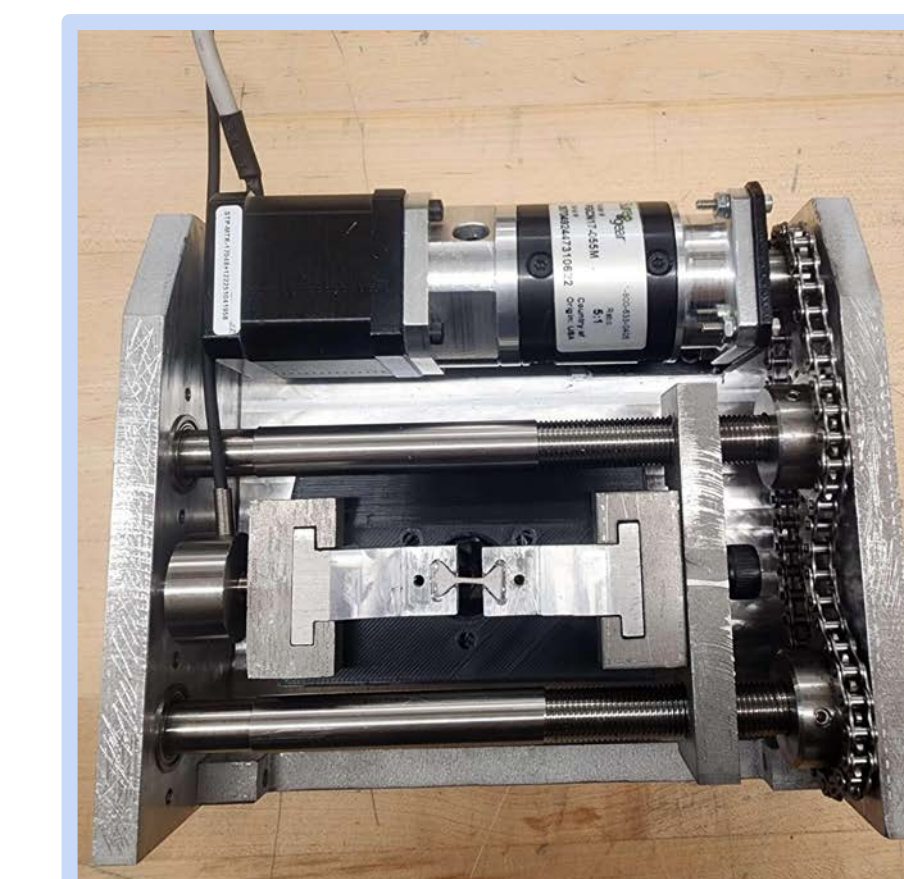
- Adding interchangeable tweezers for sample removal
- Electronic vacuum passthrough separates electrical components
- Creating a smaller base to fit the space reduction in the SEM chamber
- Punch and Die set for smaller coupons that are 4-6mm
- Programmed motors will be the source to provide stress and strain to coupons
- Unable to build where SEM imaging scans (vertically)

Scrapped Ideas

Solutions + Additions

- Safely securing electrical components
- SEM chamber fitting
- SEM base fitting (project fits in the base of the chamber with a 1x1cm space reduction)
- Designing Grippers to fit inside an 8mm hole (sample would be 4-6mm)
- Manufacturing samples (Punch/Die set or waterjet)
- Recording stress and strain (no extensometer for strain)

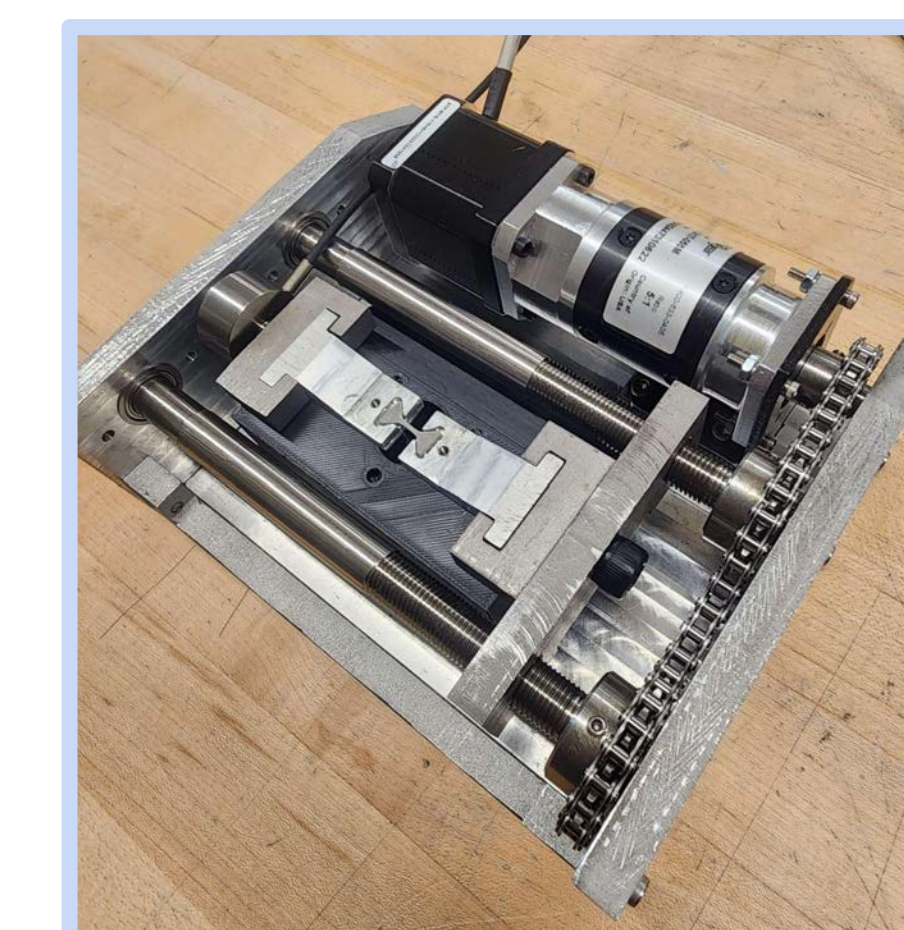
Final Device



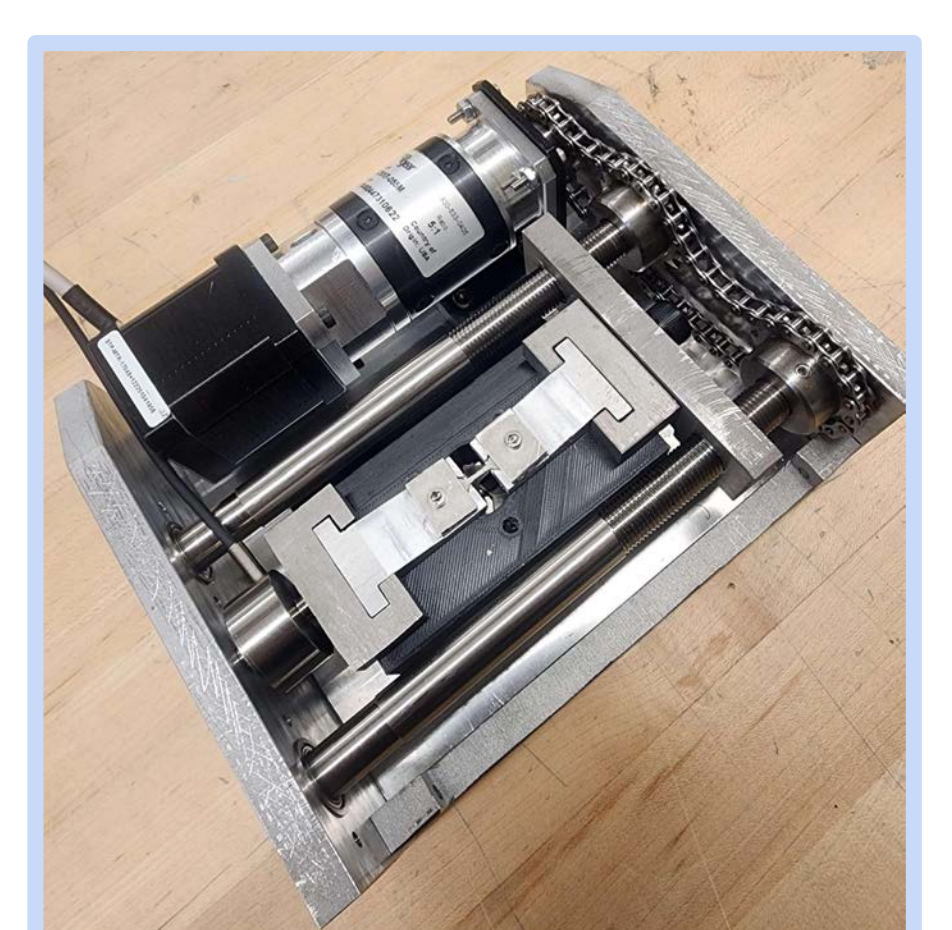
Main Device: Top View



Close Up: Gripper and Coupon



Main Device: Top Iso View



Main Device: Top Iso View w/ Coupon Cover