

AFFORDABLE METAL 3D PRINTER

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Problem Statement

Additive manufacturing is a growing branch in manufacturing which still has a room for improvement. To produce a part using additive manufacturing for metals require expensive equipment and special place to produce a part. The process usually takes a great amount of time and is produces using powder-based metal that can affect the air quality. Due to the price of the machines needed this process is not available to students by the University of Guelph.

Objectives

- Objective of this project is to reduce the price of the additive manufacturing process by doing so this will help students and creative minds to 3D print as well as visualising their ideas.
- Quick printing to allow easier prototyping.

Background Information

- Additive manufacturing also called 3D printing and it makes a use of stepper motors for precision.
- An extruder fed with the material follow the shape pattern line by line from the ground up.

Approach to Solution

- For the device to be able to satisfy all the design objectives a metal wire would be used and heated to drop metal in layers as done in plastic 3D printer since there print speed is relatively fast.
- A heating element need to be used that can reach the melting temperature of the metal.
- Tin has a low melting point of 235°C and reliable mechanical properties for small projects.
- Plastic 3D printers reach temperatures higher than the melting temperature of tin.

Design Solution

- The solution makes use of an already existing technology and modifying it to solve the problem faced.
- Changing the nozzle of typical plastic 3D printer from copper to steel so tin does not stick to it.
- Adding a heated printing bed that can gradually reduce the temperature of the metal to stop mechanical failure due to sudden contraction of the metal



Conclusion

- The design reliably allows students and creators to have access to a cheap metal printing solution.
- The use of a steel printing nozzle will allow the printer to use various type of materials for printing that include tin or a combination of other metals that melt at such a low temperature.

Future Work

- The resistant heater can be replaced by an induction heater in order to print metals like iron, cast iron, etc..
- The printer dimensions can be changed and scaled for bigger or smaller applications of metal printing.