

From folded to floor: integrating an assistive arm onto a manual wheelchair

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1 Introduction

Manual wheelchair users struggle to reach the floor. **Robogami** is a foldable, origami-inspired arm that deploys to pick up objects, then folds away.

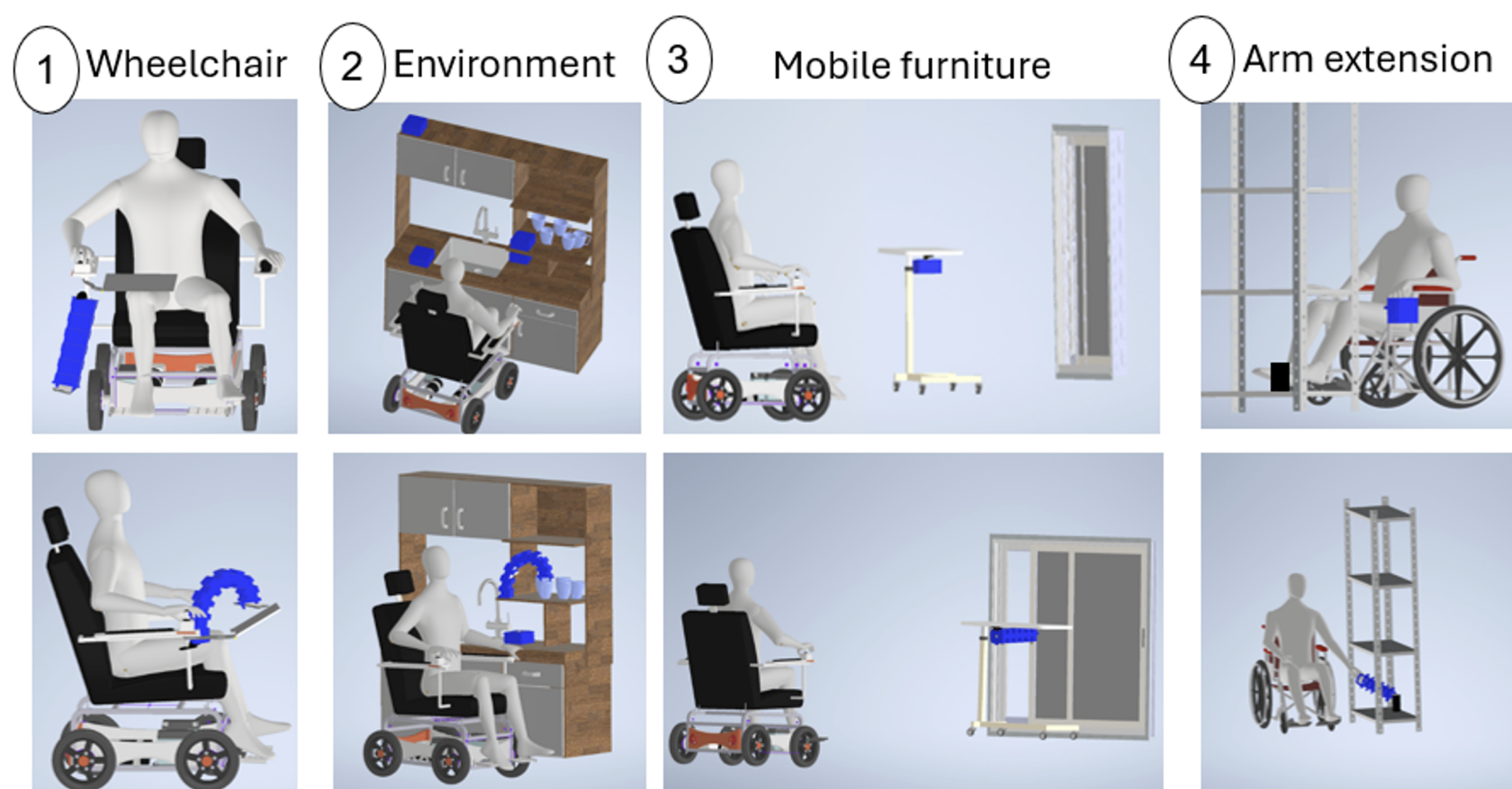


Figure 1: Four everyday use cases.

How it works: the arm is built from two or three folding segments that have three servos each.

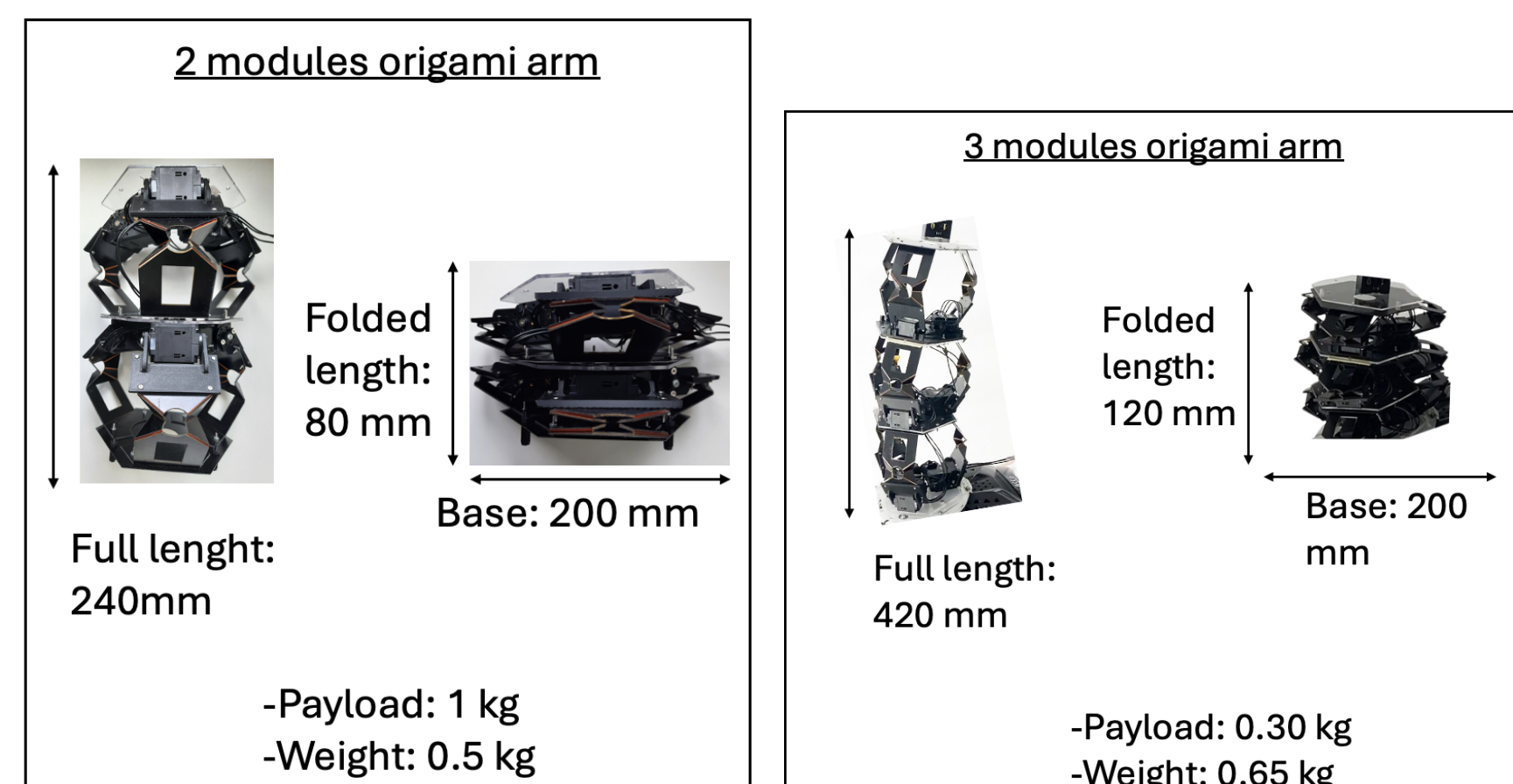


Figure 2: The two configurations of the Robogami.

2 Approach

A user study run *before* this internship mapped what wheelchair users need:

1. Non-obstructive and discreet on the chair
2. Low mass
3. Modular, replaceable sub-units
4. Sufficient power and runtime

Process: paper sketches first, then parametric CAD (Autodesk Inventor), then the prototype validated **part by part, empirically**

3 System & Build

Integration solutions.

- **Decoupling** of the gripper pump and electronics ensures the reusability of the prototype.
- **Sliding snap-fits** seat the components and close each enclosure, minimizing tool use.
- **Bayonet snap-fit** joins the pump and electronics enclosures mechanically with a quarter-turn.
- A **guiding magnet** self-aligns the bayonet before it locks.
- **Pogo pins** make the electrical link when enclosures mate.

Components. 6× Dynamixel XM430-W350 servos (2 modules); Arduino DUE + Dynamixel Shield; Airpo D2028B vacuum pump (12 V); 3S LiPo (11.1 V, 2500 mAh); enclosures and wheelchair mounting FDM-printed in PLA Tough+.

4 Results

The prototype is **functional, lightweight and modular**. Discretion and practicality remain **moderate**: the wiring routing and the pump's acoustic isolation still need improvement (Fig. 6).

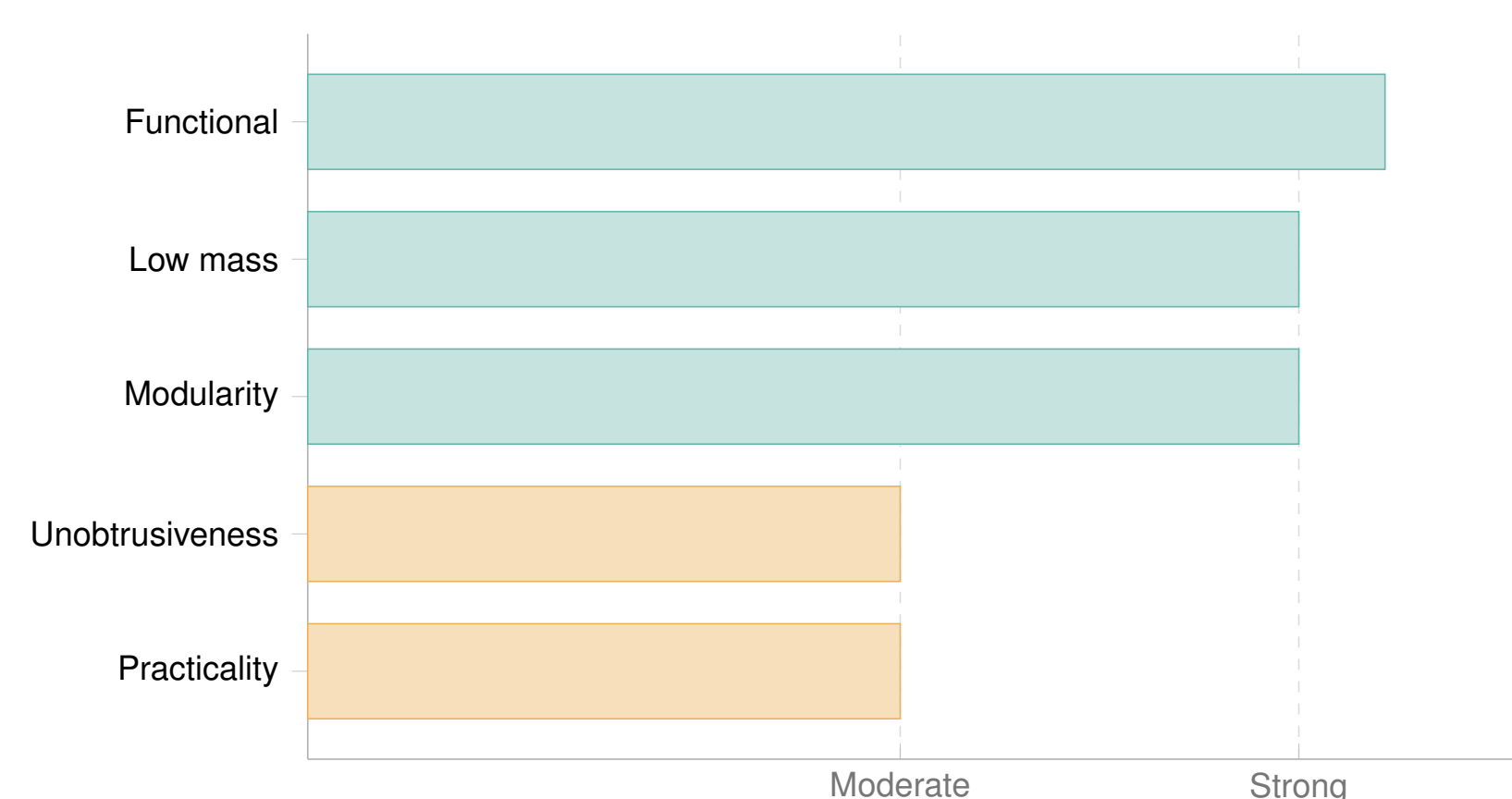


Figure 6: Self-assessment against the design requirements.

5 Conclusion & Discussion

This internship turned my Bachelor studies into practice, and showed how much **adaptability, modularity and practicality** matter, especially for people with reduced mobility.

Existing wheelchair-mounted arms are rare and costly, so the user study was key to designing for real needs. The prototype is unfinished and will not fit every chair, a measure of the work still ahead to make these users more independent.

System & Build : assemblies

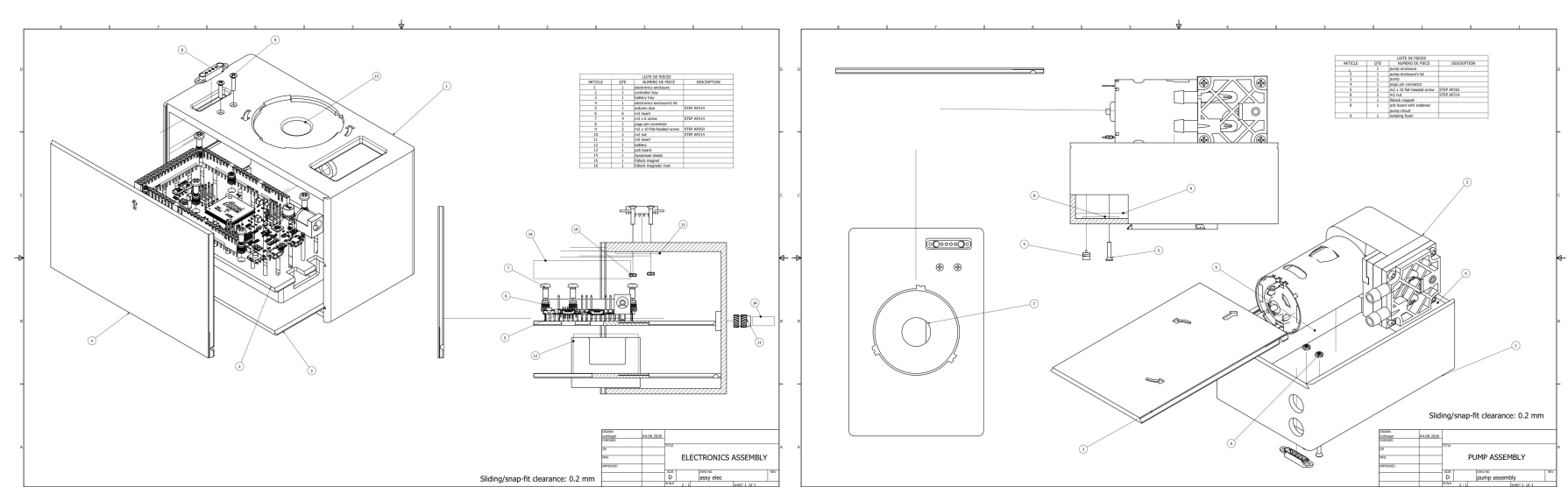


Figure 3: Electronics enclosure.

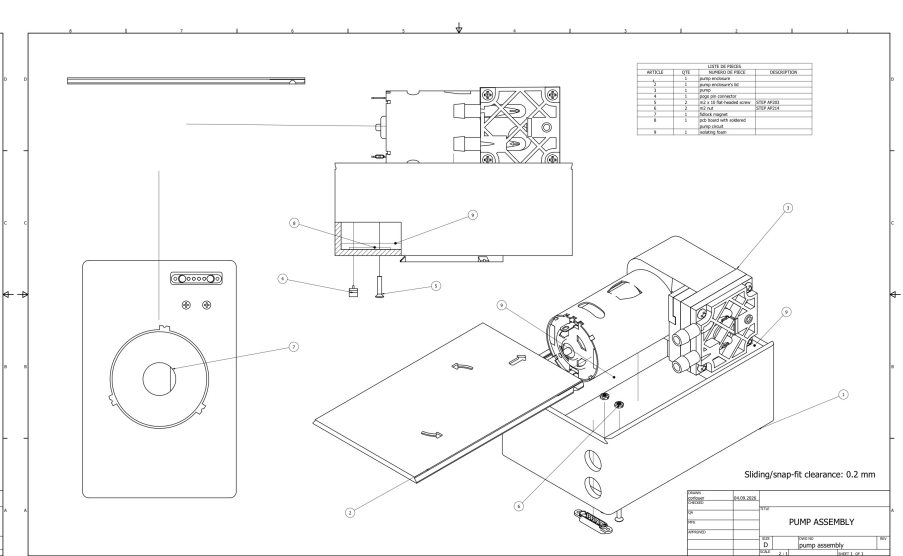


Figure 4: Pump enclosure.

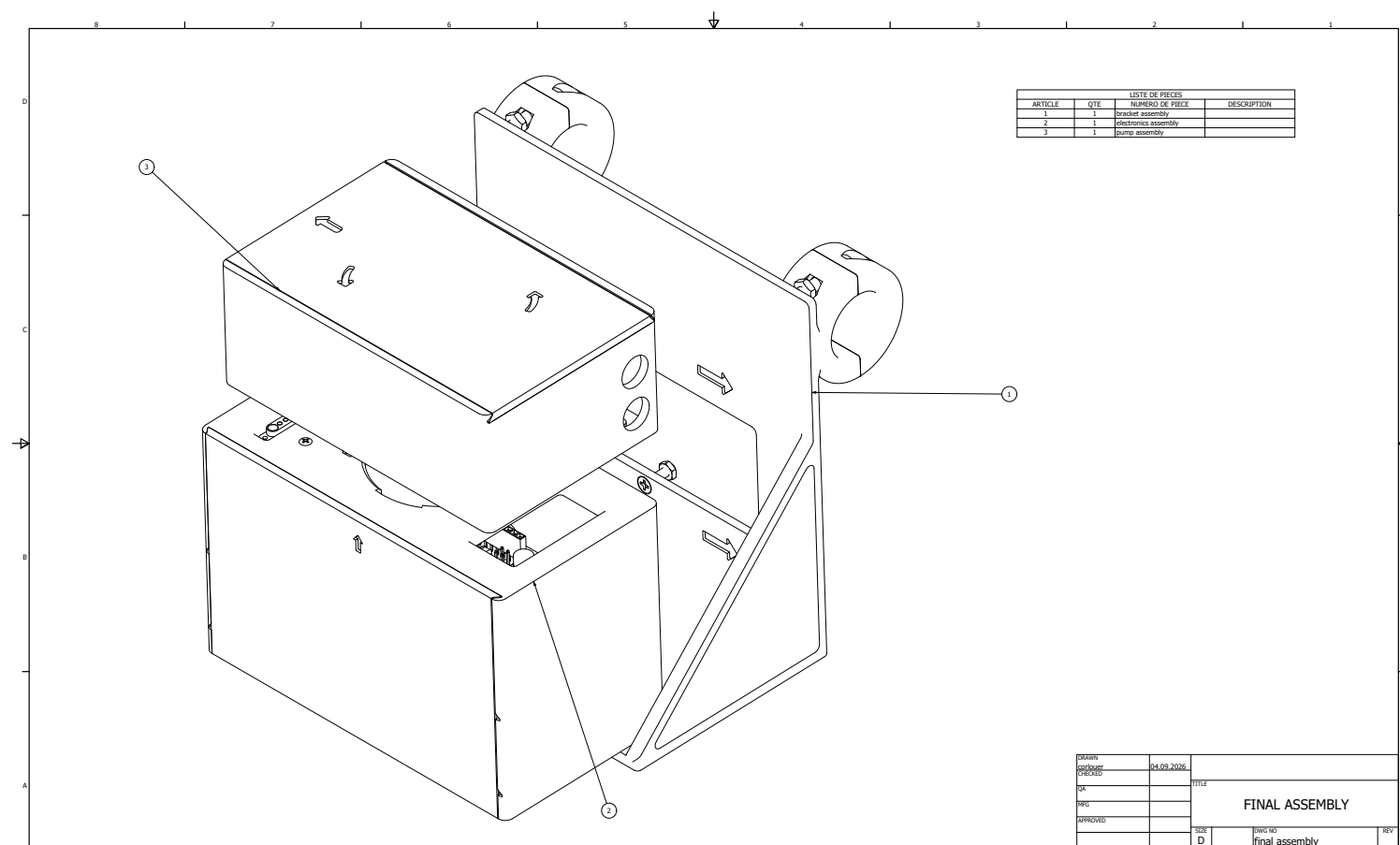


Figure 5: Final assembly.