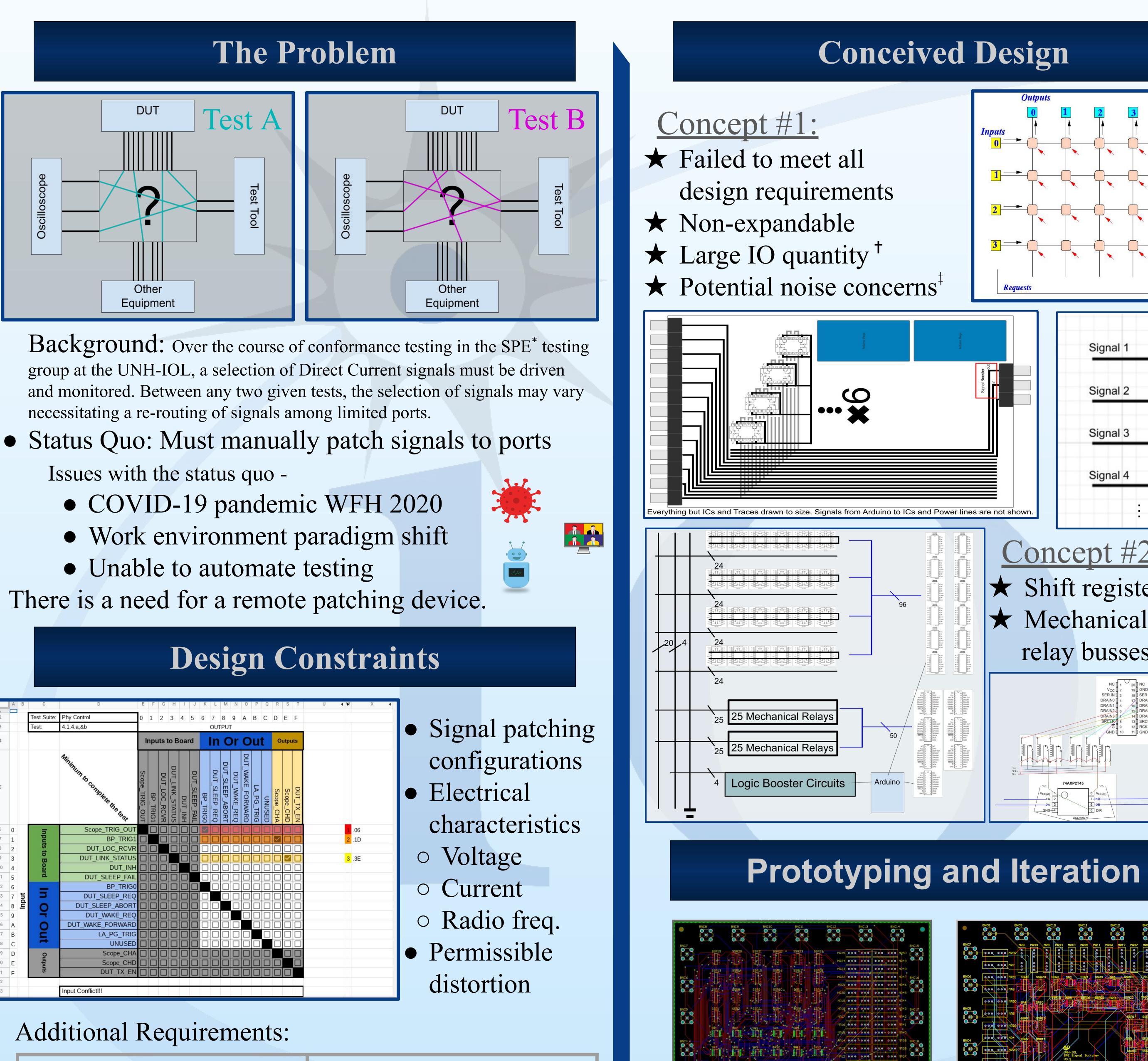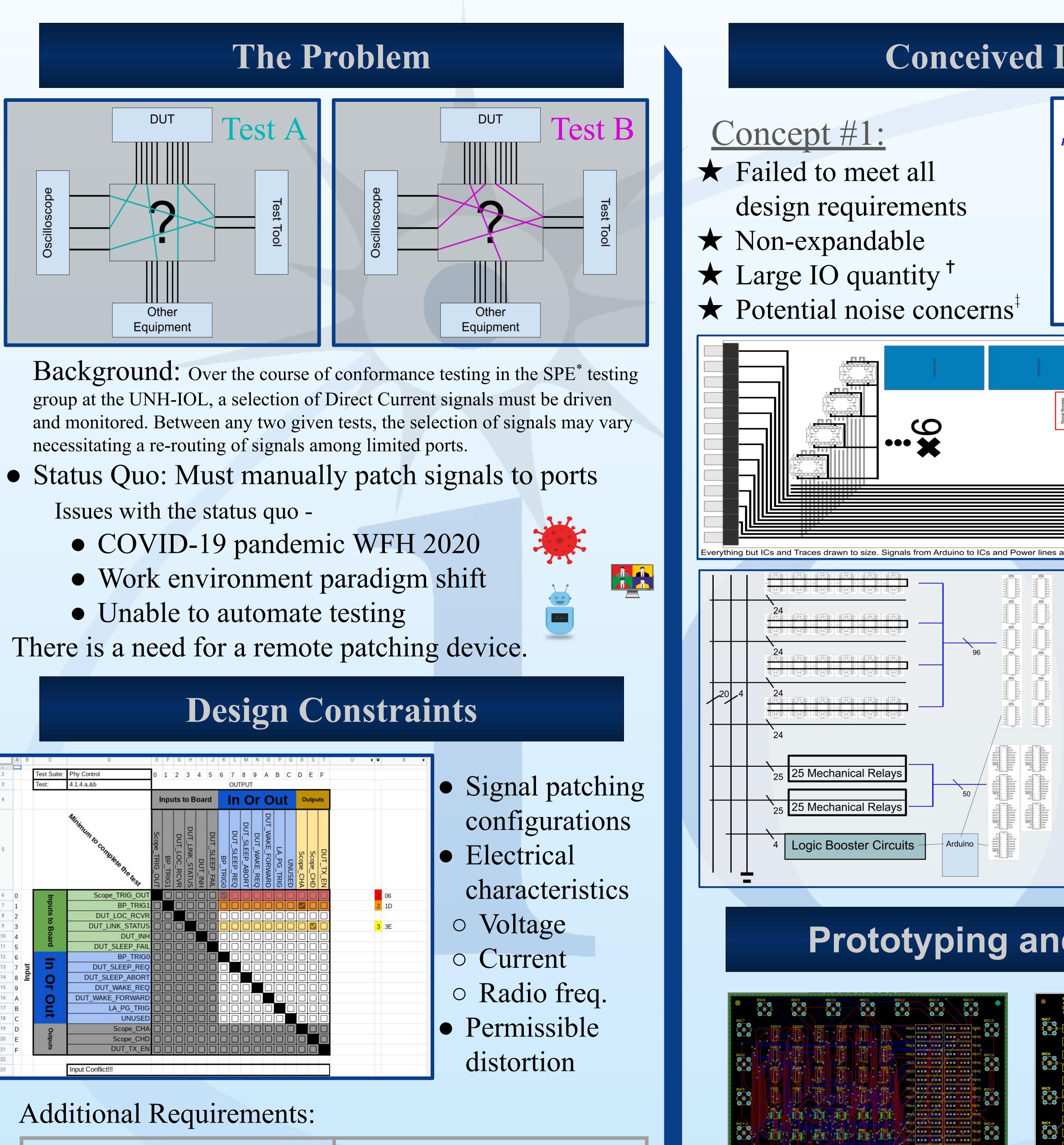# Single Pair Ethernet* Signal Switcher
Removing Physical Presence Requirements for a Remote and Automated World

Hunter Wells   *Advisors: Professor Qiaoyan Yu and Robert Noseworthy*

Department of Electrical and Computer Engineering, University of New Hampshire

University of New Hampshire

The Problem

Test A   Test B

Background: Over the course of conformance testing in the SPE* testing group at the UNH-IOL, a selection of Direct Current signals must be driven and monitored. Between any two given tests, the selection of signals may vary necessitating a re-routing of signals among limited ports.

- Status Quo: Must manually patch signals to ports

  Issues with the status quo -
  - COVID-19 pandemic WFH 2020
  - Work environment paradigm shift
  - Unable to automate testing

There is a need for a remote patching device.

Design Constraints

- Signal patching configurations
- Electrical characteristics
  - Voltage
  - Current
  - Radio freq.
- Permissible distortion

Additional Requirements:

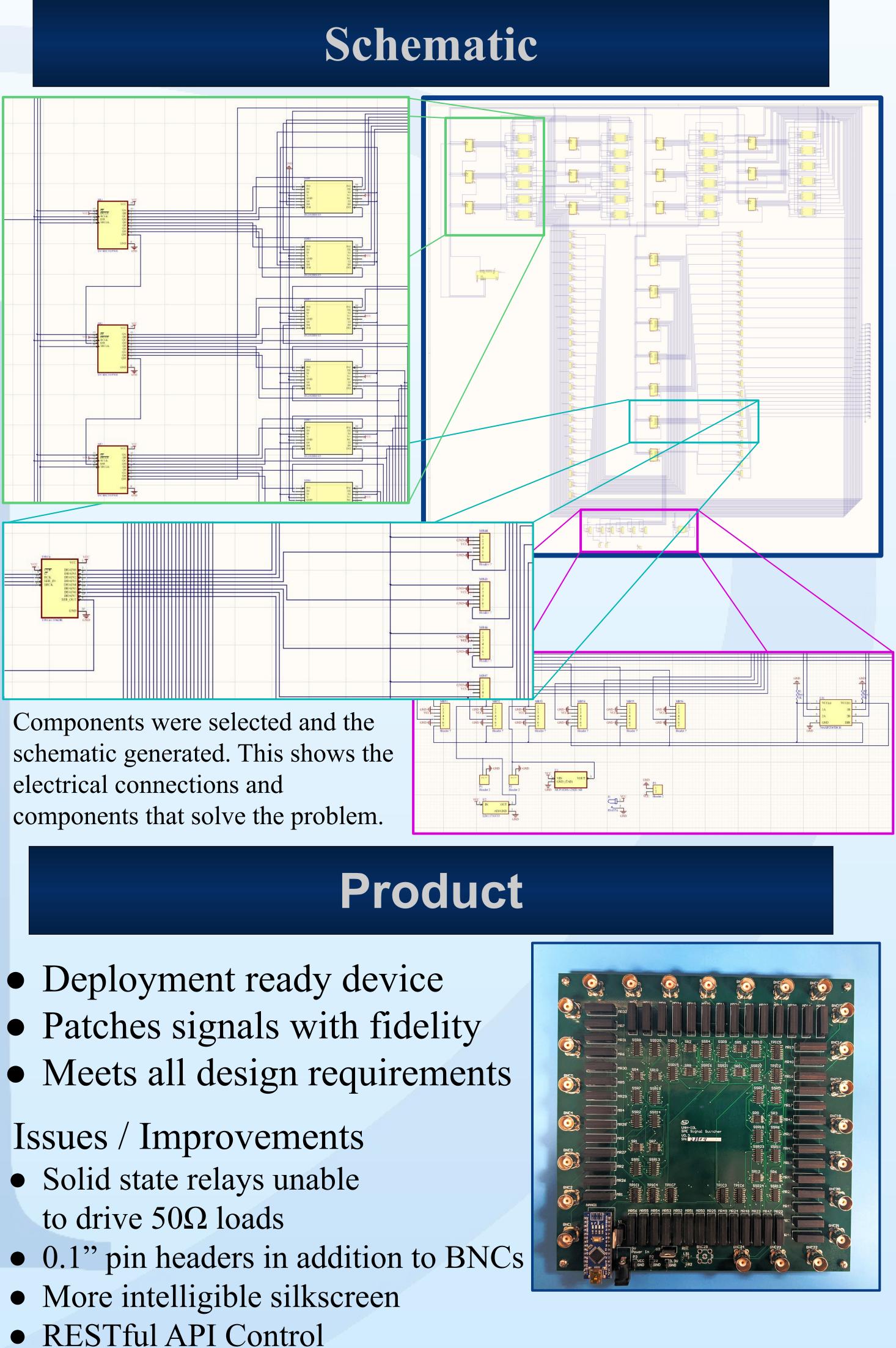|	
< 10 ns propagation delay and rise time	At least 4 signal-port connections (Busses)
Signal grounding	Signal amplification
< +/- 0.1 V in noise	Low DC resistance

Conceived Design

Concept #1:
★ Failed to meet all design requirements
★ Non-expandable
★ Large IO quantity [†]
★ Potential noise concerns [‡]

Everything but ICs and Traces drawn to size. Signals from Arduino to ICs and Power lines are not shown.

Concept #2:
★ Shift registers [†]
★ Mechanical relay busses [‡]

Prototyping and Iteration

Schematic

Components were selected and the schematic generated. This shows the electrical connections and components that solve the problem.

Product

- Deployment ready device
- Patches signals with fidelity
- Meets all design requirements

Issues / Improvements
- Solid state relays unable to drive 50Ω loads
- 0.1" pin headers in addition to BNCs
- More intelligible silkscreen
- RESTful API Control

Acknowledgments