Acknowledgment

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Filament Recycling Machine

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Introduction

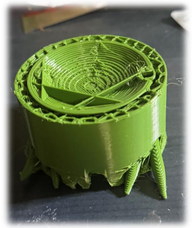


Figure 1: Incomplete 3D Print.

Figure 2: Box of PLA scraps

3D Printing is a fun hobby. But you know what's not fun? Wasted filament. 3D printing produces a lot of plastic waste that adds up over time, especially if you own a multicolor 3D printer. It can be from failed prints, support material, purged material, or just parts you don't want anymore. Instead of throwing it all away, there's a way to recycle all your scrap filament and turn it into fresh new filament that you can print with.

Background

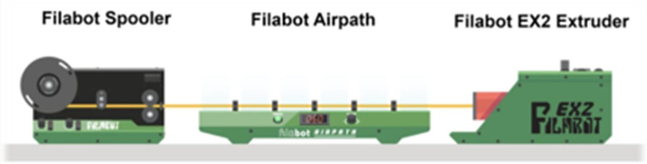


Figure 3: Filabot EX2 Extruder. Used by Professor Matthew Burnett

This is a filament extruding machine made by Filabot. Filament scraps are shredded and then are inserted into the extruder on the right. The filament is then extruder and travels through the many fans in the middle to be cooled down. After being cooled, the filament is spooled using the spooler on the left and then the filament is ready for use.

Filament made from the Filabot Extruder. Parts of the filament has bubbles in it, making it hard to use in a 3D Printer. This is caused by moisture being absorbed into the filament. Fluctuating temperatures is a problem as well.

Capstone Objective

Make a filament extruder machine that fixes some the Filabot's problem and compare their results.

Design Requirements

Category	Criteria
basic	Recycle PLA
basic	Has no moisture problem
basic	Tolerance of ±0.03mm
basic	1.75mm diameter
basic	User Manual
performance	Fit in a small space
performance	Quick recycling
performance	Minimal User Input
performance	Hatchbox like quality
excitement	Process other plastics

Preliminary Analysis

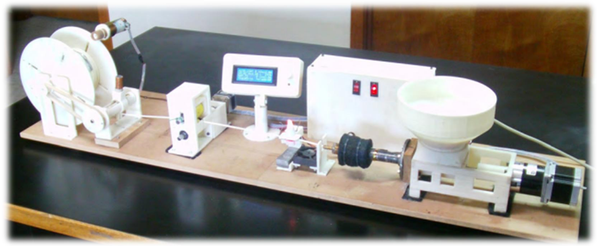


Figure 4: Filament Extruder by Hugh Lyman on Thingiverse

This is a filament extruder machine on Thingiverse in which my project is based on. Most of the layout is the same with some changes like a different spooler, roller instead of a pulley, different extruding base and an additional fan.

Budget

Item	Quantity	Cost
Band Heater 120V	1	$38.89
Plastic Shredder	1	$273.40
Nipple 4"x1/2" NPT steel pipe (44615K464)	1	$2.80
Coupler 1/2" NPSC steel (46685K264)	1	$5.52
2004 LCD Smart display Screen	1	$12.99
4 Pin Green Terminal Block	1	$3.95
Thrust Bearing 1/2" ID (6655K17)	1	$3.97
Sleeve Bearing (6391K241)	1	$2.09
5/8" x 17" Auger Bit (Size 10/16")	1	$17.78
1/2" NPT x 1/4" fit	1	$6.99
1/4" NPT x 1/8" fit (2 pack)	1	$8.67
1/2" MNPT to 1/4" FNPT adapter	1	$6.19
Welding Blanket	1	$13.95
Flange Floor	1	$5.95
12V 10A 120W Power Supply	1	$13.99
100K ohm Thermistor (W/ PTFE sleeving)	1	$3.75
120V rocker switch 2 pack	1	$3.55
12 V rocker switch 5 pack (green)	1	$6.99
250V power inlet 1 pack	1	$7.29
Filament diameter sensor (Assembled)	1	$25.00
Nema 23 geared stepper motor 15:1	1	$72.99
Total shipping	1	$94.22
	Total:	$630.92

Construction

Shredder

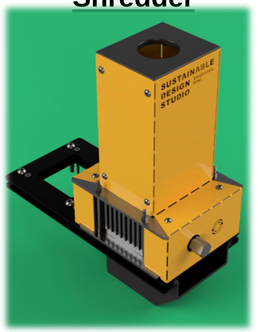


Figure 5: Plastic Shredder made by Sustainable Design Studio

Figure 6:(Left) Shredder turned by using 19mm wrench, (Right) Box of shredded filament

My Machine

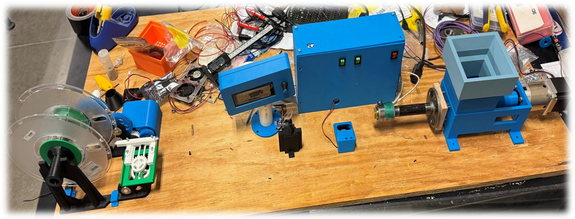


Figure 7: Assembled Filament Machine

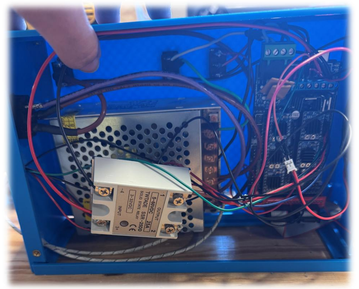
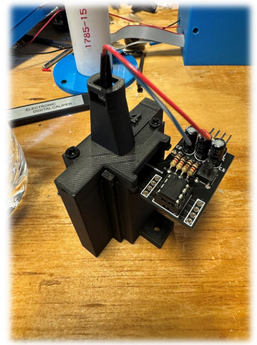


Figure 8: Machine Wiring

Results



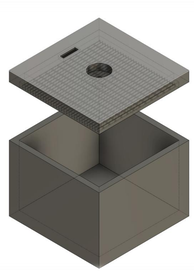


Figure 9:(Left) Diameter Sensor, (Right) Box to dry shredded filament

The diameter sensor is to measure the diameter of the filament being produced. Filament needs to have 1.75mm diameter. The box is to hold and dry the shredded filament. A hygrometer is inserted into the lid of the box to measure the percentage of moisture in the box. Small desiccant beads are inserted into the hole, and those help keep the filament inside the box dry.

Complications

References

Lyman Extruder: https://www.thingiverse.com/thing:380987