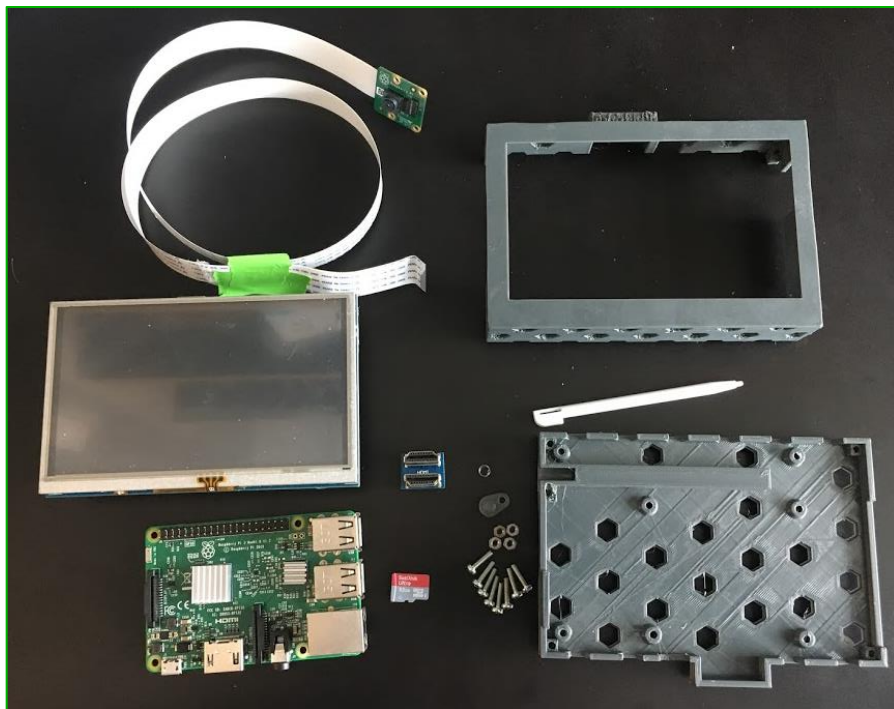


Assembly Instructions for the ONE Core Microscope Camera with Web Interface

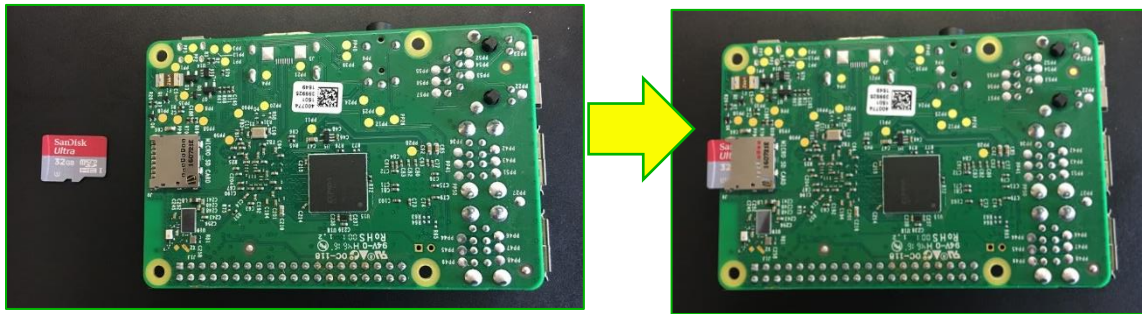
Materials (PNs can be found on the [ONE Core website](#))

- Raspberry Pi 3
- Touchscreen
- Raspberry Pi Camera V2
- 2 ft raspberry pi camera cable
- Micro SD Card (preferably class 10, at or above 16Gb)
- Eight M2 Phillips 10mm screws
- Four M2 nuts
- Basic click pen
- 3D printed Case
- Stylus (comes with screen)
- Fan (optional and not really recommended)



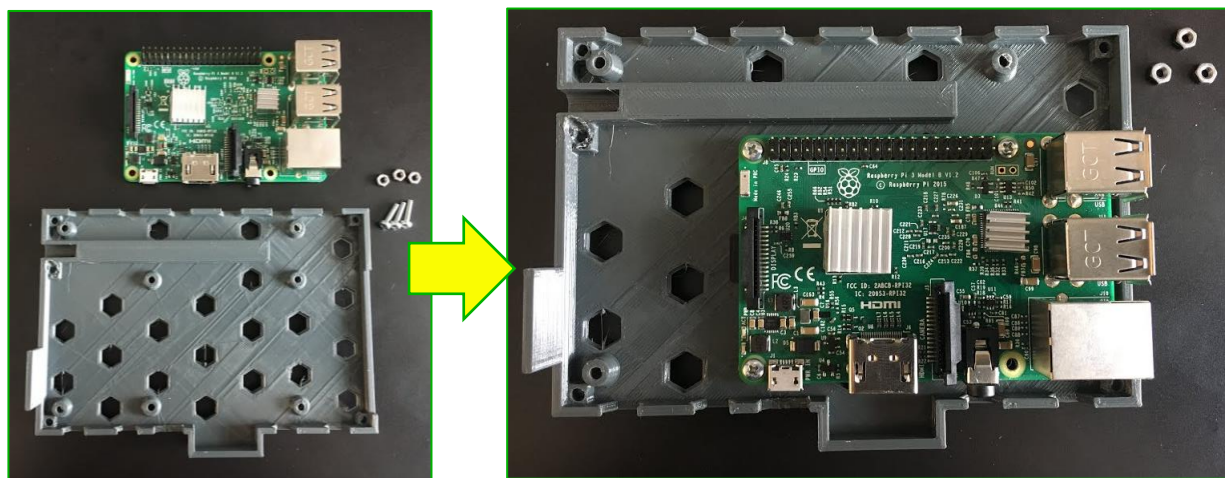
Materials Needed for this Section

Assembling Computer Hardware



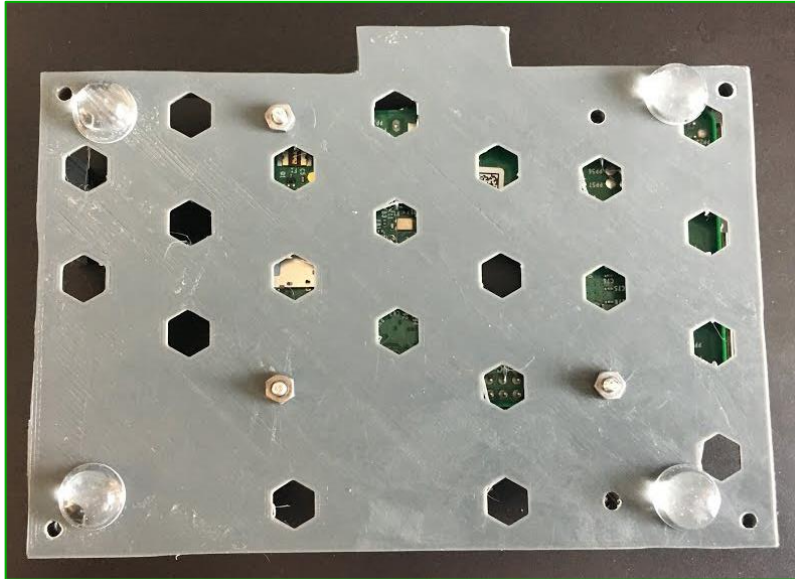
Place SD Card into Raspberry Pi

Be sure to 'flash' the microSD card with the OS image as given on the ONE Core site. You can feel free to try to start with a fresh and clean Raspberry Pi OS and go from there, but expect a day or two of headaches. Flash the OS on the microSD before continuing as you'll have to disassemble pretty much the entire assembly to access it again. The microSD card slot can be found on the back of the Raspberry Pi. The Raspberry Pi may have come with two heat sinks, feel free to throw those on. But probably not necessary.



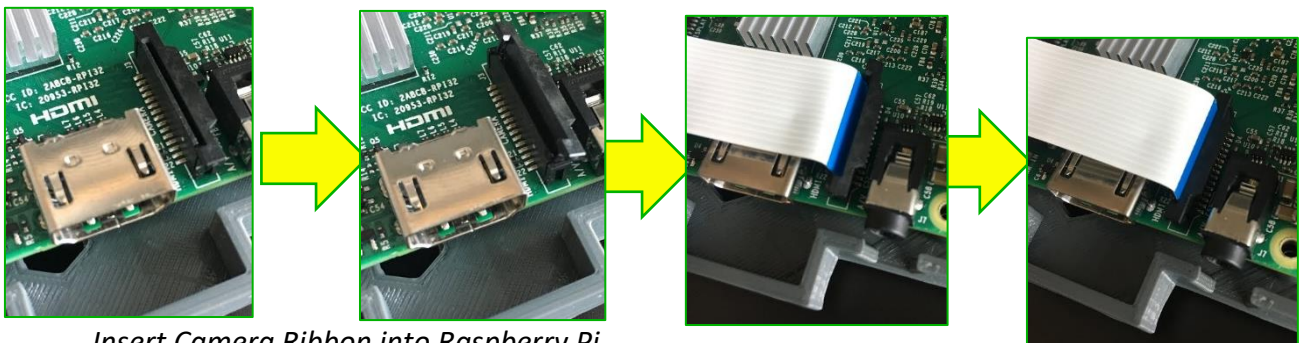
Place Raspberry Pi into Case Bottom and Insert Screws

The Raspberry Pi now gets placed within the bottom section of the 3D printed case. Ensure that the through holes on the Raspberry Pi align with the proper screw holes, and then insert three Philips screws into the through holes shown in the image above. Do not place a screw in the through hole on the Raspberry Pi's bottom right side as you'll be needing that for another component.



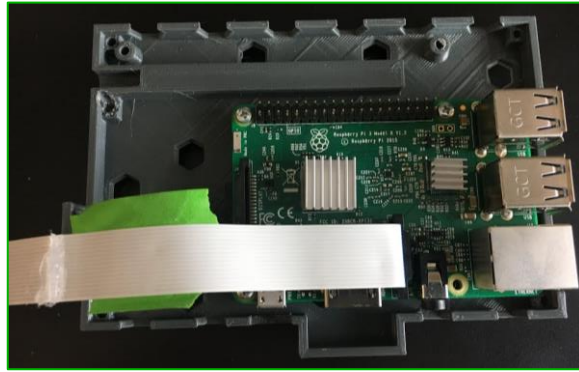
Secure Hex Nuts onto the Exposed Screw Ends

Lift the Raspberry Pi and case bottom at an angle and secure the M2 nuts onto the exposed screw ends. Be careful not to let the Raspberry Pi tip out of the case while you hold it at an angle. Maybe keep a finger or two pressing down on the Raspberry Pi to keep it in place.
Note: The image above shows four rubber feet on the bottom of our case. These are great for keeping the computer both level and well ventilated, but they aren't strictly speaking necessary.



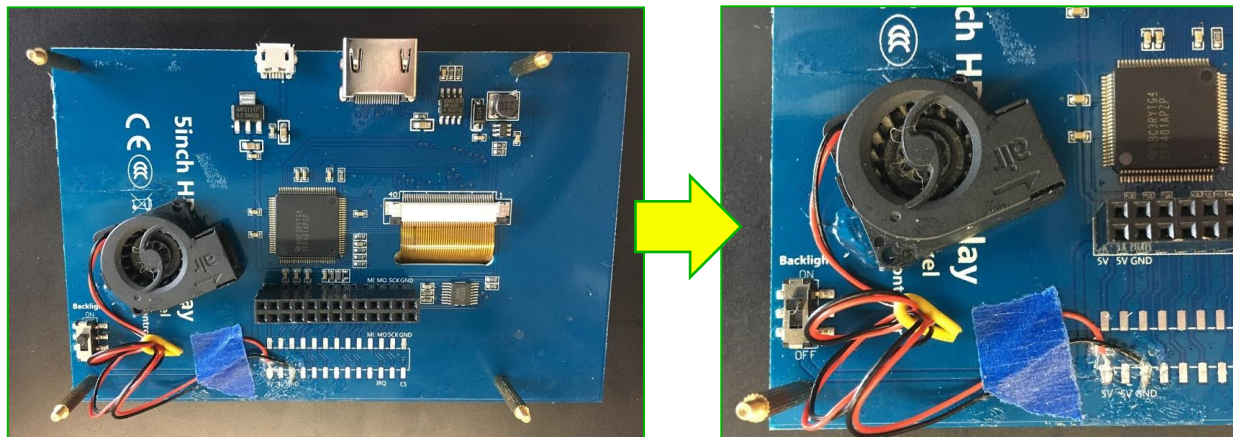
Insert Camera Ribbon into Raspberry Pi

You'll find a ribbon connector adjacent to the Raspberry Pi's HDMI port. Gently pull on the edges of the connector to pop it open. Insert the camera ribbon into this connector *with the blue edge facing away from the HDMI port*. Then gently push down on the edges of the connector to secure the ribbon.



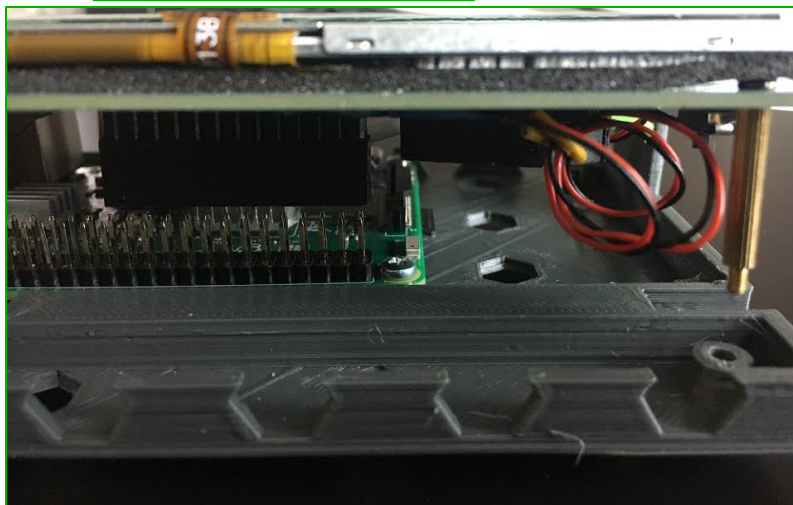
(Optional) Place A Wide Strip of Tape onto Camera Ribbon

If you want to secure the camera ribbon a bit during assembly, it can be useful to put some tape on the ribbon now. This will better allow the ribbon to stay pressed up next to the back of the screen.



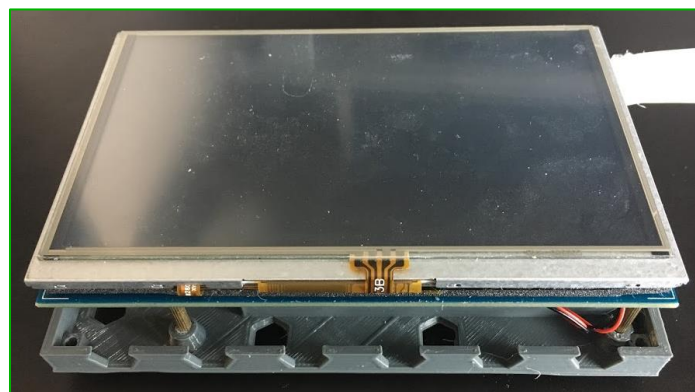
Secure and Solder Fan Onto Back of Screen

The screen can create a bit of heat. You may want a fan cooling the screen's processor. The fan can be secured with an adhesive (caulk/hot glue), and its wires can be soldered onto the screen for a power supply. One wire will go to the 5V supply, the other wire will go to ground (but this means that when the system has power the fan will be on, even if the Pi is shut down).



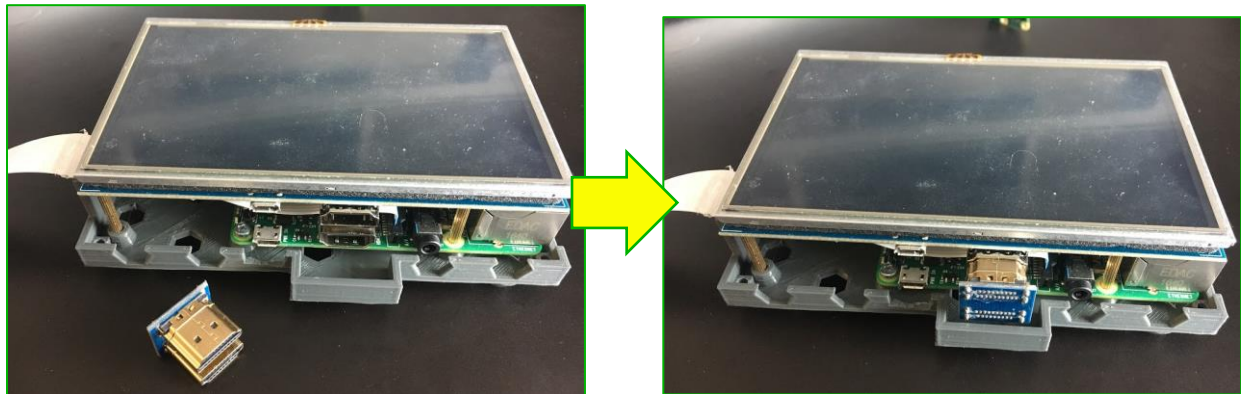
Connect Screen to Raspberry Pi

Connect the pins of the Raspberry Pi into the sockets on the back of the screen. To start the alignment, place the HDMI port of the screen directly above the HDMI port of the Raspberry Pi. Then turn the screen around 180 degrees so you can easily view the pins and sockets. You want the right-most pins to connect to the right most sockets of the screen. Ensure both rows of pins get connected.



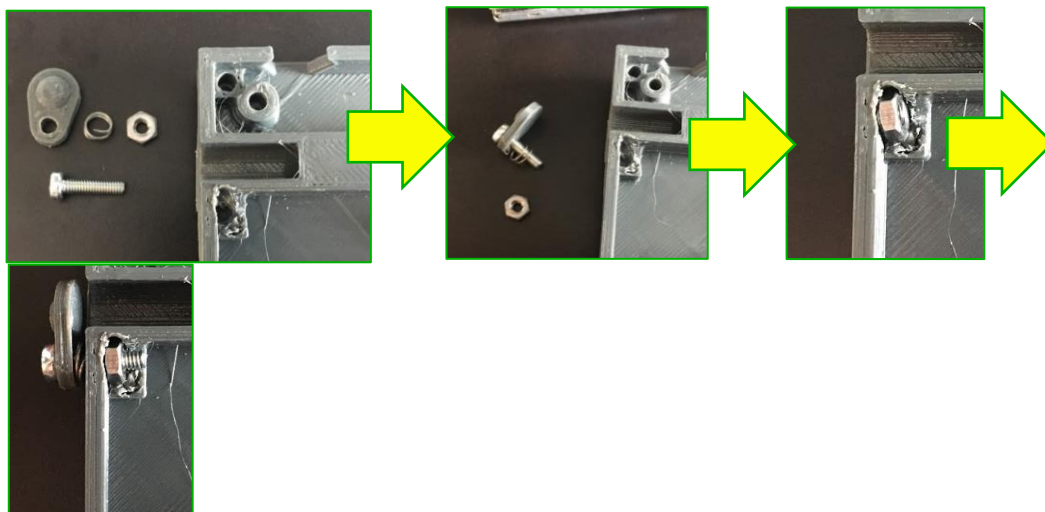
Ensure Screen Legs Aligned

With the pins of the Raspberry Pi connected, make sure that the legs of the screen are properly aligned over the proper holes.



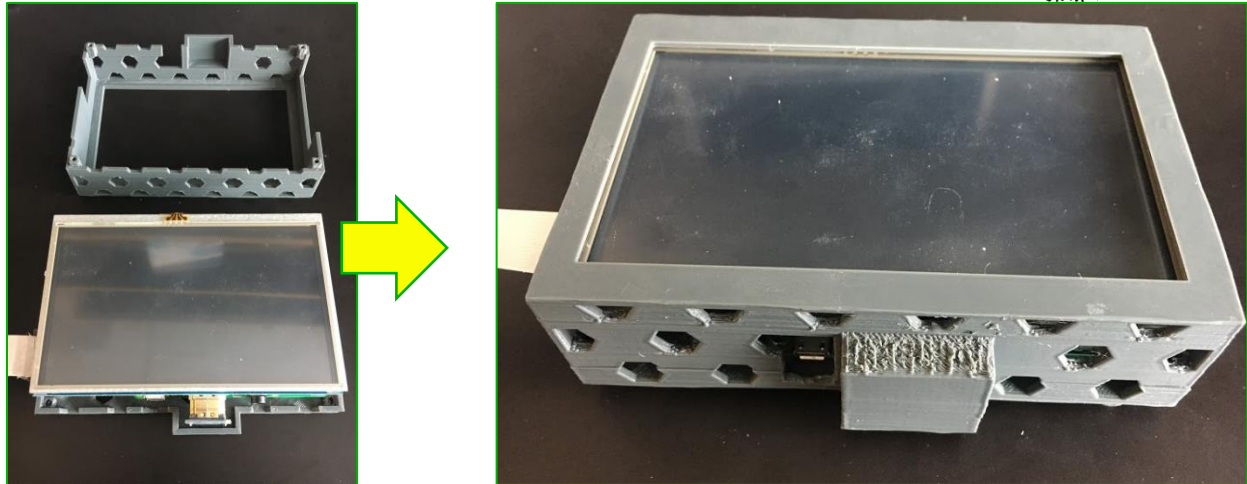
Place HDMI-HDMI Adaptor onto Boards

Slide the HDMI-HDMI adaptor into the dual HDMI ports.



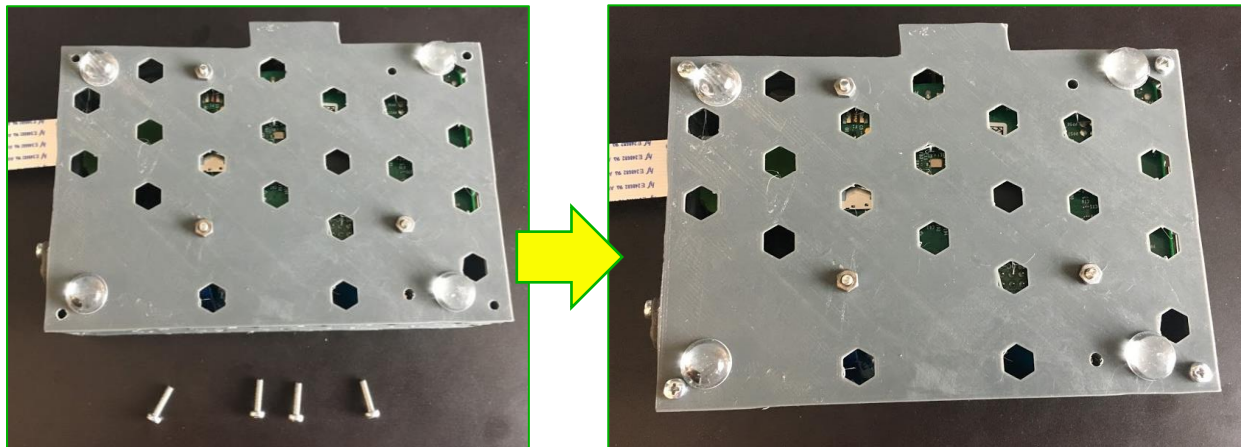
Assemble Stylus Holder

Depending on the version of the 3D design you used for the case, you might need to clip away some of the case to make room for this feature. Slide the 3D printed tab onto the screw and then place the spring onto the screw as well. Place the M2 nut on the interior side of the case in the hole adjacent to the stylus slot. Then pass the tip of the screw into the through hole and secure it to the M2 nut.



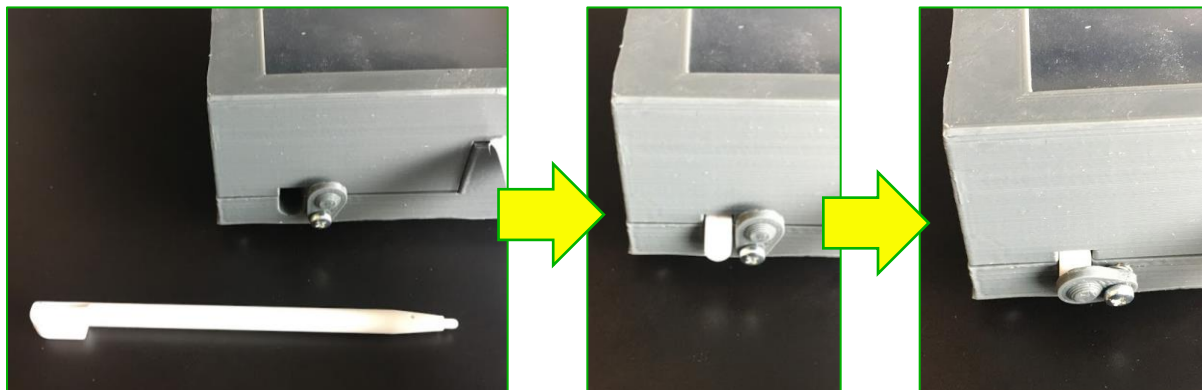
Secure on Top Half of Case

Now place the top case component onto the device. You may need to flex this part a little for its edges to wrap around the screen. Just be sure not to flex the case to the point of breaking.



Secure 3D Printed case with Screws

Carefully turn the assembly upside down and proceed to place screws into the holes on the four corners of the device.



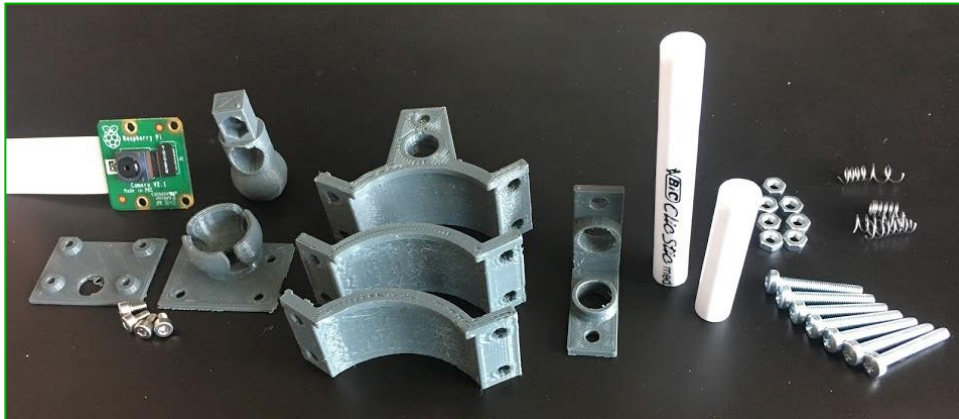
Place Stylus in Holder

Slip the stylus into the stylus holder and turn the neighboring tab to cover it.

Microscope Assembly

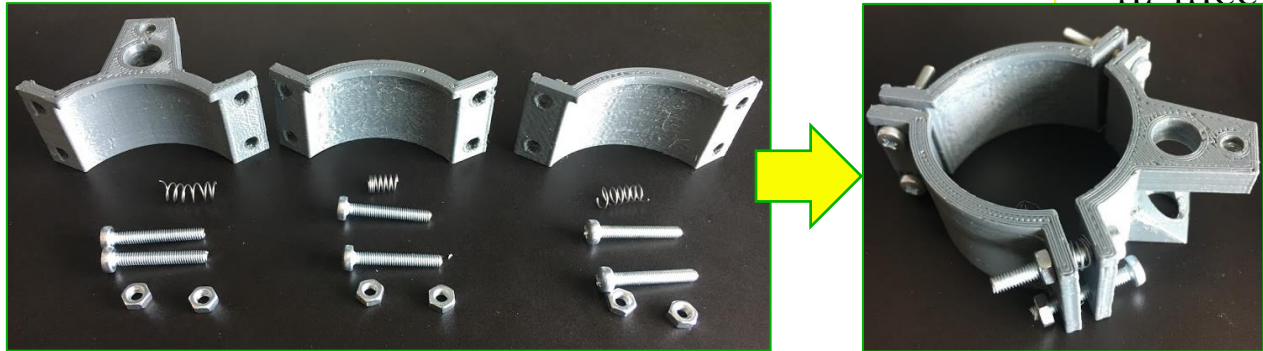
Materials:

- (7) 3D printed components
- (7) M2 Phillips 10mm screws
- (7) M2 nuts
- (4) M2 socket head screws
- (2) Sections of tubing from a ballpoint pen
- (4) sections of spring from ballpoint pen
- Raspberry Pi Camera V2.1 PN xYz



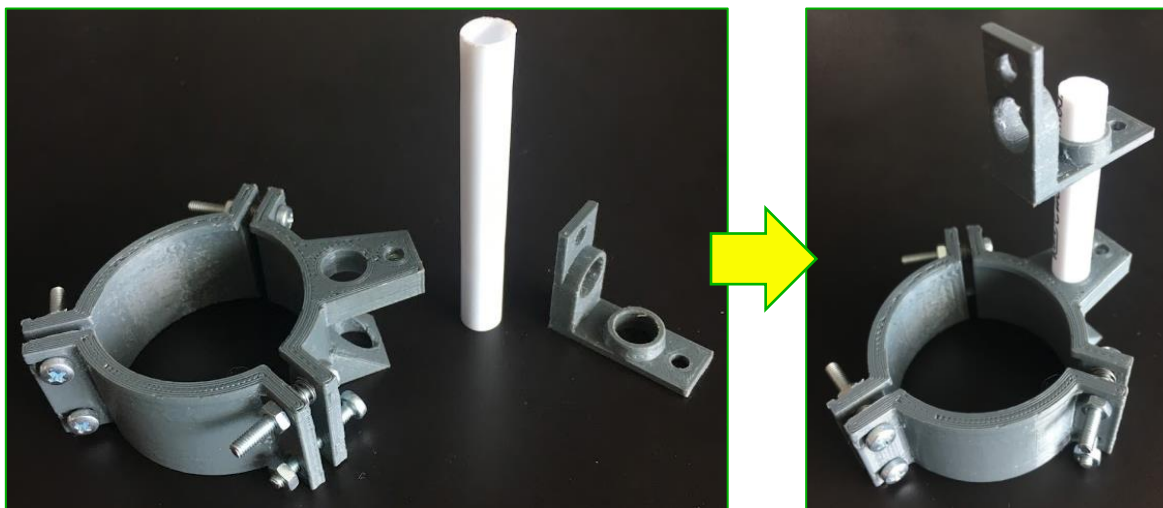
Materials needed for this section

Assembling the Microscope Base:



Assemble the ring that will act at the base of the microscope.

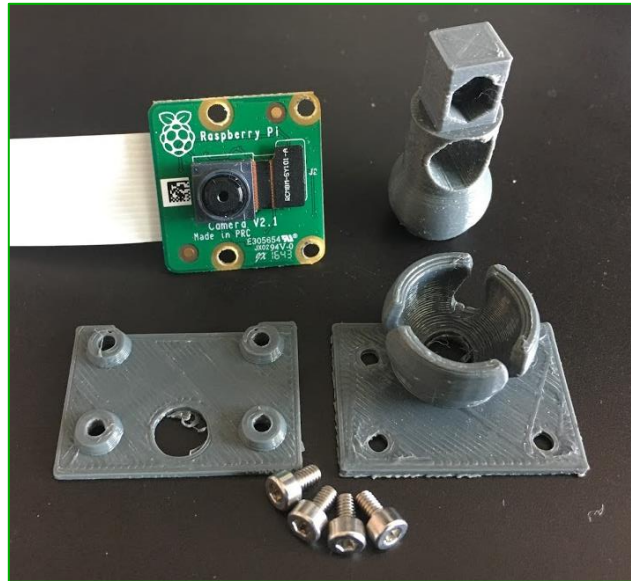
- Disassemble the clicking pen. Throw away everything but the outside tube and the spring. Cut the outside tubing as shown in the pic in the page above with a razor or something. Cut the spring into 3 with wire clippers.
- Each of the ring's three 3D printed components has a "lip" to it. The eyepiece will butt up against the lip. Keep the "lips" all facing up when assembling part.
- Each of the joints between the ring components will have two screws running through them. Putting a spring between the ring components on the top spring allows for easy manipulation later.



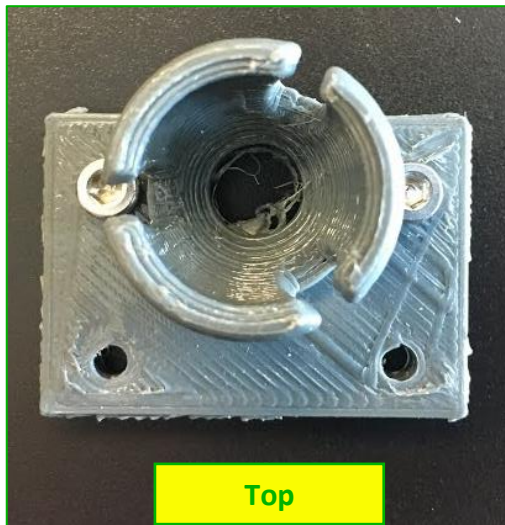
Assemble Neck of Microscope

- With the base finished, you will now insert the XyZ mm long pipe section in to the holes on the side of the base. Make sure that it is going through both holes.
- Slide the other 3D printed component on to the pipe. The tombstone side of this component will face the center of the eyepiece.

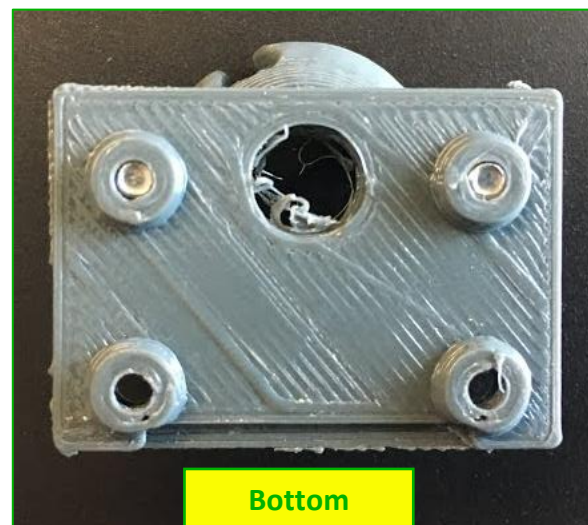
Assembling the Microscope Head



Materials Needed



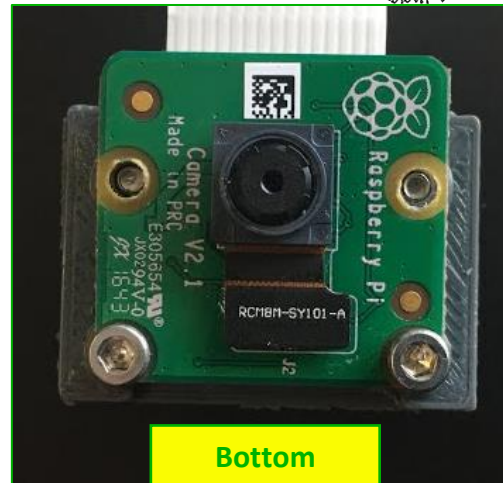
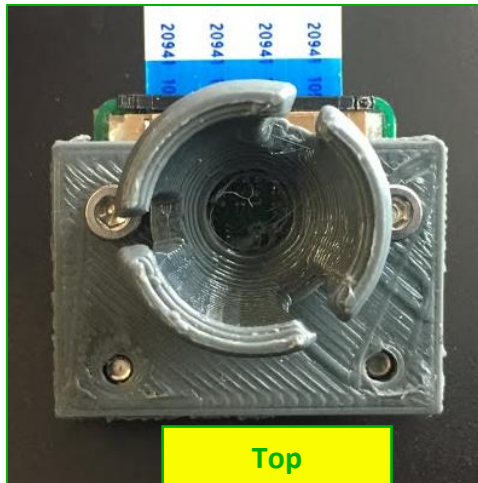
Top



Bottom

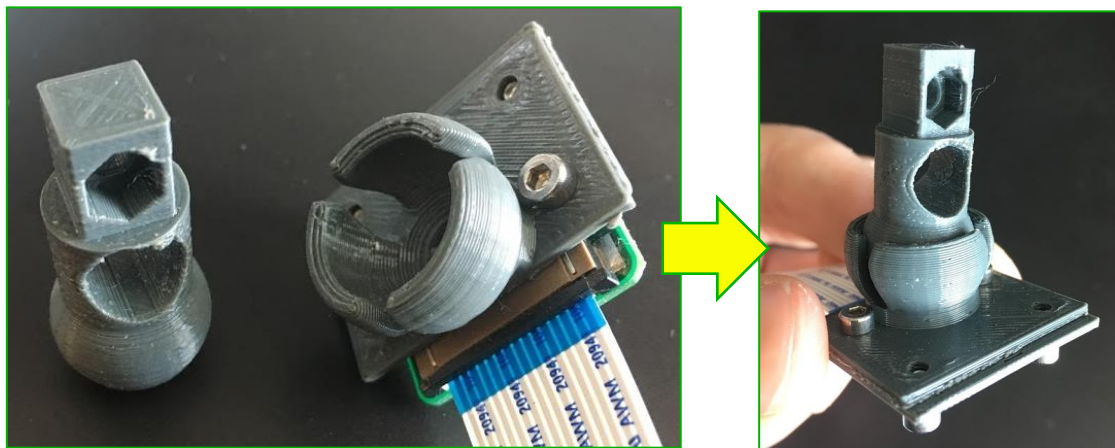
Place two hex screws into two flatter 3D Components

Align the flat sides of the two 3D printed parts shown above such that the through holes line up. Insert screws into through holes on either side of the ball-and-socket joint and tighten.

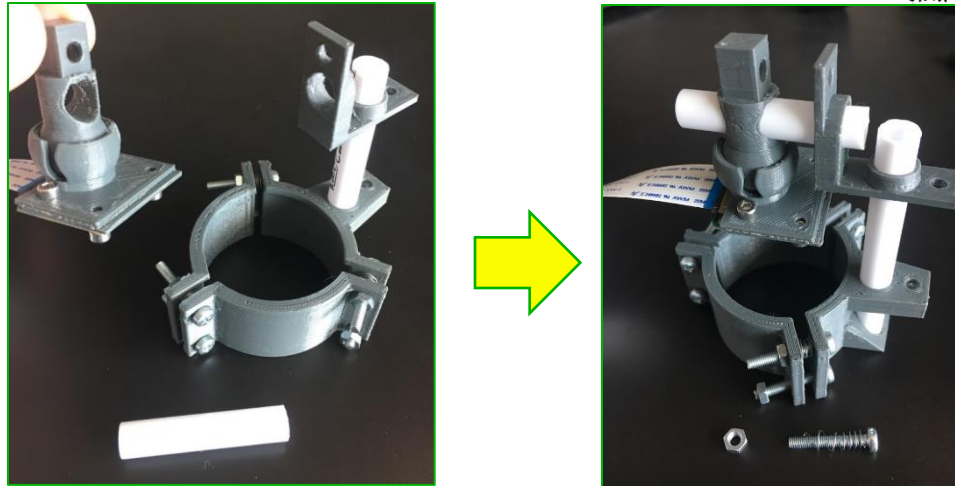


Secure Raspberry Pi camera with two M2 socket head screws

Align the camera over the other components so that the through holes on the bottom edge of the camera align with the remaining two through holes on the 3D printed components. Insert M2 socket headed screws into the through holes and tighten.

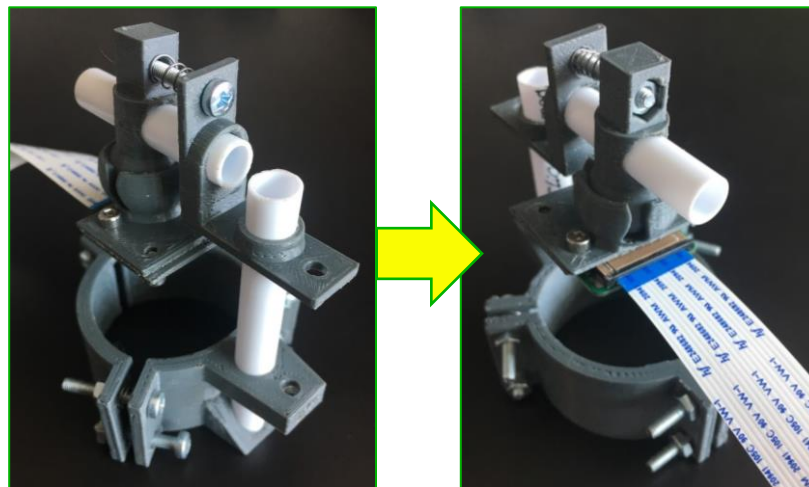


Snap together ball-and-socket joint



Press fit the camera holder to the eyepiece holder

Heck, I could try to explain this, but it's just easier to look at the pictures, eh? Put the thing in the other thing.



Place final Phillips head screw and spring

Now put a screw, nut, and spring system in. I designed it such that you could, in theory, use one hand to advance the screw for small manipulations. But the friction fit works well, and so this is probably not necessary. What is shown will move the camera up/down. You can do the same for moving the camera closer/further from the eyepiece (see the empty holes in the left picture above?), but again, kind of unnecessary with the nice friction fit you get.

Please acknowledge our facility in your publications. An appropriate wording would be:

"Engineering support was provided by the Optogenetics and Neural Engineering Core at the University of Colorado Anschutz Medical Campus, funded in part by the *National Institute for Neurological Disorders and Stroke* of the National Institutes of Health under award number P30NS048154."