Master Controller For High Energy Electron Source Part II

By Team Members:
Esayas Abera (EE)
Cyrus Safi (CE)
Jay Vakil (EE)

Sponsor Company: STI Optronics
Faculty & Industry Advisor: Dr. Wayne Kimura

Outline

- Background
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- Reflections
- Acknowledgements

Team Member Contributions

Esayas Abera	Cyrus Safi	Jay Vakil (Project lead)
• Circuit design • Breadboard design • Presentation slides • LabVIEW Front Panel Design • Report Writing	• Soldering • Proposal Preparation • LabVIEW programming	• Breadboard design • LabVIEW Block Diagram • Proposal preparation • Report Writing

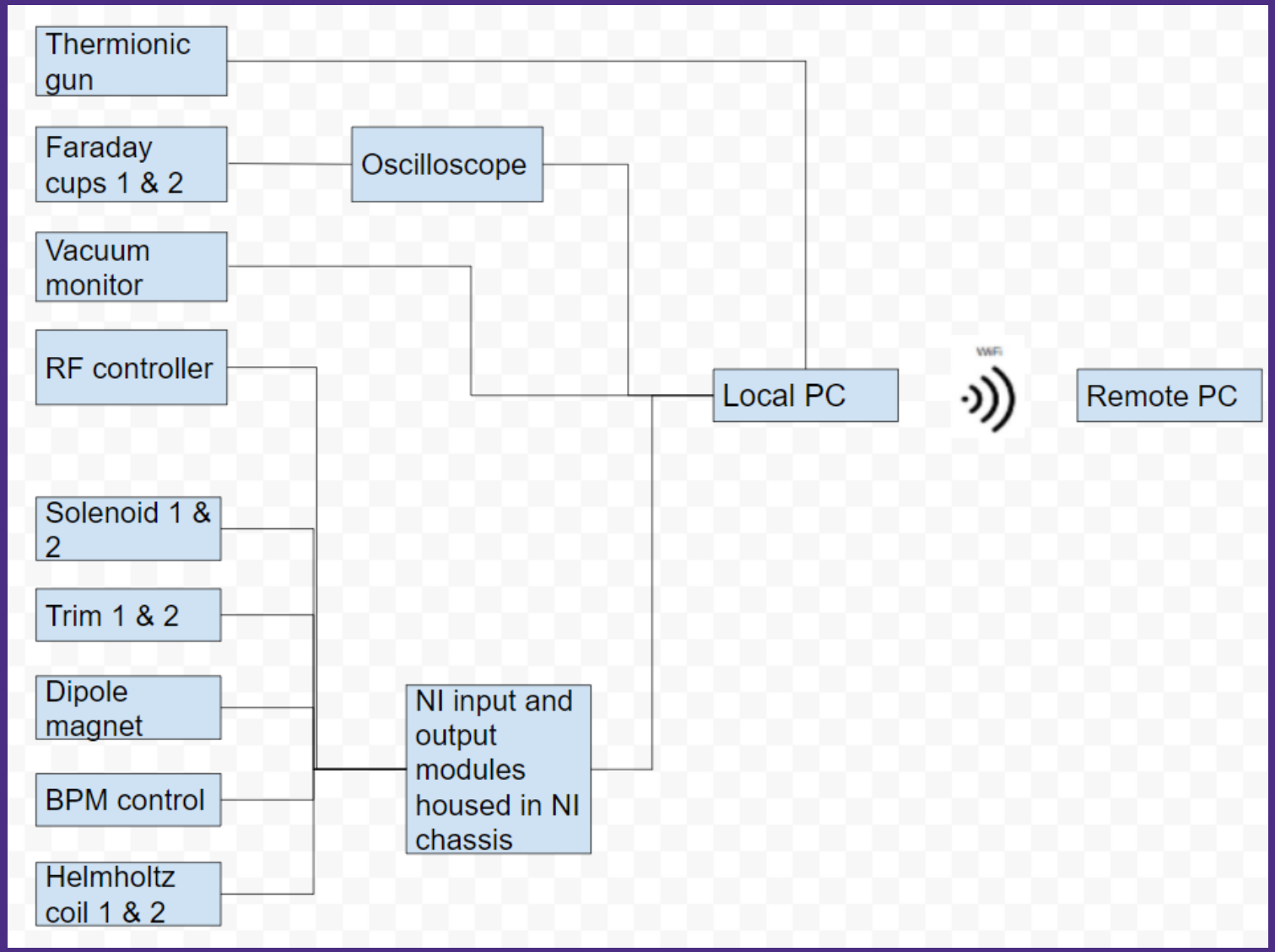
Background

- STI Optronics (STI) is small business specializing in research and development on laser applications and advanced high-energy accelerators
- STI is developing new type of high-energy electron source for accelerators based upon diamond technology
  - Experiment located at Stony Brook University, Long Island, NY
- Complex system requiring remote control and monitoring of many components
  - Power supplies for driving electromagnets
  - Pneumatic actuators for inserting electron beam position monitors (BPMs)
  - Adjustable DC voltages needed to control RF components
- Capstone project was to design and test Master Control (MC) system for controlling components
  - Consists of Local PC using National Instruments (NI) LabVIEW software
  - Use National Instruments (NI) analog output and input modules to connect to hardware
  - NI modules not immediately available used Arduino microcontroller as substitute interface between LabVIEW and hardware

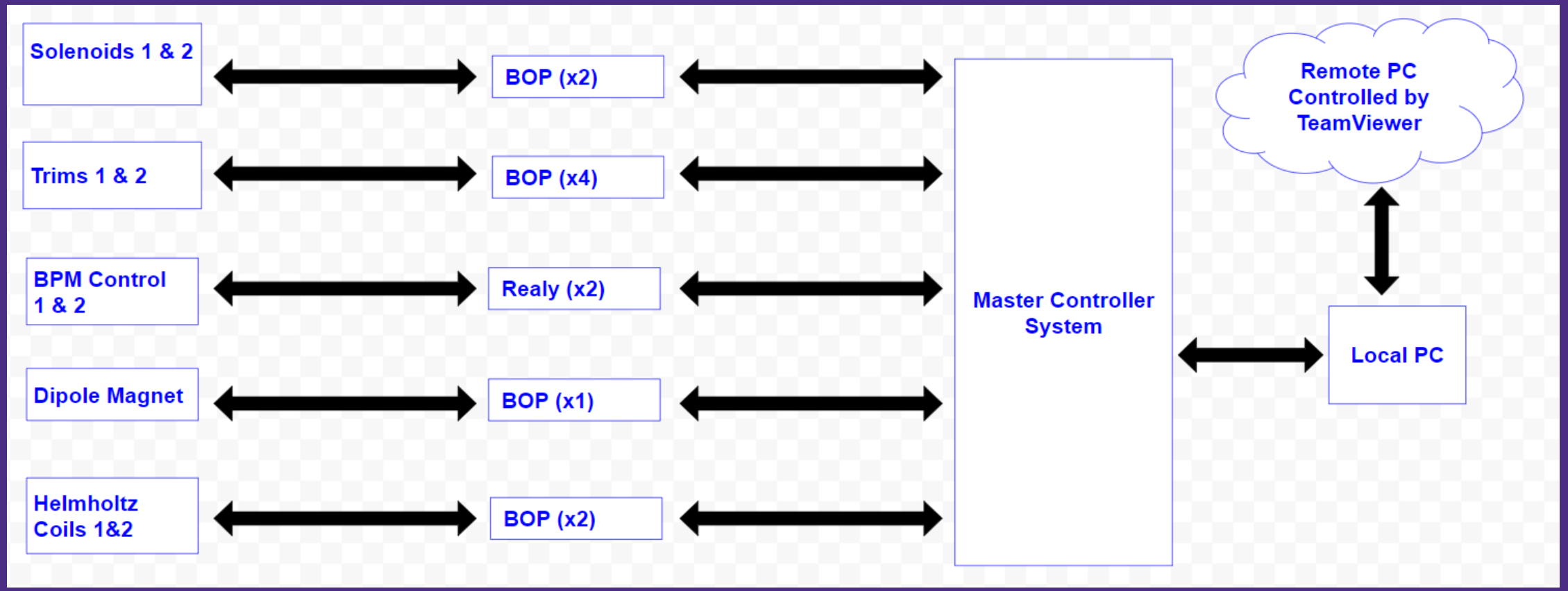
Master Control System Overview

Team 1

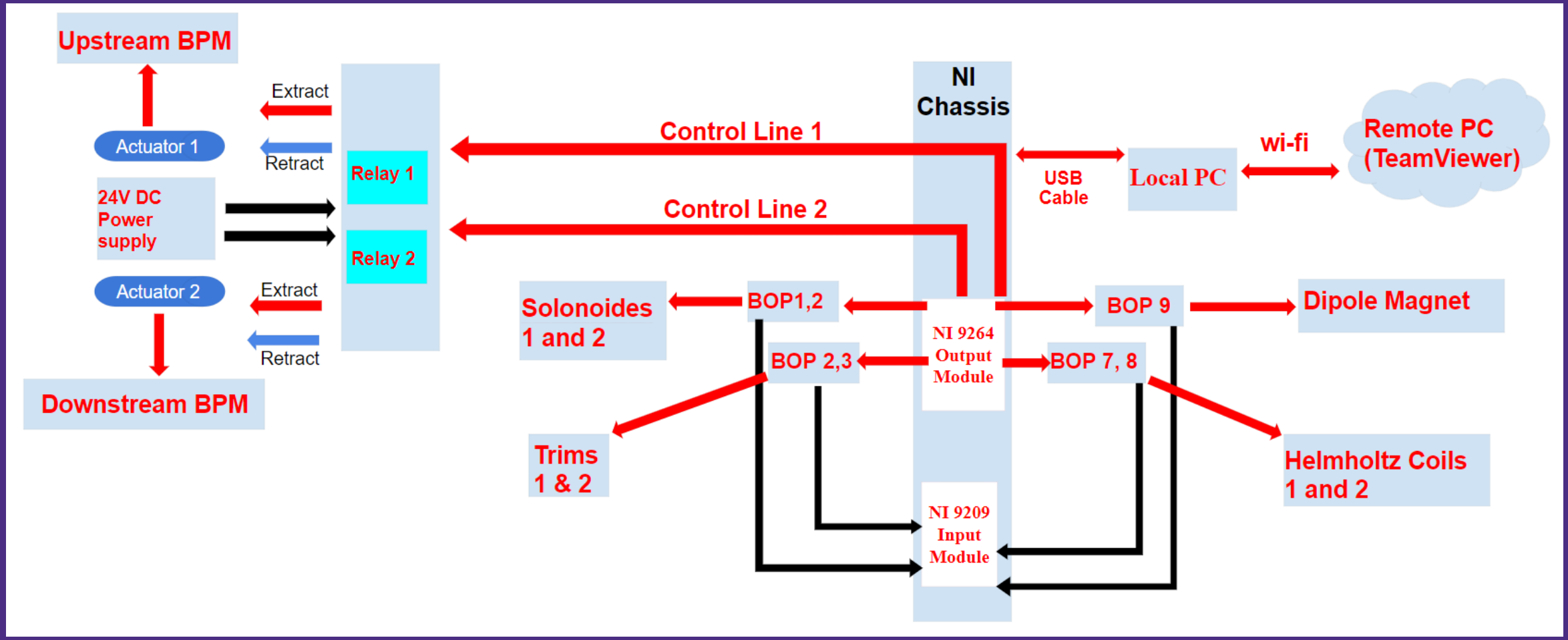
Team 2



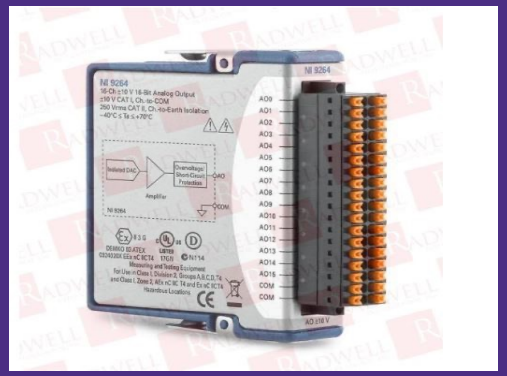
Top Level Approach



Hardware Connections for Master Controller



Hardware Components

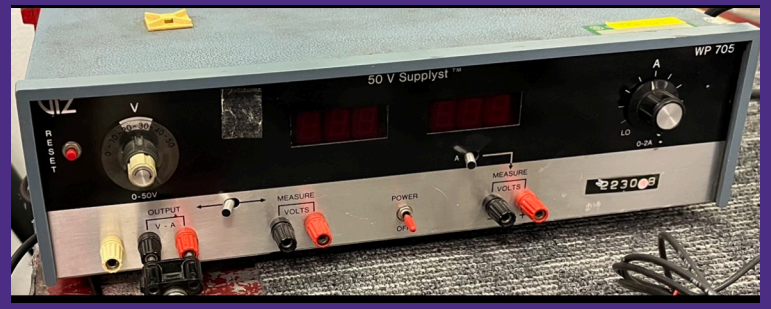


- NI 9264 (National Instruments output module)
- Has a built-in DAC
- 16 analog output channels
- 16-bit DAC resolution
- Output range
  - Max +/- 10.65V
  - Max +/- 10.65 V
  - Typical +/- 10.5 V

- NI 9209 (National Instruments input module)
- Has a built-in ADC
- 16 analog input channels
- 24 bits ADC resolution
- Input range
  - Min +/- 10.2V
  - Max +/- 10.2V
  - Typical +/-10.4 input

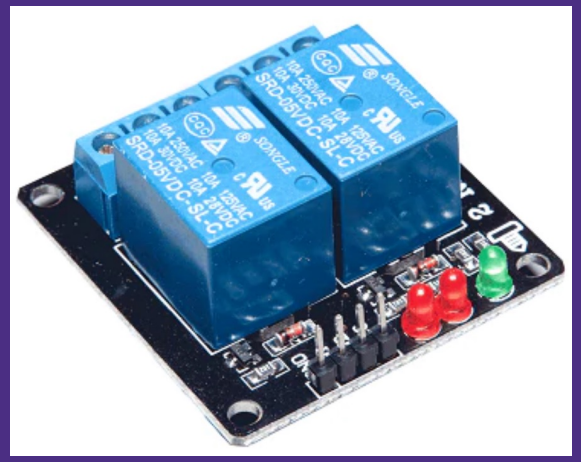
- NI chassis: cDAQ-9174

- KEPCO (20-10) BOPs (Bipolar Operational Power Supplies) (x9)

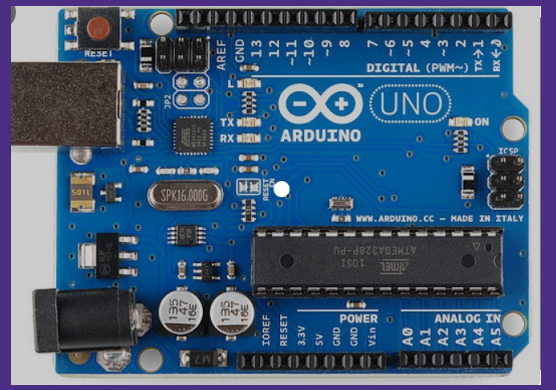


- 24V DC Power Supply (x1)

Hardware Components (cont.)

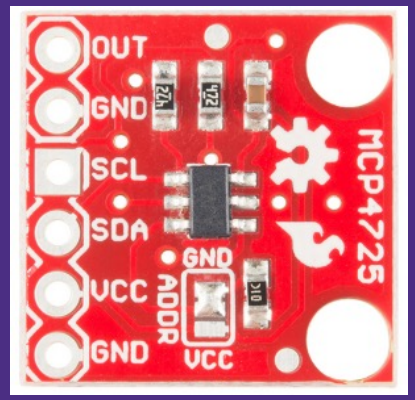


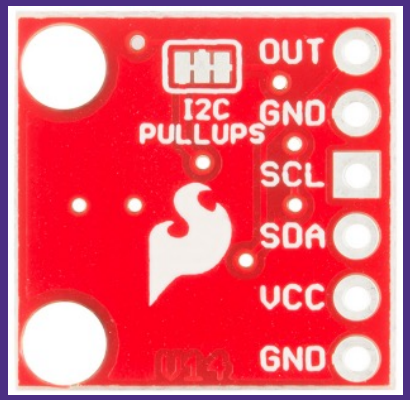
- LC 200 relay (x2)
- Single pole double throw
- Needs 5V to power up DAC board
- Controls two actuators



- Arduino UNO microcontroller (x1)

- Local PC to use LabView and program Arduino
- Core i7 512GB
  16GB Ram

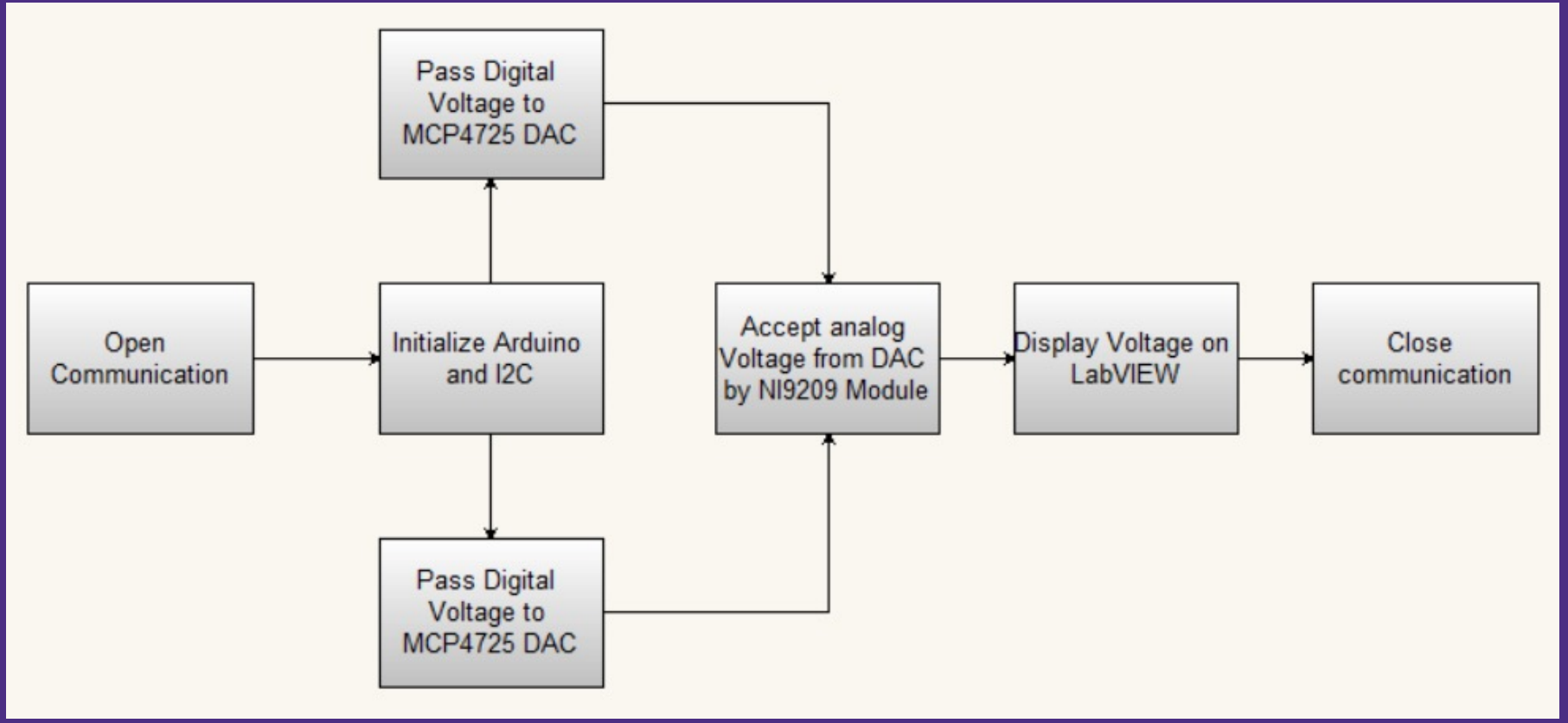




- MCP4725/12-bit DAC (x2)

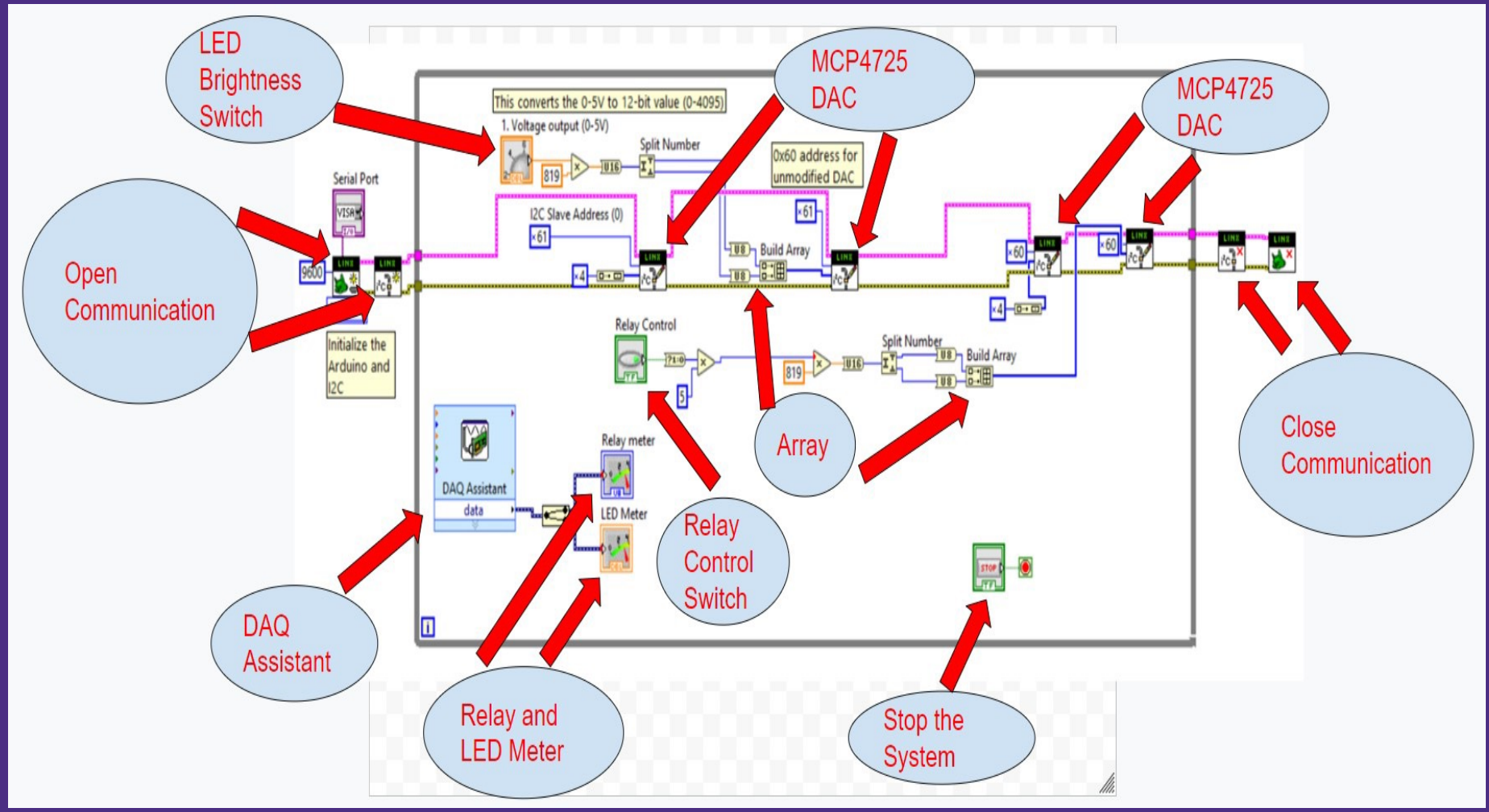
Software Approach

- Use National Instruments (NI) LabView
- Use Arduino as substitute for NI output module



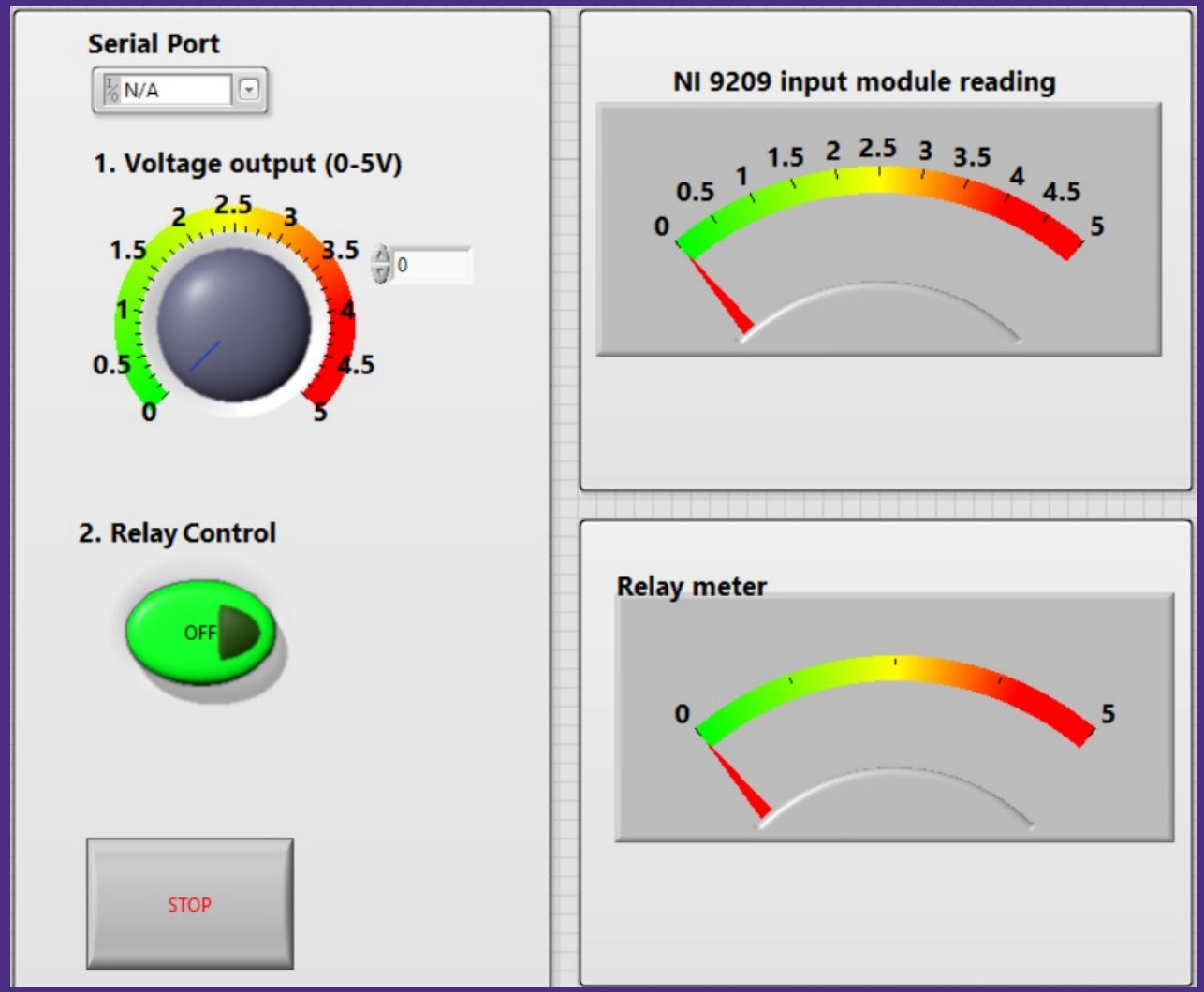
Software Design

- LabVIEW Block Diagram



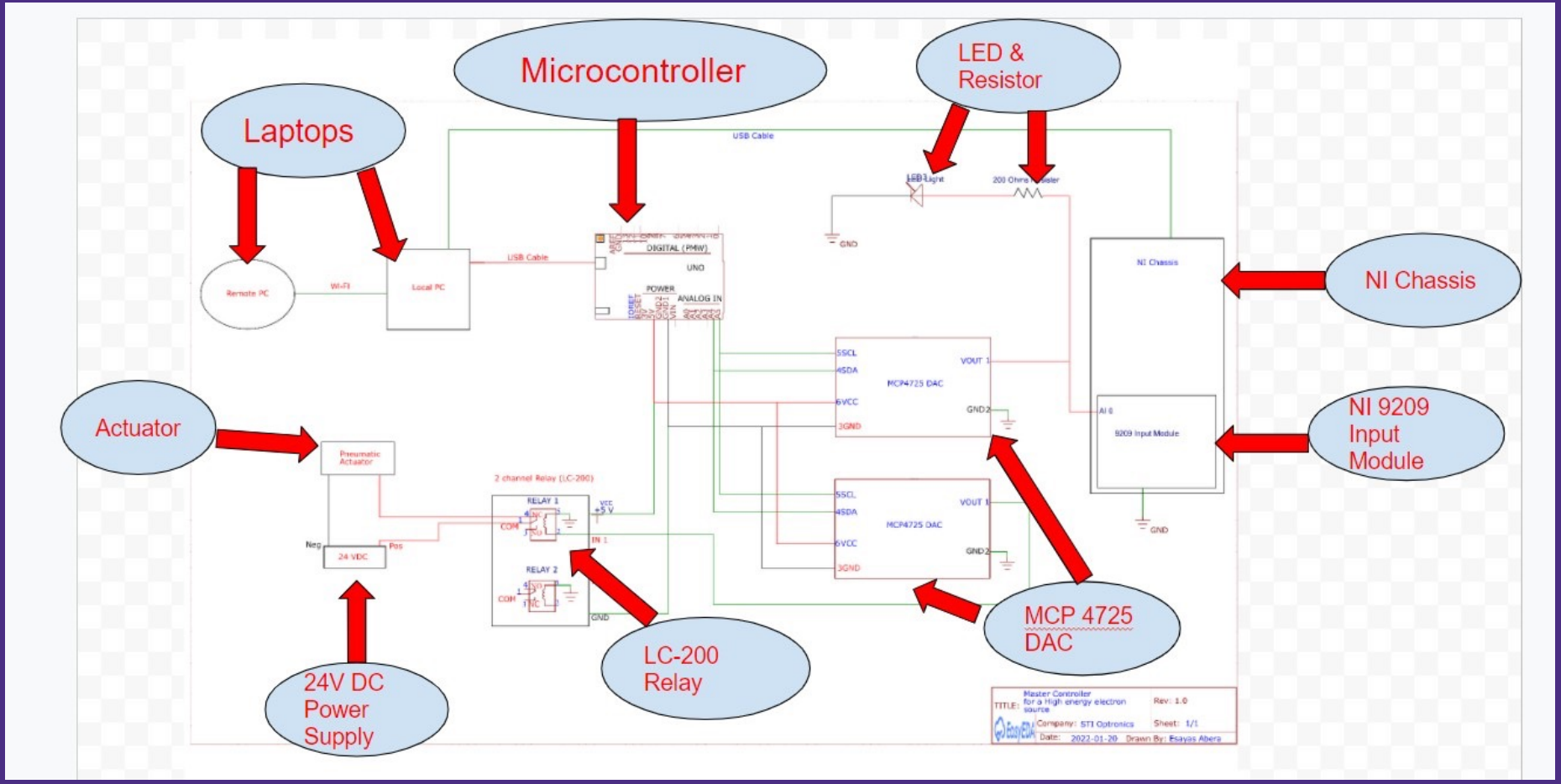
Software Design

- LabVIEW Front Panel

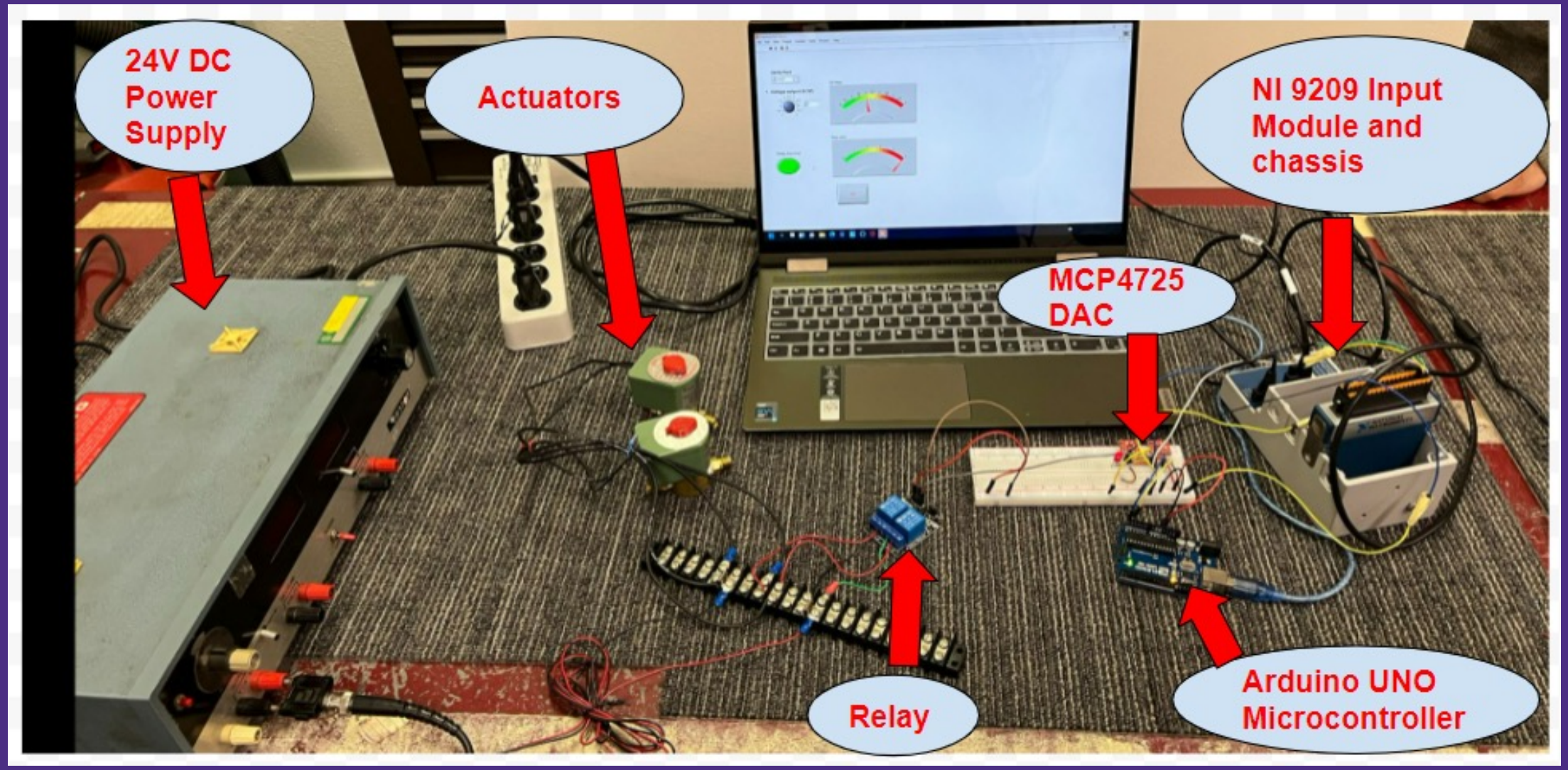


Circuit Design for Breadboard Testing

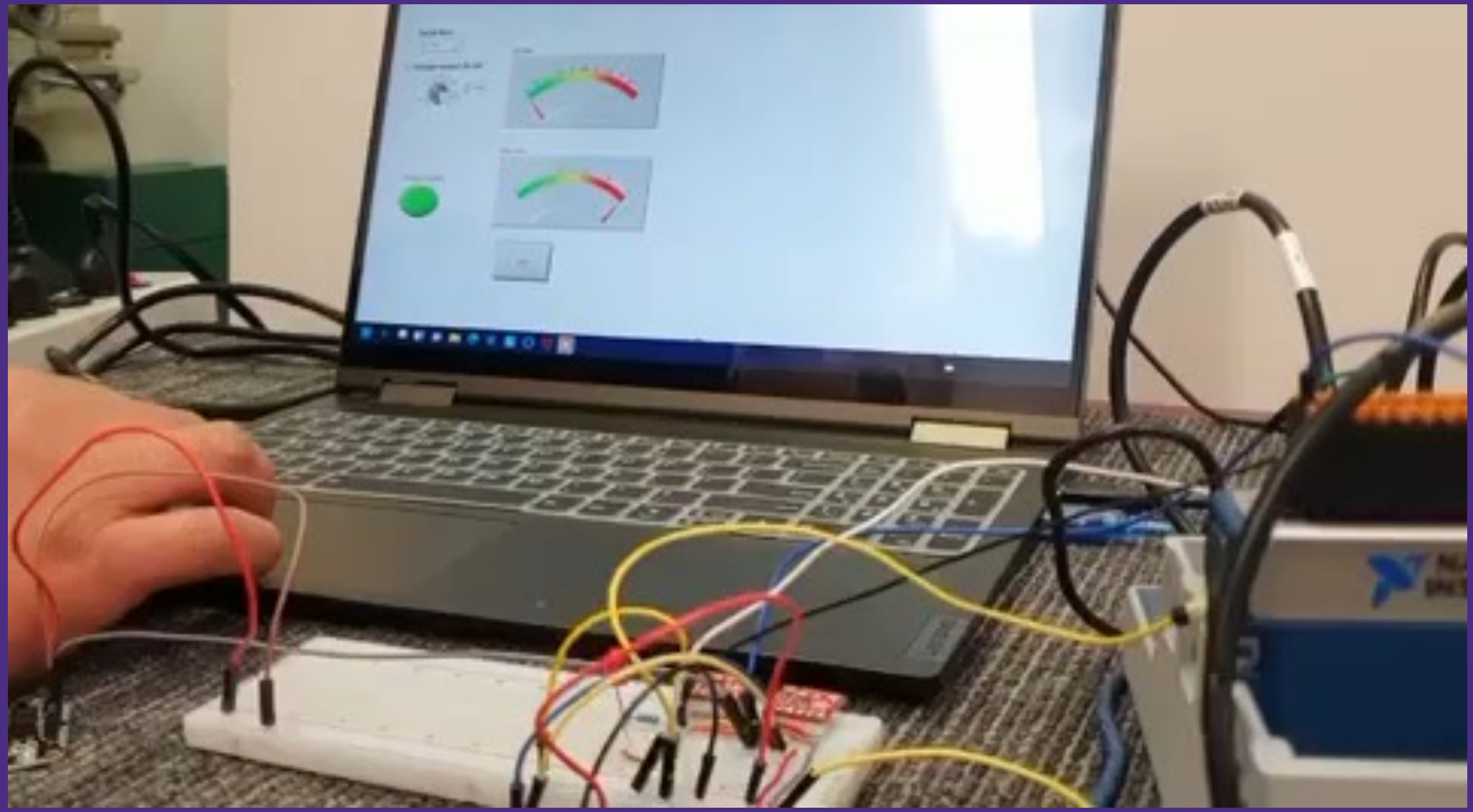
- Actual hardware located at Stony Brook University, New York
- Need to substitute components to test Master Controller system
- NI analog output module on back-order, could only test NI input module



Testing and Results



Testing and Results (Video)



Future Tasks

Replace	Update	Test
Replace microcontroller with NI 9264 output module	Update LabVIEW program to include NI 9264 output module	Test system to ensure desired power is delivered to each component

Reflections

- It is not easy to get hold of technicians, so contact them early
- Ensure that hardware components you chose are available and can be shipped on time
- It is very important to communicate with your team members
- Don’t depend on circuit diagrams you found online
- Make sure that each team member understands details of project
- Always plan to finish before due date
- Don’t give up

Acknowledgment

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