

Technical report of the clay printing with robotic arm project [ALFRED]

Project's DVIC page :

<https://dvic.devinci.fr/robotic-arm-clay-printing>

How to set up the project:

1 : Set up the stepper motor's power supply:

To power the stepper motor it is necessary to use an H bridge and a microcontroller, here an arduino uno. The arduino uno code uses the stepper.h library to tell the motor to spin as fast as possible.

The motor needs a 3.3V power supply while the arduino uno can be powered between 7 and 12V. Currently a current generator is responsible for providing the two different voltages. Before assembling anything, check that the stepper motor turns correctly.

2 : Assemble the extruder

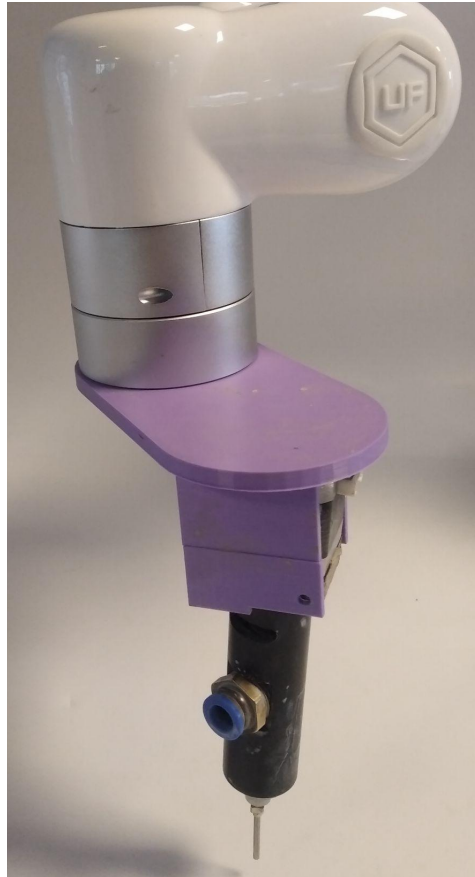




Attach the auger and gasket to the motor and check that everything is clean. Place the plastic shell around the motor and check that nothing is impeding the movement of the motor before going any further. It is important to plug in the motor to check if it is running well as soon as you have any doubts about this to avoid having to disassemble everything to understand why it is no longer running.

Then place the motor and the shell in the PLA part making the connection with the robotic arm. Place the screw to hold everything and check that the motor is running well. Finally add the nozzle and its connector to the plastic shell.

3 : Robotic arm connection

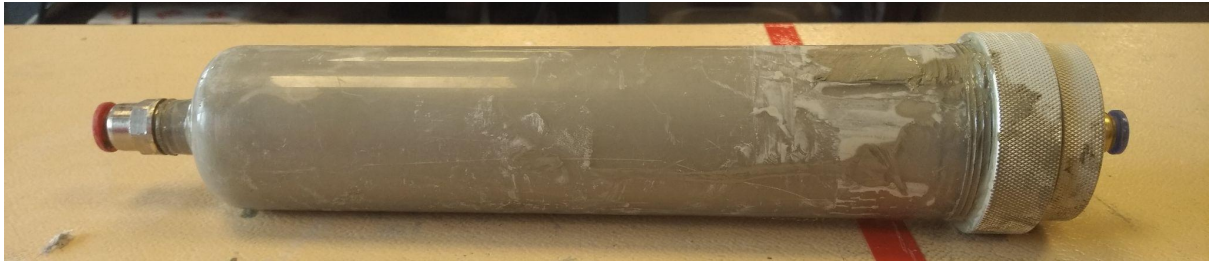


Use the PC at the robotic arm to connect to the robotic arm with the xarm app. Put the robotic arm in manual mode and then position it so that you can easily attach the extruder to the arm. Attach the extruder to the arm.

Launch the python code of the print to check if the position in Z is good. Do not hesitate to modify the value of the speed parameter in the python code so that the arm moves faster. If any problem occurs, use the stop button on the xarm application from the PC to stop the robot without turning it off. Doing a CTRL C from the command terminal will not stop the robot. Using the emergency stop button at the robot's power supply will stop all the motors and freeze them in a slightly lower position than before, which is not ideal if you want to stop the robot because it seems too low. Don't worry though, the robot usually stops on its own if it hits an obstacle.

4 : Clay supply





Fill the cartridge with clay if it is empty. The clay should be moist enough but not too runny either. An ideal consistency is close to that of toothpaste. Mix the clay using a mixer or your gloved hands so that its texture is uniform. Do not leave air bubbles in the clay cartridge. Close the clay cartridge and connect the air compressor to it at the inlet and the nylon tube at the outlet.

Turn on the air compressor and put the pressure at around 4 bar until clay comes out of the pipe. Then lower the pressure to between 2 and 3 bar.

Then connect the hose to the running extruder and wait for the clay to come out of the nozzle.

5 : Launching of the print

Run the python code with the extruder running.

Throughout the print pay attention that there is no clay overflowing the extruder from the top. Adjust the pressure, if too much clay overflows, the pressure is too high. If no clay is overflowing but there is also not enough clay coming out of the nozzle, the pressure is too low. Changing the pressure value only has an impact on the system after a few seconds, it is not immediate. It is ideal to have clay overflowing the system slightly, so that there is enough clay coming out of the nozzle.

6 : Cleaning

This step should not be neglected!!

Shut down the whole system. Separate the nylon tube from the extruder. If the system will soon be used again, close the pipe quickly with a suitable cap. The pipe must not be left in the open air while it is filled with clay. If so, the pipe will be unsalvageable, there will be no point in trying to clean it.

To empty the clay cartridge and the pipe, first separate the two then turn on the air compressor and put it under low pressure, between 0 and 1 bar. The clay cartridge will empty. Once the cartridge is empty, turn off the compressor, raise the black gasket to the middle of the cartridge and connect it to the pipe still full of clay. Turn on the compressor again to empty the hose.

Completely disassemble the extruder and remove the clay on each of the elements. To go faster, immerse everything in a basin filled with water during cleaning.