Assessment #12: Evidence of Learning - Semester 2

Interview Assessment

Name: Kumar Samyak
Date: 1/26/25
Topic of Study: Robotic Hand
Name of Professional: Dawud Rahmati
Profession: Electrical Engineering Student
Company: University of New South Wales (Sydney)
Date of Interview: January 18, 2026
Time: 9:00 pm - 9:30 pm

This was my second interview with Mr. Rahmati, and I wanted to showcase my progress with my robotic hand and receive his feedback. At this time, I was with my first iteration of the robotic hand. I had all the fingers working with all the servos and the Raspberry Pi Pico. It was essentially the CAD from my original work, 3D-printed and assembled with a couple of modifications (like using the correct model of my servos). So, I wanted to show him the working robotic hand and talk about future plans from there onwards.

Firstly, he commented on how far along I am on this project compared to last year, thanks to my accessibility to my 3D printer and other resources, like the Raspberry Pi Pico from my electrical engineering teacher. After all the affirmations and discussions about my state in ISM, we discussed the critique points. Firstly, he called out the size of the spools I had. For context, the spools stick out both below and above the hand and are about twice the height of the hand. So, I had to explain that the horns (attachments to the servos) are made of metal, and that I had used the smallest size on the servos. He suggested that I either purchase just the plastic horns and cut them to make smaller spools. He also agreed that I could try 3D-printing smaller spools with pinion/gear teeth already in them to avoid the need for a horn through a resin 3D printer or a smaller nozzle. One interesting thing that arose through the conversation was the engineering behind this decision. He explained that since I wasn't using the full 180-degree range of motion of the servo, I could make the spool smaller to reduce the hand's size. The actual math behind this is simply just the circumference of the spool (2*pi*r) and how that relates to the length of the tendon pulled to curl the finger. So, reducing the radius of the spool would result in more

rotations of the spool to achieve the same length of tendon pulled. So, I should maximize rotations to minimize the hand's size.

Secondly, a point of discussion was the “failure” of the passive retraction mechanism of the fingers using TPU. I had inserted the TPU inserts in just the index finger for testing purposes. I learned that either the servo was too weak to pull the finger with the TPU (which went against my previous separate testing) or that my clearances were too low, thanks to elephant’s foot (previous evidence of learning research analysis). However, Mr. Rahmati explained that it could be solved by making the inserts longer or shorter, as they essentially act like a spring. So, changing the spring’s size would decrease the force required to stretch the spring. We were indecisive about whether making it bigger or smaller would decrease this force, so I will test two versions of the inserts. He offered a second solution to this problem, but it is more expensive. He said that I could purchase a lower shore hardness TPU than my 90A TPU. A lower shore hardness material would deform more easily but still offer some elasticity properties. Thus, by replacing the 90A TPU inserts with, say, 80A TPU, the servo will have an easier time pulling the finger while still maintaining passive retraction. He did warn me that going too low on the shore hardness would make it impossible to 3D print, so I had to be careful and use filaments my printer could support reliably.

Lastly, we talked about what I should focus on after I solve these two glaring problems. We both agreed that I should design mounts for the Raspberry Pi Pico and PCA boards on the back of the palm to keep the electrical wires tidy. I could look up some casing models for both boards and combine them into a single casing for my purposes. We also talked about the top plate for the hand and its shape. He suggested that I include some design elements that offer more grip, like TPU inserts in the fingertips and on the palm, to increase grip strength without sacrificing much. At the end of the day, he said I should prioritize one thing at a time and not think about everything at once.

Annotated Article: Annotated Everything about Elephant Foot in 3D Printing - Makenica