Purdue SOET Team #23

3D Printer Design

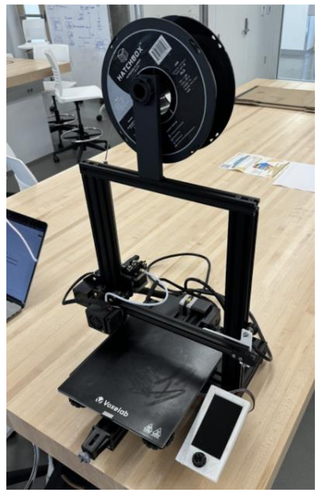
Seth Troyer, Max Ringger, Caitlyn Porter, & Braden Bearman
Mentor: Dr. Fred Berry

PURDUE UNIVERSITY
Polytechnic Institute

OBJECTIVE

The objective of this project was to redesign a 3D printer that was originally designed by a previous capstone group. The design was meant to be efficient and easily manufacturable in the Purdue Smart Manufacturing Lab. This may include reducing the number of components and creating a sort of "recipe" that can easily be followed to improve the efficiency of the manufacturing process.

This senior capstone project was conducted by Seth Troyer, Max Ringger, Caitlyn Porter, and Braden Bearman. For further information regarding the design and components of the printer, please reach out to us via email at TroyerS@purdue.edu , MRingger@purdue.edu , PorterCg@purdue.edu , or BtBearma@purdue.edu .



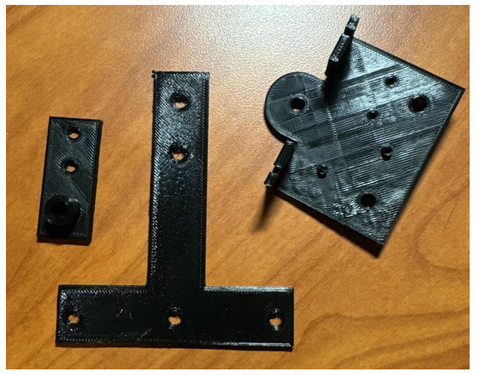
CUSTOMER PROBLEM AND BACKGROUND

The problem we were tasked with to solve consisted of improving the manufacturability of a 3D printer. We were given an original printer along with the bill of materials. Our goal was to rebuild the 3D printer by ordering our own parts, and search for ways to make the process easier and more efficient. After searching for better parts, we were then asked to create a "recipe" that could be used to break the printer down into subsections. We chose 4 subsections: the base, vertical support sections, the x-axis cross member, and the controller. This recipe of subsections would be used to make the manufacturing process much smoother in the Purdue Smart Manufacturing Lab. After diving into the project, we learned that a large portion of the bill of materials was missing, therefore we were required to take a step back and redesign the printer. By utilizing web searches and CAD designs, we were able to complete the printer and solve the issue at hand. We decided to change a multitude of parts from the original printer's design to make the printer easier to assemble without sacrificing the usability of the printer.

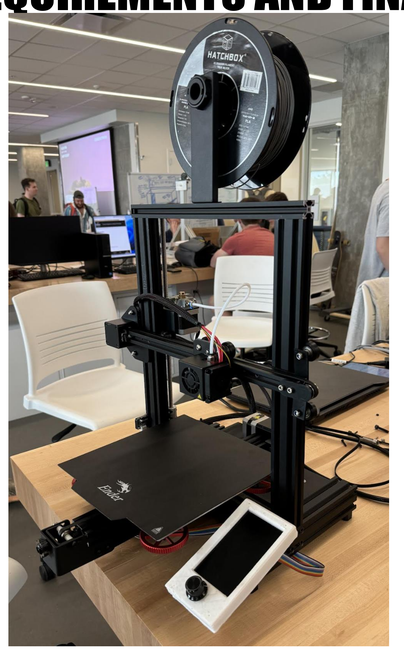
CONCEPTS AND EXPERIMENTATION

A lot of experimentation took place throughout this project, especially in the parts we designed using CAD software. A multitude of brackets needed for this printer were very difficult to find for purchase, therefore we decided to simply create our own. We first designed the parts on CAD before using additive manufacturing to create a prototype. This prototype was used to ensure that all of the hole placements were correct. Now that the parts have been properly tested, the files can now be used to manufacture the parts out of steel or aluminum using a CNC machine. Another example of experimentation throughout our project consisted of drilling at tapping the aluminum extrusion in order to fasten all of the chassis together. We utilized the resources at the Bechtel labs to precisely drill the holes and thread them using a hand tap.

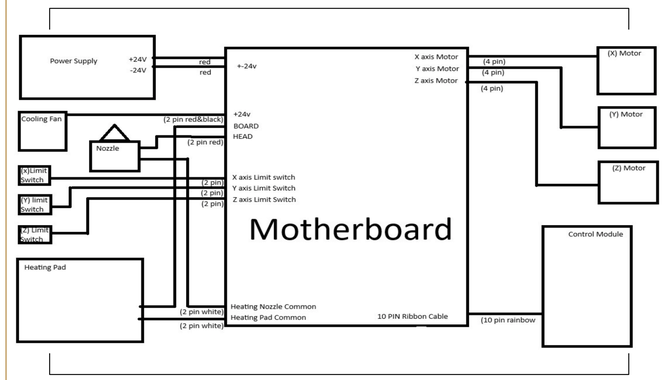
A majority of the project consisted of ordering a multitude of fasteners for all the brackets and components within the printer. The assembly of the newly designed 3D printer required most of our attention this semester. The process was not linear throughout our experience because after completing different sections, we would find better ways to assemble, therefore causing us to back track often throughout the duration of this project. This was highly expected throughout the project because our goal was to not only build the printer, but find as many ways to improve the design and manufacturability of the printer.



REQUIREMENTS AND FINAL DESIGN



TESTING RESULTS



CONCLUSION AND RECOMMENDATIONS

This project has been a fun and very challenging experience. After all of the hardships we have faced throughout this project, it is extremely rewarding to see the final design of the printer come together. A very important recommendation about things we have learned would be to stay organized throughout the project. In a project like this one, many parts will be arriving at different times, therefore you need to keep them organized to improve the efficiency of the manufacturing process. If all of the parts get mixed up, it is easy to use the wrong screw for the application. Given the difficulties we faced with the incomplete Bill of Materials, we are very happy with the progress we completed this year. Our goal halfway through the project was to redesign the printer with a complete bill of materials and recipe for assembly and are very happy to have completed this goal. After completing the design, we found a few more design improvements that we wish we would have used at the start, therefore we will be adding these recommendations into the final gate reports to relay this knowledge to the next team conducting this project.