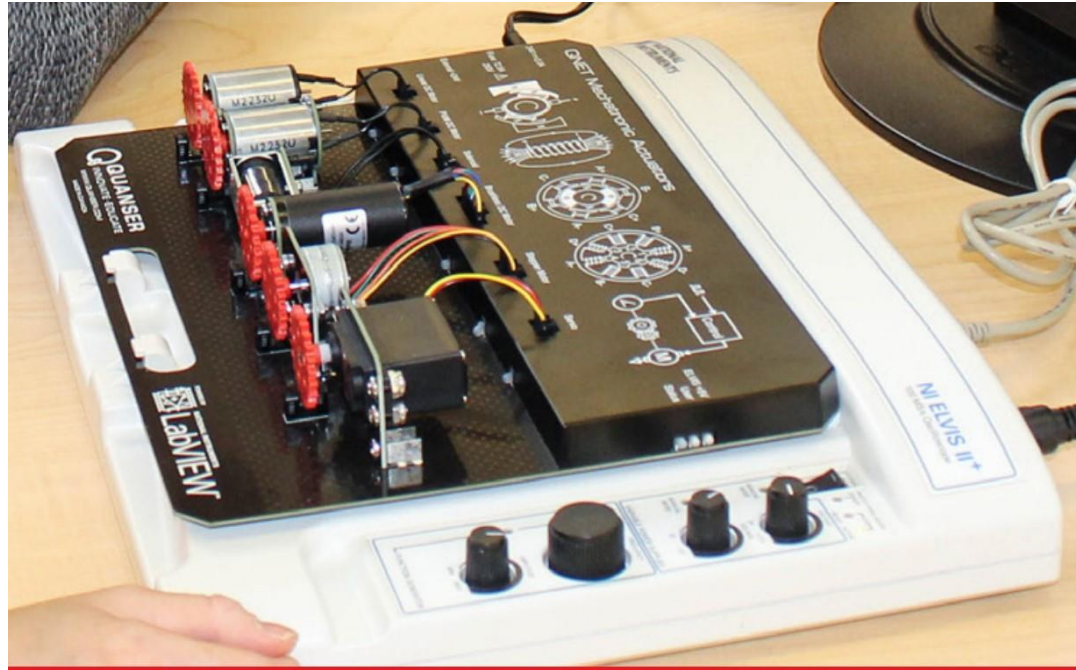


Executive Summary



A mechatronic actuator board is a system of motors developed by Quanser used by the MAE department at UTA to instruct students in the function and control of motors. It is composed as follows: A **Brushed DC Motor** driven by **Linear Signals**, a **Brushed DC Motor** drive by **PWM Signals**, a **Solenoid**, a **Brushless DC Motor**, a **Stepper Motor**, and lastly a **Servo Motor**

The actuator board interfaces with the NI Elvis II board which from there is controlled by virtual instruments constructed within NI Labview software.

Background

- As the number of students within the MAE department has grown, it has become increasingly difficult to schedule the necessary lab time for students to perform the experiments using the single board within the department's possession. Thus, it has been requested that an additional board be constructed to ameliorate this problem.
- The project deliverables were as follow: A **Schematic** of the actuator board, the **PCB Layout**, a **Bill of Materials** with sourcing, One functional, physical mechatronic actuator **Board**, suggested **Alternative Experiments** that students may perform, and all relevant **Documentation** so construction may be easily replicated.



Figure 1. Original Board

Experimental Setup

- A PCB will be designed in EasyEDA then exported to KiCad
- Four virtual instruments must be constructed to match the experiments conducted using the original. The first three components are combined into a single program, while the remaining three are operated independently.
- The virtual instruments will be programmed using Labview 2019 and performed using the NI Prototyping board and then again with the constructed PCB.

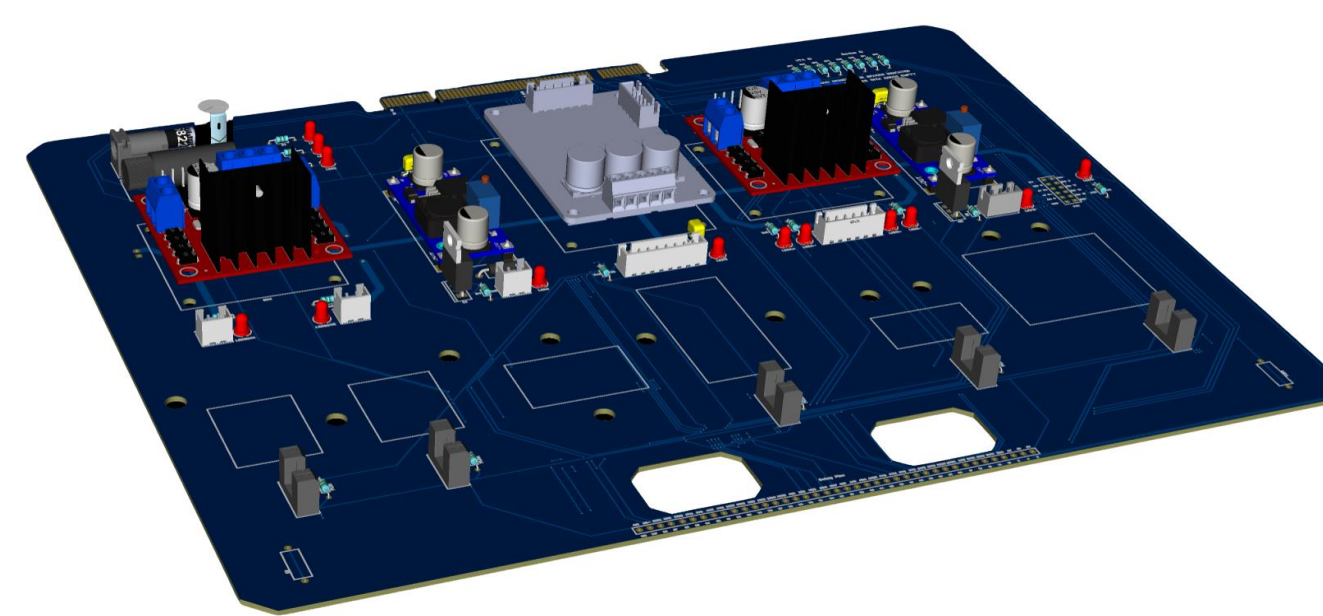


Figure 2. 3D Model of PCB

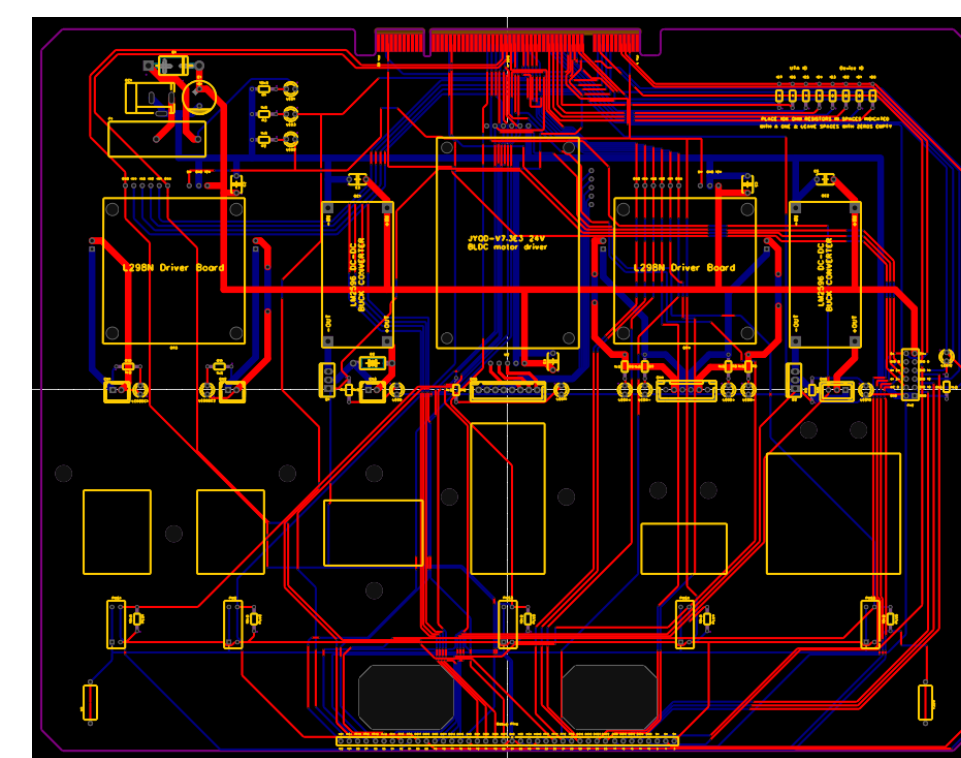


Figure 3. Design of PCB

Experimental Test Plan

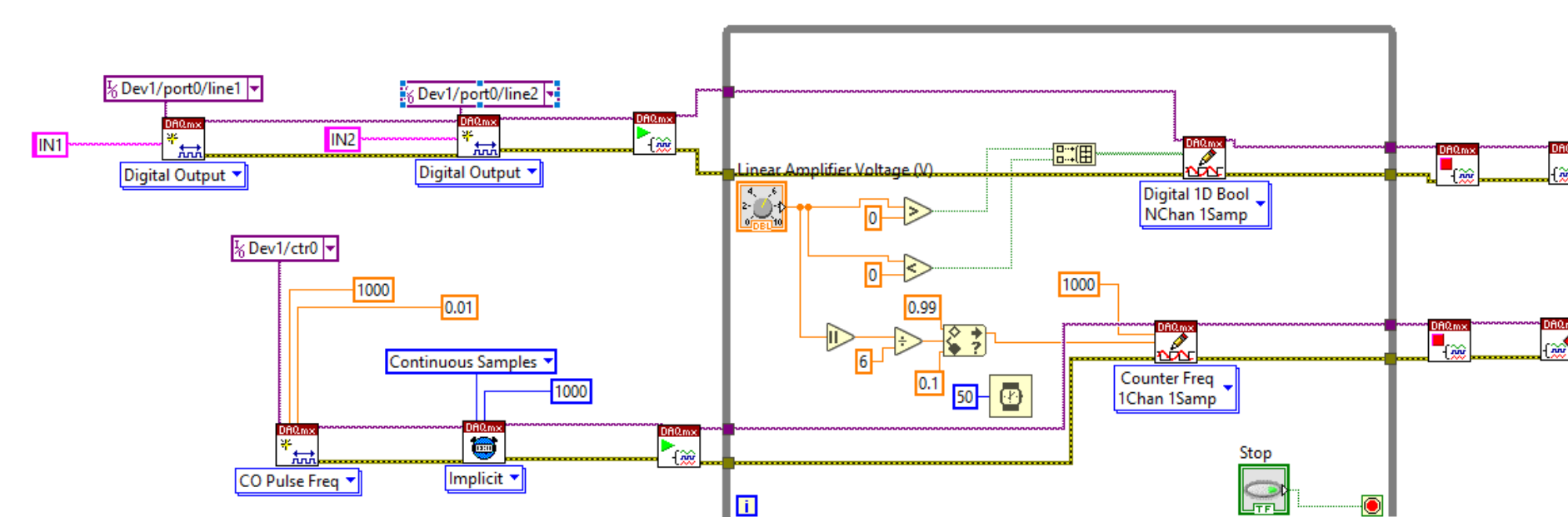


Figure 4. Brushed VI

- The virtual instruments have been constructed in Labview with the goal of replicating the originals as closely as possible both in appearance and functionality.
- Working through the Instructor Manual [1] of the original, has allowed us to ensure our designs match the standards and requirements of the experiments.

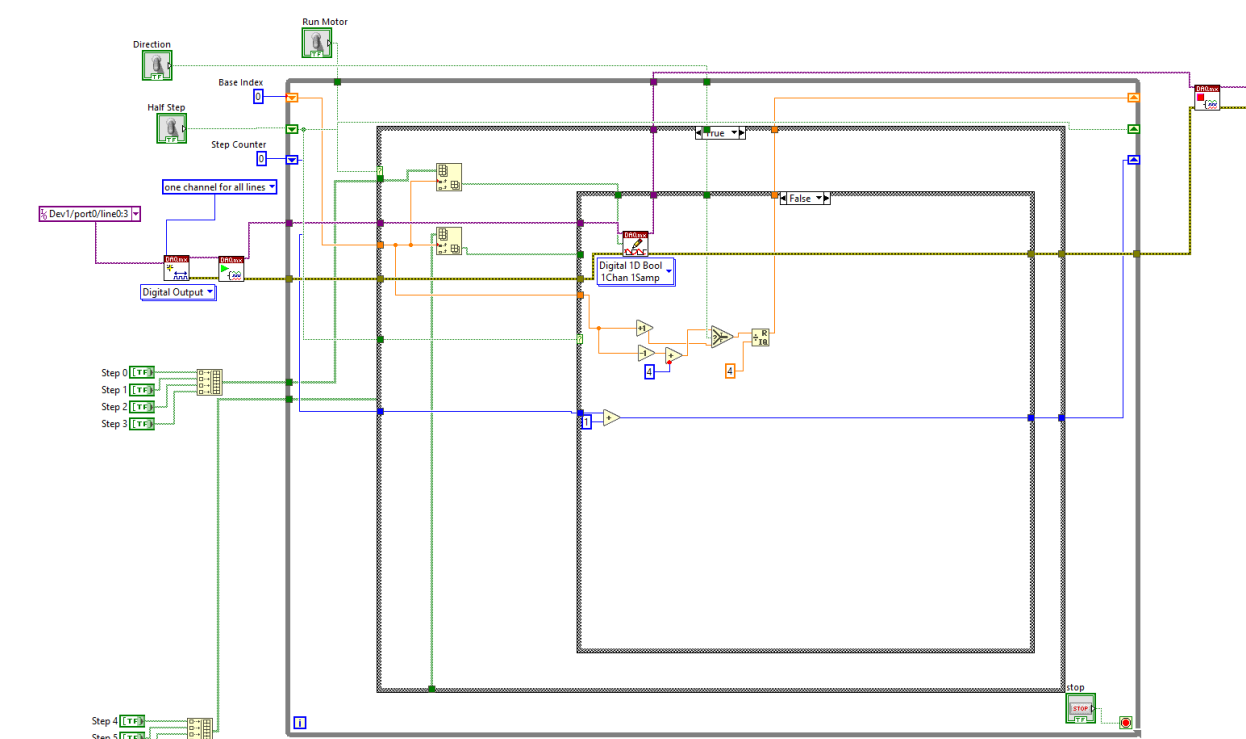


Figure 5. Stepper VI

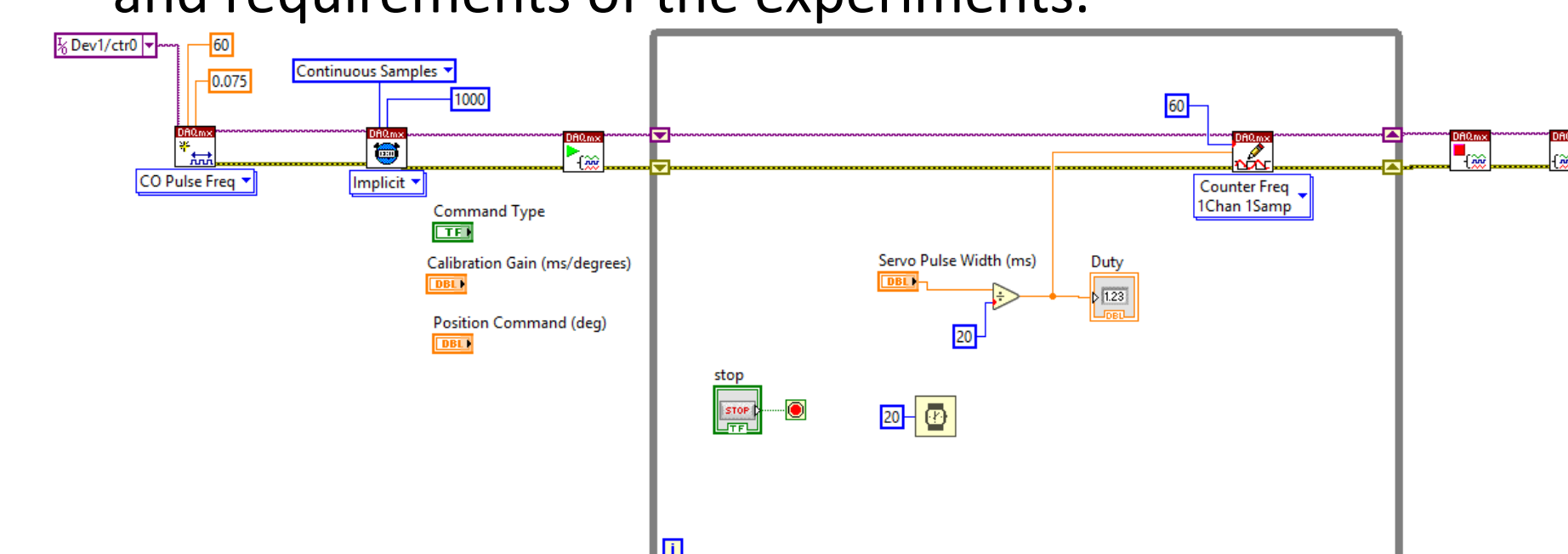


Figure 6. Servo VI

Experimental Results

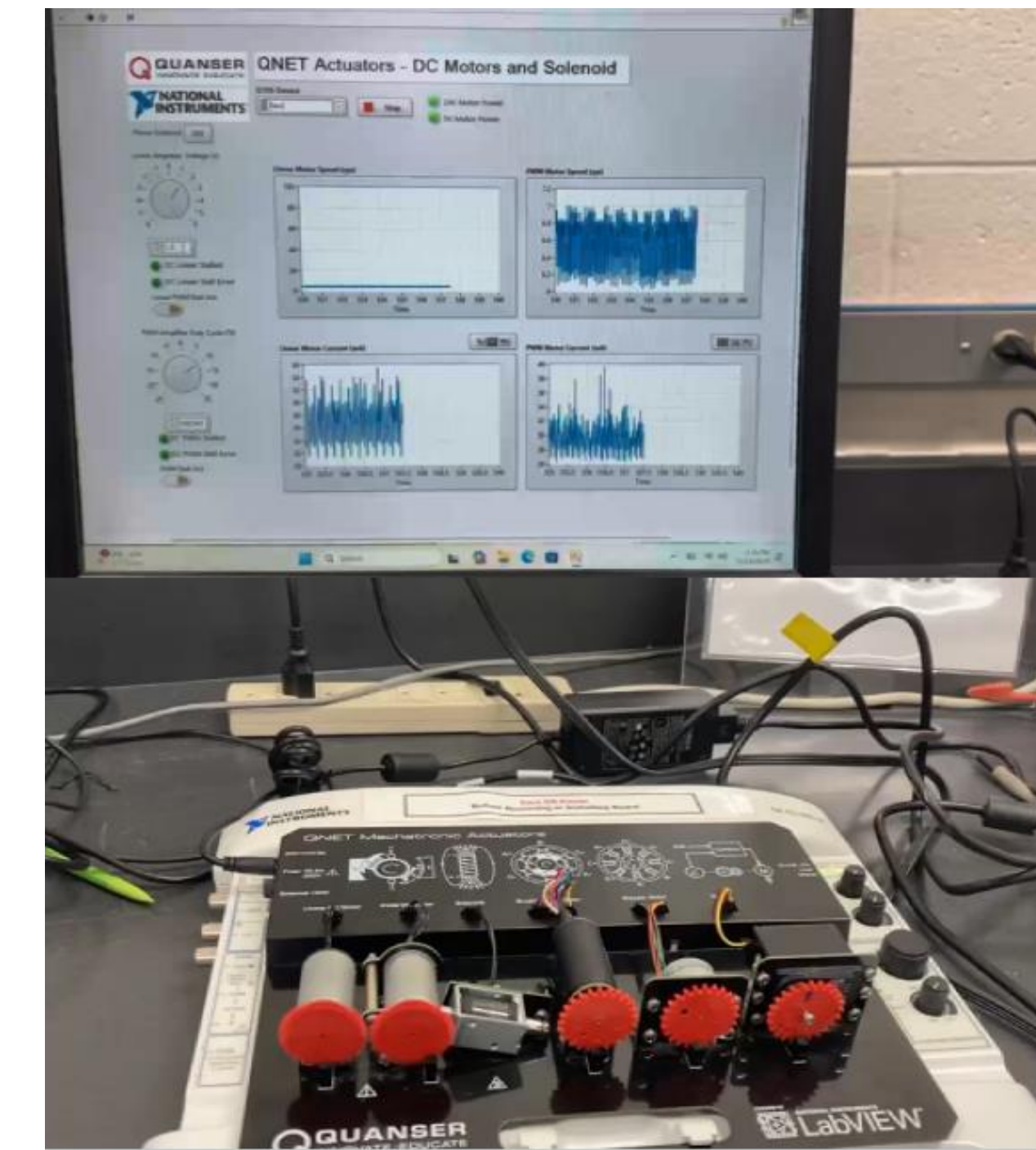


Figure 7. Brushed Motor Original

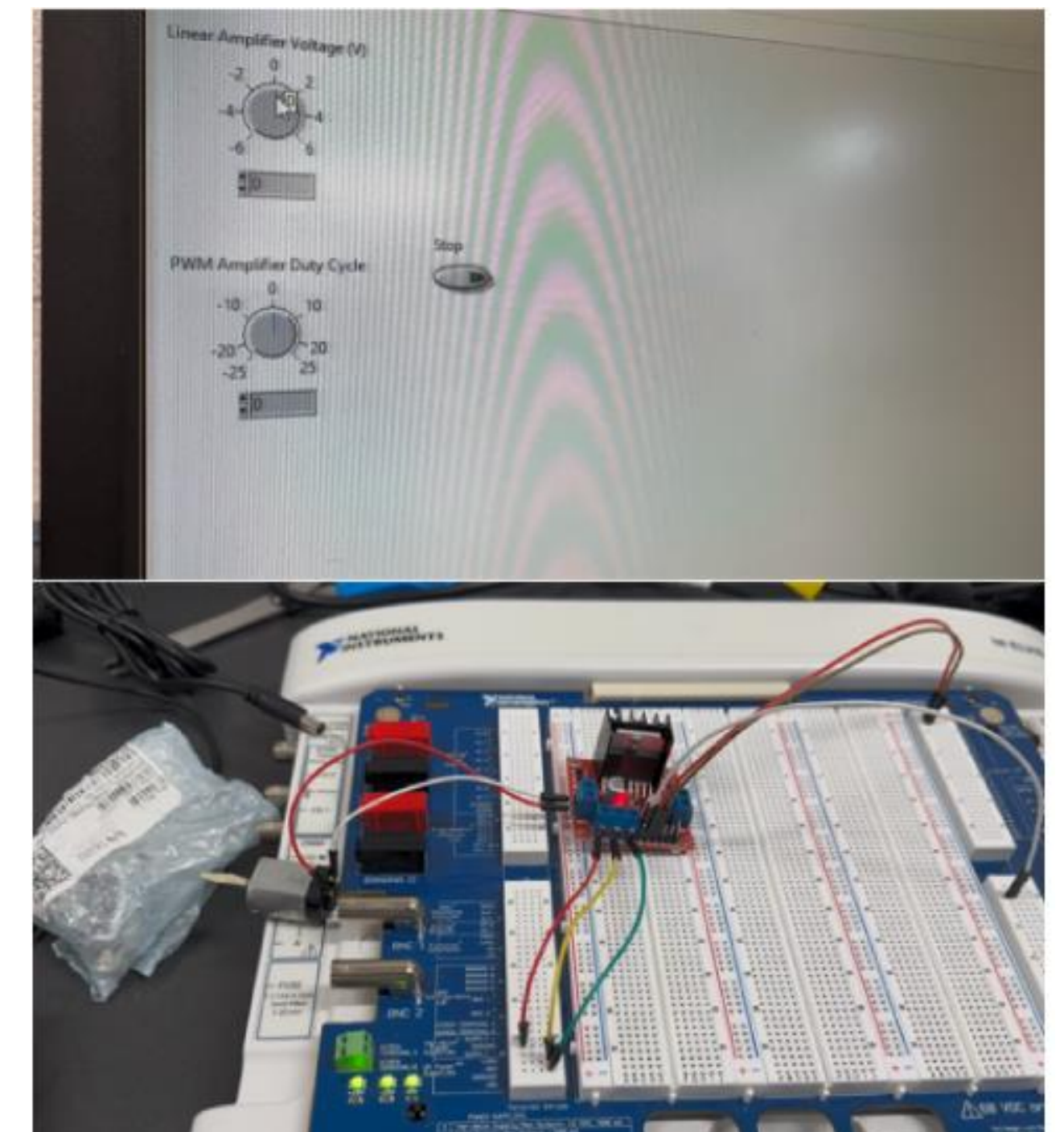


Figure 8. Brushed Motor Prototyping

Conclusions

- The Schematic and PCB Layout have been finalized, and the PCB is out for shipping.
- The virtual instruments for the Brushed/Solenoid and the Stepper are currently operational while those for the Servo and the Brushed are currently in progress.
- Documentation of the Student Manual written in LaTeX and the Bill of Materials are complete.
- After the mechatronic actuator board is finished, the information compiled will be used by our sponsor within the MAE department to fabricate additional copies of the board and to set the precedent for future development teams to replicate the remaining Quanser boards possessed and used by the department.



Figure 9. Additional Boards

References

- P. Martin, M. Krug, and J. Apkarian, "QNET Mechatronic Actuators Board for NI ELVIS Instructor Workbook," Quanser, 2015