

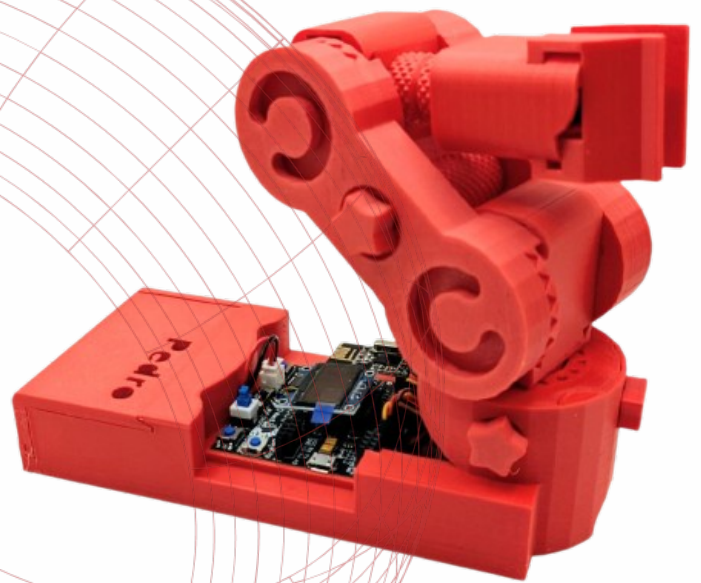
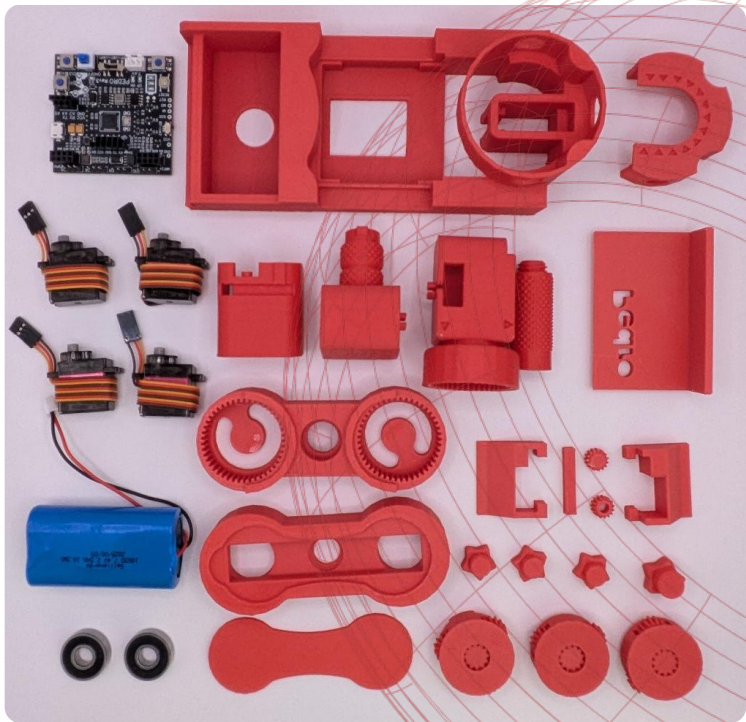
BEGINNER

pedro



STEM Program

Lesson #3: Pedro Assembling



Complete this lesson
to earn your Pedro
Badge



Add it to your Pedro
Passport to track
your STEM journey

YOUR MISSION: Discover the Pedro Board, the electronic brain that controls Pedro robot.

Learning Goals

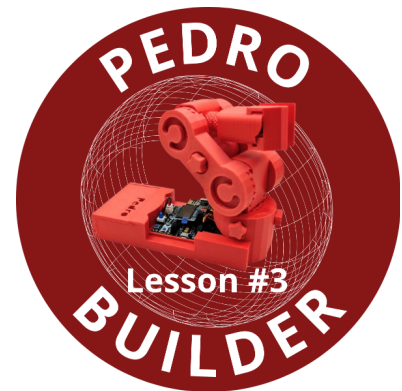
In this lesson, students will assemble the Pedro robot while discovering how robotic arms are designed.

They will explore the mechanical structure of Pedro, learn about servo motors, and understand how planetary gear systems improve motion and precision.

This lesson combines engineering, mechanics, and fabrication in a hands-on experience.

At the end of this lesson, you will unlock your Pedro Badge.

🏆 the Pedro Builder Badge



Teacher Notes

- No prior robotics experience required.
- Duration: 60–90 minutes
- Difficulty: ● Beginner
- Required Materials
 - **1 not Assembled** Pedro robot **per student or per group**
(recommended: groups of 2 students)
 - **1 computer** with the Arduino IDE installed



Think: The **brain icon** encourages students to make careful observations, share their ideas, and engage in discussion by explaining and justifying their answers.



Learn: The **light bulb icon** indicates important concepts that students should read carefully. Students are encouraged to ask questions and discuss these topics about the robotics concepts presented in the lesson.



Make: The **pencil icon** indicates that students must complete the activity on the page. These activities are designed to reinforce the concepts learned through experimentation, and problem-solving.



- ✓ All Pedro 3D printed parts (22)
- ✓ Pedro Board
- ✓ 2 ball bearings 8x22x7 mm
- ✓ 4 continuous rotation (360°) servomotors
- ✓ 7.4V DC battery





Planetary Gear System

A **planetary gear system** (also called an **epicyclic gearbox**) is a compact gear mechanism widely used in **robotics, industrial machines, electric vehicles, and aerospace systems**.

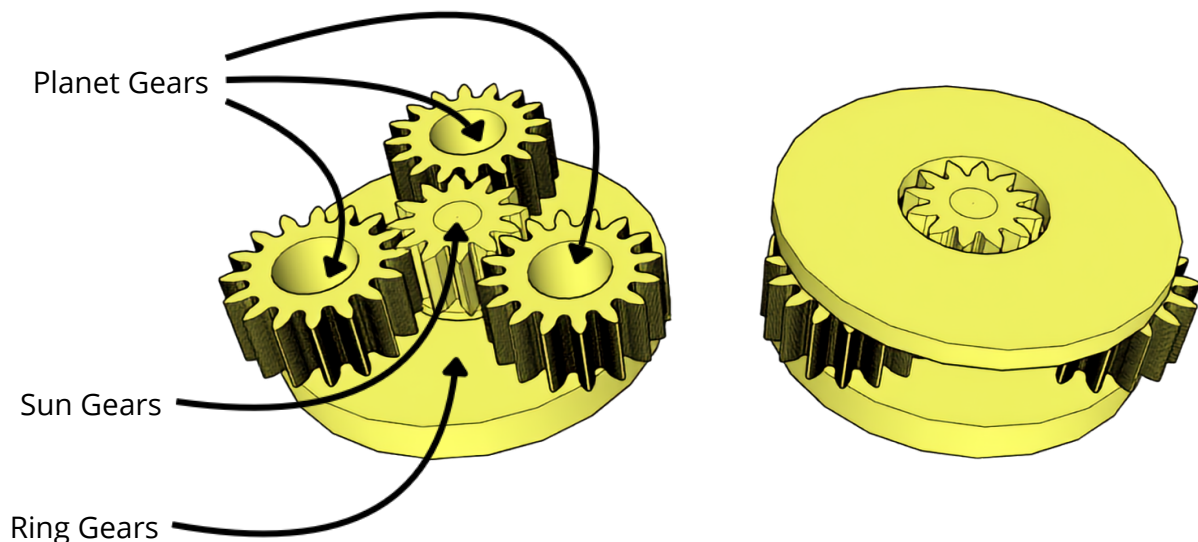
Its purpose is to **transmit motion, reduce speed, and increase torque**, allowing a motor to move heavier loads with greater precision.

Unlike a simple pair of gears, a planetary gear system distributes the force across several gears, making it stronger, smoother, and more efficient.

A planetary gear system is made of three main elements:

- ⚙️ The **sun gear**: the central gear (driven by the motor)
- ⚙️ The **planet gears**: three gears rotating around the sun
- ⚙️ The **ring gear** holding everything together

Together, these three components create a powerful and compact transmission system. Pedro uses **three fully 3D-printed planetary gear modules** located in its main joints: Base, Shoulder and Elbow joint. Each module is driven by a **continuous rotation servomotor** positioned at the center of the gearbox.



Encourage students to manipulate the gearbox before explaining how it works. Let them observe that **all the gears move together**, and ask them to describe what they see using their own words.



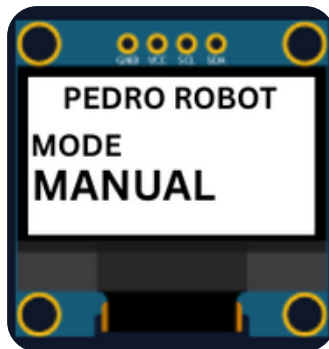
Board Configuration

The **Pedro Program** is the core software that powers and controls the robot. It acts as the robot's "brain," managing all behaviors and interactions.

Through this single program, students can access and explore multiple control modes, allowing them to understand how a robot receives instructions, processes them, and translates them into physical actions.

1. **Insert** the Oled Screen into the Pedro board
2. **Connect** the board to your computer with the Micro USB cable.
3. Open **Arduino IDE**
4. **Install the required libraries** from the Library Manager:
 - Tools → Manage Libraries → search **PedroRobot** → Install
 - Tools → Manage Libraries → search **U8glib** → Install
 - Tools → Manage Libraries → search **RF24** → Install
5. Select the port that appear when you connect Pedro robot: **Tools → Port**
6. Select the board: **Tools → Board → Arduino AVR Boards → Arduino Micro**
7. Open the PedroRobot program: **File → Examples → PedroRobot → Pedro**
8. **Compile and upload** the program to your Pedro board.

✓ If everything is correct, Pedro's OLED screen will display **MANUAL MODE**.

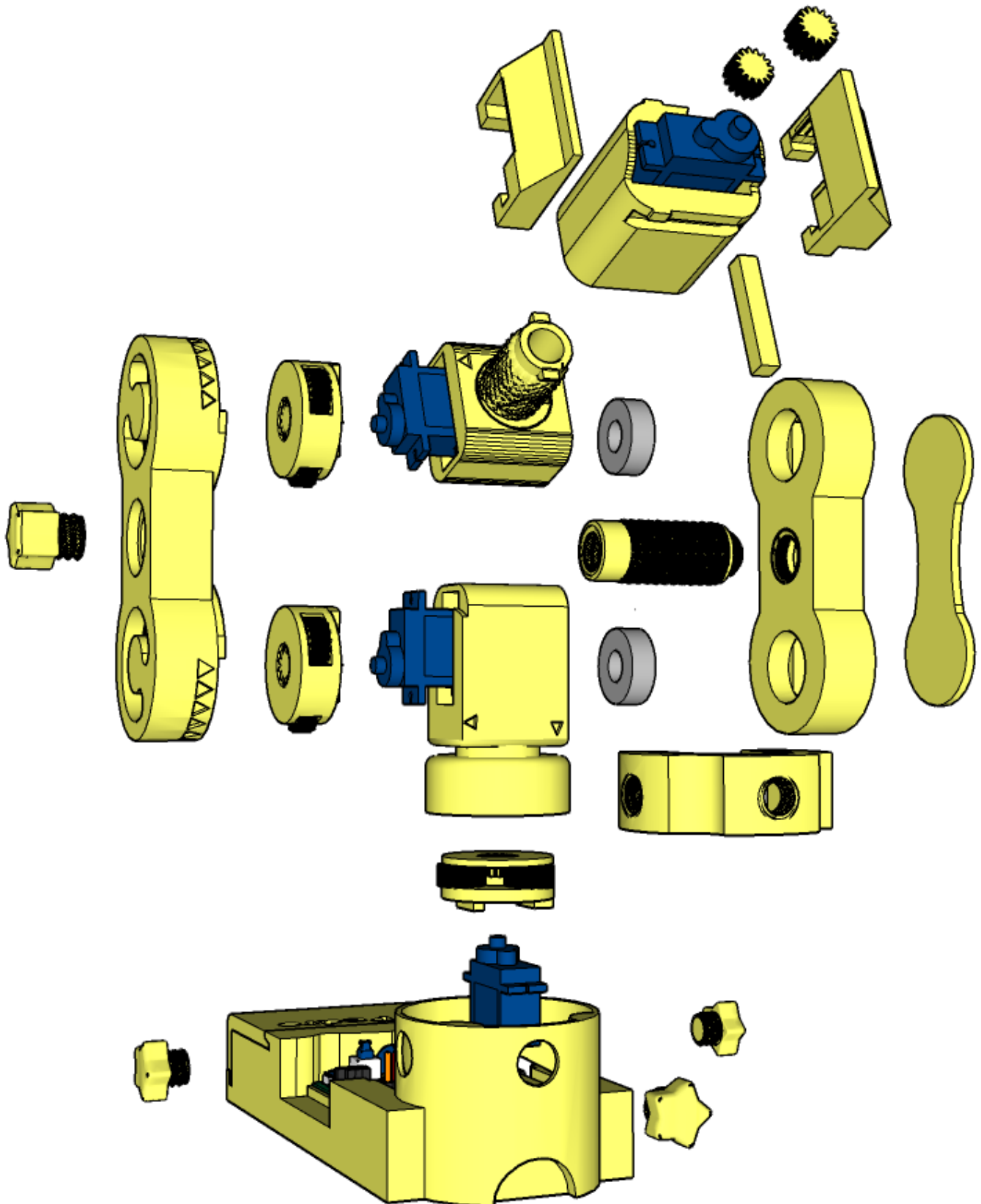


Press **A0** and observe what happens. Each time you press **A0**, Pedro selects the next servo. The LED corresponding to the selected servo lights up, indicating which part of the robot you are controlling. The mapping between the LEDs and the servos is shown below:

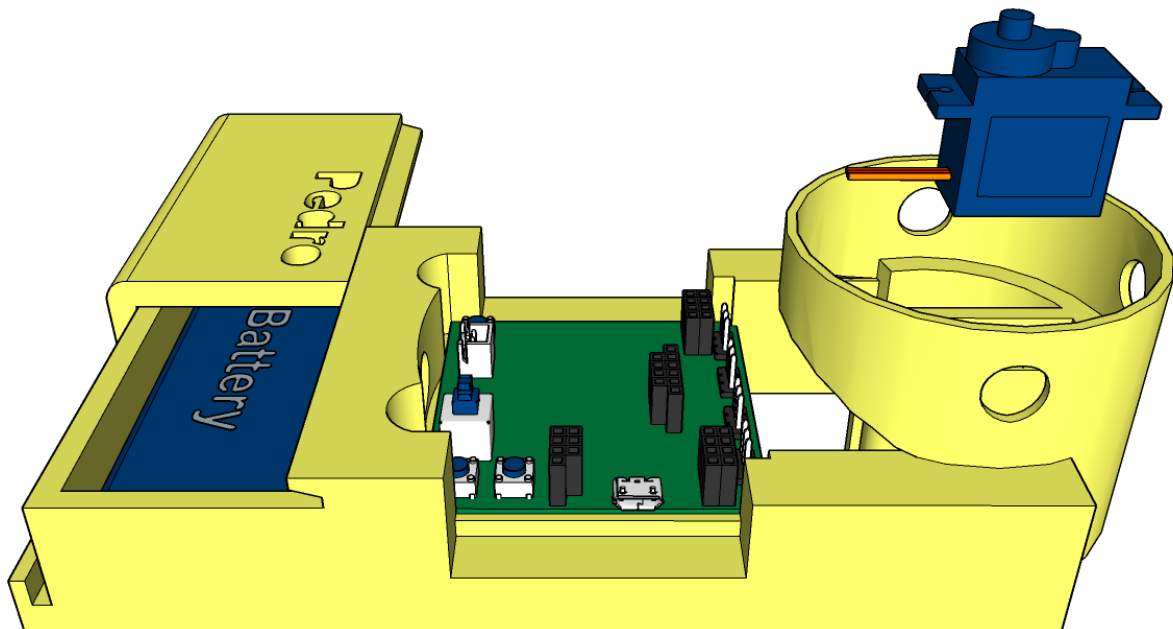
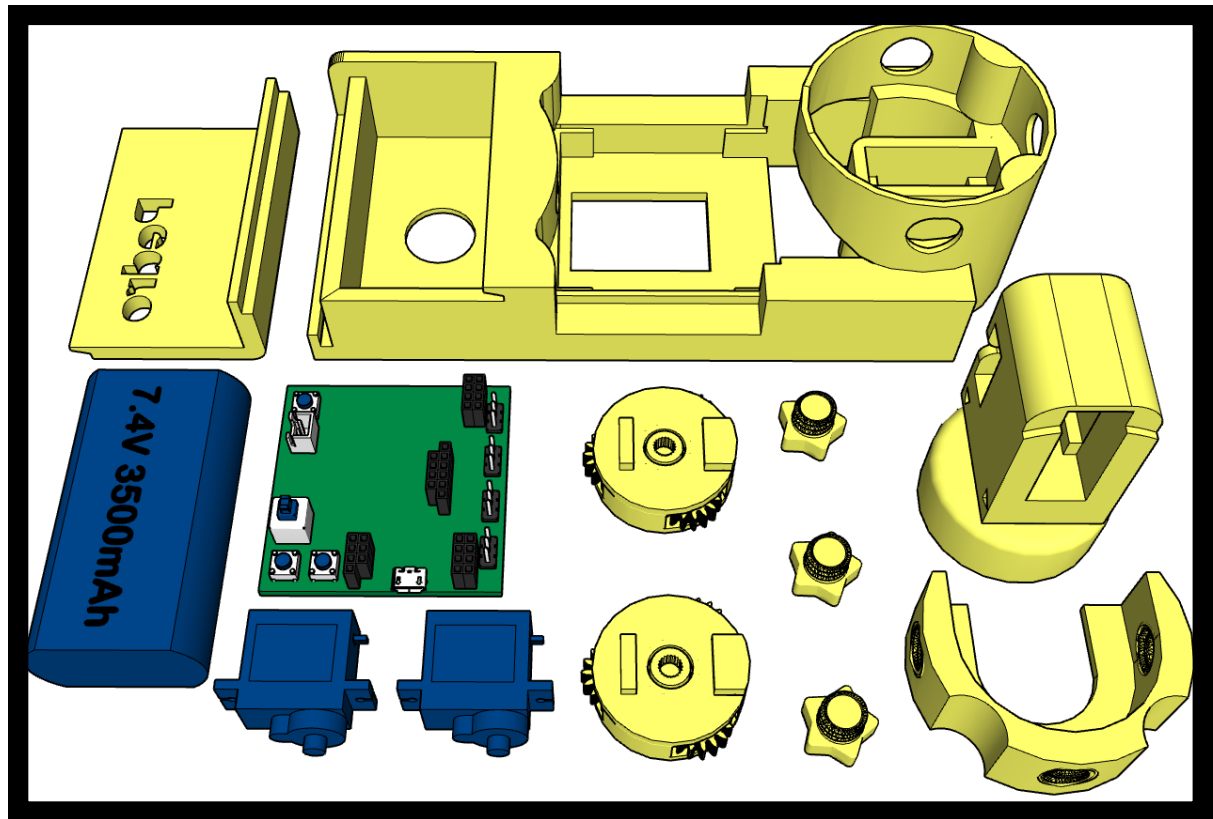
- LED D13 → servo D5 (Base)
- LED D11 → servo D6 (Shoulder)
- LED D8 → servo D9 (Elbow)
- LED D7 → servo D10 (Gripper)

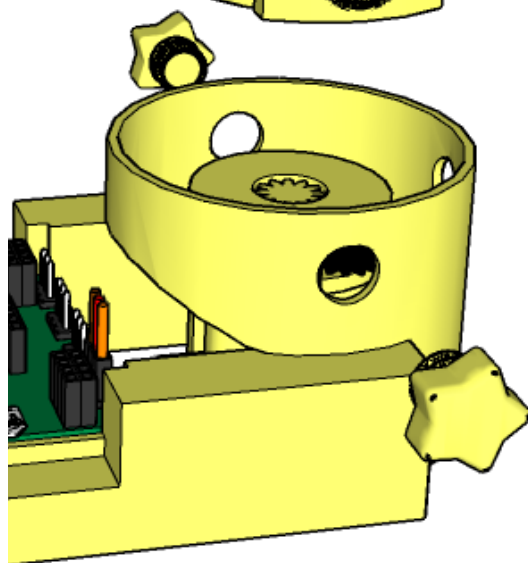
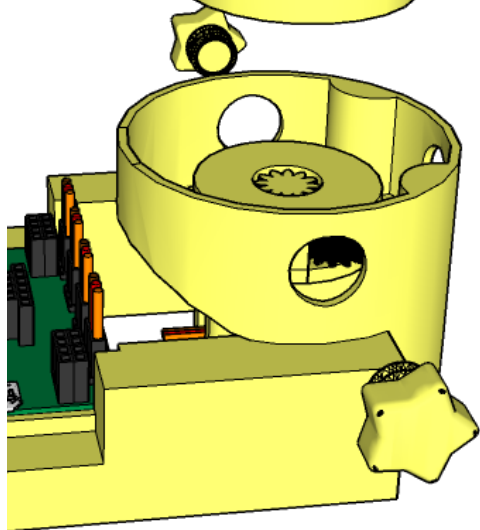
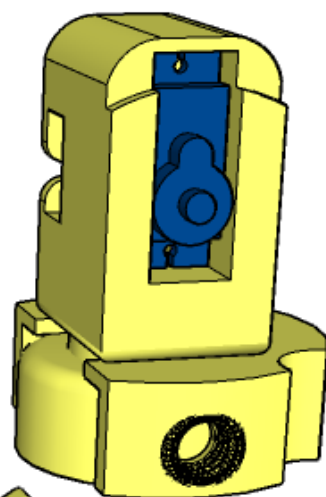
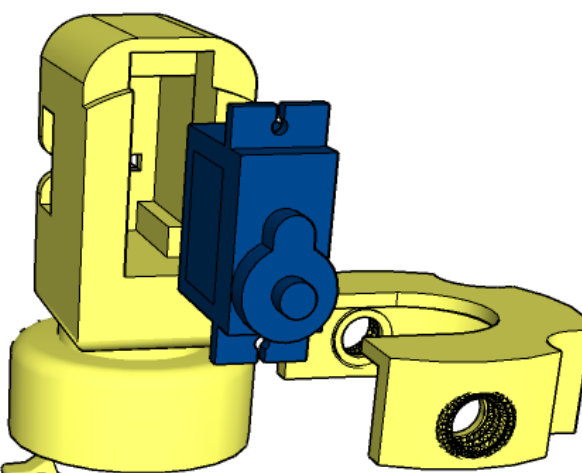
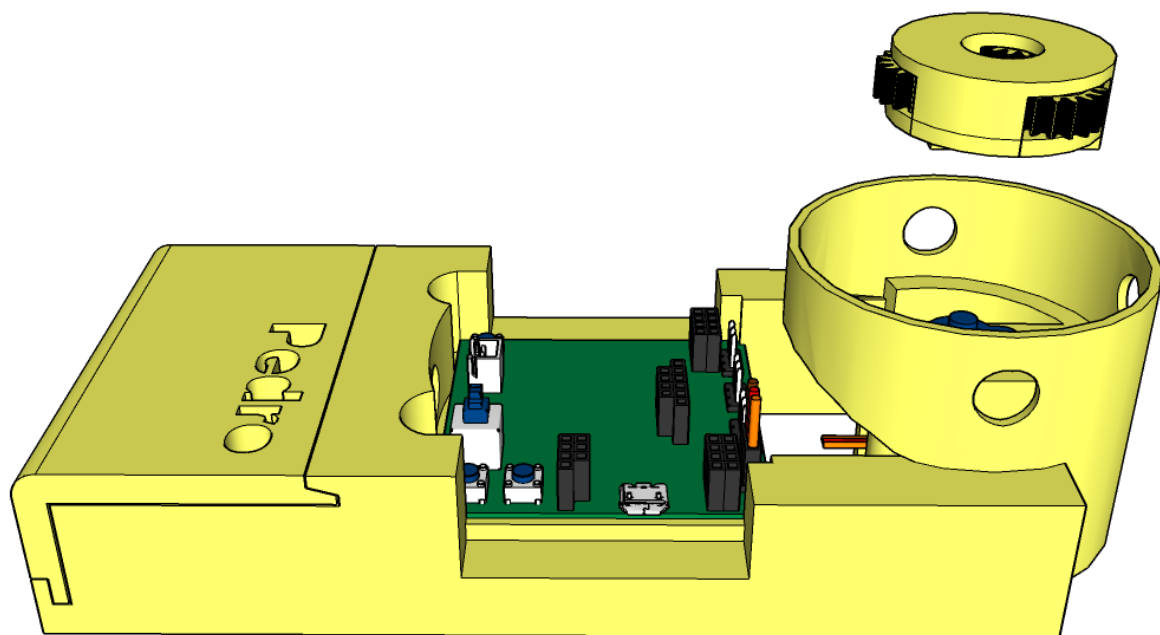


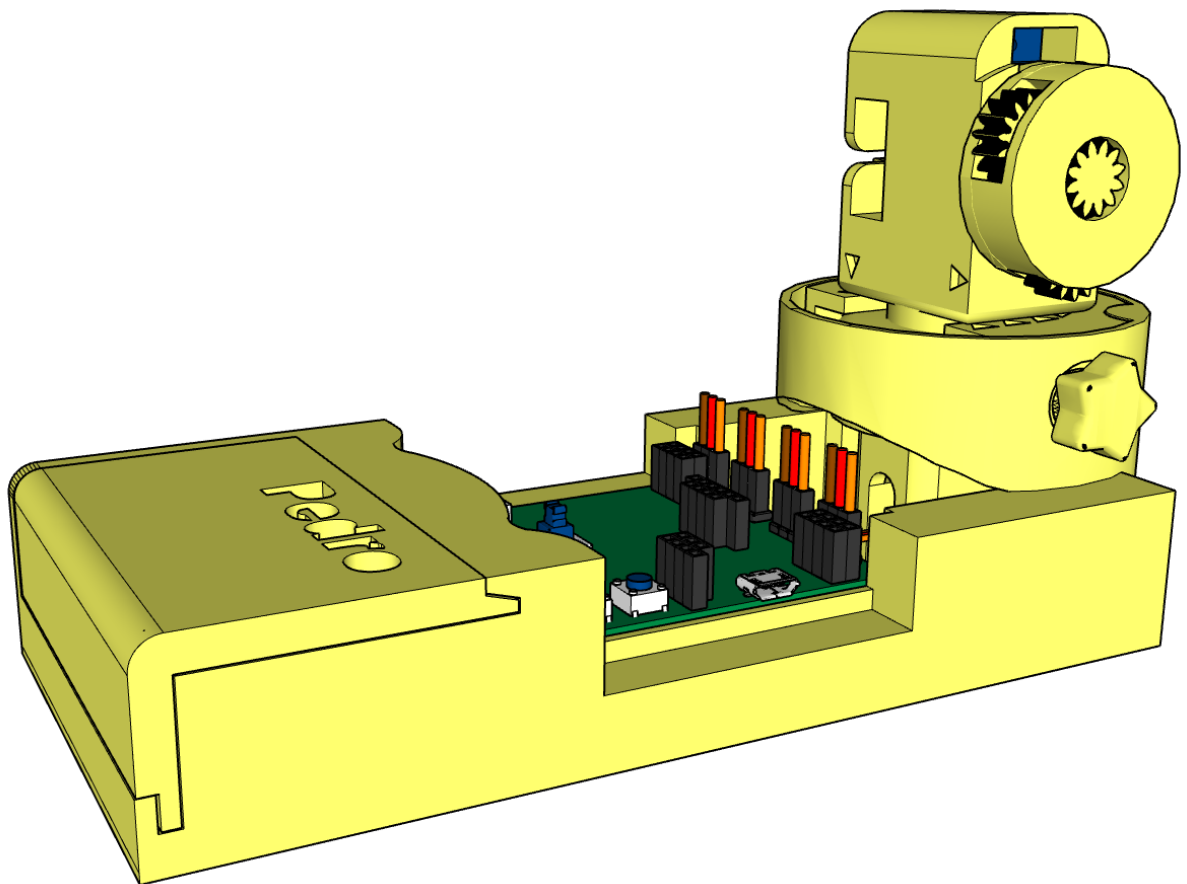
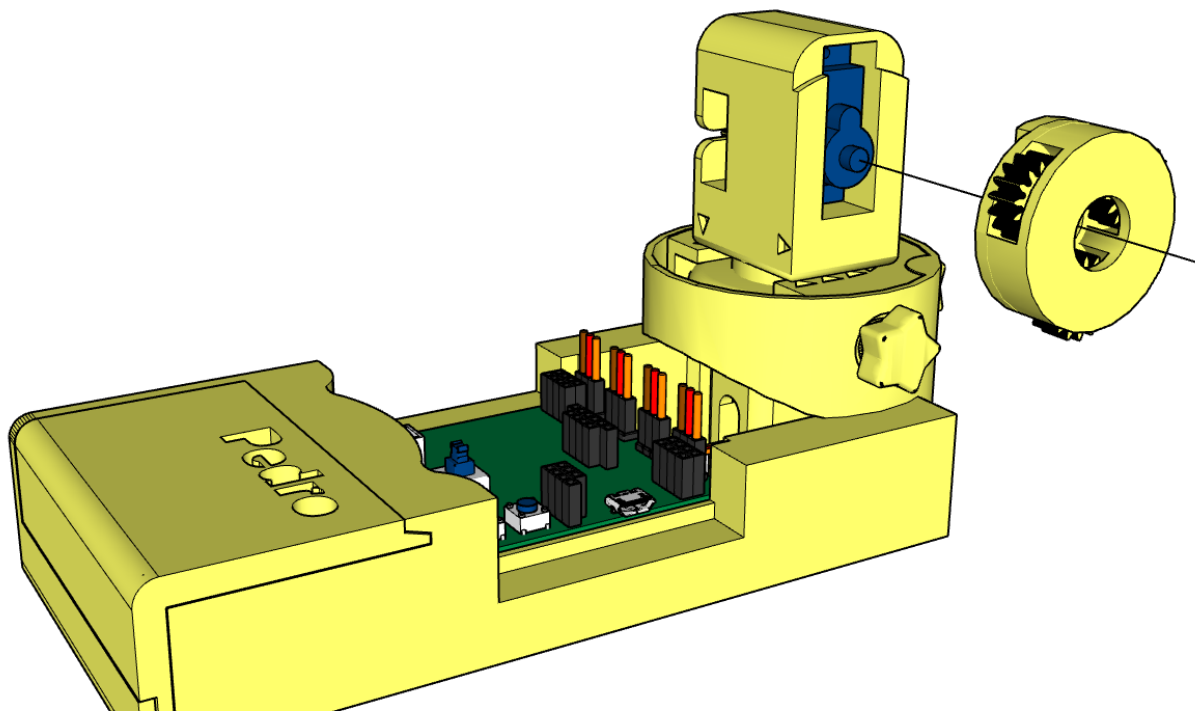
Assembly Instruction



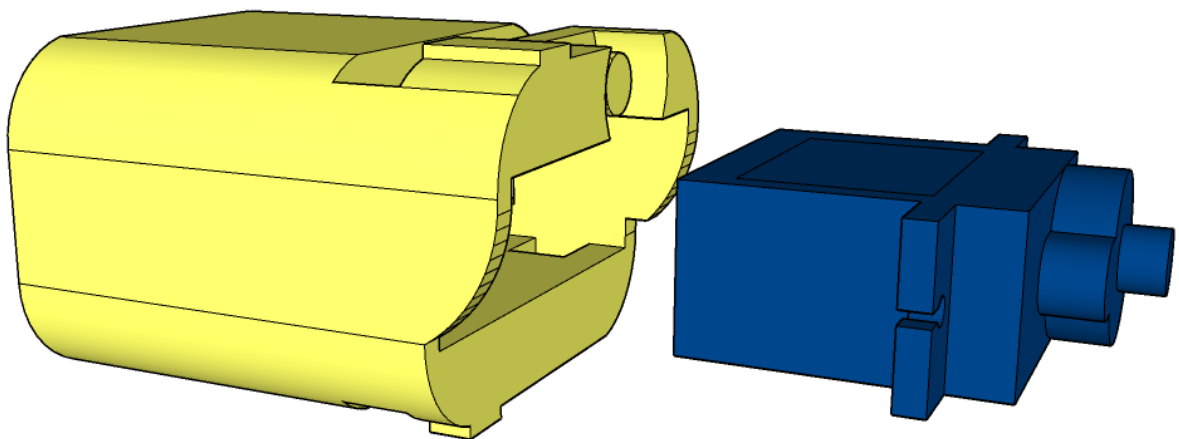
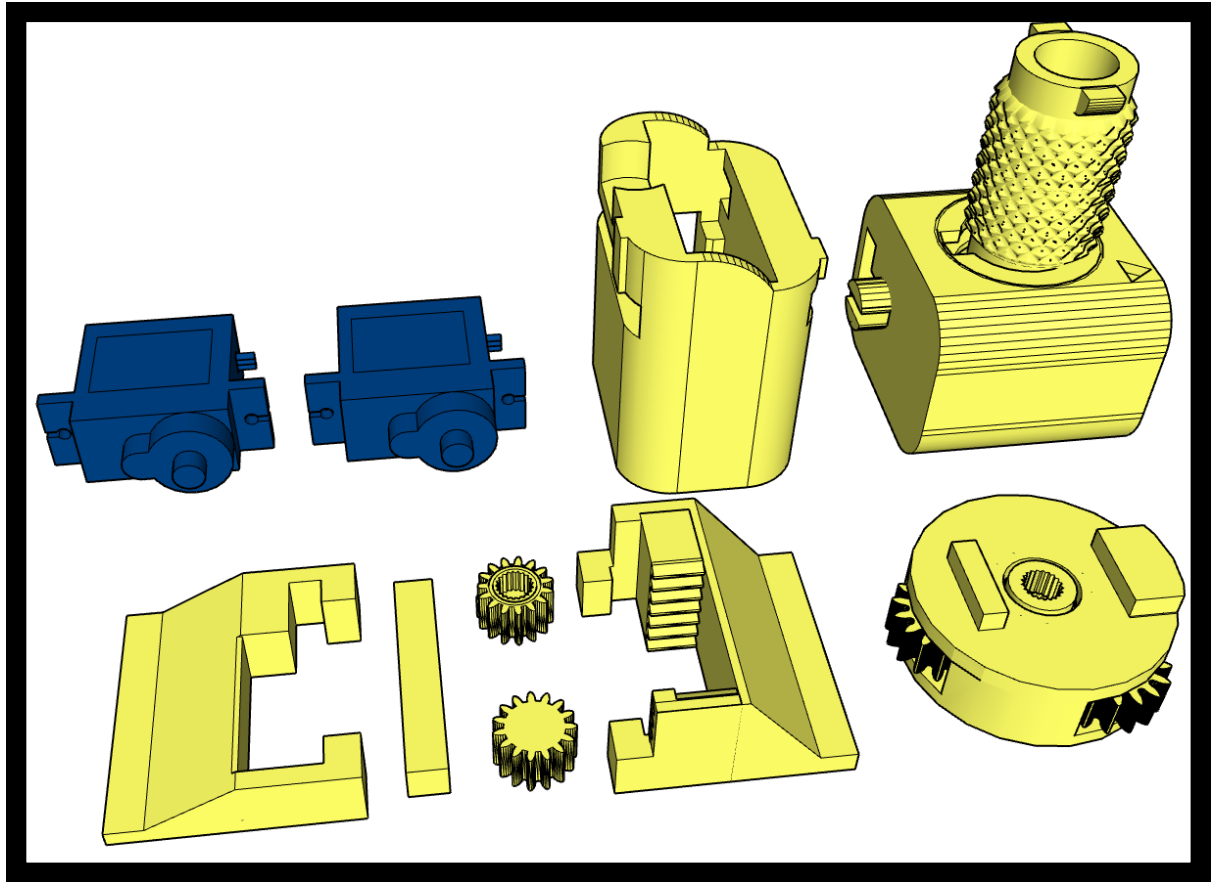
STEP 1: The Base

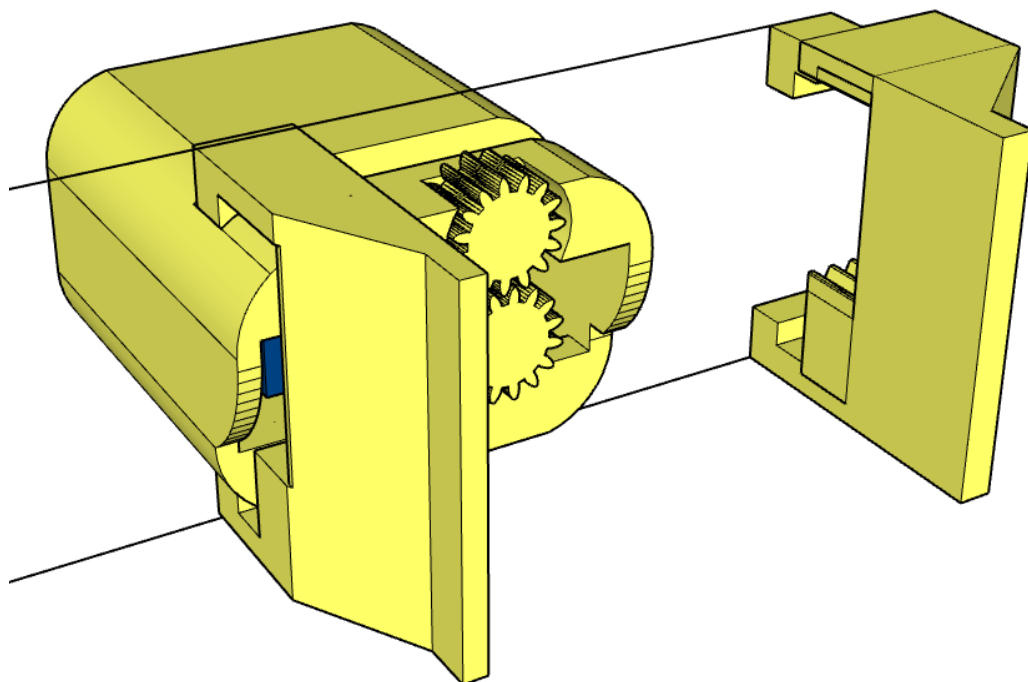
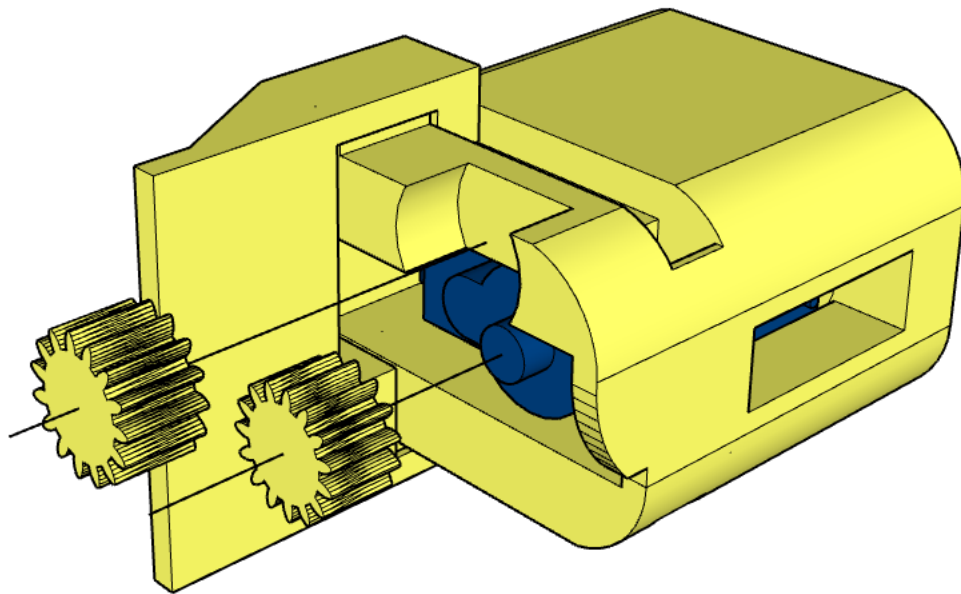


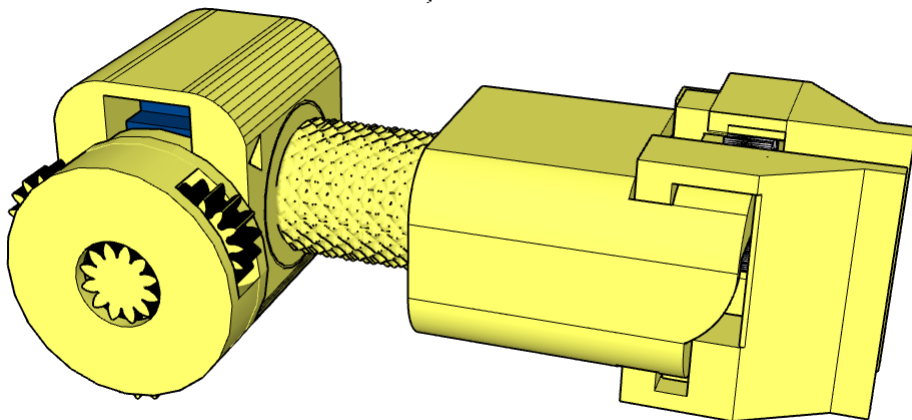
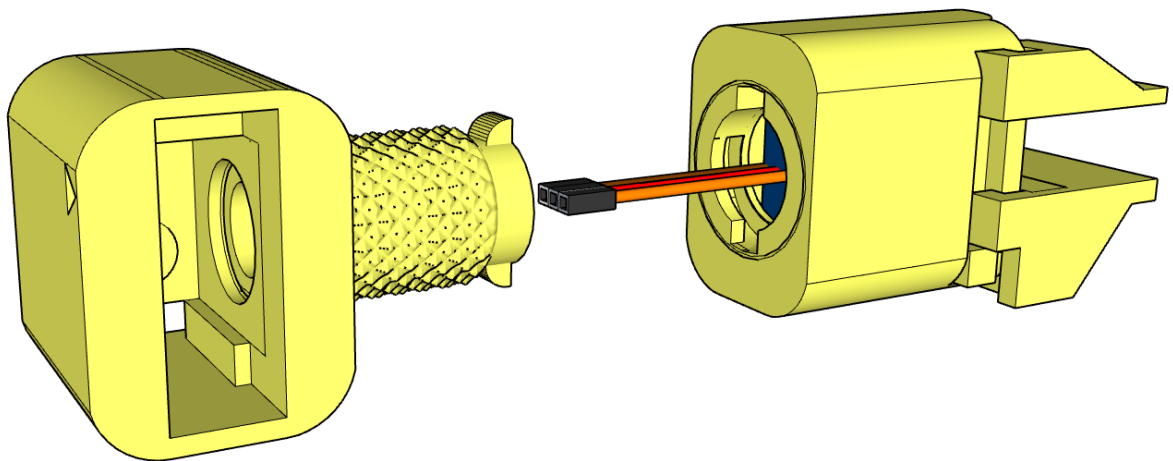
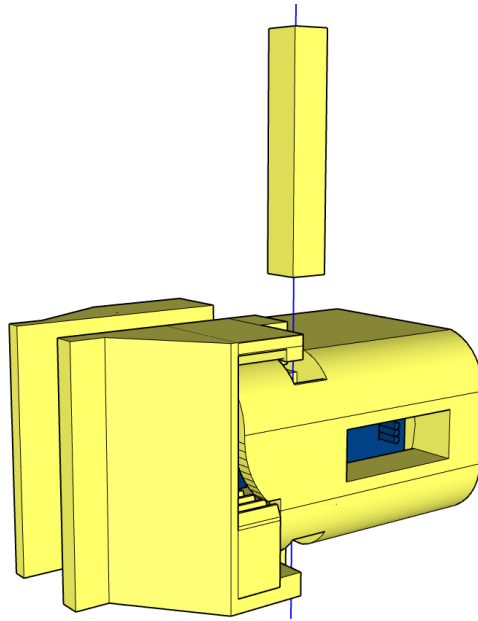




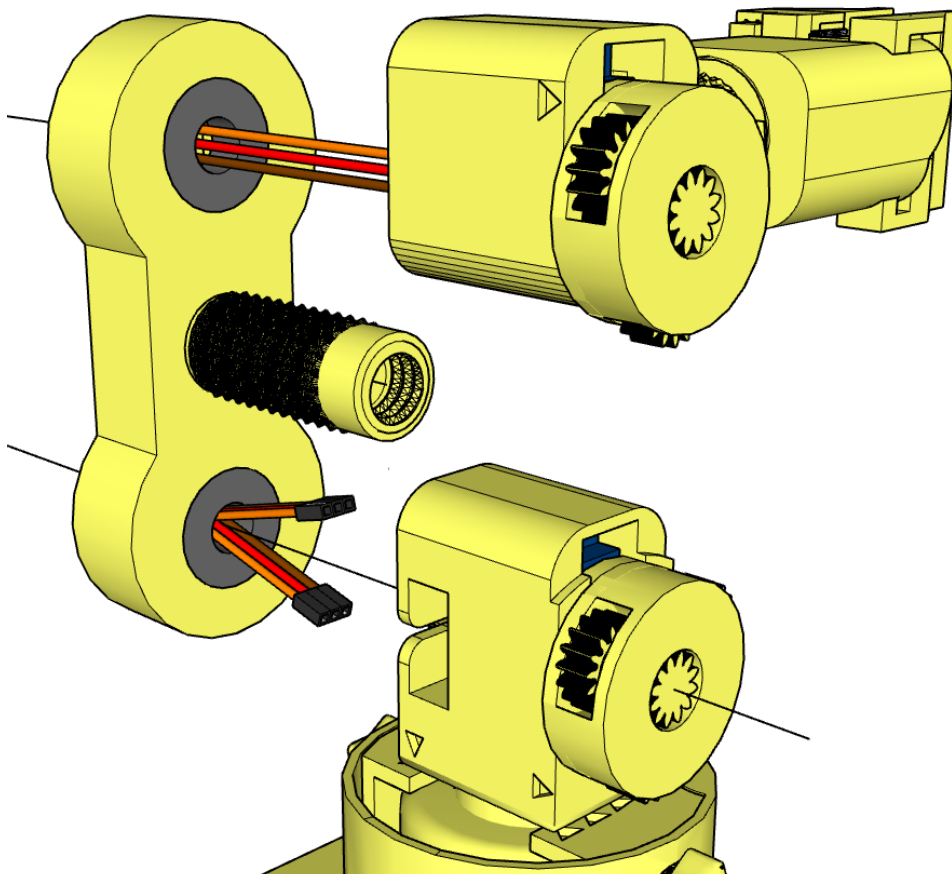
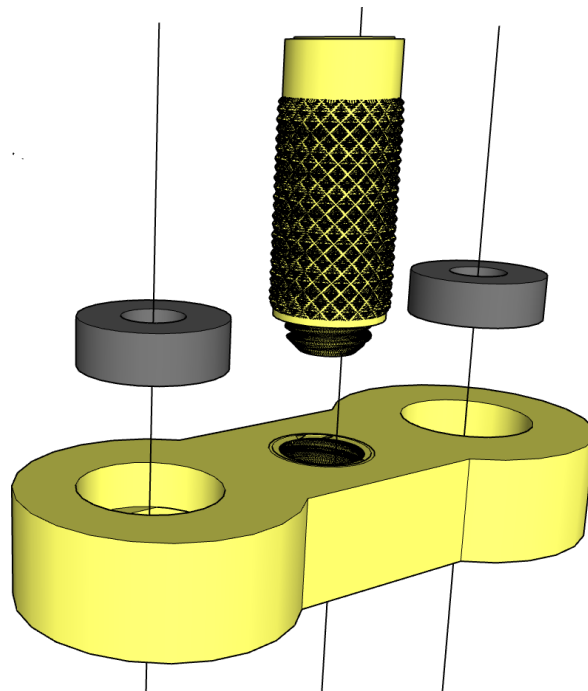
STEP 2: The Gripper

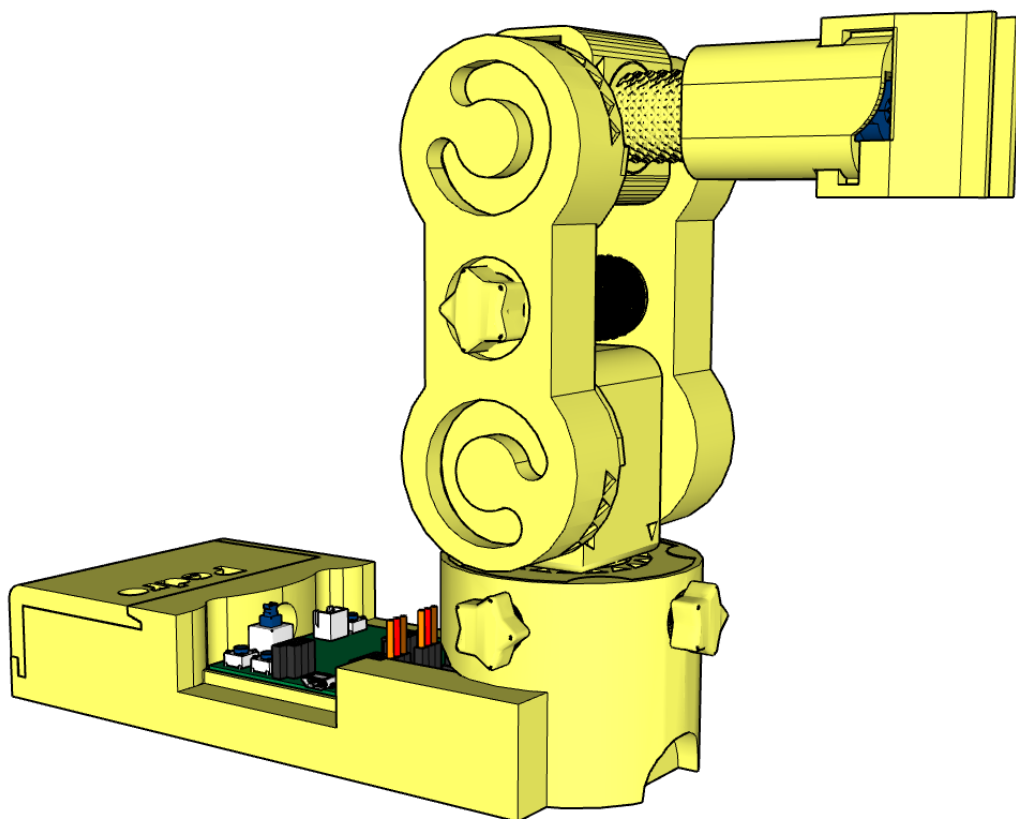
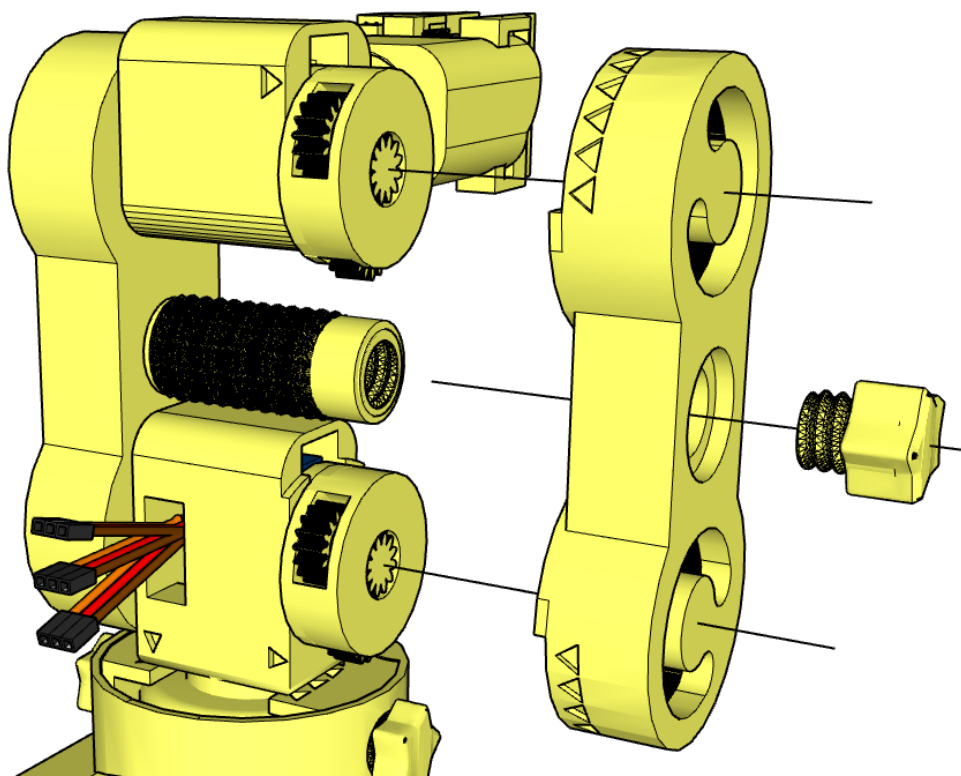






STEP 3: The Arm







Quiz - Check Your Understanding

1. What is the main goal of the Pedro Lesson 1?

- ☐ Build a drone
- ☐ Discover the Pedro robot
- ☐ Learn 3D modeling only
- ☐ Program a mobile app

2. What kind of motor does Pedro use?

- ☐ Stepper motors
- ☐ Brushed DC motors
- ☐ Continuous rotation servomotors (360°)
- ☐ Hydraulic actuators

3. How many servomotors are used in Pedro?

- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5

4. What is the purpose of the first servomotor?

- ☐ Controls the gripper
- ☐ Controls the base rotation for horizontal movement
- ☐ Controls the shoulder
- ☐ Controls the elbow

5. What does the fourth servomotor control?

- ☐ The base
- ☐ The shoulder
- ☐ The elbow
- ☐ The gripper

6. What type of bearing system does Pedro use?

- ☐ Magnetic bearings
- ☐ Ball bearings
- ☐ Roller bearings
- ☐ Gear bearings

7. What is the purpose of the planetary gear system in Pedro?

- ☐ To reduce torque and increase speed
- ☐ To increase torque and improve precision
- ☐ To provide electrical power
- ☐ To connect sensors

8. How many planetary motion modules does Pedro have?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

9. Which gear in the planetary system is driven by the motor?

- ☐ The planet gear
- ☐ The sun gear
- ☐ The ring gear
- ☐ The outer shell

Congratulations Mission Completed!

You have unlocked: 🏆 the Pedro Builder badge
Don't forget to stick your Pedro Badge into your Pedro Passport before starting the next lesson.

