Purdue Polytechnic SOET - Team 57

MOLD-A-RAMA

PURDUE UNIVERSITY

Polytechnic Institute

Troy Crooks, Matthew Gammon, Riley Sinclair, Kyle Anderson, Owen Connelly - ***Milton Edward Aguirre and Paul McPherson***

OBJECTIVE

The "Mold-A-Rama" is an old-fashioned novelty blow molding machine. They were commonly found in places like museums or zoos, utilizing injection molding to create souvenirs right before a patron's eyes. Our objective was to recreate this magic using an approach combining injection and blow molding in order to create Purdue related memorabilia. The goal was to create a prototype of the system that would then be further developed and displayed on campus.

CUSTOMER PROBLEM AND BACKGROUND

- Project initiated by Purdue Polytechnic's School of Engineering Technology.
- Direct client: Professor Paul McPherson.
- Team tasked with designing and manufacturing a blow molding machine, similar to the novelty "Mold-A-Rama" machines.

Expectations included:

- Researching the fundamental functions of blow molding machines.
- Understanding the injection process and mold dynamics.
- Studying traditional machine assembly and control systems.

Purpose of the project:

- Created by SOET to produce a displayable product for Purdue's campus.
- Professor McPherson aimed to showcase Purdue Polytechnic students' skills.
- Intended to inspire and engage both new and returning students.

CONCEPTS AND EXPERIMENTATION

Robotics:

- Responsible for mold interchange and removal of the finished part. Allows for multiple molds.

Hydraulics:

- Comprised the main structure of the table assembly. Controlled opening and closing of the mold faces.

Pneumatics:

- Powered by multiple solenoid valves.
- Delivered actuation to both the injection system and the robotic mechanisms.

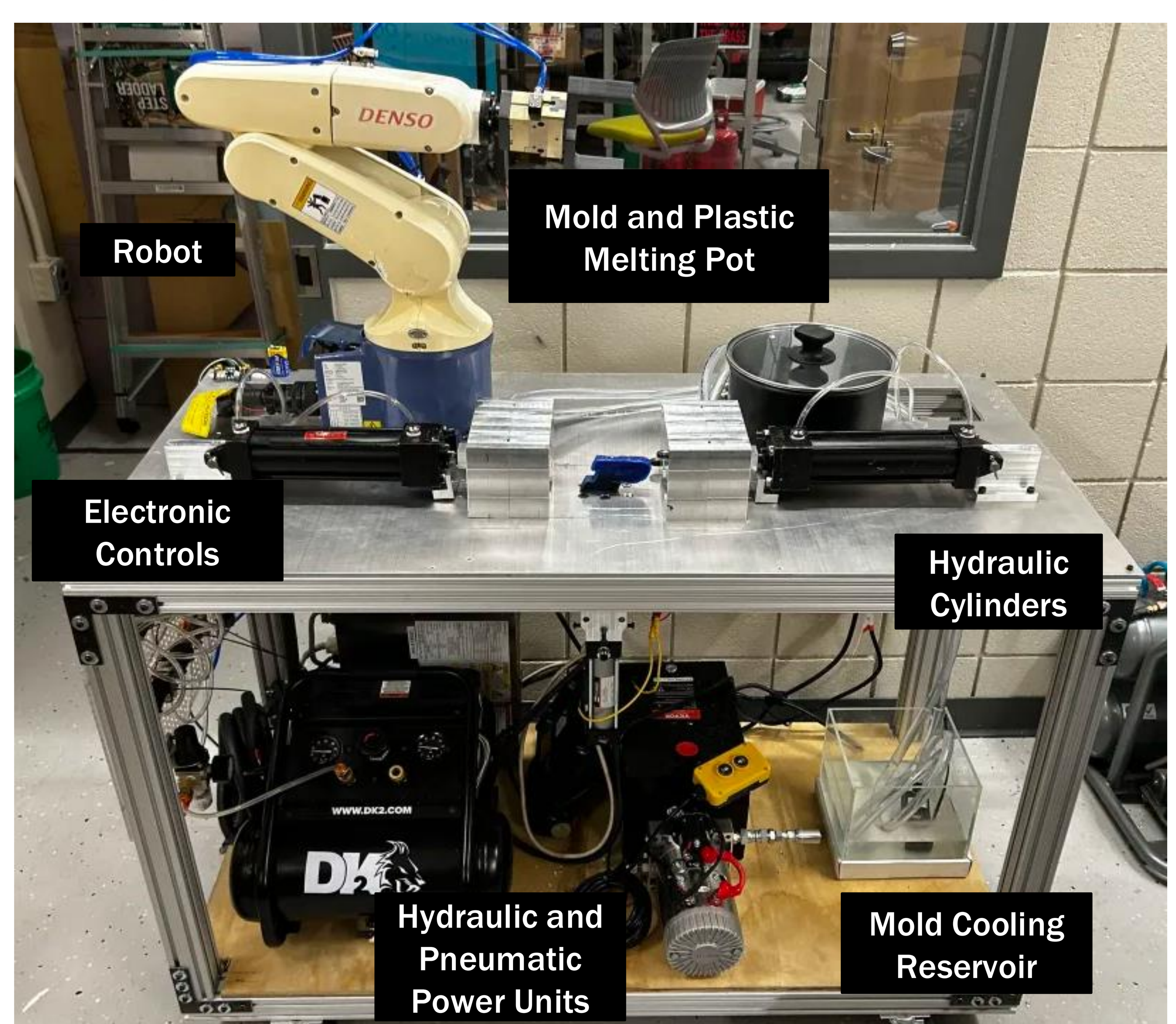
Injection System:

- Core of the machine, responsible for plastic injection.
- Drew molten plastic into the assembly and injected it into the mold.
- Final air shot ensured the plastic conformed tightly to mold surfaces.

Electronics:

- Distributed electrical power to all subsystems.
- Controlled solenoids operating the hydraulic and injection valves.

These systems were developed based on the original Mold-A-Rama machine, with the injection and robotics differing. The robotic arm was added as a flare and to allow for multiple molds, and our injector incorporates blow molding elements, as opposed to injection molding, to create a cheaper, lighter part. Each of these subsystems was first designed independently and then merged into a single CAD model for refinement. Standard and custom parts were ordered or fabricated, primarily at the Bechtel Innovation Design Center. Once the components were assembled, each subsystem underwent preliminary testing to ensure basic functionality. Subsystems were then integrated into the full model and tested as a cohesive system to evaluate performance at scale.



REQUIREMENTS AND FINAL DESIGN

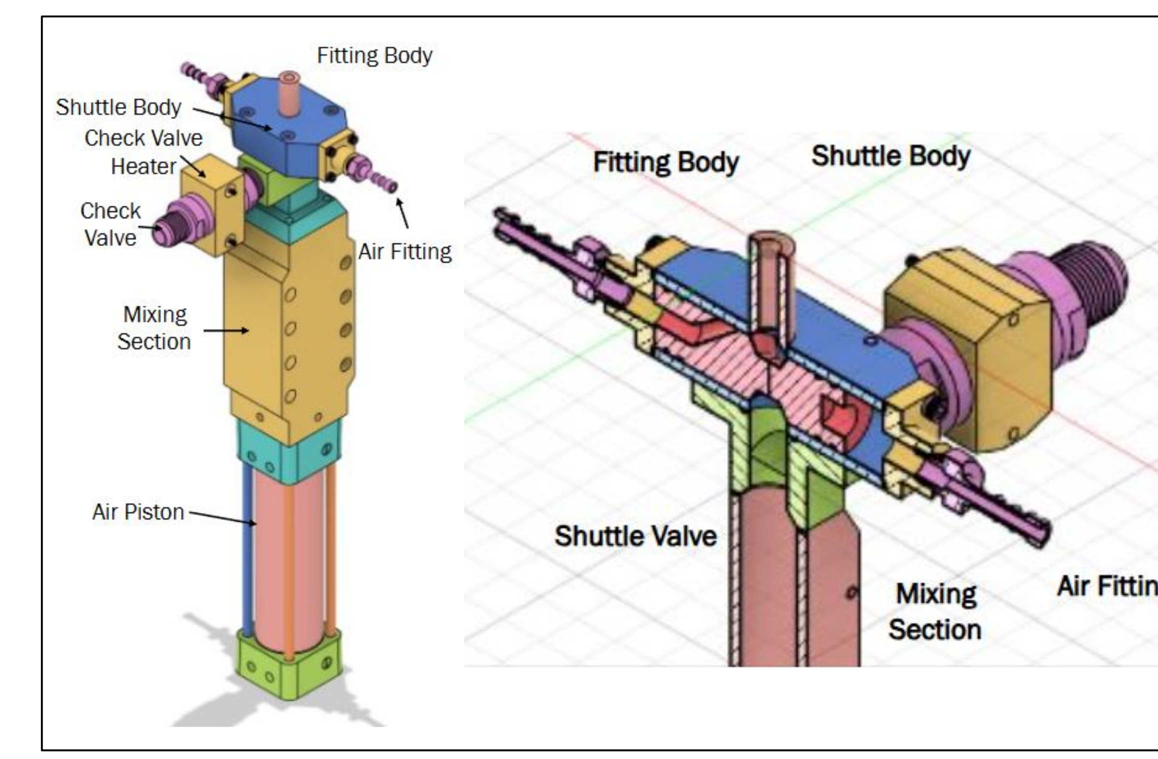
The main requirements identified for our design were:

- Create a blow-bolded part using molten plastic (HDPE or PP)
- Utilize a 120-volt power supply
- Must fit through a standard door (24"x48"x60") and be easily maneuverable
- Frame must withstand >200 lbs
- Molding process must be clearly visible
- All processes function within a safe enclosure
- Have an intuitive user interface
- Completed under a $2,000 budget
- Capable of interchangeable molds
- Utilize as many standard parts as possible
- Integrate both hydraulic and pneumatic systems
- Focus on documentation for future iterations and developments

The testing of the machines involved checking individual functionality of the subsystems. The main goals that we accomplished in testing were:

- *Heating Components to 400°F*
- Pressurizing pneumatic lines to 60 psi and hydrailic lines to 120 psi
- Pumping water through each mold cooling block
- Actuating injector and display ejection of fluid

TESTING RESULTS



CONCLUSION AND RECOMMENDATIONS

We believe that this project became a good showcase of the skills developed during an SOET degree, which was the goal as given by Professor Paul McPherson. The experience encapsulates the process of completing an industry project from start to finish.

Due to some unfortunate circumstances, not all components are present on the final assembly, meaning that the final functionality of the project is limited. Currently, though the connectivity of the project in minimal, has been shown to operate independently, including:

- Actuation of the hydraulic cylinders in sequence
- Pneumatics retaining full power to each solenoid
- Electronics having full control over individual solenoids
- Plastic injector actuates in sequence without leaks.
- Injection system reaching minimum temperature (400°F)

Moving forward, the next steps of the project is to finish the connectivity of the components and solidify testing of the injection system. Due to limitations of the plastic holding pot, a full injection of plastic has not been completed, and is the next item on our list of items to finish.