

1. Introduction

2. Tools & Materials Required

Tools
Laser Cutter
3D-Printer
Soldering iron
CNC *
Relevant Screwdrivers and Power tools

Material
Bearings (Or equivalent)
Motor (Or equivalent)
PSU (compatible for motors)
Speed Controllers (Or alternative to control motors)
Bolts (M3 -> M6)
Nuts (M3 -> M6)
Plastic Filament (Recommended materials are: PLA, ABS and PC+)
Wood (6mm MDF)
Wood (16mm x2) *
Wood (6mm) *
Plexiglass (3mm Acrylic) *

* For optional components

3. Safety Precautions

Safety

1. Always wear safety goggles when cutting or assembling.
2. Use gloves when handling sharp metal or acrylic parts.
3. Ventilation required during laser cutting or soldering.
4. Disconnect power before testing mechanical movement

If you follow the same materials and fabrication methods listed below, do NOT try to shred the following:

1. Fully completed 3D prints
2. Thin (and thick) large surface areas
3. Harder material than PLA and PETG
4. Large strings of filament that can wrap around the axle
5. Examples:

If you follow the same materials and fabrication methods listed below, you should be able to shred the following:

1. Support in PLA and PETG
 - a. NOTE: May vary depending on support variant, organic support has been most successful in testing
2. Brim
3. Small prints dependent on their infill (0-10%) and their infill pattern
4. Examples:

Disclaimers for usage:

1. The shredder itself might start to move/rotate if overloaded, since it's not bolted to any surface area. Be aware.
2. The axle connectors might break if overloaded
3. When gears are run for a long time or at a high speed, a lot of heat can be generated, this may cause melting or very hot screws.

4. Overview of Components

See the external build of materials (BOM) for a brief overview of all components used in the system. Each component is assigned a unique ID (in parentheses) which is consistently referred to throughout the manual to ensure clarity during fabrication and assembly.

4.1 Shredder

Component (id)	Fabrication Method	Material	Quantity
Axle (1)	3D-Printed	ABS	2

Shredder-blade (2)	3D-Printed	ABS	10
Spacers axle (3)	3D-Printed	PLA	10
Spacers wall (4)	3D-Printed	PLA	10
Spacer mount wall (5)	3D-Printed	PLA	10
Front and Back Wall (6)	Laser Cut	MDF (Wood)	2
Side walls (7)	Laser Cut	MDF (Wood)	2
Wall snap connector (8)	3D-Printed	PLA	8
Bearing connectors (9)	3D-Printed	PLA	8
Roof (10) *	Laser Cut	Plexi-glass	1
Roof-handle (11) *	3D-Printed	PLA	1

*Optional components

4.2 Gearbox

Component (id)	Fabrication Method	Material	Quantity
Gear axle connector()			
Ring Gear (12)	3D-Printed	PLA	1 * Module * Gearbox
Planet Gear (13)	3D-Printed	PLA	4 * Module * Gearbox
Input Gear (14)	3D-Printed	PLA	1 * Gearbox
Output Hub (15)	3D-Printed	PLA	1 * Gearbox
Sun Gear Carrier (16)	3D-Printed	PLA	1 * Module * Gearbox
Ring Gear Holder (17)	3D-Printed	PLA	1 * Module * Gearbox

4.3 External

Component (id)	Quantity	Link
Motor ()	2	
Bearings Axle ()	4	
Bearings 608 - ZZ ()	4 * Module * Gearbox	608 - ZZ Deep Groove Ball Bearing
Bearings 6002 2RS ()	1 * Module * Gearbox	6002-2RS Deep Groove Ball Bearing
Bearings 685-2RS	1 * Gearbox	685-2RS Deep Groove Ball Bearing

4.4 Arduino

Component (id)	Quantity	Link
Arduino Uno()	1	https://store.arduino.cc/products/arduino-uno-rev3?srsltid=AfmBOoryz0R57xpHzzZM81fNsVgdM2d6e5Gq1D9oCW6niAZb1saQQDX
16x2 I2C LCD Display () Address: 0x27	1	
Momentary Push Button	1	
WS2812B LED Strip () 4 LEDs	1	
220Ω resistor ()	1	
Breadboard ()	1	
Jumper wires ()	14	

5. Fabrication Instructions

5.1 Laser Cut parts

These instructions and settings are based on Epilog Fusion 75w, settings should be tuned to your specific machinery.

General settings

- 6mm MDF
 - Raster: Power 100% ; Speed 4% ; Frequency 10
 - Vector:
- 3mm Acrylic
 - Raster: Power ?% ; Speed ?% ; Frequency ?

Instructions

5.2 3D printed parts

These instructions and settings are based on Prusa Mk4s, settings should be tuned to your specific machinery.

General settings

- Layer Height: 0.2 mm
- Nozzle Size: 0.4 mm standard

Filament Settings

- PLA
 - Parts in PLA are not under heavy load, therefore 10-20% infill should suffice.
 - Follow your filaments specific temperature settings.
- ABS
 - Should be printed in an enclosed printer, heated 20-30 mins before starting.
 - Use Large brim and glue to keep the print from warping.
 - Consider turning auto-cooling/fan off while printing.
 - Follow your filaments specific temperature settings.

Instructions

- Axle (1)
 - Material: ABS
 - Infill : 25%
 - Infill pattern : Gyroid
 - Printed horizontally to align layer lines perpendicular to torque forces
- Shredder blades (2)
 - Material: ABS
 - Infill : 30%
 - Infill pattern : Gyroid
 - Perimeters : 6
 - Printed horizontally to align layer lines perpendicular to torque forces

- Spacers axle (3)
 - Material: PLA
 - Infill : 10-20%
- Spacers wall (4)
 - Material: PLA
 - Infill : 10-20%
- Spacer mount wall (5)
 - Material: PLA
 - Infill : 10-20%
- Wall snap connector (8)
 - Material: PLA
 - Infill : 10-20%
- Bearing connector (9)
 - Material: PLA
 - Infill : 10-20%
- Roof handle (11)
 - Material: PLA
 - Infill : 10-20%
- Ring Gear (12)
 - Material: PLA
 - Infill : 20%
- Planet Gear (13)
 - Material: PLA
 - Infill : 15-20%
- Input Gear (14)
 - Material: PC+
 - Infill : 20%
- Output Hub (15)
 - Material: PLA
 - Infill : 20%
- Sun Gear Carrier (16)
 - Material: PLA
 - Infill : 20%
- Ring Gear Holder (17)
 - Material: PLA
 - Infill : 15-20%

5.3 Mount for gearbox and Motor

The motor and gearbox assembly requires a stable base to maintain alignment and withstand torque during operation. The mounting procedure described here is based on the motor and gearbox modules used in this project. If you are using a different motor, you may need to adjust the dimensions accordingly. Mounting Instructions:

1. Prepare the Base:

Using a CNC machine, mill a recessed slot approximately 4.3 mm deep into a 16 mm

thick wooden base. The length of this slot should match the total length of your assembled gearbox modules. This slot helps stabilize the gearbox by allowing the ring gear holder to rest securely.

2. Layer and Fasten:

Stack and fasten the milled 16 mm wooden base with a 6 mm MDF sheet to create the correct total platform height (~22 mm). Fasten these together using appropriate screws or bolts to ensure rigidity.

3. Positioning Requirements:

The mount must raise the gearbox to a total height of approximately 37 mm, while maintaining the 4.3 mm recessed channel for proper alignment and secure placement of the gearbox

Note: This method ensures the gearbox aligns correctly with the shredder axles (1). While this design is optimized for the motor used in this manual, users may adapt the approach for other motors, provided the height and alignment constraints are respected.

6. Post-Processing (Sanding, Tapping, Deburring, etc.)

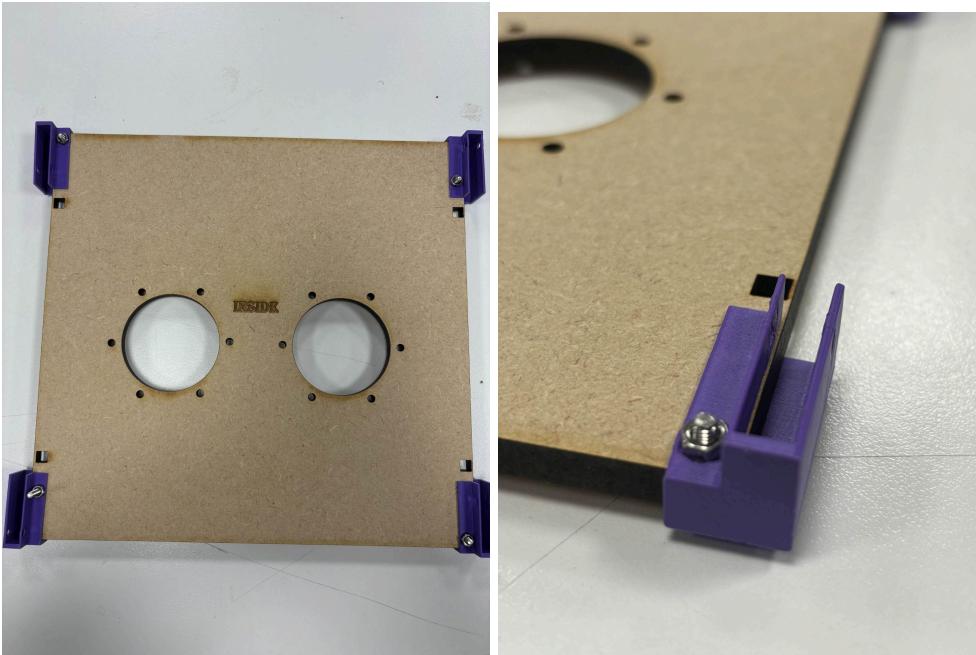
The axle might need sanding if spacers or shredder blades either don't fit or are too tight.

7. Assembly Instructions

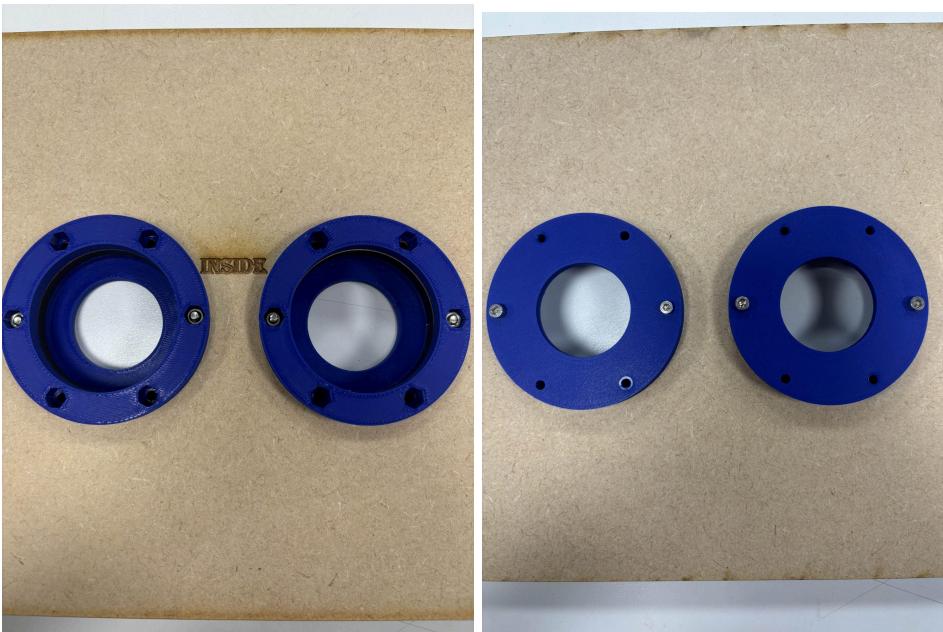
7.1 Sub-Assemblies

7.1.1 Shredder

1. Attach wall snap connectors (8) to both front and back walls (6). Make sure the text "inside" on the connectors faces upward, as shown in the reference image. Use M3 bolts and nuts to secure them.



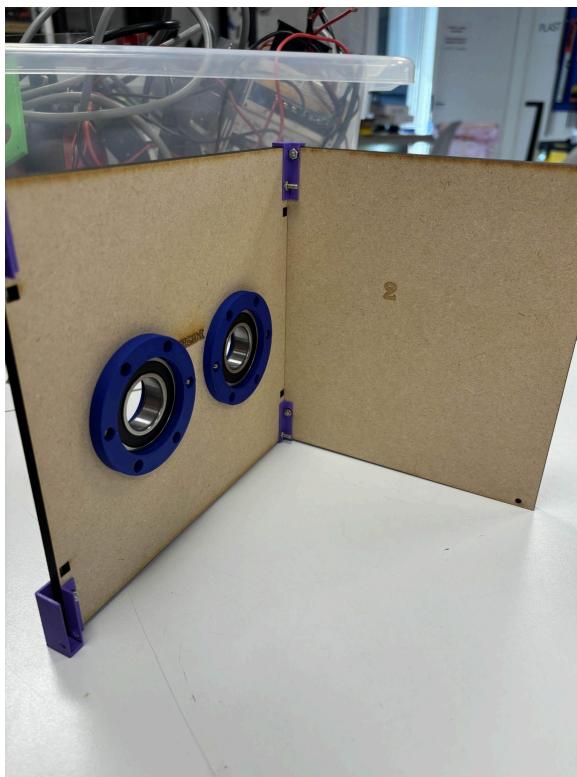
2. Using M3 bolts and nuts, mount the bearing connectors (9) onto the inner side of both front and back walls (6).



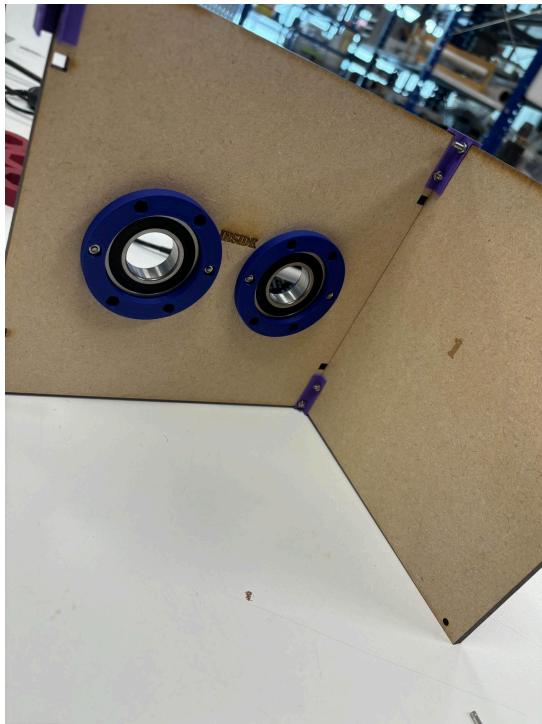
3. Insert the bearings into the connectors (9) from the inside, pushing them in until they are flush with the wall.



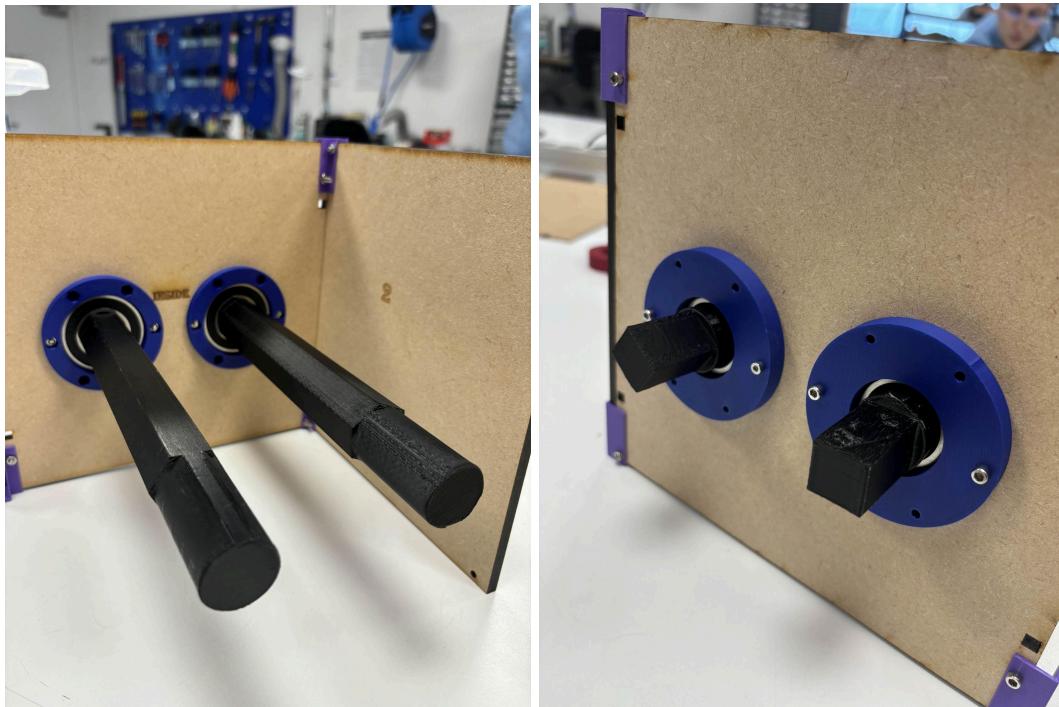
4. Attach the side wall (7) labeled "2" to the left side of one of the walls with axle holes (6).



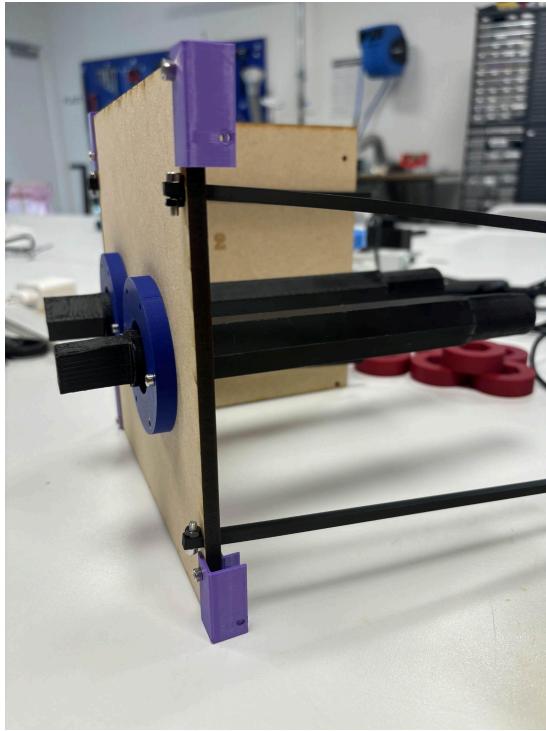
5. Attach the second side wall (7) labeled "1" to the other wall (6) in the same fashion..



6. Insert both axles (1) through the bearings on the wall connected to side wall 2. Ensure the square end of the axle faces outward, as illustrated.



7. Insert M3 bolts and nuts into the mounting holes for the spacer mount wall (5). Press the assembled mounts into their designated square holes in the wall (6).

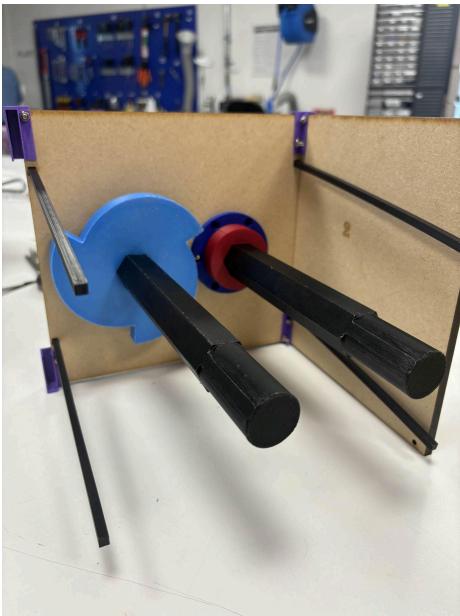


8. Begin assembling the rotating mechanism on the axle:

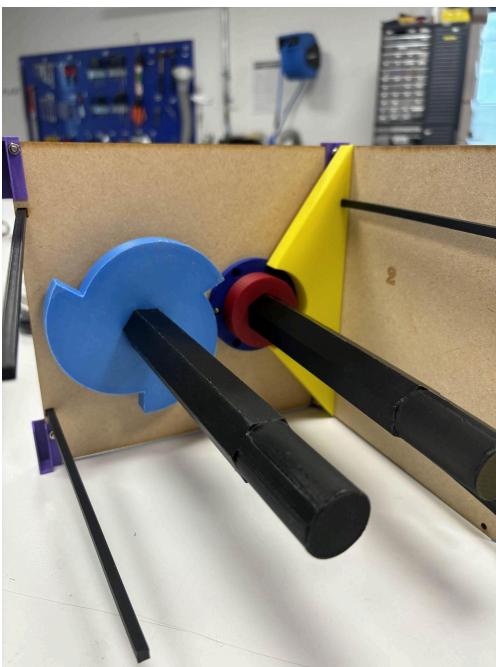
On the right-facing axle (1): Add a spacer axle (3)



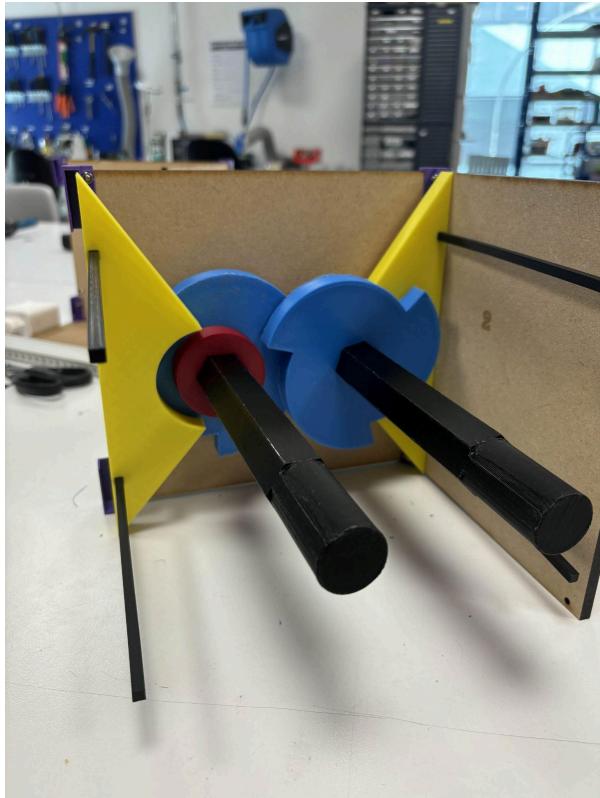
then a shredder blade(2) on the left facing axle (3).



Add a wall spacer (4) on the same side as the axle spacer (3)



Now repeat this for the other side



Repeat the previous step, alternating spacers (3), shredder blades (2), and wall spacers (4), until the axles are fully loaded on both sides.

9. Once both axles are fully stacked, attach the remaining front or back wall (6) to enclose the assembly, completing the shredder structure.

7.1.2 Roof (Optional)

1. Screw handle in roof

7.1.3 Gearbox

1. Start by taking the

7.1.4 Mount for gearbox and Motor

- 1.

7.2 Final Assembly

1. Mount Gearbox and Motor
2. Connect gearbox with shredders axle
3. Electronics

8. How to use