I. Introduction

A camera slider is a piece of equipment used in videography and filmmaking to create smooth, controlled camera movements. It consists of a rail or track and a carriage that holds the camera and moves along the rail, providing smooth and precise movement for the camera. It is arguably one of the quickest ways to add some serious production value to your videos. There are several benefits to using a camera slider in your videos, below I have a few listed:

1. Cinematic movement: Camera sliders can provide cinematic movement to your video footage, allowing you to create smooth, controlled camera movements that add a professional and polished look to your work.
2. More creative shots: Camera sliders can help you capture more creative shots by providing a wider range of movement and angles than simply holding the camera in your hand.
3. Consistency: Using a camera slider ensures consistent movement throughout your footage, avoiding jerky or unsteady shots.
4. Time-lapse and motion control: Camera sliders can be used to create time-lapse videos and motion-controlled shots, adding another dimension to your videography work.
5. Easy to use: Camera sliders are relatively easy to use, making them a great option for videographers of all skill levels.

However motorized camera sliders, on average, can cost anywhere from $200-$1,000+, depending on how much you are willing to spend. With this in mind I thought it would be a perfect opportunity to fire up the old 3D printer, soldering iron, and coding suite to save some money as well as learn new skills along the way!

II. Design and Preparation

This camera slider is a heavily modified version of The DIY Life's project. However, it wasn't quite what I was looking for, while his design worked for his use case, it did not scale well for mine. The most pressing issue was that I had a significantly heavier camera than his, consequently, recordings with the older slider design were very shaky, which effectively defeats the whole point of the project. Additionally I was looking to add extra features, mainly time-lapse, homing, looping, and a configurable countdown.

Material To Purchase

Part	Quantity	Link
2040 Aluminum Extrusion 700mm	1	2040 Aluminum Extrusion Link
2040 V-Slot Gantry	1	2040 V-Slot Gantry Link
GT2 Tensioner	2	GT2 Tensioner Link
GT2 5mm 20T Pulley	2	GT2 5mm Bore 20T Pulley Link
GT2 8mm 80T Pulley	1	GT2 8mm Bore 80T Pulley Link
GT2 Belt	1	GT2 Belt Link
GT2 300 mm Belt	1	GT2 300 mm Belt Link
Nema 17 2.5” Stepper Motors	2	Nema 17 Motor Link
Nema 17 Motor Mounting Plate	1	Nema 17 Motor Mounting Plate Link
Camera Ball Joint Mount	1	Camera Ball Joint Mount Link
M2 Machine Screws		M2 Machine Screws Link
M3 Machine Screws		M3 Machine Screws Link
M3 5X6.5 MM Brass Insert		Brass Insert Link
M4 T Slot Nuts		M4 T Slot Nuts Link
M4 Machine Screws		M4 Machine Screws Link
Arduino Pro Mini 5V	1	Arduino Pro Mini 5V Link
TMC2208 Stepper Motor Drivers	2	TMC2208 Stepper Motor Driver Link
100uF Capacitors	2	100 100uF Capacitors Link
Rotary Pushbutton	1	Rotary Push button Link
Header Pins		Header Pins Link
PCB Switch	1	PCB Switch Link

Printed Circuit Board	1	Grab Gerber Files from The DIY Life
Homing Switch	2	Homing Switch Link
20 AWG Flexible 2 Conductor Wire	1	20 AWG Wire Link
Threaded Barrel Jack	1	Threaded Barrel Jack Link
12 Volt 2A Power Supply	1	Power Supply Link
Shaft D Ring ¼” Tripod Screw	1	Camera Tripod Screw Link
Rotary Damper	1	Rotary Damper Link
Heat Shrink Tubing		Heat Shrink Tubing Link
Stepper Motor Cables		Stepper Motor Cables
OLED Display	1	OLED Display Link

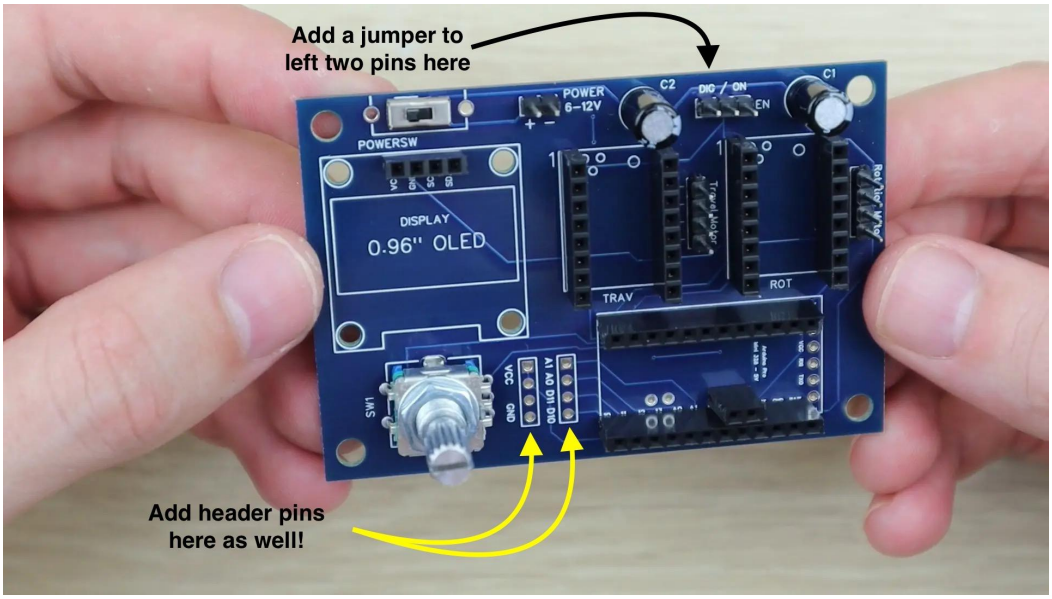
3D Files to print

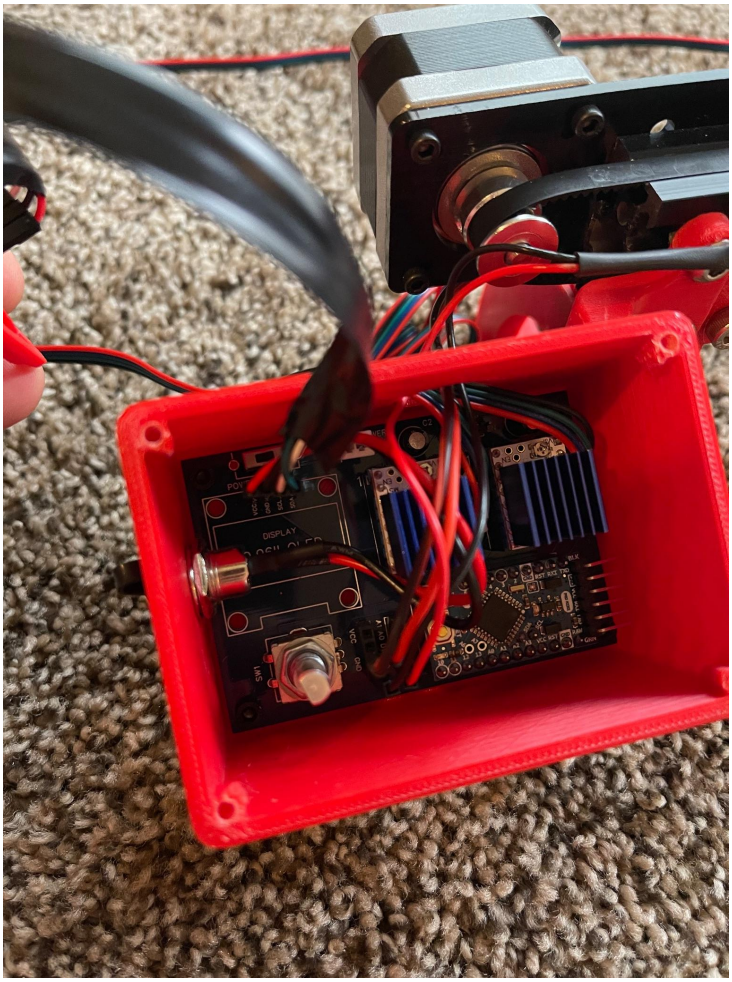
Part	Quantity	STL
Belt Clamp	2	belt_clamp.stl
Case Lid	1	case_lid.stl
Case Main Body	1	case_main_body.stl
Homing Switch Mount	2	homing_switch_mount.stl
OLED Backplate Mount	1	oled_backplate_mount.stl
Rotation Motor Base	1	rotation_motor_base.stl
Rotation Motor Base Top Part 1	1	rotation_motor_base_top_part_1.stl
Rotation Motor Base Top Part 2	1	rotation_motor_base_top_part_2.stl
Rotation Motor Mount L Bracket	4	rotation_motor_mount_l_bracket.stl
Rotation Spindle Bottom	1	rotation_spindle_bottom.stl
Rotation Spindle Top Part 1	1	rotation_spindle_top_part_1.stl
Rotation Spindle Top Part 2	1	rotation_spindle_top_part_2.stl
Selector Knob	1	selector_knob.stl
Stand Legs	2	stand_legs.stl
Tripod Shoe	1-2	tripod_shoe.stl

III. Printing, Soldering, Flashing, and Assembly

- Print Parts
    - Print the parts in the quantity listed. I used Hatchbox PLA for this project, with the standard settings, 200C extruder and a 60C bed temp. The only parts that need to be printed with support are the case main body and the Rotation Motor Base Top Part 2. For the case, print with the bottom on the bed, and add support beneath the arm. Finally, the Rotation Motor Base Top Part 2, flip it upside down and print with supports underneath the feet.

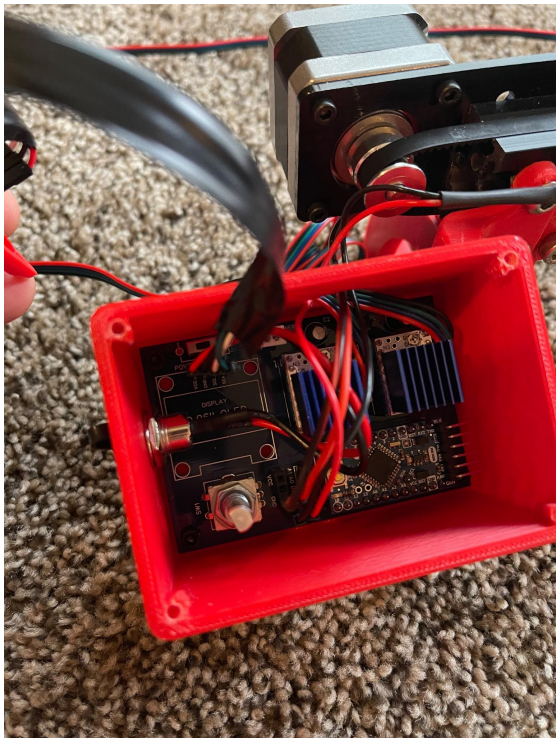
- Get PCB (thanks Mike!!)
    - The DIY Life created a PCB that worked flawlessly for our needs. You can find the gerber files on his project page. I used PCBWay to have them printed, I had 10 made since there was no difference in price between 5 and 10.
- Solder!
    - Solder the header pins, capacitor, and switch as shown in the below pictures. For greater detail, I would recommend The DIY Life's instructions on his website. The first picture is from his website, the second picture is from my project. Make sure you add the extra header pins and jumper!





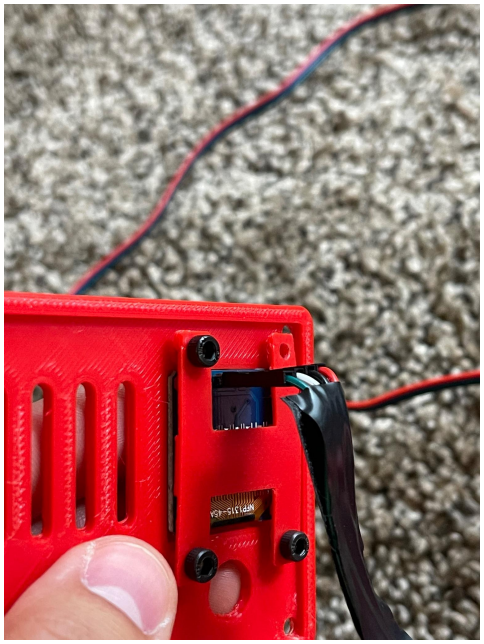
- Flash Arduino
    - After putting together the Arduino, flash the code onto the board using your preferred method, I personally used the Arduino IDE. The code should work, if you notice that your motors are working in the opposite direction from what you would expect, just flip the polarity of the wires and that should fix it.

- Assembly
    - Case Assembly- Pretty straightforward, mount the PCB to the bottom of the case, and then mount it to the aluminum rail. The DC barrel jack screws in from the left.

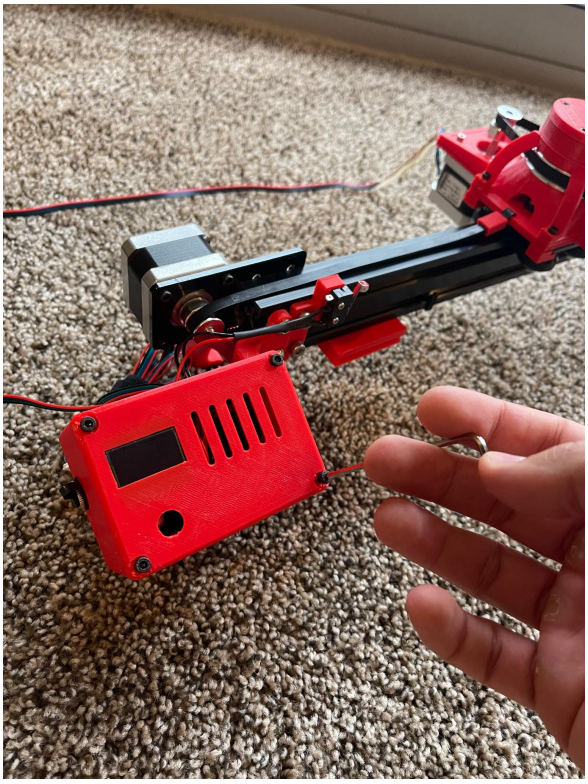


Mounted Main Case on the rail

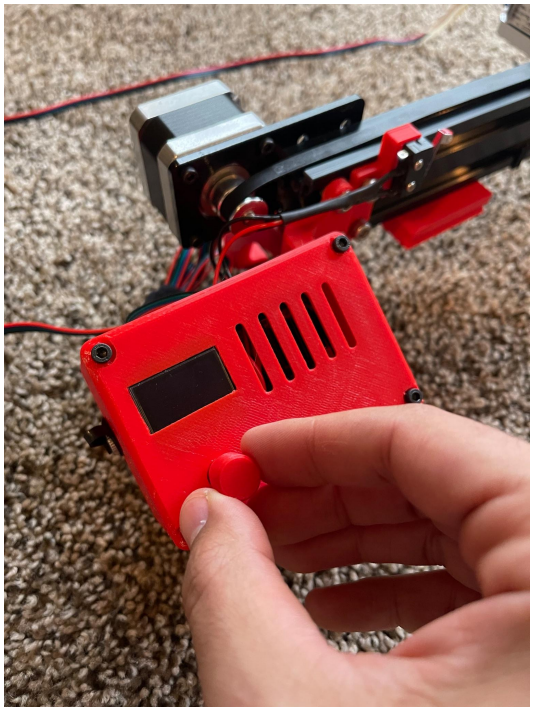
Run the wires through the back



This is how the OLED gets mounted onto the case lid, note - I need to redesign the bracket so don’t screw in the upper right hand corner M3 screw, as it interferes with screwing down the lid, but for now it will work 🙂



Screw the case lid down onto the case main body



Add the selector knob, it should just press fit.

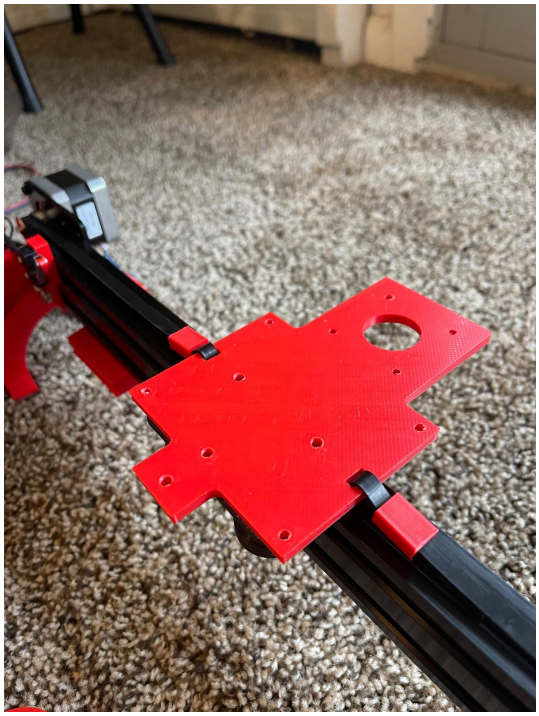
- Add Stands

I added rubber feet to the bottom to help with traction, the stands mount with M4 screws and T slot nuts.

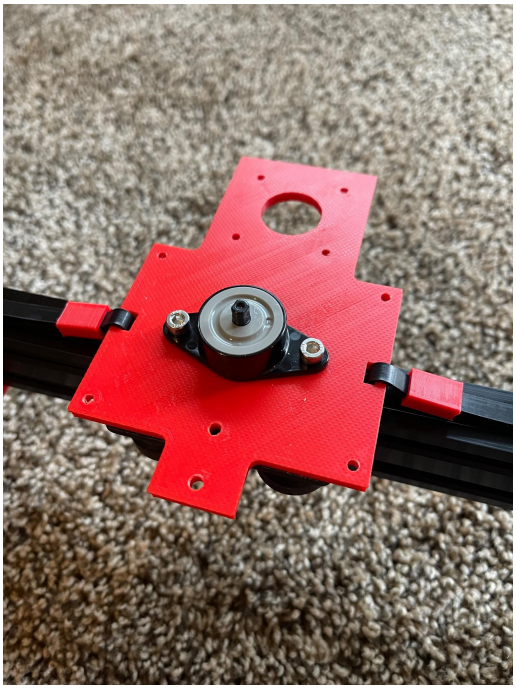
- Mount homing sliders

Run wires from the PCB to the limit switches - add heat shrink tubing to keep it all tidy! Make sure to keep them as far to the ends as possible.

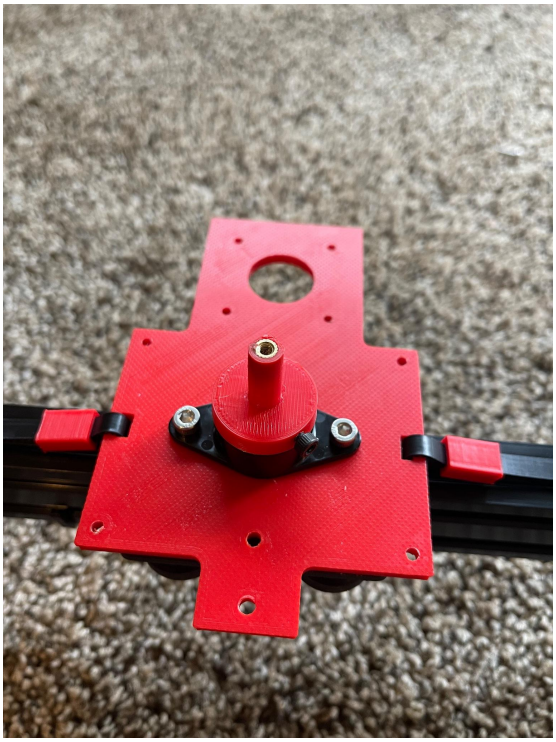
- Rotation Motor Assembly



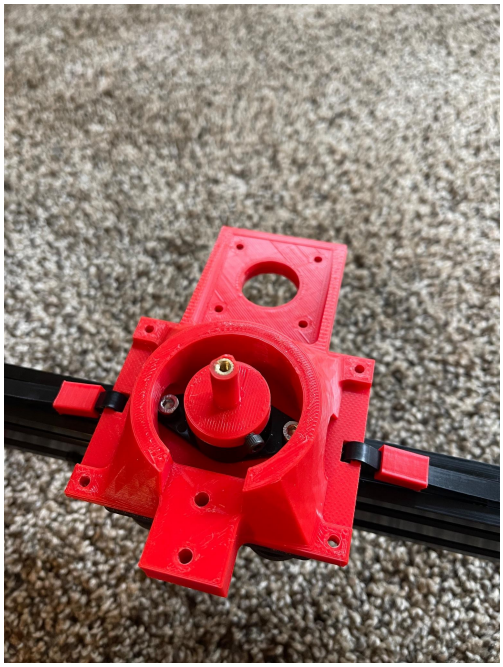
The rotation motor mount base is snap fit onto the V slot gantry, no tools needed here!



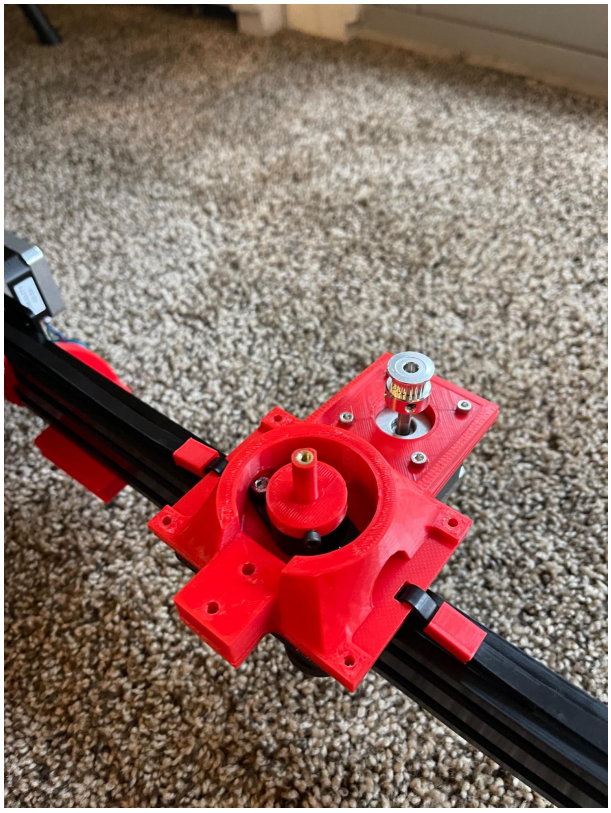
Use M4 screws to mount the rotary damper



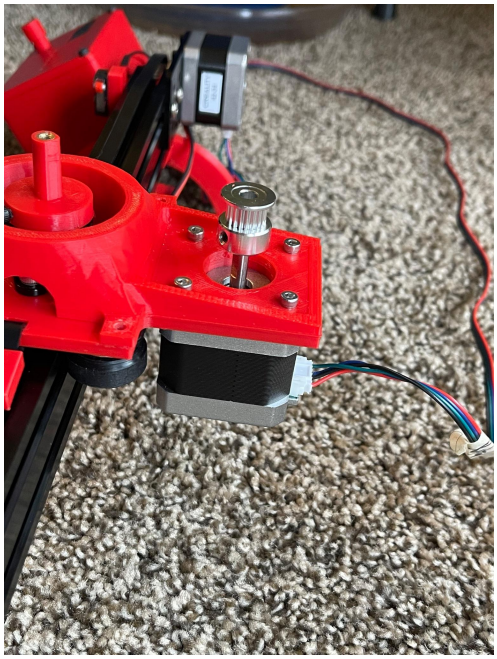
Add the spindle bottom, it should press fit onto the damper. Notice the threaded brass insert. Don’t forget to tighten the set screw!



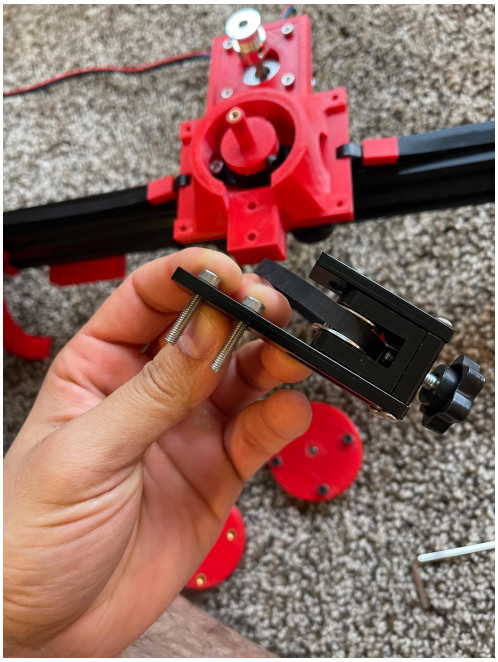
Add and line up rotation motor mount top part 2 - this adds rigidity and stability to the structure



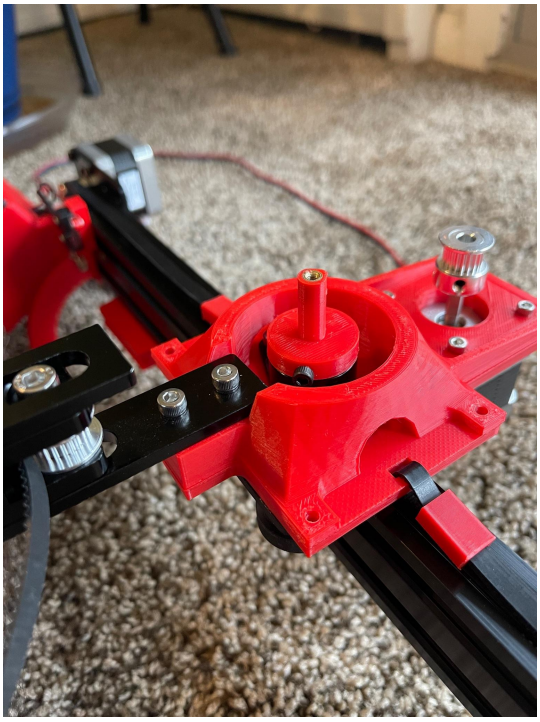
Use M3 screws to mount Nema 17



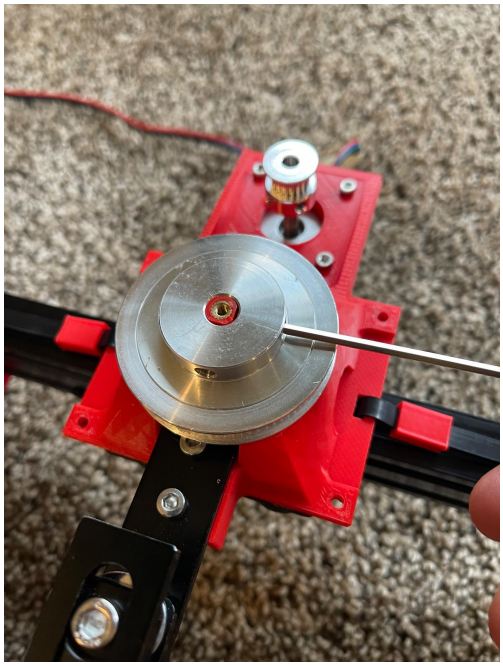
Notice that the cable is run from the back of the motor - do this to avoid interference



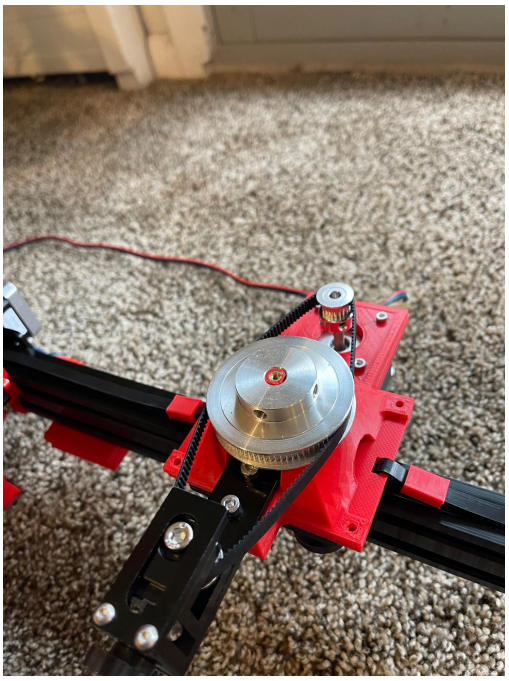
I used M4X20 screws for the belt tensioner



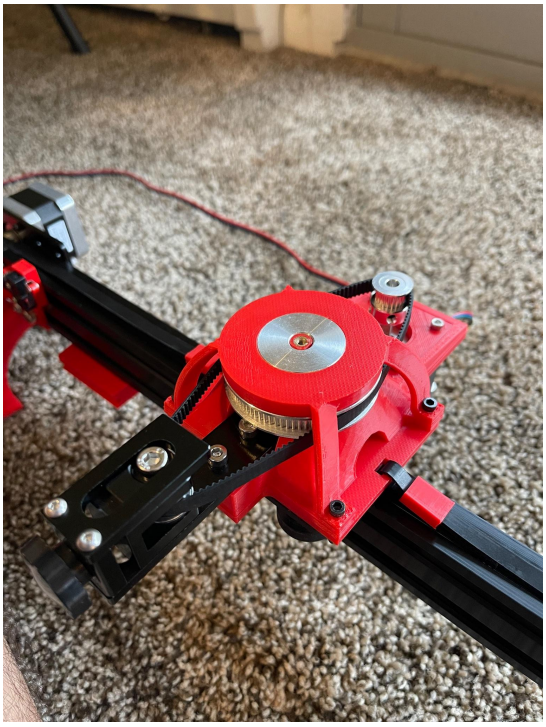
Screw down the bolts and mount the belt tensioner tightly!



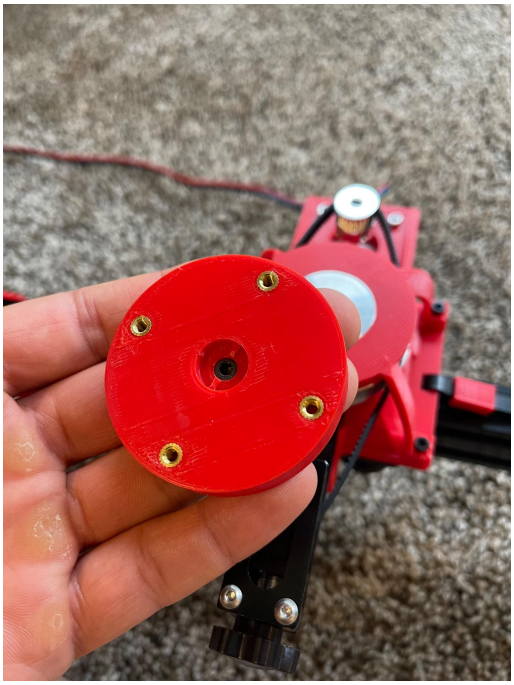
Add the 80T pulley, line up with straight parts on the spindle and tighten the set screws.



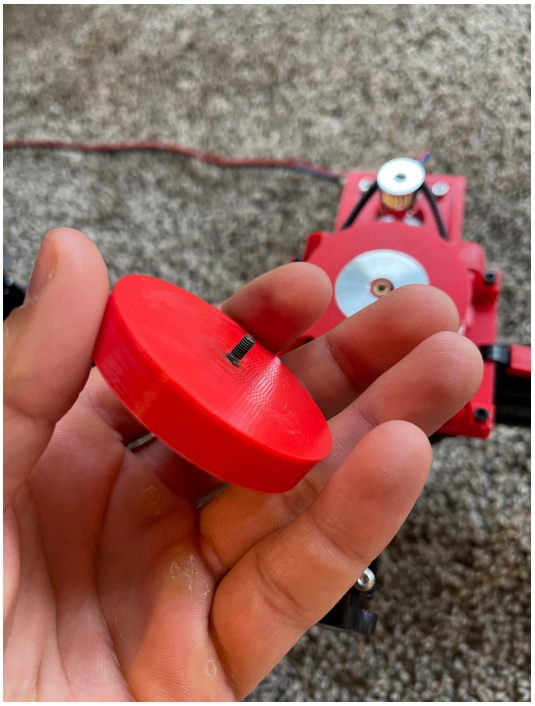
Loop the GT2 300 mm belt around both the 80T and 20T pulley - make sure the belt tensioner is loose to accomplish this!



Add rotation motor top part 2, and put in M3 screws - they should just be thru holes so the bolts should fit nicely - this part adds additional stability for the camera.

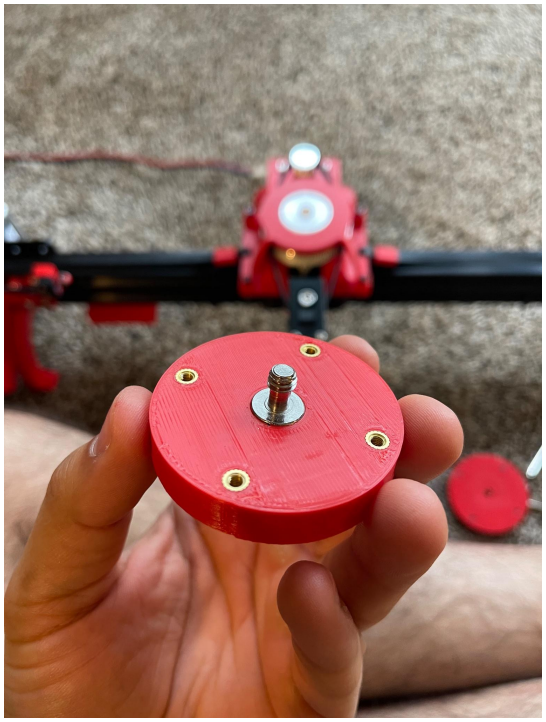


Screw down M3 in spindle top part 1 - the head should sit flush - notice the threaded inserts.



M3 screw should be sticking out the bottom of spindle top part 1

Remove D-Ring from ¼” camera screw

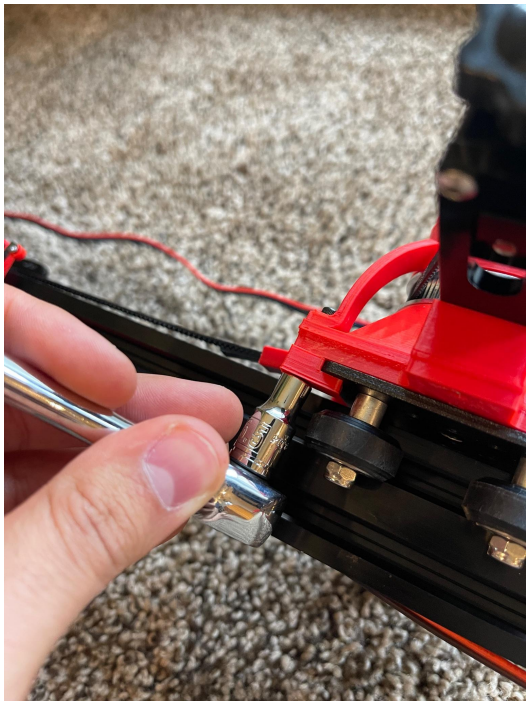


The camera screw should sit flush!

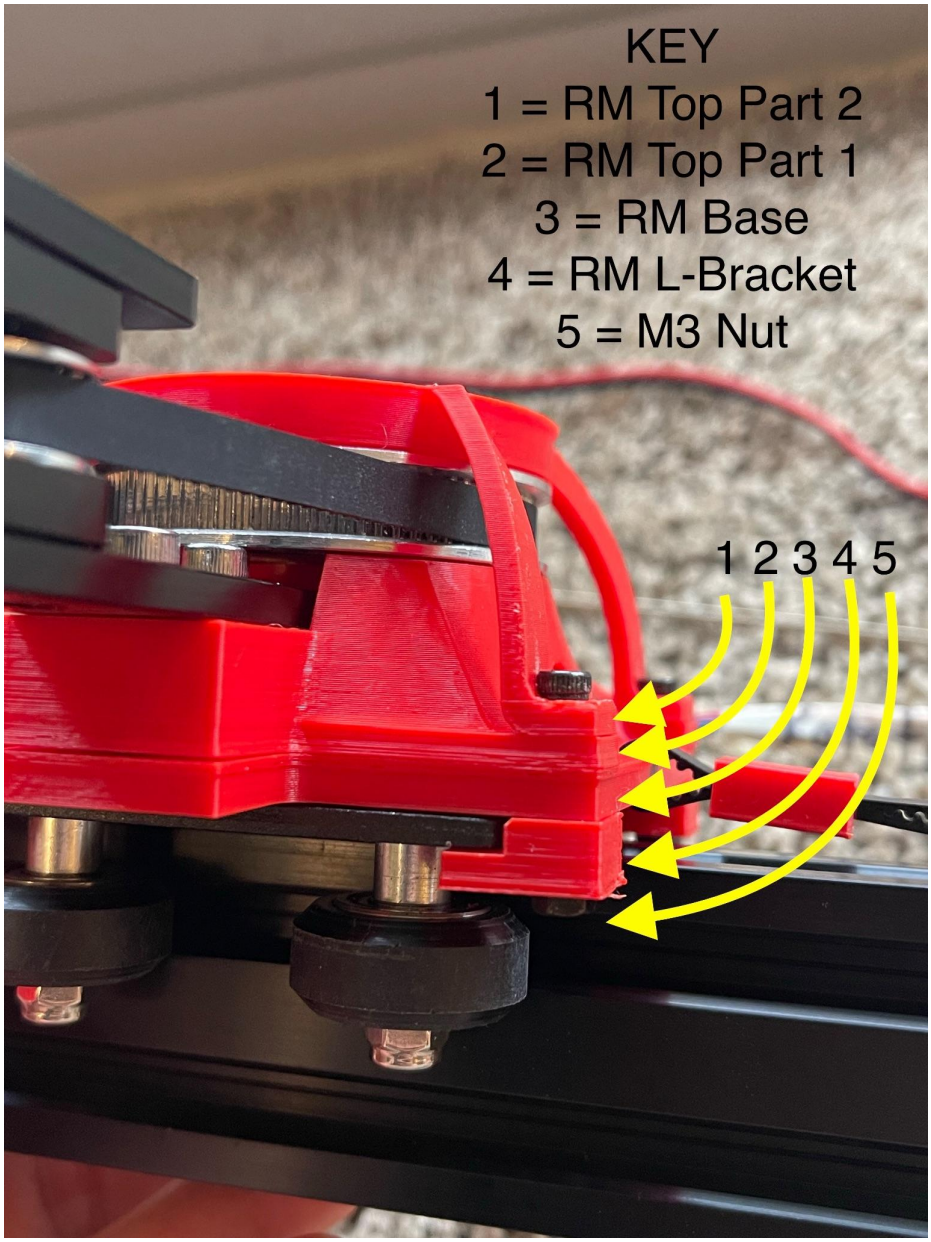
Screw down spindle top part 2 onto spindle top part 1, everything should be tight and flush with each other!

Screw the top spindle assembly into the spindle bottom assembly.

(Optional: add blue loctite to avoid accidental unscrewing)



Screw L- mount bracket down, use an M3 nut and ratchet to really secure everything down!

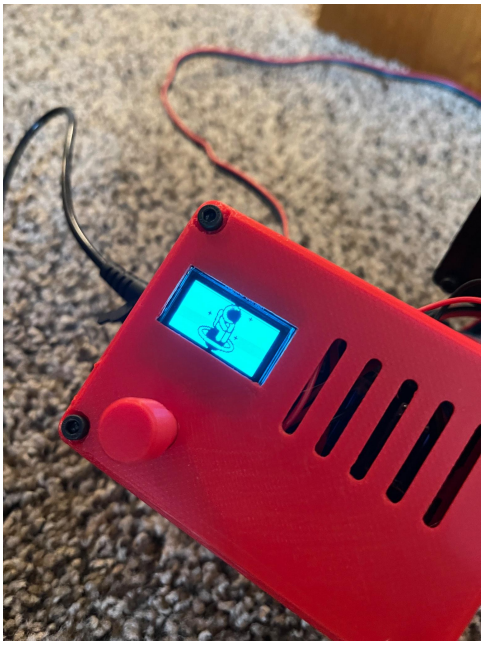


I did my best to explain the process, here is a side profile to really highlight each part in the entire rotation assembly.

Screw down the camera ball joint!

Add the panning belt tensioner, panning Nema 17 motor, cut the belt down to size and loop through the rotation assembly. With any luck your end project should look like this!

IV. Plug in for the first time!



When you plug into power, you should be greeted with this start up screen

The main menu - the options are “Home Slider”, “Pan & Rotate”, or “Track Object”.

V. Testing and Usage

- Test Homing
    - Verify switches properly interrupt
- Test Pan & Rotate
    - Verify pan and rotate directions
        - (Note: the “Left” and “Right” directions assume the user is directly behind the case, such that the aluminum rail is on their right side. IE when you select “Right”, the gantry should go AWAY from the case end, and vice versa for selecting “Left”)
    - Verify the rotation distance
    - Verify the pan distance
- Test Track Object
    - Verify it can hold an object in frame when tracking.

VI. Example Footage

- Check out the “Example_footage” directory on the github! I am still very much learning the basics of filming, but this slider definitely opens some doors for creative shots.

VII. Conclusion

This project was a fantastic first step into the world of Arduino and documenting a project, it really let my creativity shine, all while giving me a new tool in my content creation arsenal. By creating this slider, I am able to up the production value of future videos, while saving some money. As with all things, there are some tweaks I would like to make, I mainly want to update how the track object mode works, but for now it will get the job done. I also want to redesign the spindle, since the attachment screw shares the axis of rotation with the camera it can sometimes loosen itself, I used blue Loctite to help mitigate this. It also really highlighted the need for configuration management since I was rapidly iterating on designs. I used github for the code which worked, but I am not sure how to do that for 3D models, so I will have to improve upon that for future builds.

I hope you enjoyed my project, please feel free to download or upgrade any of my stl’s/code. I have put everything on an easy to navigate github repository. If you are feeling generous, please consider donating to my Buy Me a Coffee fund. I really enjoyed making and documenting this project, I plan on doing more of these in the future!