Teaching materials

Guide notes 0. Introduction to the Platform

MISCE project

Mechatronics for Improving and Standardizing Competences in Engineering

Competence: Robotics

Workgroup: Universidad de Castilla-La Mancha

Universitat Politècnica de València

This document corresponds to the introduction lecture, presenting the experimental platform, for the competence ‘Robotics’ using the ‘Robotic Hand Platform’

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Visit https://misceproject.eu/ for more information.

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1 Platform overview

The final aspect of the experimental platform is shown in Figure 1.

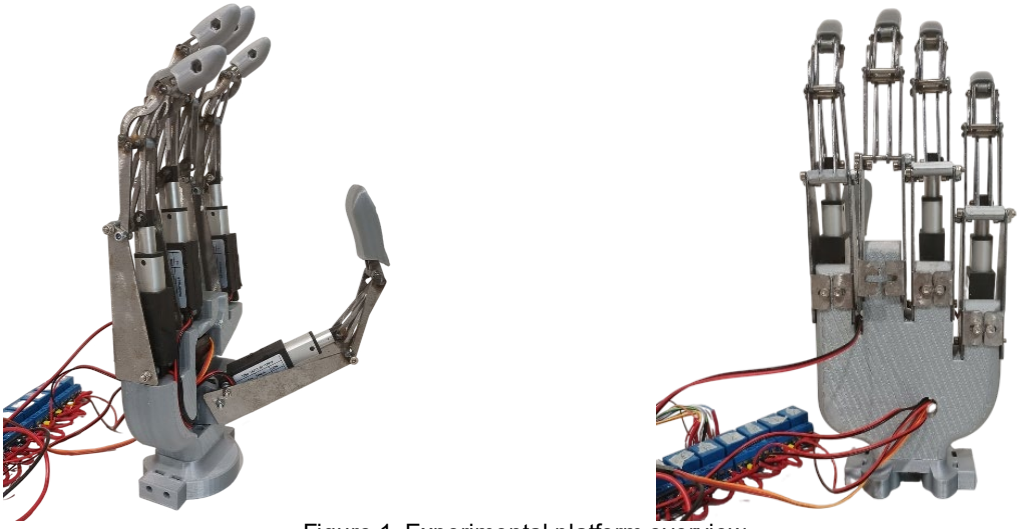

Figure 1. Experimental platform overview

The main functional elements to understand the basic operation mode of the experimental platform are the following ones:

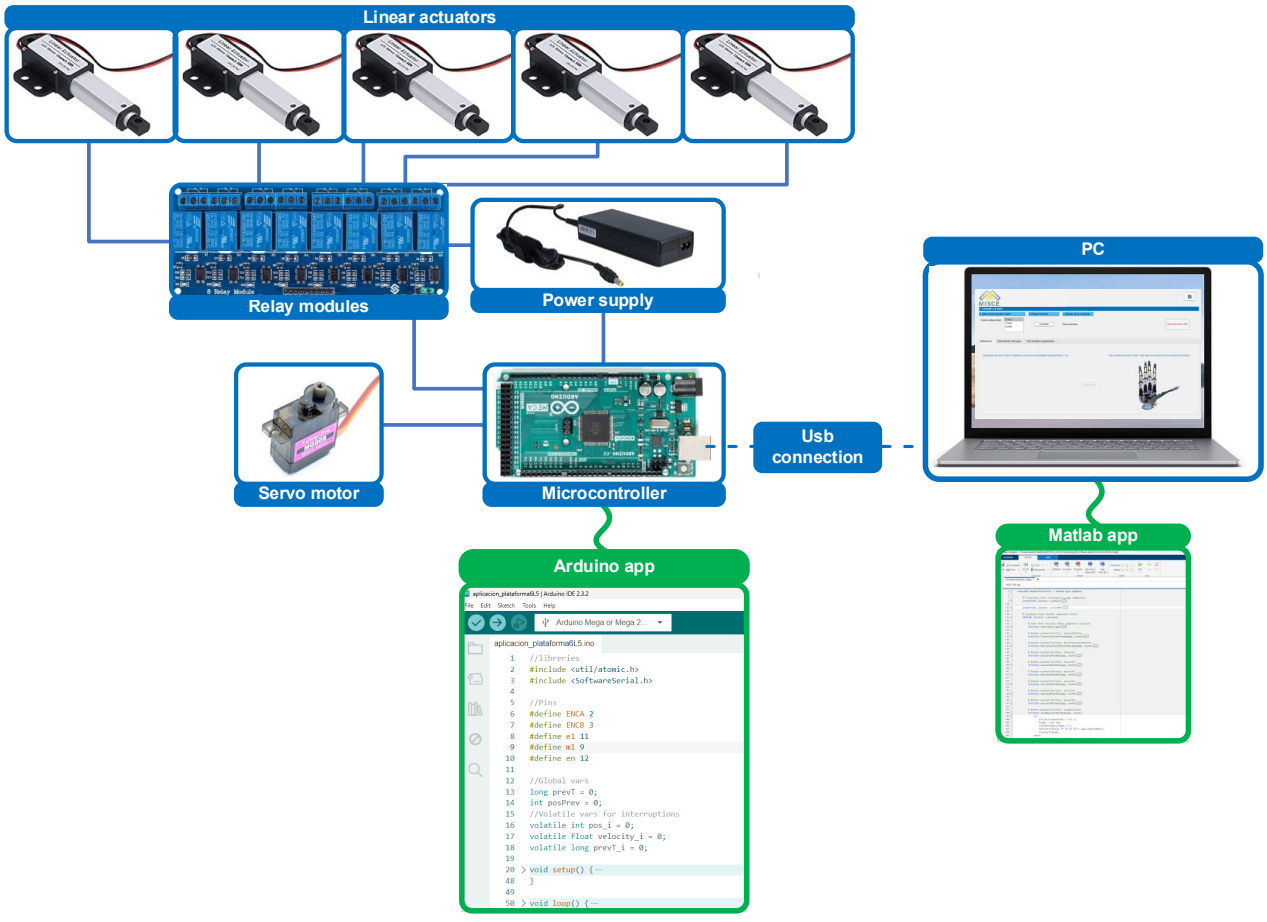

Figure 2. General wiring diagram

For the operation of the hand platform, it is necessary to:

- Connect the 12V power supply to the Arduino connector.
- Connect the communication USB cable.

The Matlab graphical interface provides the necessary tools to control the hand. It is possible to verify the correct wiring using the connection and positioning option in the main window.

2 App description

When launching the app for managing the platform a two layers interface will appear (see Figure 3).

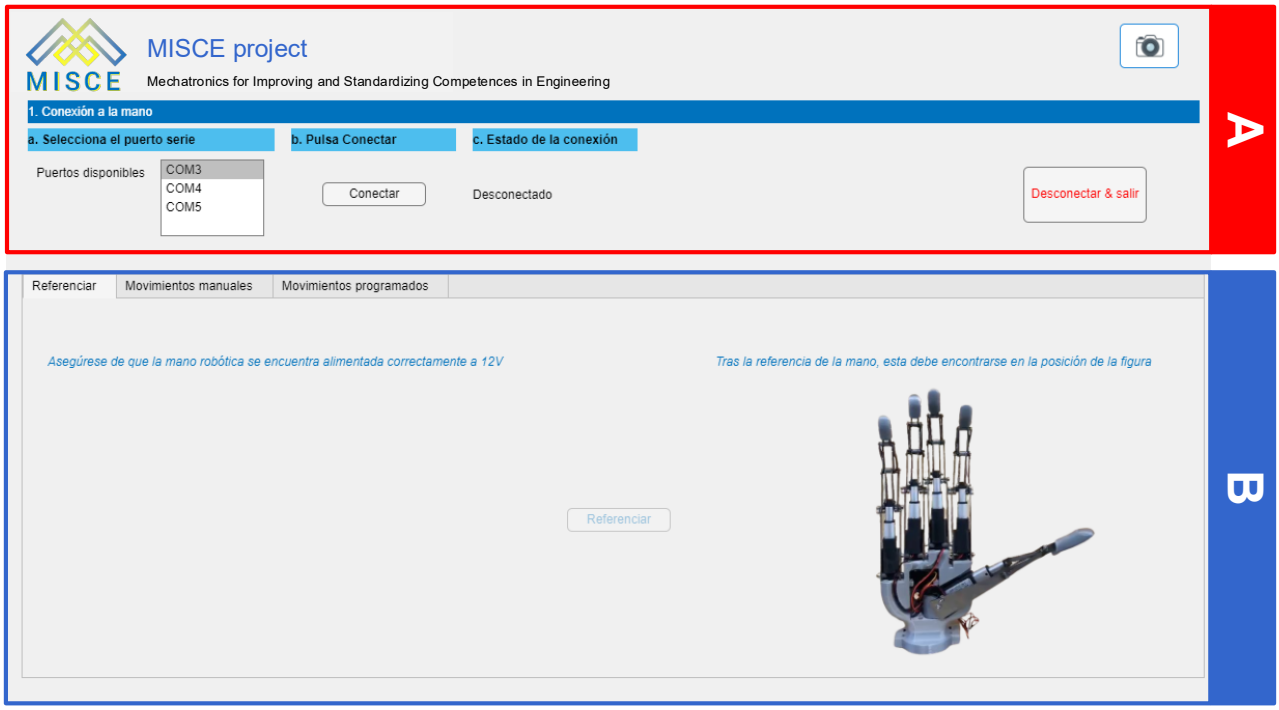

Figure 3. Overall view of the robotic hand Control app

In layer A (in the top) the proper serial port must be selected and click on 'connect'. When the connection to the platform is established the connection state will change to 'connected'.

At any time, if the user wants to exit the application, the 'Disconnect & exit' button must be pushed.

Layer B (in the button) has 3 tabs which correspond to 3 different operation modes that are detailed in the following sections.

2.1 Tab 1: Reference

Referencing the robotic handsets all fingers to a known open position. This process establishes a precise starting point for movements and ensures consistent operation. It is essential for accurate control and repeatable tasks (see Figure 4).

Procedure:

1. Connect the robotic hand via USB to the computer.
2. Open the control software.
3. Select the correct communication port (COM port).
4. Click the “Reference” button to initiate the referencing process.

Result:

After referencing, the robotic hand moves all fingers to a predefined open position. This ensures that each finger starts from a known, consistent point, as shown in the Figure 4, allowing precise and repeatable movements in subsequent tasks.

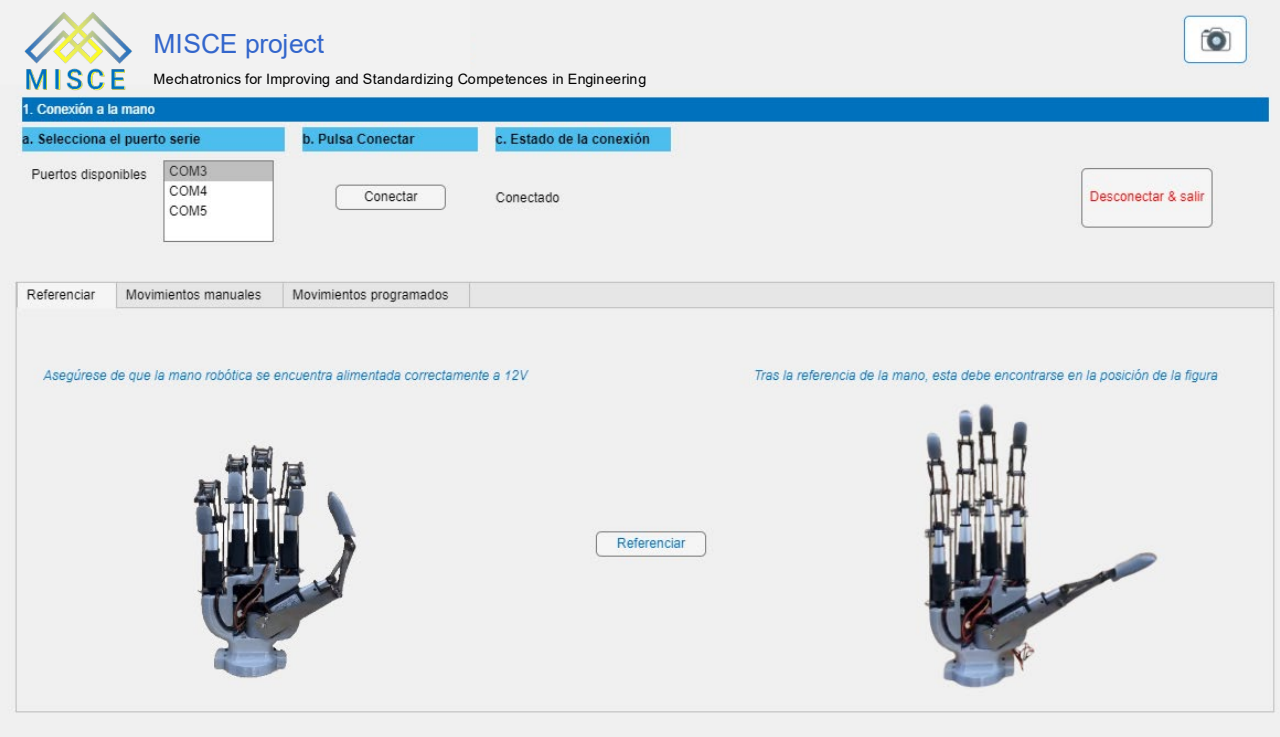

Figure 4. Tab 1: Reference

2.2 Tab 2: Jog Control

Manual movement mode allows individual control of each finger from the interface. The screenshot of this operation mode is shown in Figure 5.

Procedure:

1. Select the “Manual Movement” tab.
2. Use the interface buttons to move each finger individually.
3. Note that the thumb has two degrees of freedom, allowing both opening/closing and lateral movement.
4. Adjust finger positions as needed for testing or demonstration.

Result:

The expected result is precise and independent movement of each finger, demonstrating the hand’s full range of motion and verifying proper control of all degrees of freedom.

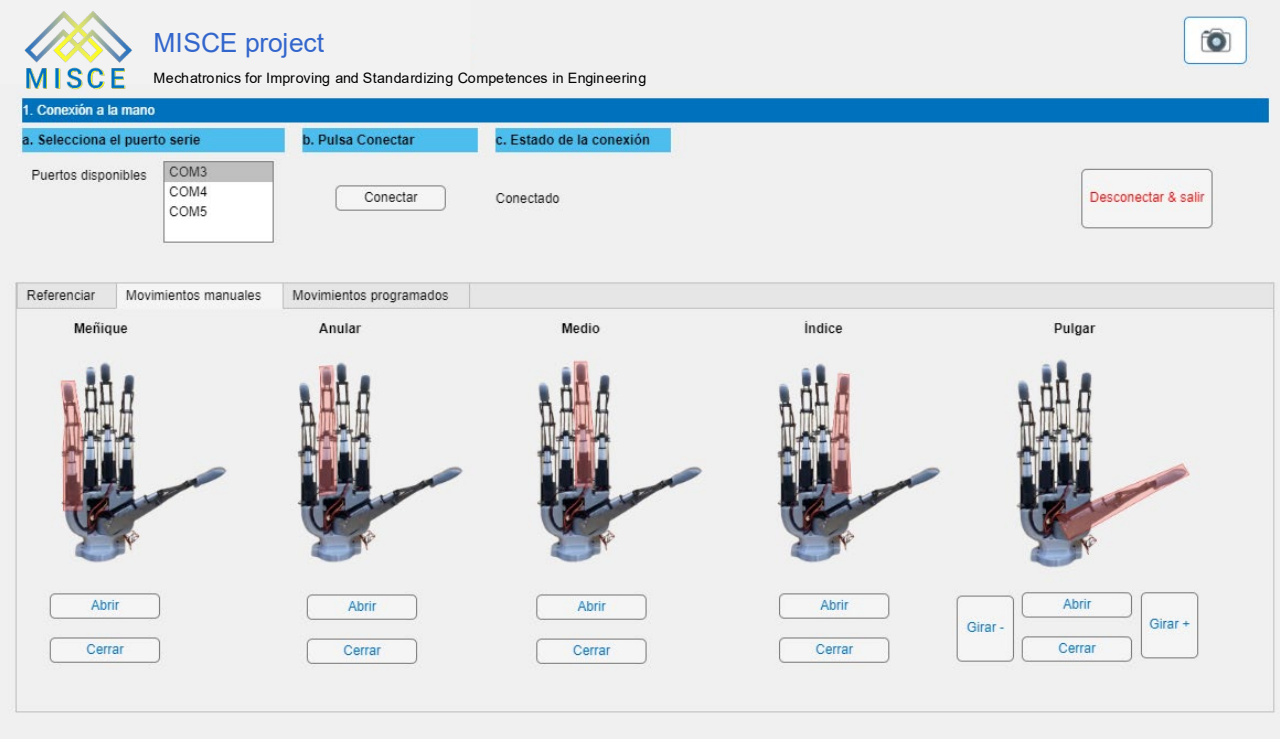

Figure 5.Tab 2: Jog Control

2.3 Tab 3: Preset Movements

This mode provides preconfigured grasping movements like pinching, opening, and closing for easy and quick control. The screenshot of this operation mode is shown in Figure 6.

Procedure:

1. Select the “Programmed Movements” tab.
2. Choose the desired grasp type from the dropdown list.

Result:

The robotic hand performs the selected preprogrammed grasp smoothly and accurately, demonstrating consistent and repeatable movements.

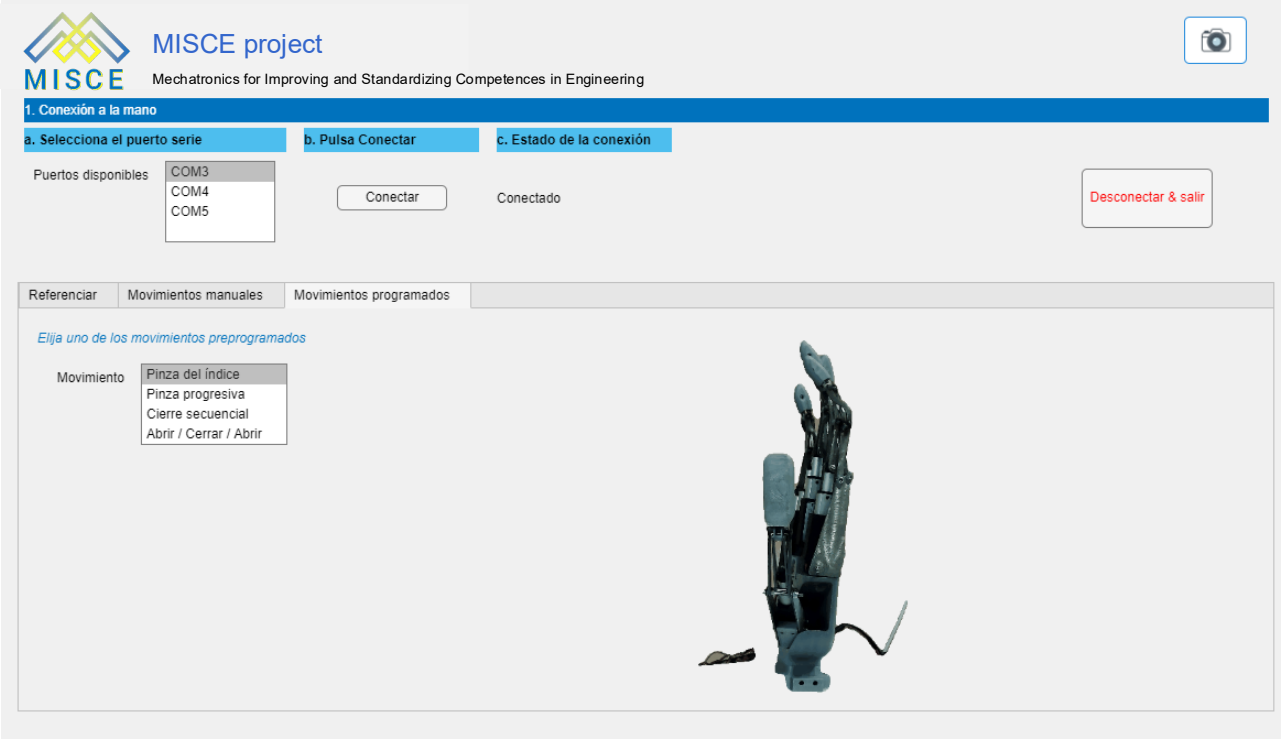

Figure 6. Tab 3: Preset Movements