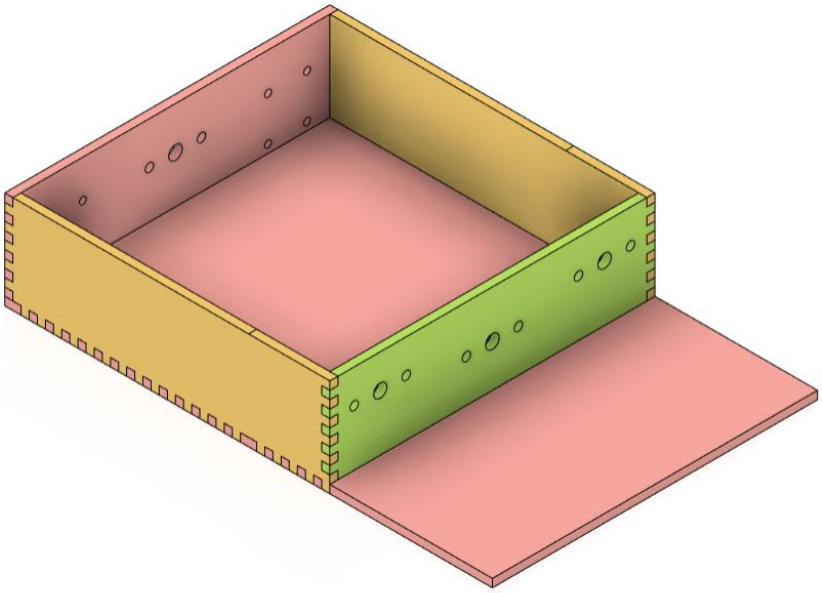
Hendrikse Jérémy

Session 1 report

This report will resume everything I've already done before this session and then describe this session.

Small reminder: Our robot is made to be used in warehouse, it will be able to pick up and drop boxes on shelves (approximately 15*15*10cm).

I oversee the grabbing system and elevation platform. I started by creating a 30*20cm (maximum size) wood base that can at the end be fixed on the drivetrain made by Julius. The base will consist of two different compartments, one for all the electronics and one that will hold the elevation system that will be big enough to place boxes on it. The two compartments are respectively 20cm and 10cm long (See image below).



3D model of the wooden base

I've created this model in Fusion360 to be able to add all my components to it and if some parts need to be 3D printed it is possible without any further development. The base will be made from 5mm thick wood. I've chosen wood because the shape isn't complex, is faster to process and easily modifiable. In my 3D model I've exported my 2D sketches as DXF files and opened them in Inkscape to be able to use the laser cutter. I then assemble and glued the different parts together.

Before I continue explaining the process, I need to instore some vocabular of the parts I will introduce in the next paragraph:

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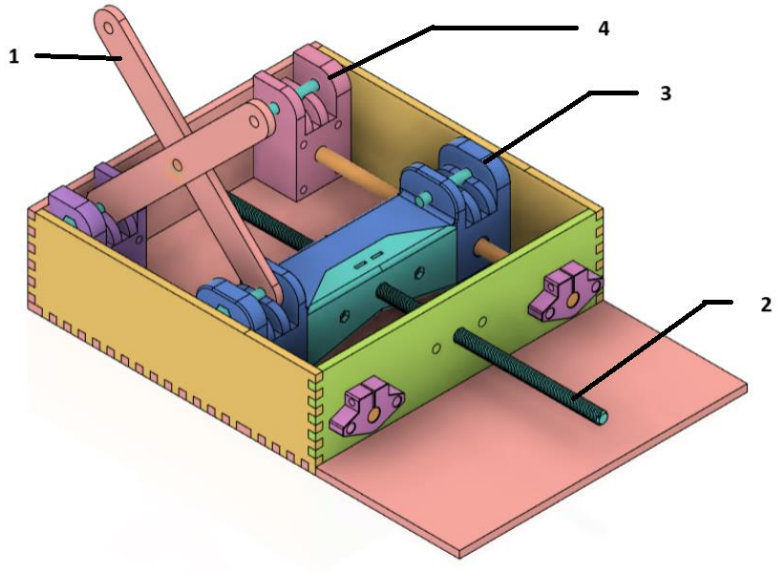
1. Lattice
2. Screw rod
3. Slider
4. Lattice fixation
5. Slider rods



After I had a solid base, I created a fixation (4) for the lattice (1) and the slider rods (5) this fixation will be 3D printed to be as compact as possible. The parts obviously need to be compact because bigger the system is, lower to elevation platform will be able to go.

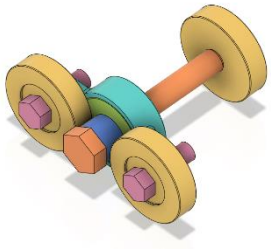
After I've had the lattice fixation, I needed a moving part to make the scissor lift mechanism to work, I had linear rolling gear that could slide on the rods but I needed to add fixation for the lattice so I designed a part that could be 3D printed. After some prototypes I came to good version. I now needed to connect it to the Screw rod. The screw is there to create motion in the system and is submitted to forces. So, after some design I found out I needed to connect both sliders together and to the screw. I've designed this part and 3D printed it.

I now had everything I needed so I created the lattice in fusion 3D, made them from 5mm thick wood with the laser cutter and could assemble everything. (see the image above to see the final assembly).

I couldn't resist the temptation to connect a stepper motor to it and try the first prototype. It worked!!

Now that I had a working elevation system, I had to design the platform and the gripping system.

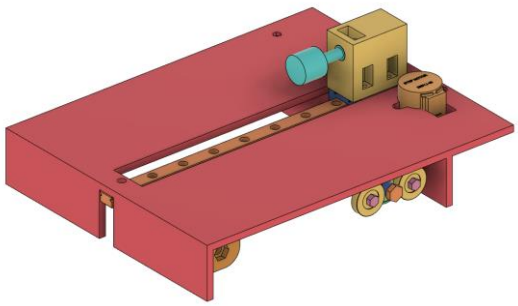
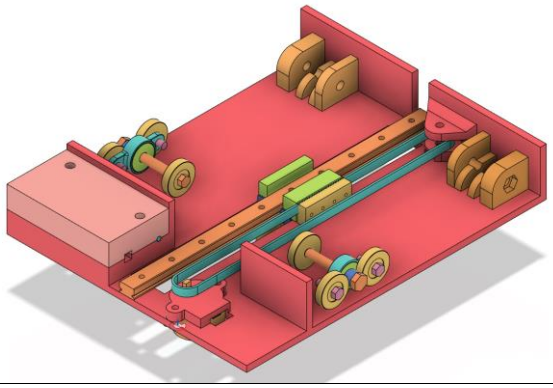
There are much less constrains on the lattice fixation on the platform because all the movement comes from the bottom. I took the same design as the lattice fixation on the base and adjusted it to go under the platform. For the moving part I choose to assemble small wheels, screws, and ball bearing to have smooth gliding motion (see image below).



Moving fixation for the lattice

I first wanted to have a wood platform and screw all the parts to it, but it rapidly seemed a bad idea because I had to attach a lot of 3D printed parts to it and wanted to have the smoothest surface possible on top of the platform. A lot of screw would mean a lot of holes and not easy holes to make sure they wouldn't overshoot the surface.

I now had a platform and needed to add the box gripping system. As explained in the Art of Work I've opted for a suction system that consist of a vacuum pump, an electro-valve, and a suction cup. The suction cup needs to be mounted on a linear guide to be able to go in contact with the box and then pull it. The linear motion system will be connected to a belt actioned by a stepper motor. So, in the design of the platform, I needed to add place for a stepper, a belt, wheels to fix the base, a vacuum pump and an electro valve. I had the final design as shown in the image below.

	
Upper side of the platform	Under side of the platform

Everything in dark pink and orange will be printed together. The light pink part will be printed separately.

As you can see on the image above the suction cup is mounted on a 3D printed support screw to the linear motion guide.

I made all the design with the dimension I could find on the internet while waiting for the parts to arrive and to measure them correctly.

Today I received most of these parts and retrieved the electronic parts I needed: a small stepper for the belt and the module to drive it and an H-bridge to drive the vacuum pump and supply the big

stepper for the elevation platform. I also connected the vacuum pump and suction cup and tested them to make sure the suction would be enough for our application.