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Team F: ADD_IN

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ILR08

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I - Individual progress

My goals these two weeks were to complete the mounting of the nozzles and test them. And also test the home switch for the rotary join.

1.1 Rotary joint home switch:

Even though the rotary joint can rotate continuously, we need a home switch in order to initialize the rotary joint at startup always in the same position. The choices were mechanical and optical switch, and I went for the optical one for durability and precision reasons. So to do that I ordered a photo-sensor, the EE-SX3239-P2 shown in figure 1.1. I then designed an encoder wheel that has only one slot, figure 1.2, which will attach to the barrel with a set screw.

Figure 1.1: EE-SX3239-P2 sensor

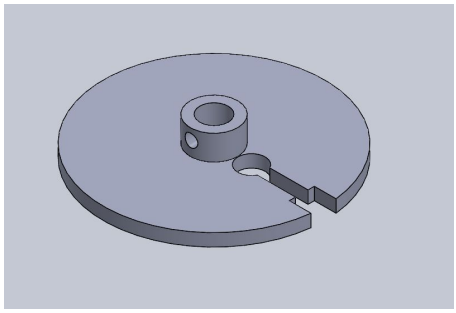
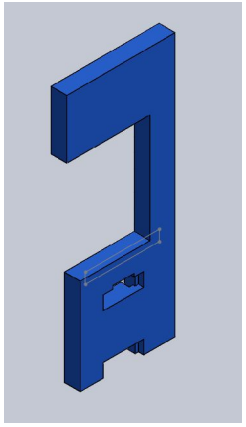
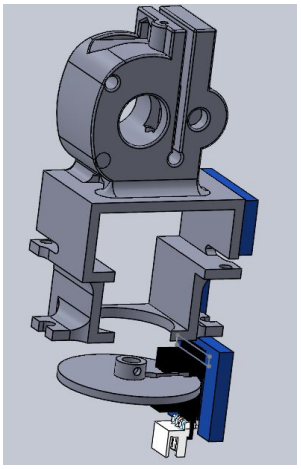


Figure 1.2: Encoder disk

I had originally planned to attach the homing switch to the motor shaft, but due to lack of space that would've increased the length of the extruder. So instead it is mounted below the slip ring, on the barrel, using a small add-on to the original mount that will hold the sensor, as shown in figure 1.3.





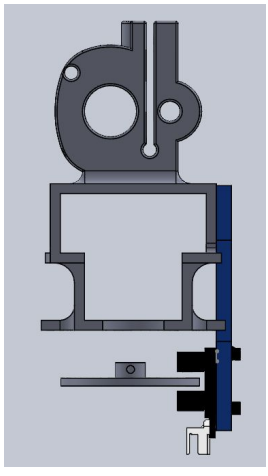


Figure 1.3 a) Add-on part b) Assembly Isometric view C) Assembly front view

I also designed and printed a new mount containing the attaching feature for the sensor, but considering the post processing needed on the mount, which doesn't print out perfectly well, it is easier to just attach the add-on using epoxy glue. Also the sensor selected has similar I/O specs as the mechanical switches the printer originally has on the other axes, so it is plug & play on the board. And was tested to be working.

1.2 Testing the nozzle:

In this part I had to test the extruder, and I met some issues. At first the printer was extruding while rotating, but the rotary axis wasn't going on 'HOLD" when it was not being rotated, this caused the nozzle to be rotated due to the friction forces with the print bed. This issue has then been solved on Firmware, preventing the rotary axis from timing-out. The second, and biggest issue was clogging. Because we removed the insulation and added heat sinks, it became mandatory to constantly run the fan for the heat sinks to be effective. We learned this the hard way, by leaving the nozzle hot without the fan for a few minutes, the filament would melt along the barrel, causing a clog that is very difficult to undo. That is worsened by the fact that the inner wall of our steel tube, although "smooth bore" sticks much more with filament than PTFE did, so after clogging I had to completely change the inner tube of the barrel. This happened 2 times and I will be working this week on permanently fixing it by adding a PTFE insulator in the barrel. A third issue happens when rotating the nozzle a lot without extruding any filament, the twist in the filament accumulates, and is not released by the extrusion, causing at some point a torsion force that is more than the holding torque of the stepper, which jumps back some steps and releases the tension. This only happens in extreme cases, but it of course must not happen, especially that we do not have feedback. Once we add PTFE the filament should be able to rotate within the barrel and not accumulate as much tension, and I will also monitoring this issue and ways to fix it during this week.

On the positive side, during the few tests I did the extruder seemed to be straight and very precise when it is not clogging, printing perfect circles when only rotating the R axes, and line on the other axes. I will have to fix the issues aforementioned before being able to do better testing.

II - Challenges

The challenges that I encountered this week were mostly the ones mentioned above with the clogging of the hot end, it is especially time consuming because with the current more complex extruder, un-mounting and mounting after each clog takes a lot more time than with the original extruder in fall. Also adding the encoder disk and the sensor while keeping a small form factor was challenging, but that has been solved.

III - Teamwork

These past two weeks, Nikhil found the bug in the firmware, with Dan's help, and then made some improvements by making the R axis relative and adding the initialization (homing) sequence to it. Dan and Astha worked on improving the GUI, and Astha also implemented a collision checking feature on the software, which checks for collision between the parts and the hot end (heat block, heat sink washers). It will be useful on parts that are concave.

IV - Future Plans

Our future plans are to fix the issues we currently have with the hot end, and mount the second hot end Dan designed on the second printer. Nikhil will also implement the kinematics of the nozzle on the firmware to make sure the path followed is the one described by the G-code. We will then focus on testing and improving our system.