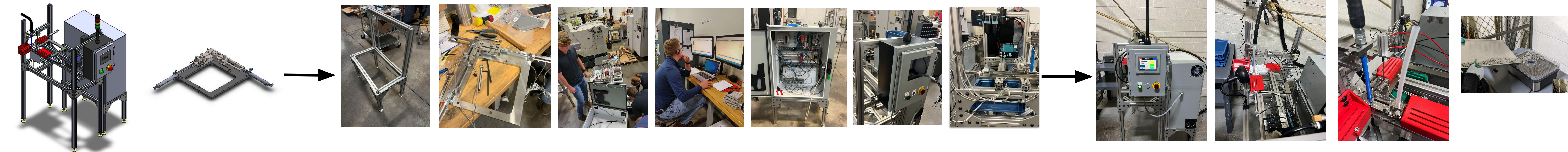


Team 15: Dry Ice Deburr Automation

Team Members: Lily Andrysiak, Logan Heft, Connor Finkel, Benjamin Marth, Zachary Hasse, and Andrew Latunski

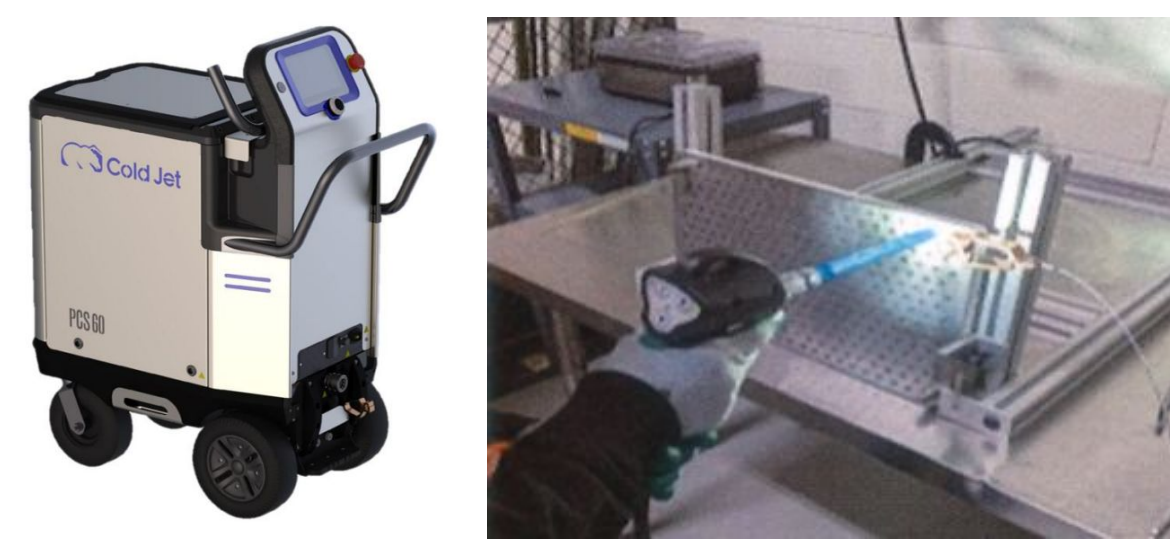
Faculty Advisors: Dr. Ryan Krauss, Dr. Wendy Reffeor, and Dr. Christopher Pung

Sponsor: NN, Inc. **Sponsor Contact:** Joe Bollo



Problem Statement

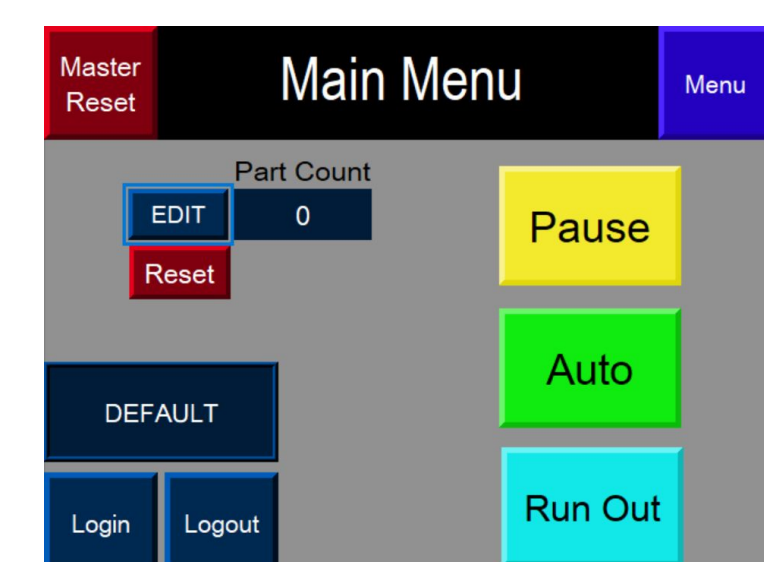
Automate the Dry Ice Deburring operation for a Valve Seat component at NN, Inc. to improve productivity and employee safety.



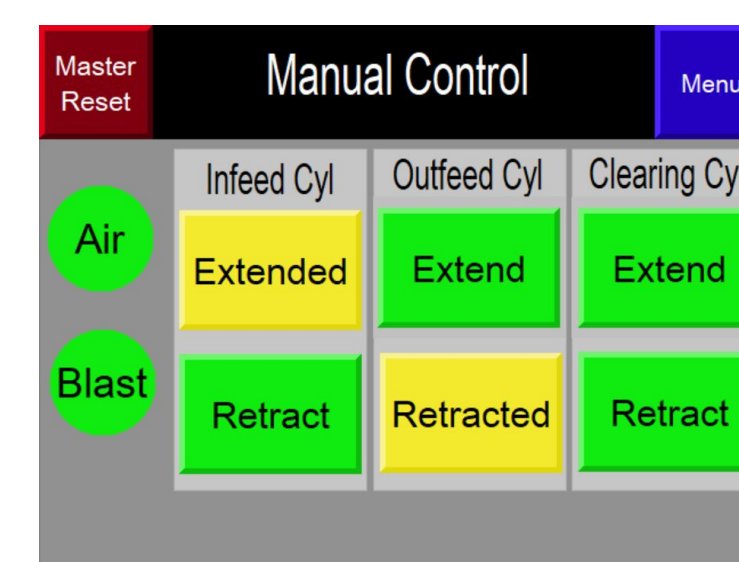
Existing Manual Operation

Controls Design

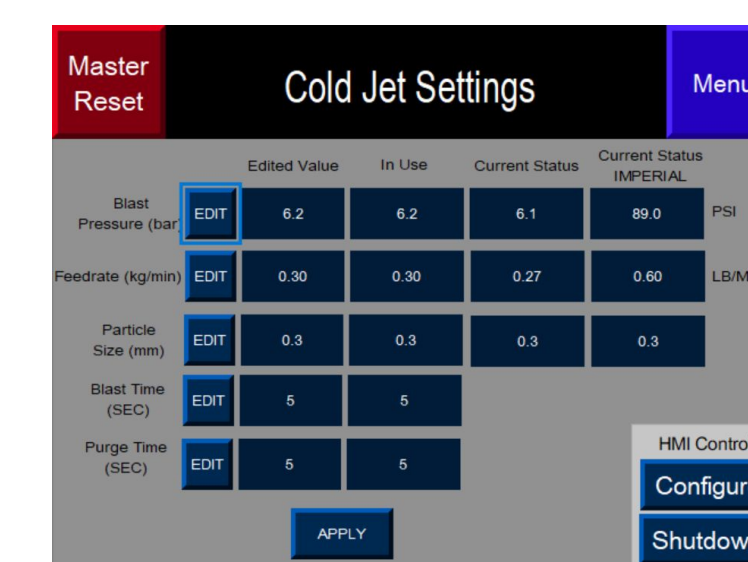
The machine is controlled by a CompactLogix 5370 PLC. One I/O module with 16 ports interfaces the PLC with the automation electronics such as the Keyence sensors, pneumatic cylinders, stack lights, safety relay, HMI, E-stop, and cycle start/stop buttons. The operator will interact with this automation cell through a Panelview Plus 7 HMI. This allows them to cycle start/stop, manually actuate the cylinders, and check and alter dry ice machine status and parameters.



HMI Main Display



Manual Mode



Cold Jet Parameters



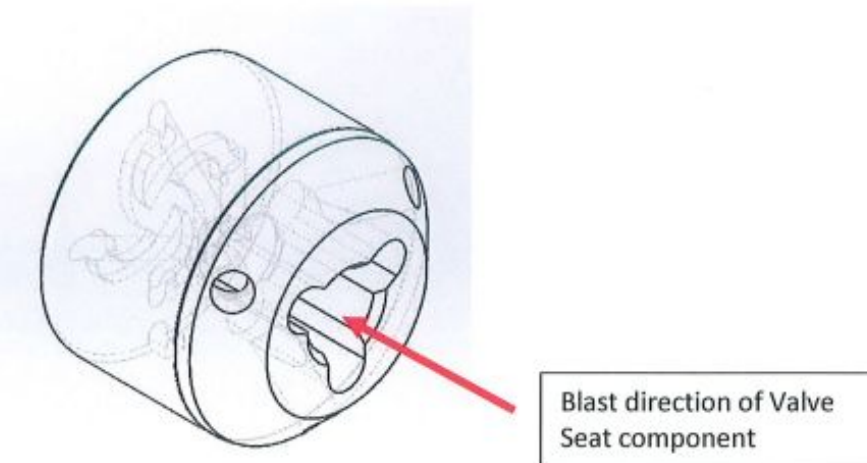
Control Panel

Mechanical Design

The primary mechanical component of this automation is the tooling plate. This plate consists of two blocks guiding the part between tightly toleranced channels (± 0.12 mm). The channels guide the part from infeed to blasting to outfeed. Each channel is covered to maintain the parts orientation from the bowl feeder.

Key Specifications

- \$25,000 Budget
- Single piece flow while maintaining orientation.
- Target cycle time of less than blast time +5 sec. per part.
- Dry ice blast gun to operate at 1/8 - 1/4 inches away.
- Sensors to verify part flow throughout the machine.
- Machine communicates with existing Cold Jet dry ice machine to initiate blasting.
- Machine to have an HMI for cycle start, stop and required safety relays.



Blast direction of Valve Seat component

Testing Results

Final testing of the automation was a 2000 part runoff to verify a cycle time less than blast time +5 sec. per part. With a 5 sec. blast time, the cycle time was 9.5 sec. per part, validating the specification. This includes a 5 minute defrost every 100 parts to combat ice buildup.



Final Automation



Blasting Plate