

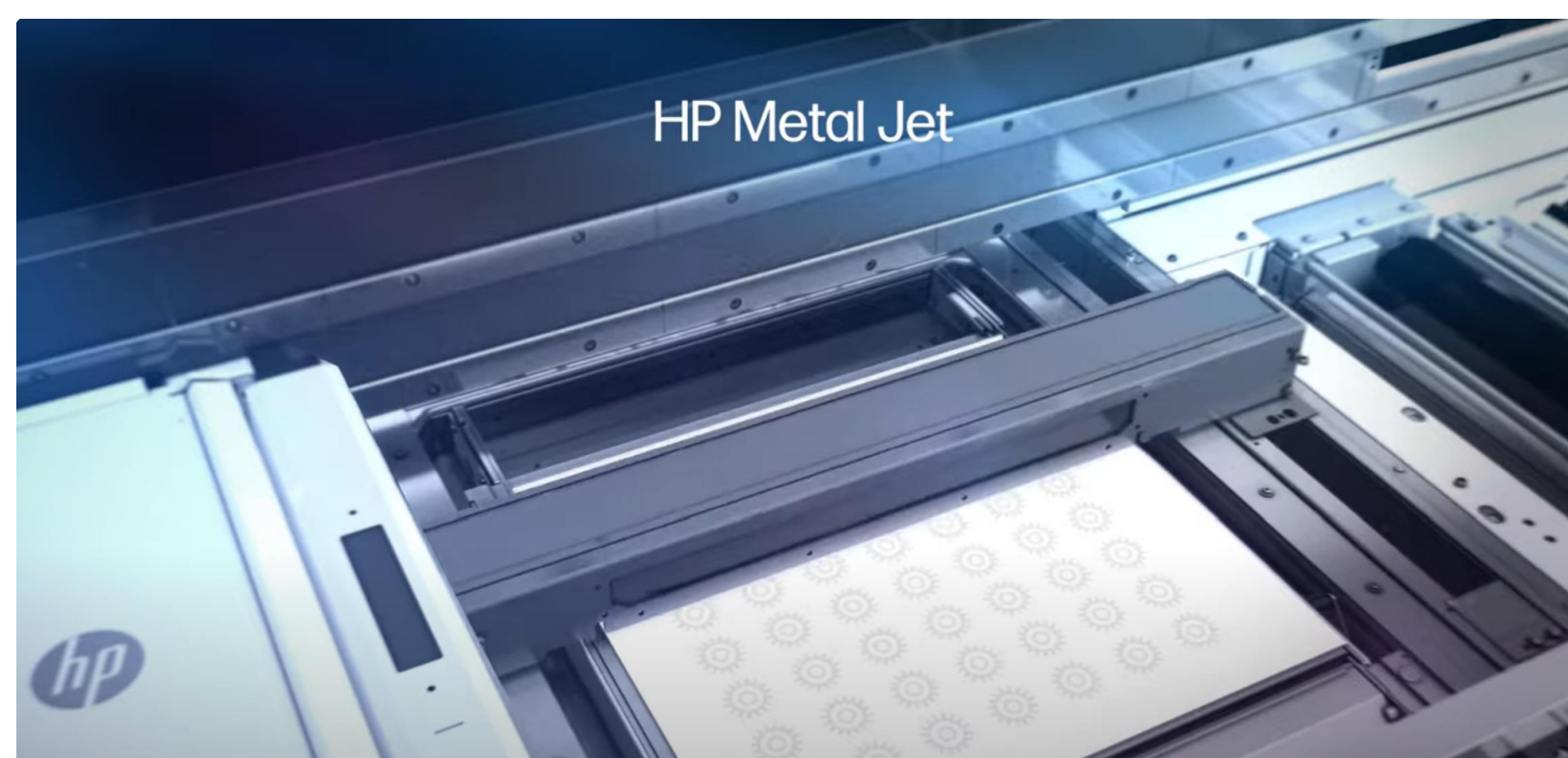
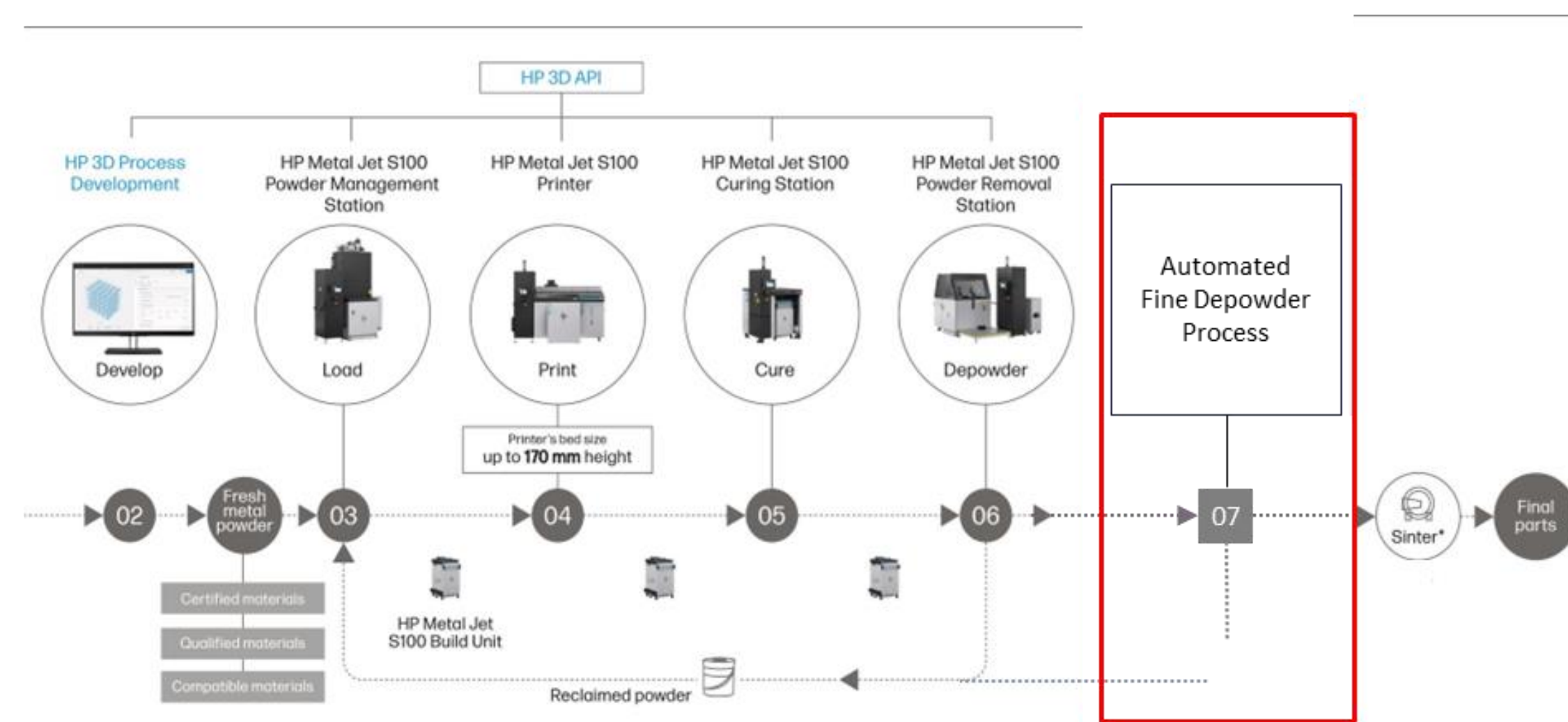
Metal Binder Jet Fine Depowdering Process

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OBJECTIVE

Research and develop a prototype system to remove fine powder from metal binder jet parts. Investigate automation opportunities for part movement, part evaluation, and overall process control.

This project was conducted as part of the engineering technology senior capstone course. The partnership with Eaton cooperation contained a non-disclosure agreement which limits the details that can be shared about the development and final findings of the system developed.



CUSTOMER PROBLEM AND BACKGROUND

What industries utilize parts created from this process?

- Automotive
- Defense
- Electronics
- Medical

What does the customer need?

- A reduction in process times
- A highly repeatable process
- Automation which accommodates the engineering constraints.

What are the engineering constraints?

- Parts being processed can sustain 10 Mpascals max
- Parts being processed can sustain 35 psi of air pressure
- Current process time for 160 parts is approx. 8 hours

CONCEPTS AND EXPERIMENTATION

Process Methods In Similar Products Are:

- Compressed Air Jets
- Vibration apprentices
- Turn Tables
- Soft Bristle Brushes
- Ultrasonic Atomizer
- Fluid Based Powder Removal

Experimentation:

- Air Jet Orientation
- Vibration Medium
- Powder Containment Systems
- Automated Features



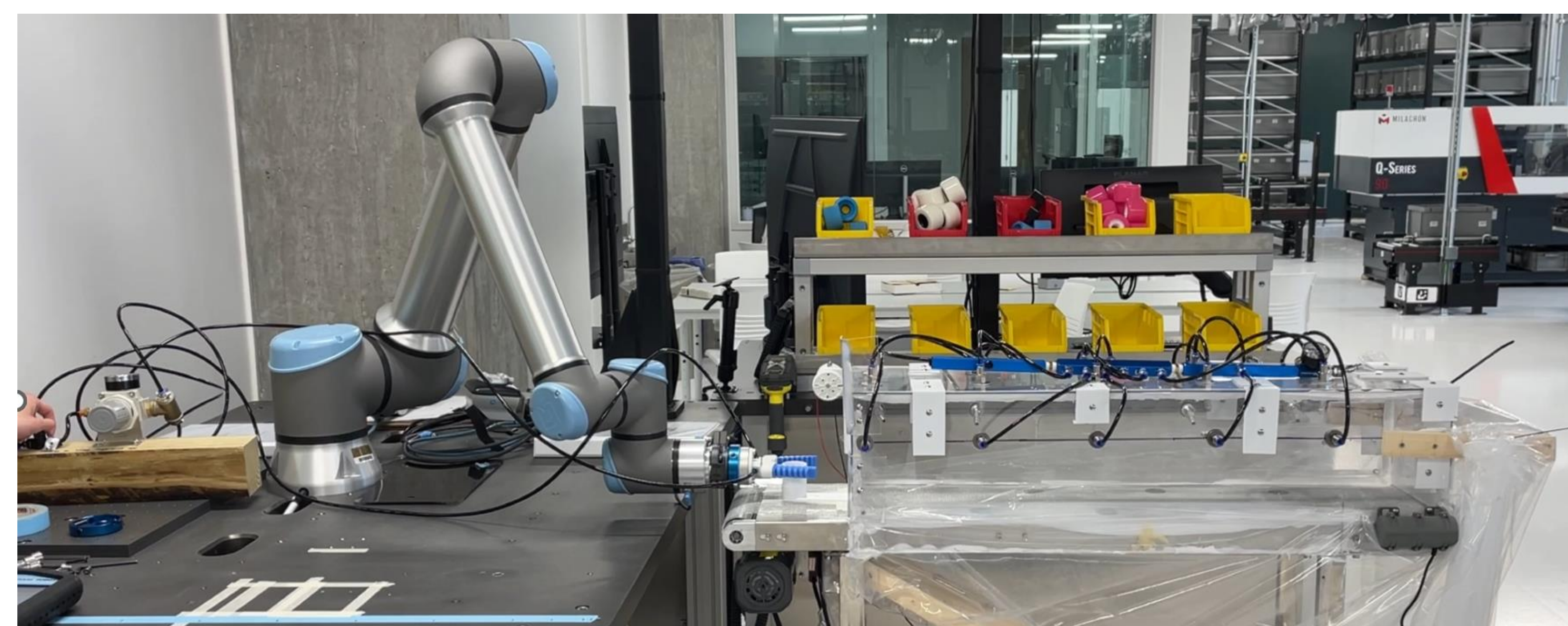
REQUIREMENTS AND FINAL DESIGN

Requirements:

1. Impart less than 10 Mpascals on part
2. Batch process time < 8 hours
3. Removal of 75% powder by mass
4. Collection of 75% powder for recycling
5. Removal of 20% of the human based labor time

Final Design Components:

1. Conveyor Belt
2. Air Jet System
3. Dust Collection System
4. Microcontroller Based Controls
5. Pneumatic Actuated Gripper
6. UR-10e Co-Bot



TESTING RESULTS

- 42% Powder Removal.
- Process Time : 200 min.
- Approx. 3.445 kpascals applied to the part.
- 30 psi output across air outlet system.

CONCLUSION AND RECOMMENDATIONS

Conclusion:

Our team feels that our prototype has proven a viable platform to address the automation needs during the metal binder jet process. This prototype does have many areas which can be improved which will result in the design expectations being more closely met during the next revision.

Recommendations:

- Utilize more industrialized components.
 - Robotics
 - Programmable Logic Controller
 - Powder Containment | Shaker Table
- Improve wiring connections for durability.
- Implement sensing components to increase the adaptability of system.
- Investigate optimization of air flow.
- Investigate computer vision as an evaluation technique for part cleanliness.
- Investigate the further integration of robotics and automation to decrease overall process times.