Economical 3D Bio-Printer

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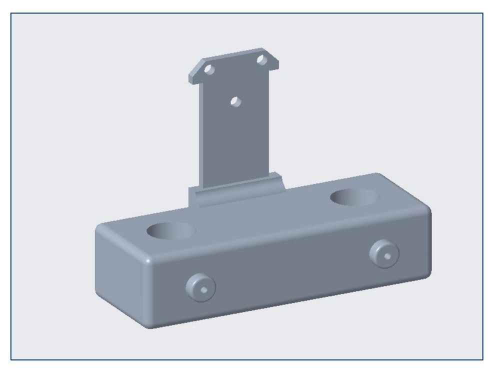
Motivation

To construct an affordable 3-D bioprinter that can print biomaterial at a fraction of the cost. This will allow for bioprinting to become much more versatile and available.

Methodology

❑Custom Extruder Design

The pneumatic system required a custom 3D printed part to house the dual extruding syringes. The part was designed to fit on to the carriage plate replacing the original extruder that came stock on the printer. The extruder features space for two separate syringes at once and holds them securely in place.

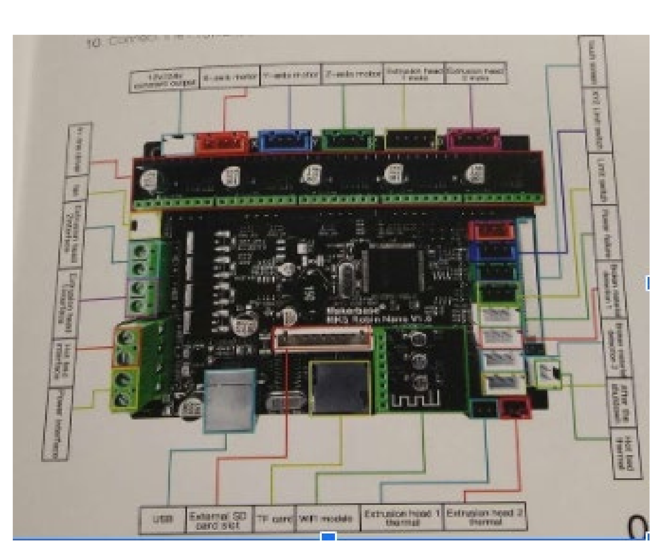


❑Gantry Design

The gantry used in the project came stock on the Two Trees Saphire Pro being modified for the project. The gantry is capable of printing with an accuracy of 0.01mm and a maximum printing speed of 300mm/s, which makes it a great candidate for speed and precision bioprinting.

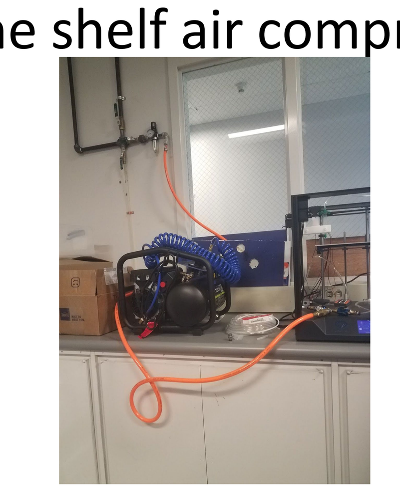
❑Control Systems

The control systems for this project came mostly premade. The new extruder was wired to the leads of the old extruder so that no external power source was required. Modifications to the printer boundaries were made in the code to account for the new extruders size.



❑Pneumatic Extrusion System

Any pneumatic system must have some sort of compressed air. The pneumatic circuit for this printer utilizes a normal off the shelf air compressor as the power for the system.



It is very important to be able to control this pressurized air. This was accomplished using pressure regulators and solenoids. Using regulators, the pressure flowing into each syringe can be customized for the specific material inside of it. The solenoids allow for control of the pressure flow. The solenoids were integrated and controlled through the stock board that came with the 3D printer. When the solenoids are switched off, the pressure flows through the syringe and extrudes material. With the solenoids on, the pressure exhausts to the atmosphere and causes the extrusion to cease. The solenoids are basically the on/off switch for the airflow. Controlling this airflow is what allows for precise material deposits when forming shapes or structures.

Results/Discussion

There were some minor issues that we were faced when trying to integrate all the parts. With some simple resolutions, we were able to get the printer working.

Conclusion

The printer can extrude air through the solenoids which will help push out the biomaterial onto the heated bed. Different files can be uploaded for printing and as well material for printing.

Future Implications

By researching and developing 3D bio-printing technology, the accessibility of this technology will drastically begin to increase. As the technology becomes more common and affordable, it will be able to positively impact more and more people that need its life-saving potential. The printer developed for this project will be WCU's first step into its research of this incredibly important field of study.

Acknowledgements

We would like to thank Western Carolina University and Dr. Nazmul Ahsan for this opportunity to work on this project.