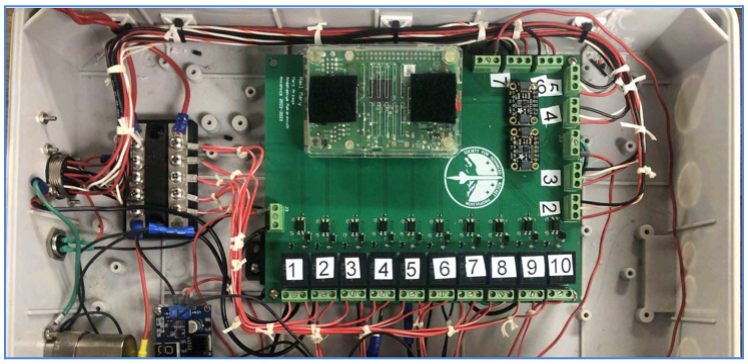
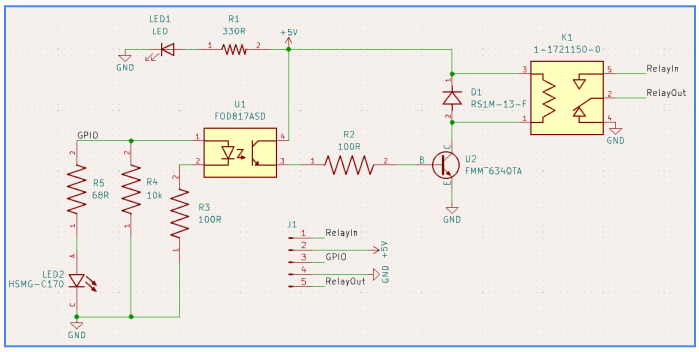
Owen Wilhere Portfolio of Engineering
linkedin.com/in/owen-wilhere-9121a5231
github.com/OWongit

Relay Switch for Launch Controller



a.



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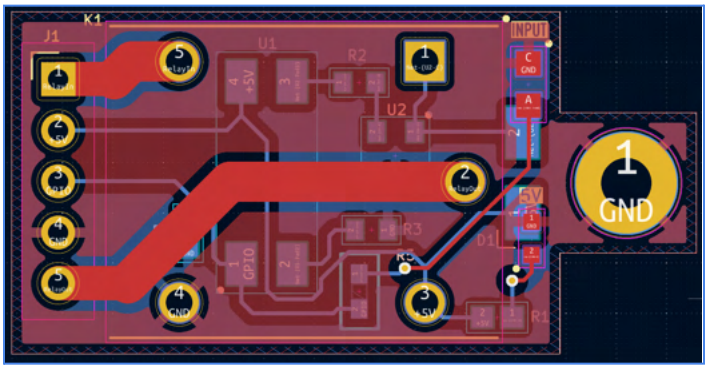
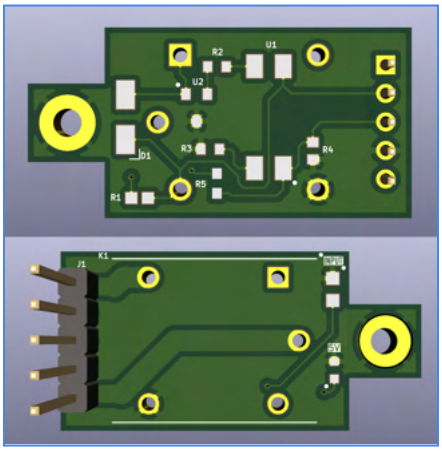


c.



d.

Redesign a relay switch circuit to interface externally with a larger launch controller system, enabling the reliable handling and control of higher voltage signals for precise valve actuation.

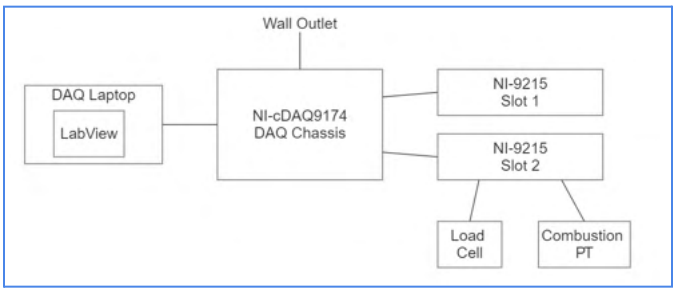
a. Existing launch controller system. The relay switch components, labeled 1 through 10, frequently experience failures or malfunctions. To address this issue, the redesign incorporates detachable relay modules, allowing for easier maintenance and replacement.

b. Relay switch daughter board schematic includes two additional LEDs: one to indicate the reception of a 5V signal and another to confirm the signal input from the microcontroller, enhancing diagnostic capability and system monitoring.

c. PCB layout of the daughter board is designed as a two-layer configuration, optimizing manufacturing costs while maintaining a compact form factor. It interfaces with the main board via a 5-pin connector and is externally mounted using a grounded through-hole for improved stability and electrical grounding.

d. 3D rendering of the PCB provides a visual representation of both the front and back sides, with the front side positioned at the bottom. The front and back silk layer labeling of components ensures clarity in component placement and routing, ideally helping with manufacturing accuracy.

Real-Time Monitoring of Rocket Engine



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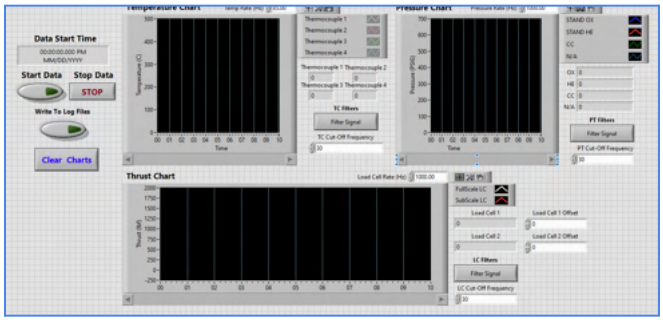

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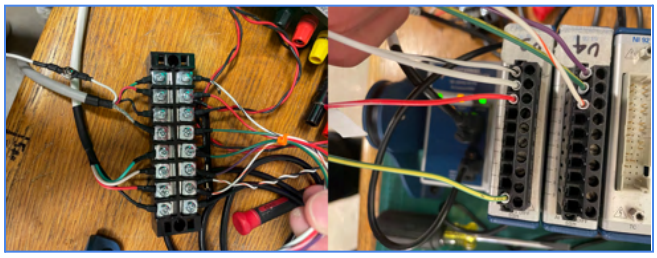


c.

d.

Capture and visually present real-time data from a load cell and pressure transducer in a rocket engine through graphical representation.

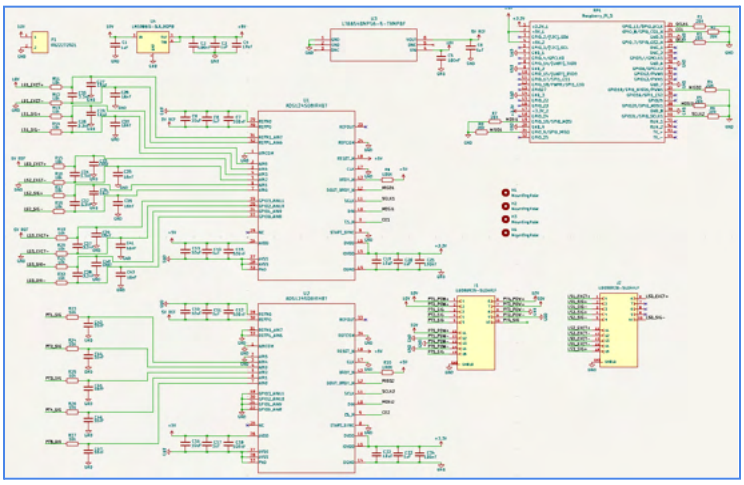
a. Block diagram of the Data Acquisition (DAQ) system illustrates the signal flow within the National Instruments DAQ setup. The system captures high-resolution analog signals from an external load cell and pressure transducer, converting them into digital data for processing and analysis.

b. Real-time display implemented using NI LabVIEW, showcasing pressure, thrust, and temperature measurements. The system allows for toggling of signal filtering and provides an option to enable or disable data recording to an MS Excel spreadsheet.

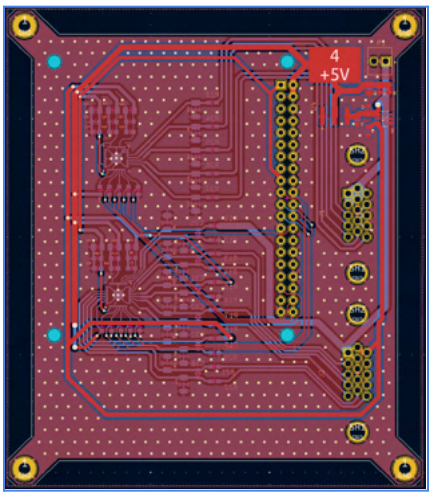
c. Wire harnessing for system organization: The DAQ hardware receives sensor inputs and a DC power supply for sensor excitation, ensuring proper signal routing and electrical connectivity.

d. Image capturing the combustion process of the rocket engine during testing.

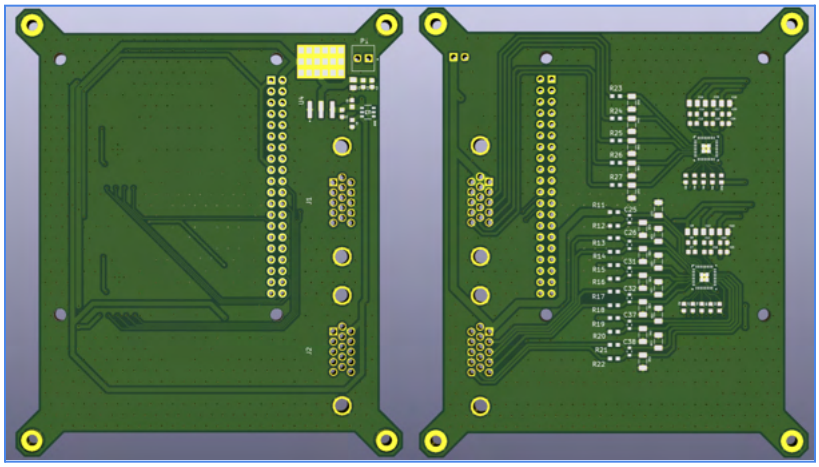
Improved DAQ System for Sensor Data



a.



b.



c.

Develop an improved Data Acquisition (DAQ) system utilizing a Raspberry Pi 5 microcontroller, engineered to process analog signal data from three load cells and five pressure transducers.

a. Schematic for the DAQ system. Analog sensor data is acquired via two 15-port external connection terminals and processed by two 24-bit, 12-channel analog-to-digital converters (ADCs) before being relayed to a Raspberry Pi microcontroller. The board is powered by a 10 V supply, with a regulated 5 V rail provided by a fixed positive low-dropout (LDO) regulator and a precise 5 V reference generated by a dedicated precision voltage reference component.

b. PCB layout for the DAQ system is designed to ensure thermal management and optimal grounding. An array of thermal vias is implemented to facilitate efficient heat dissipation and establish electrical connectivity between the front and back ground planes. Additionally, trace widths vary to accommodate the current draw of each component, ensuring reliable power distribution.

c. 3D rendering of the PCB provides a visual representation of both the front and back sides, with the front side positioned at the bottom. The front and back silk layer labeling of components ensures clarity in component placement and routing, ideally helping with manufacturing accuracy.