3D Printer for Cementitious Material

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Background

Cementitious printers allow for structures, such as houses, to be built quicker and less expensively than traditional methods while also requiring minimal human labor. Cementitious 3D printers are capable of printing single and multiple layers, and patterns, to create complex geometry not possible by traditional methods.



Figure 1: Rendering of possible uses for a cementitious 3D Printer

Objective

The project focuses on the development of a 3D printer for cementitious materials with a 10-foot length in the x, y, and z direction. Previous teams have built the gantry and electrical system along with coding, but further progress needs to be made to complete and refine these aspects. The work focuses on the extruder, gantry, coding, and testing.

System-Level Requirements

No.	Requirement	Performance Objective
1	Printing Materials	Cementitious Mixes
2	Printing Volume	10ft x 10ft x 10ft
3	Automation	Minimal Interaction
4	Printing	Multiple Layers
5	Accuracy	1cm Error Margin
6	Modular	Rapid assembly

Design Approach

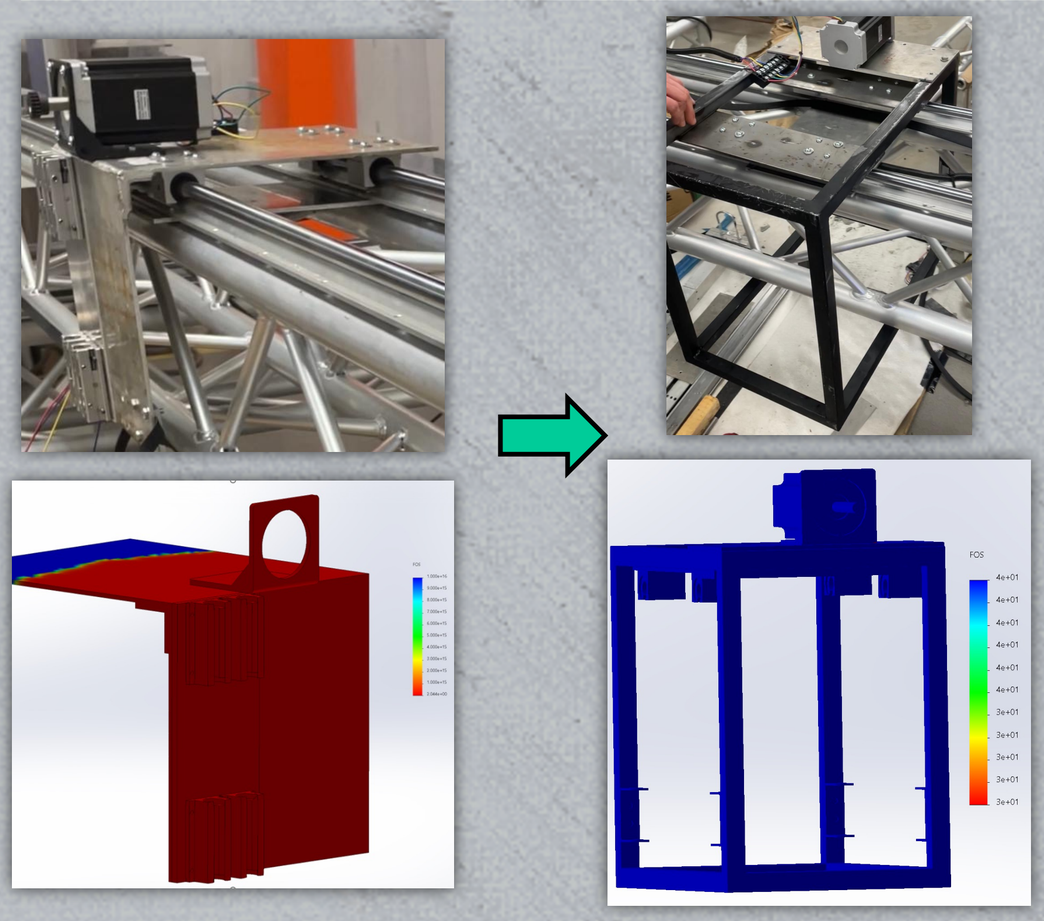


Figure 2: Previous z-axis bracket and FOS of 1-3 (left) and the newly made bracket with a FOS of 30-40 (right)

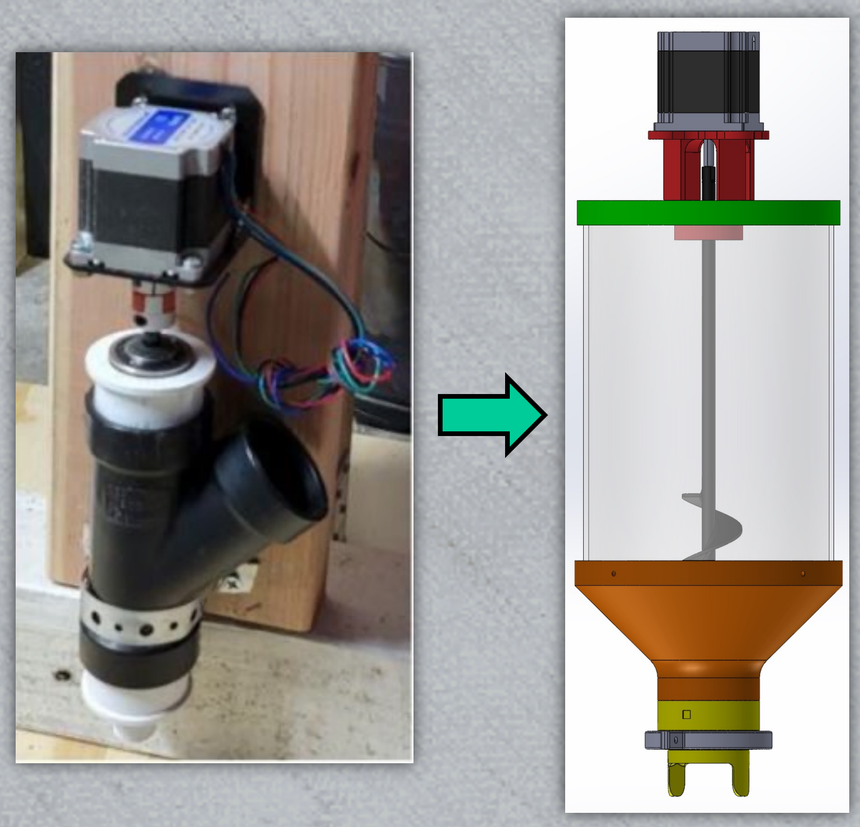


Figure 3: Previous extruder and the newly made extruder consisting of 3D printed parts

As a continuation project, the design approach was to assess the printer's status and then complete and improve upon the aspects of the printer to have minimal human interaction needed for autonomous printing. Notable improvement needed to be done on the extruder, overall gantry, electronic components, and the pump integration. The printer's viability would then be empirically tested through the use of various test prints as well as the use of different cementitious mixtures.

Results



Figure 4: Several layers printed consecutively with different cementitious mixtures which exemplify the printer's capabilities

Conclusion

To conclude, the results obtained was to allow a print of several layers over another the improvements to the 3D printer are the new Extruder which contains a longer logger to allow more mix to come out at a constant rate. The Reservoir was design to hold more volume per load and the High Flex pump will be attached to the extruder to allow the passage of the concrete mixture. The gantry obtained a bracket attachment which will stabilize the load in the Z-axis and will avoid any vibrations that the gantry system may obtain. The team also determined on the printer being ready to be raised to its full length.