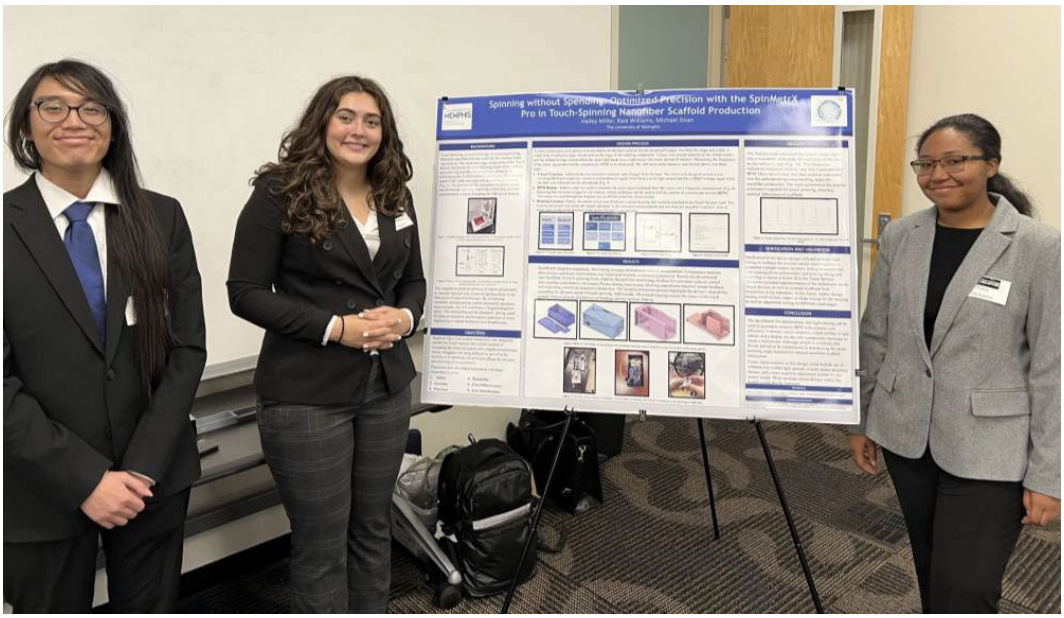
1st Place Award for Fall 2023 Outstanding Biomedical Engineering Senior Design Project

Team: The Spinsters

Student team members: Michael Doan, Hailey Miller & Kaia Williams



Team advisors: Dr. Gary L. Bowlin, Professor & Herbert Herff Chair of Excellence, Department of Biomedical Engineering, The University of Memphis

Problem statement:
The current method of measuring the rotational speed of the rotating crank and stage components on the Touch-Spinner is unreliable, so the cross-hatching fiber angle cannot be consistently adjusted to create replicable polymer scaffolds for vascular tissue engineering research, resulting in high variability of cross-hatching angles across separately produced polymer nanofibers.

A brief description of the design
The design has three major components: (1) a light-sensing comparator circuit, (2) an OLED display that shows the RPM (rotations per minute) value calculated from Arduino code, and (3) a 3D-printed circuit housing that allows the device to be attached to the Touch-Spinner frame. (Figure 1). The device includes a laser that shines at a piece of reflective tape placed on the rotating component. Each time the component makes one full rotation and the laser reflects off the tape, a photodiode senses the reflection and creates a pulse signal, which can be calculated to show RPM on the OLED display using Arduino code. The circuit housing was 3D-printed using polylactic acid (PLA). Both the crank and stage components have their own tachometers because of their different rotation speeds, with a unique housing created for each because of their different orientations on the Touch-Spinner. With this design, users of the Touch-Spinner are able easily obtain RPM measurements necessary for scaffold production without the hassle of using a traditional handheld tachometer.

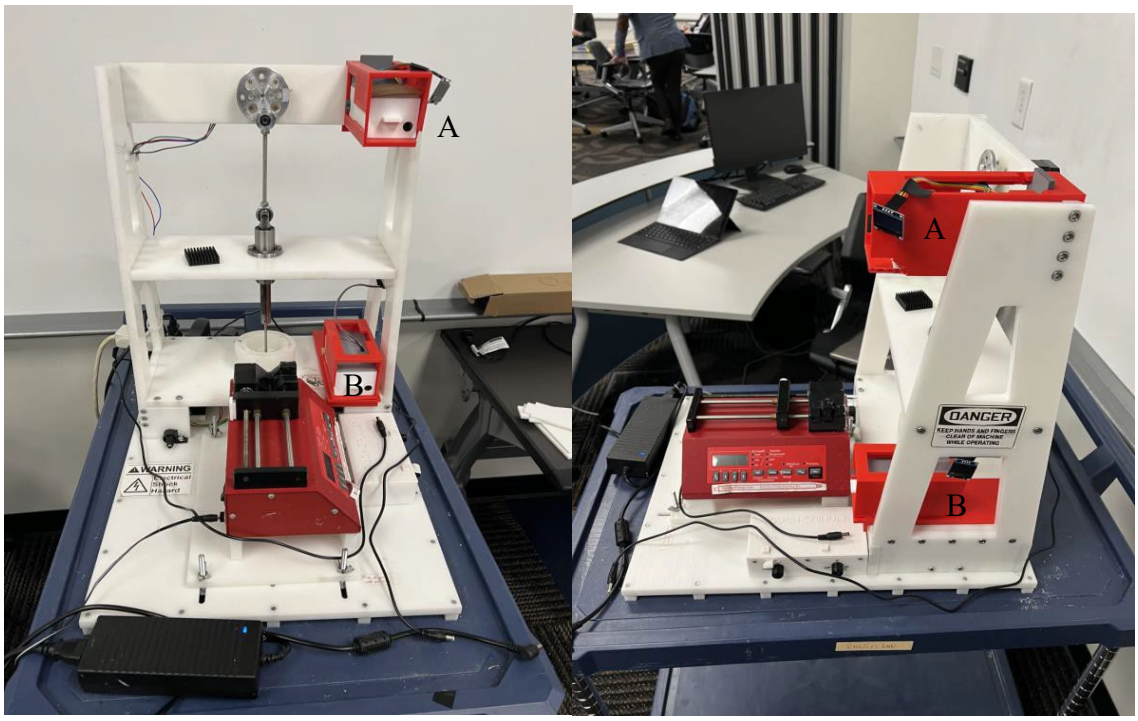


Figure 1. Protype touch spinning machine. The machine features a dual-tachometer system of the SpinMetrX Pro attached to the Touch-Spinner (unplugged). The top tachometer [A]measures the rotation of the crank, while the bottom tachometer [B] measures the rotation of the stage.

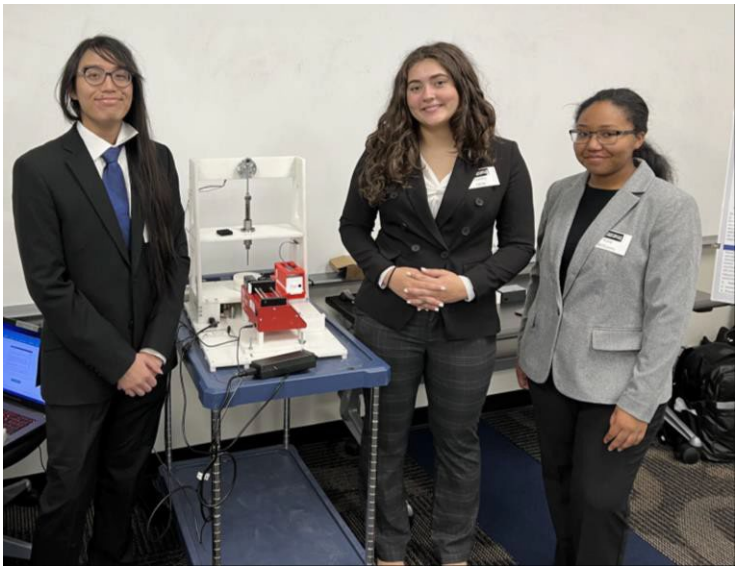


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Figure 2. Design Team with prototype and poster

Statement of project impact

Our device gives researchers in the Tissue Template Engineering and Regeneration Laboratory a tool to produce consistent and reliable scaffolds. We want to give tissue engineering researchers the ability to take steps towards implementing novel touch spinning technologies in research and to eventually lead to the manufacturing of touch spin scaffolds for use in tissue

engineering and regenerative medical devices. We also hope that the introduction of our device will establish the Touch Spinner as a concrete modality in the tissue engineering/regenerative medicine disciplines.

Lessons Learned

We learned how to efficiently communicate and collaborate within a team setting. How to fully carry out a design process from start to end. We also learned how to give professional presentation and write a complete technical design report.