The Recyclops

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***Abstract* – The goal of the *Recyclops* is to convert recyclable plastics and rejected 3D printed parts into new filament spools. With a user-friendly and compact design, the appeal of this device focuses on hobbyists and small businesses. To accomplish this, the material undergoes multiple stages of shredding, melting, extruding, and coiling. A user interface is implemented to display, and control rotation speeds and heating temperatures based on the type of plastic for optimal quality of the final product.**

I. Introduction

The rise and improvements of additive manufacturing in both the manufacturing industry and low-volume production hobby communities opens a new path for ideas to emerge. New products and techniques can assist the additive manufacturing processes usefulness and practicality while simultaneously driving down its undesired economic expenses. This new era also presents the urgency for green alternatives through reducing, reusing, and recycling. An attempt to apply this generation's green initiative in 3D printing is being made by few products currently on the market. However, they are unable to apply all necessary steps for filament conversion in a single, user-friendly device. The *Recyclops* aims to seamlessly accomplish the conversion from recyclable waste and failed 3D printed parts into new spools of usable filament in a single process and relieve the user from conversion inconvenience.

II. Methods and Materials

A. System Overview

The device incorporates the multiple stages in a compact design standing 0.48 meters tall and 0.83 meters long. It is driven by a 120VAC motor that is used to turn the shredder and extruder of the system via a belt-pulley drive train. Material is introduced into the shredder where steel blades grind the material into smaller-sized particles for optimal heating. They are funneled into an extruding barrel that uses a tapered screw to transport material through multiple stages of heating in preparation for extruding. Once material is at optimal melting temperature, it is extruded through an extruding nozzle and coiled onto a spool for 3D printing use.

B. Shredding

The shredder is made from Ultra-Strength High Carbon steel and controls particle sizing through a combination of blade design and a particle sieve. Until the particles are reduced to a size small enough for heating, they collect in a metal sieve and are picked up by the rotating blades. The shredder produces a torque of roughly 50.83 N-m to handle thicker plastic containers used to hold common household goods.

C. Heating and Extruding

The material is transported to the extruding nozzle by an auger rotating at 70 revolutions per minute (RPM) within the heating barrel. To avoid pressure build up, the auger contains a tapered, conical center. This eliminates air bubble entrapment that may negatively affect the final product. Heating of the material is carried out using five heater bands placed along the extruding barrel. Barrel temperature

is monitored using a thermal coupler that communicates with a proportional-integral-derivative (PID) controller for any temperature adjustments which are fed back to the heater bands.

D. Coiling

The coiler consists of three main parts, the spool, traversing mechanism and the cooling fan. As the filament exits the extruder it is cooled and guided onto the spool via the traversing mechanism. This mechanism ensures that the filament will be wrapped around the spool with no worry of entanglement. The spool can then be removed from the bracket for use with a 3D printer.

G. Environmental and Economic Impact

With only 25% of plastic produced in the U.S being recycled and 62% of Americans claiming a lack of knowledge prevents them from recycling correctly, this device can help alleviate the environmental stress on our planet caused by plastic waste[1]. The *Recyclops* also helps lower the cost associated with 3D printing. Where the average price of a spool for filament is $20, operating this device using recyclable plastics can lower it down to $0.10 per spool making 3D printing a cheaper hobby and tool for industries [3].

III. Conclusion

In all, the *Recyclops* clears a path for new ideas and interests in the additive manufacturing industry to grow. By establishing a new way to encourage correct recycling habits and incorporating multiple conversion stages into an easy to use, compact design, its implementation will have economic, environmental, and societal impacts

Work Done by Others

Some design tips and research was provided by the non-profit organization *Precious plastics* and their website which helped advance the team to achieve optimal results in a shorter time frame [2].

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References

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