3D Filament Recycler

Abdulaziz Abdulghafour
Marc Hsu
Nicole Tabac
Micki Yasuda

Overview

- Project Description
- Shredder
  - Design
  - Manufacturing
  - Final Assembly
- Extruder
  - Design
  - Manufacturing
- Spooler
  - Design
  - Manufacturing
- Extruder & Spooler Final Assembly
- Testing Procedures & Results

Project Description

- Financial Sponsor: W.L.Gore
- Advisor & Mentor: Chuck Vallance
- Design a 3D Filament Recycler for Fusion Deposition Modeling (FDM) Printers
  - 3 Main Functions:
    - Shredder, Extruder, and Spooler
  - Recycling PLA and ABS
  - Producing 1.75 mm diameter filament

Project Description

Figure 1: Shredder Assembly

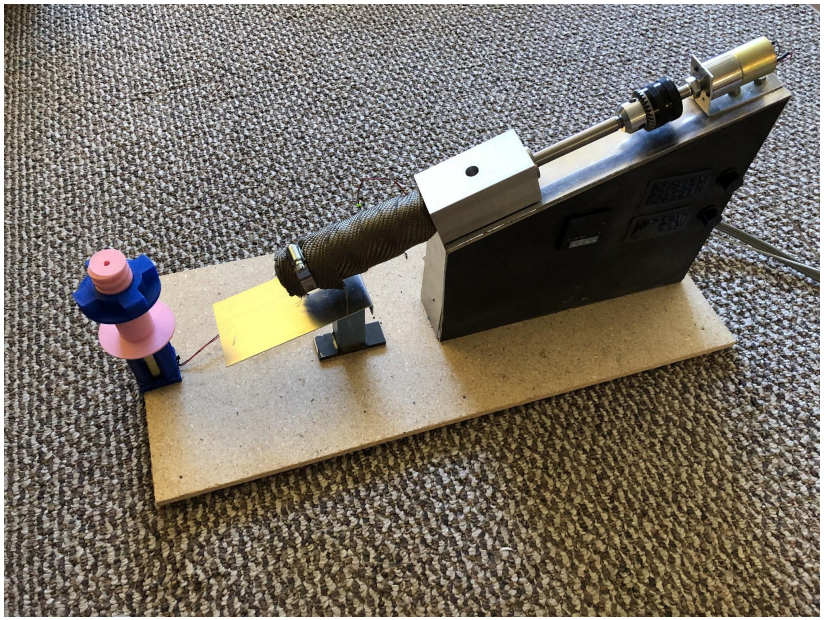

Figure 2: Extruder Assembled

Shredder Design

- Design Features
  - 9” x 11” x 12”
  - 1:1 gear ratio
  - CNC shredder teeth
  - Shafts with keyway
  - 3D printed (PLA) gears
  - Hand crank
  - Includes drawer to catch filament

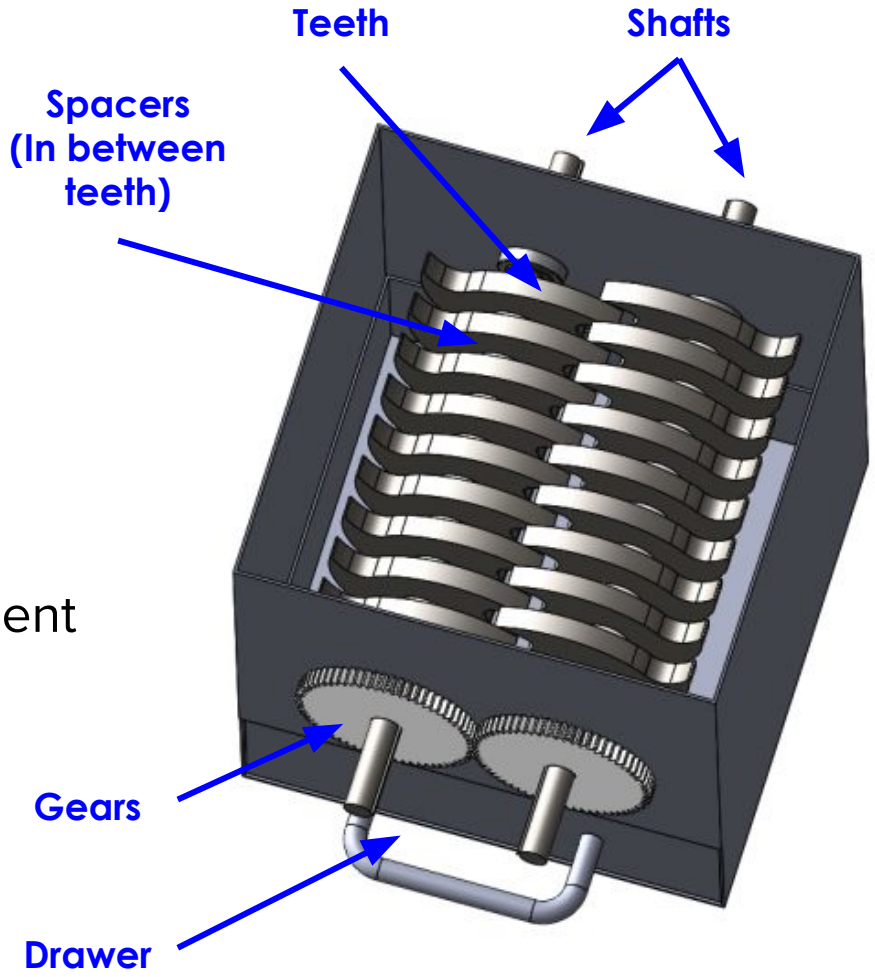

Figure 3: Shredder CAD model

Shredder Manufacturing

- Manufactured parts:
  - 16 GA Aluminum Sheet Metal
    - Box, lid, drawer
  - ⅝ DIA A36 Steel Rod
    - Keyed shaft
  - ½ THK A36 Steel Plate
    - 15 blades
  - 3D Printed (PLA) Gears
  - ⅝ THK Particle Board Panel
    - Box

Figure 4: Shredder box first iteration

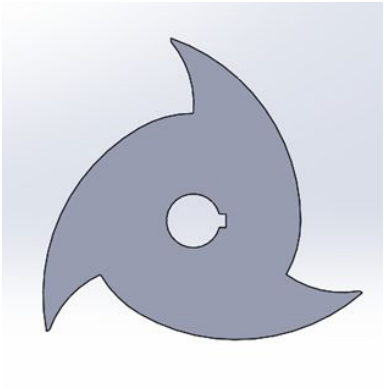

Figure 5: Shredder tooth design

Shredder Final Assembly

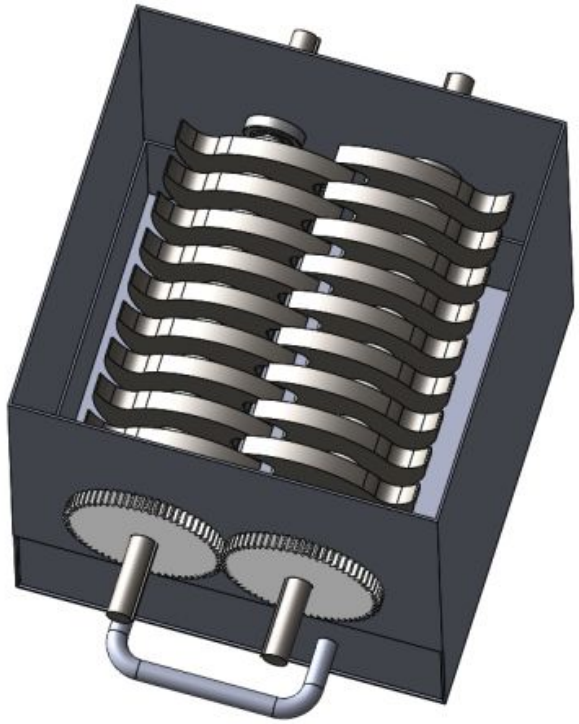

Figure 6: Shredder CAD final assembly

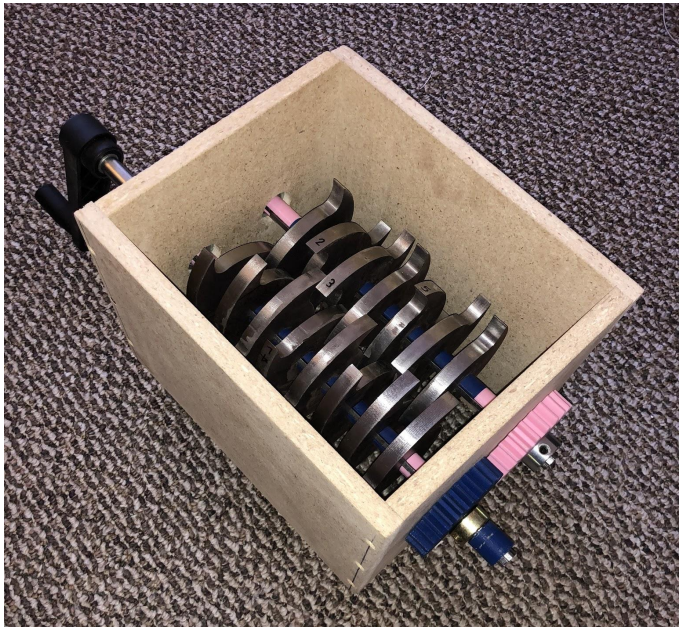

Figure 7: Shredder final assembly

Extruder Design

- Kept separate from Shredder for mobility
- Extruder Design Features
  - 30” x 12” x 6”
  - Set angle (45°)
  - Threaded nozzle, shaft, and housing
  - Chuck with auger motorized
  - Heating band with PID controller and toggle switch

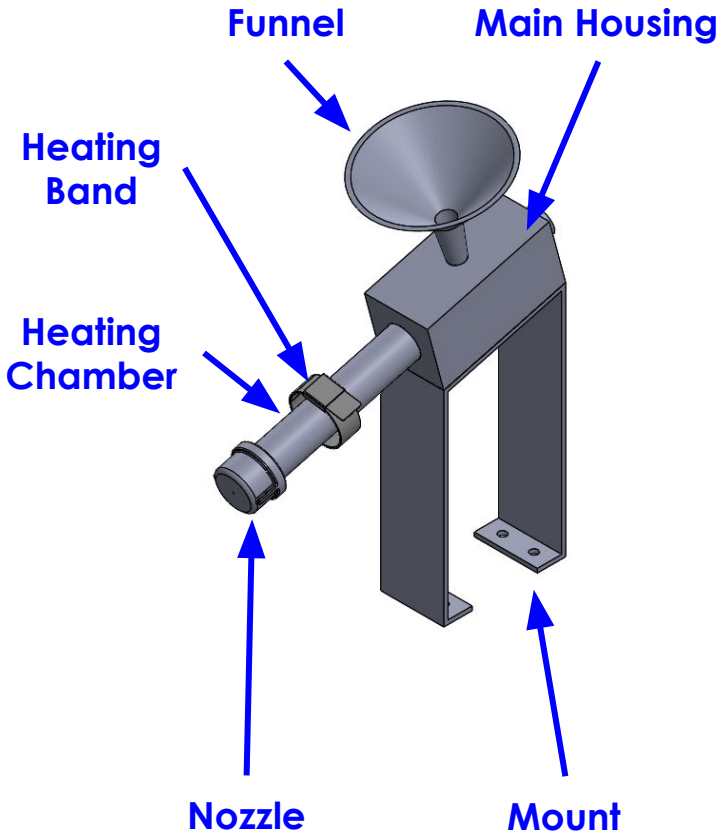

Figure 8: Extruder CAD

Extruder Manufacturing

- Manufactured parts:
  - 16 GA Aluminum Sheet Metal
    - Extruder and Motor Mount
  - 2” x 3” x 7” 6061 Aluminum block
    - Housing
  - ¾” SCH 40 Steel Pipe
    - Threaded Heating Chamber
  - Heat Shroud

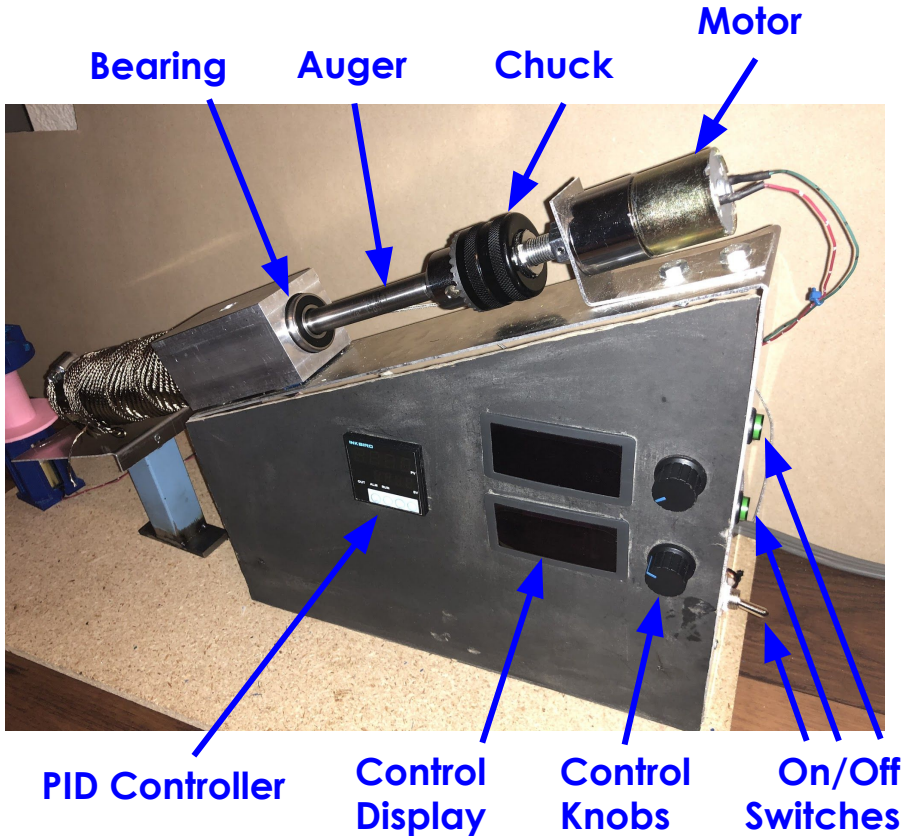

Figure 9: Extruder Control Panel

Spooler Design

- Spooler Design Features
  - 2” x 2” x 8”
  - Shaft and lock nut design to fit any size spool
  - All 3D printed parts
  - Speed controlled with toggle

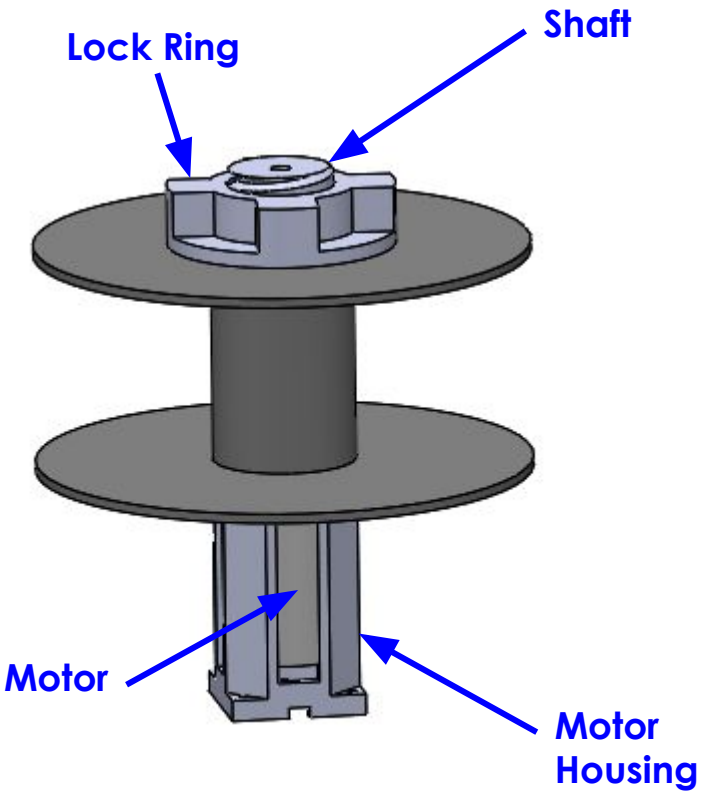

Figure 10: Spooler CAD

Spooler Manufacturing

- Manufactured parts:
  - All 3D printed components
  - Easy to assemble
  - Mounted on base plate with extruder
  - Accommodates different size spools
  - Spool speed of 3 to 30 RPM

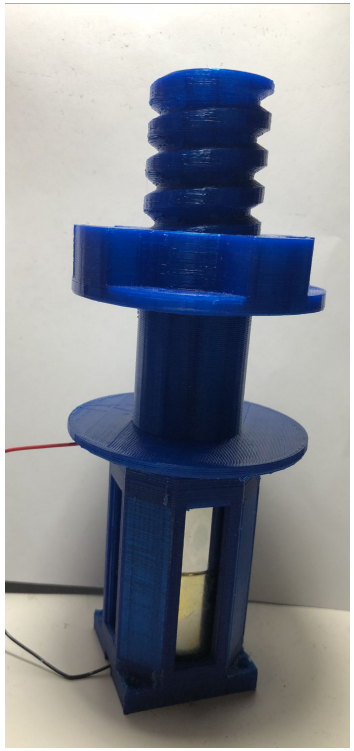

Figure 11: Spooler

Extruder & Spooler Final Assembly

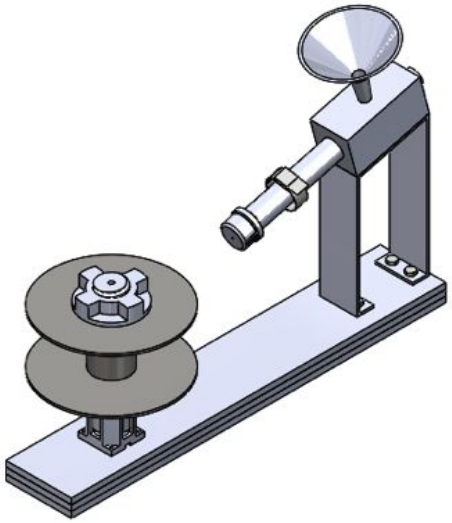

Figure 12: Spooler CAD Final Assembly

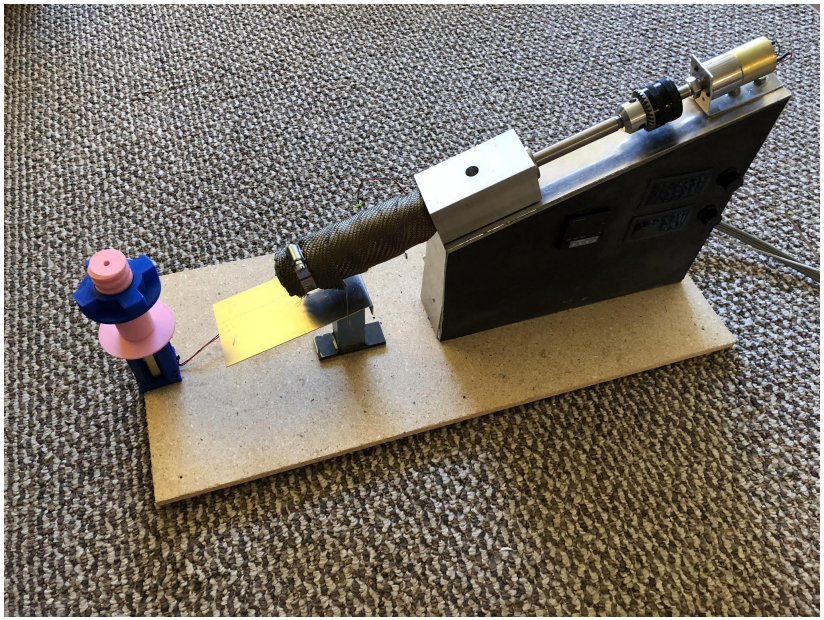

Figure 13: Spooler Final Assembly

Electronics

- Used for the extruder and spooler
- 1 household outlet plug
- On/Off switch
- PID controller for heating band
- 2 motor controllers
- 2 cooling fans

Figure 14: Electronics panel

Testing Procedures & Results

Table 1: Testing Results

Shredder	Extruder	Spooler
Shredding Ability: Crushes maximum ½” thick pieces	Warm Up: 30 minutes at 245°C	Shaft Speed: 10% ± 1% (3 RPM)
Torque required: Hand-Crank	Extrusion: Extrude at 205°C 55% ± 1% (17 RPM)	

Questions?