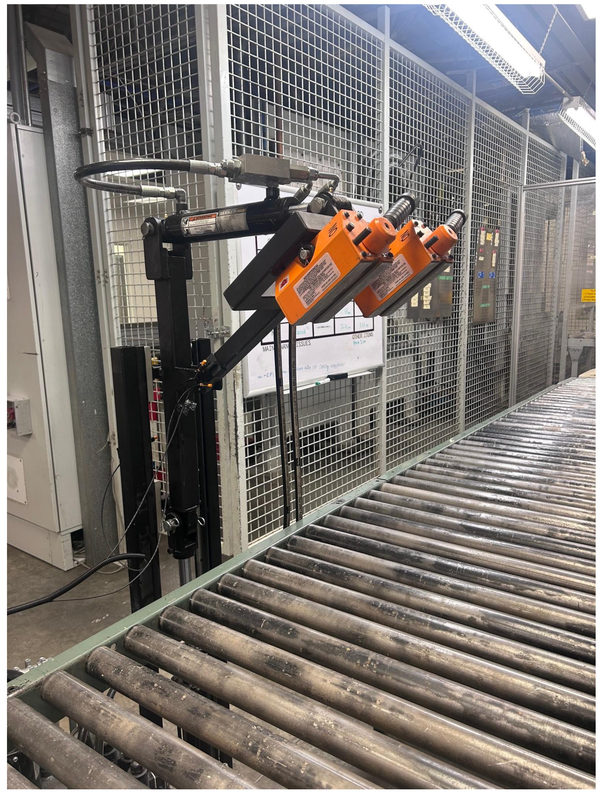
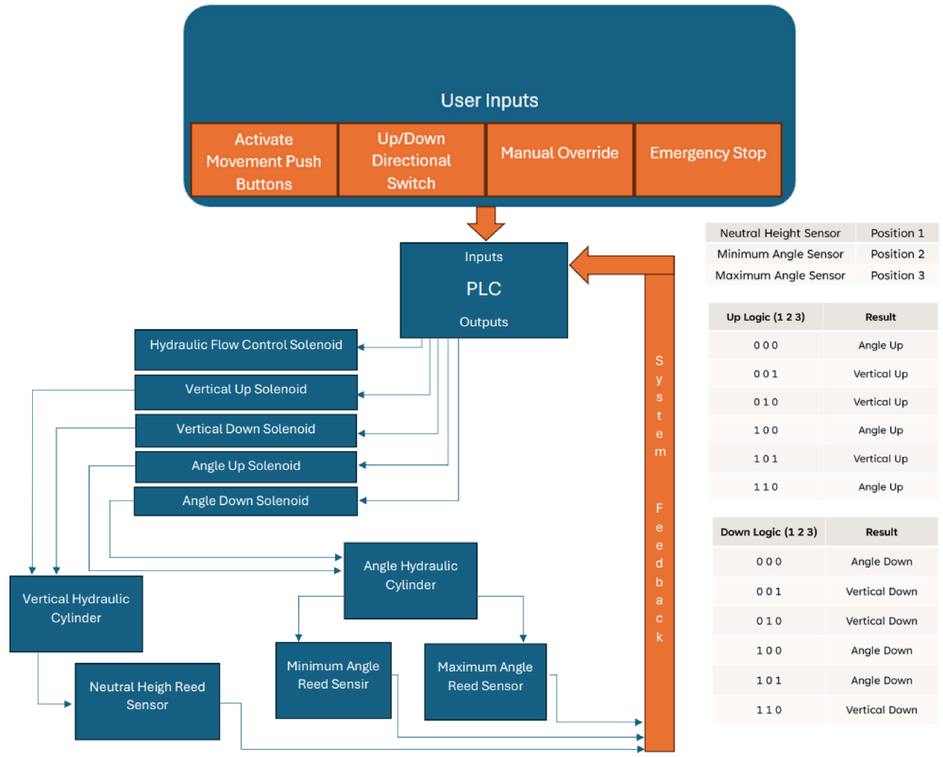
TTM Plate Lifter

Project

- TTM Technologies is a PCB manufacturing company. As part of the process of making multi-layer PCBs, resin leaks onto steel plates. These plates must be cleaned before they can be used again, or costly PCB defects will occur. For TTM Logan, defects due to improper cleaning of steel plates costs ~$100,000 per year.
- The Plate Lifter is an automated solution for cleaning the underside of the plates. This is accomplished by
  - Hydraulics for controlled lifting
  - PLC control for safety and automation
  - Lever-activated magnets for attaching plates to the lifter
  - Simple controls for operator use





Neutral Height Sensor	Position 1
Minimum Angle Sensor	Position 2
Maximum Angle Sensor	Position 3

Up Logic (1 2 3)	Result
0 0 0	Angle Up
0 0 1	Vertical Up
0 1 0	Vertical Up
1 0 0	Angle Up
1 0 1	Vertical Up
1 1 0	Angle Up

Down Logic (1 2 3)	Result
0 0 0	Angle Down
0 0 1	Vertical Down
0 1 0	Vertical Down
1 0 0	Angle Down
1 0 1	Angle Down
1 1 0	Vertical Down

Methods

- Design & Engineering
  - Developed a custom steel frame for structural support
  - Integrated hydraulic cylinders to lift steel plates
  - Used lever-activated permanent magnets for secure attachment, even in event of power outage
- Control System
  - Programmed a Siemens S7-1200 PLC
  - Implemented Ladder Logic for control sequencing
  - Used reed switches for positional feedback within control sequence
  - Designed an operator interface for simple, safe control
- Testing and Validation
  - Verified Lifting capacity under maximum load
  - Ensured safe operation under simulated emergency situations such as earthquake and power outage

Conclusion

- The TTM Plate Lifter met all design goals, providing a safer way to clean steel plates
- Testing showed consistent, stable ability to lift the plates
- Through this process I learned
  - Hydraulics for controlled lifting
  - PLC control for safety and automation
  - Lever-activated magnets for attaching plates to the lifter
  - Simple controls for operator use
- Future Improvements
  - Hydraulics for controlled lifting
  - PLC control for safety and automation
  - Lever-activated magnets for attaching plates to the lifter
  - Simple controls for operator use

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