



SMARTSIM

DL SMART-ROB

ROBOTICS COURSE



DE LORENZO

SMART SIMULATOR FOR LEARNING ROBOTICS WITH PLC

The DL SMART-ROB is a software that has been developed to teach robotics with PLC in a unique and effective way.

With this software, students can improve their individual experience on studying industrial robotics in practice.

Professors can explore this trainer to provide experiments to students with the following topics:

- ✓ **Scara 2D robot: model, applications, classifications;**
- ✓ **Palletizing robot: model, applications, classifications;**
- ✓ **Direct kinematics: what it is and how to implement;**
- ✓ **Inverse kinematics: what it is and how to implement;**
- ✓ **Denavit–Hartenberg notation: what it is, how to apply and how to implement.**

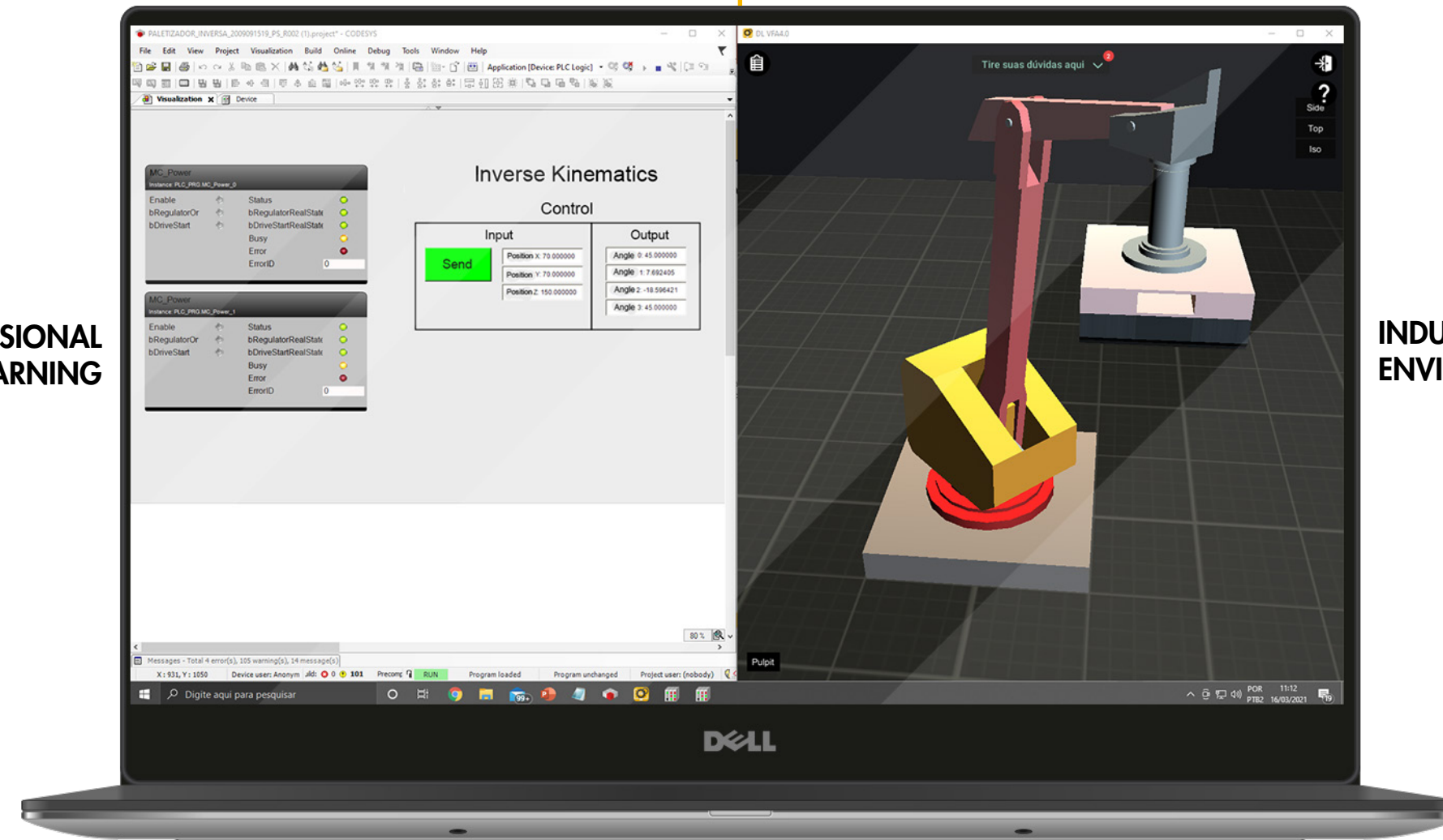
This software works integrated to Codesys Control (not included).

**INDUSTRIAL
PLC PROGRAMMING TOOLS**

**POWERFUL
3D SIMULATOR**

**PROFESSIONAL
LEARNING**

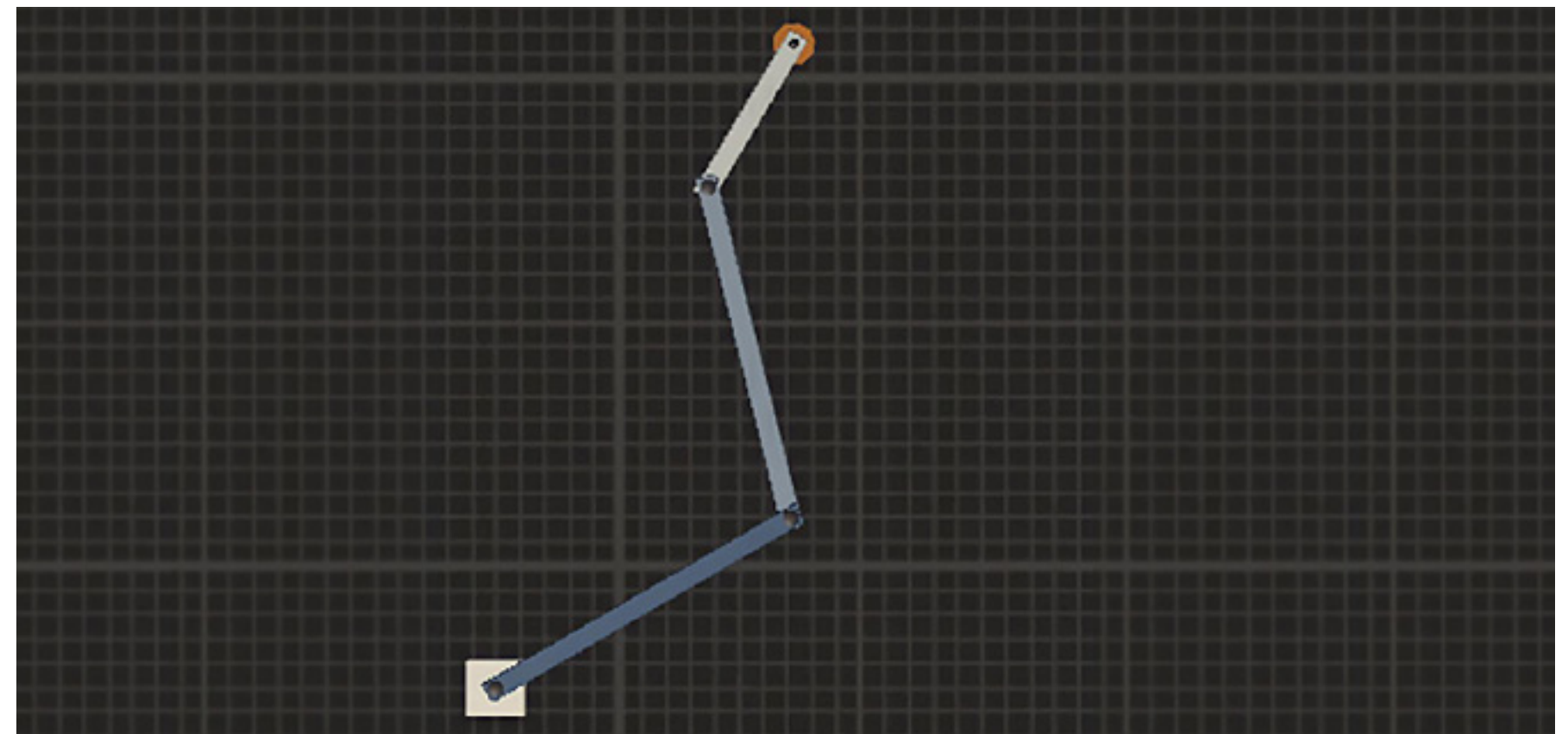
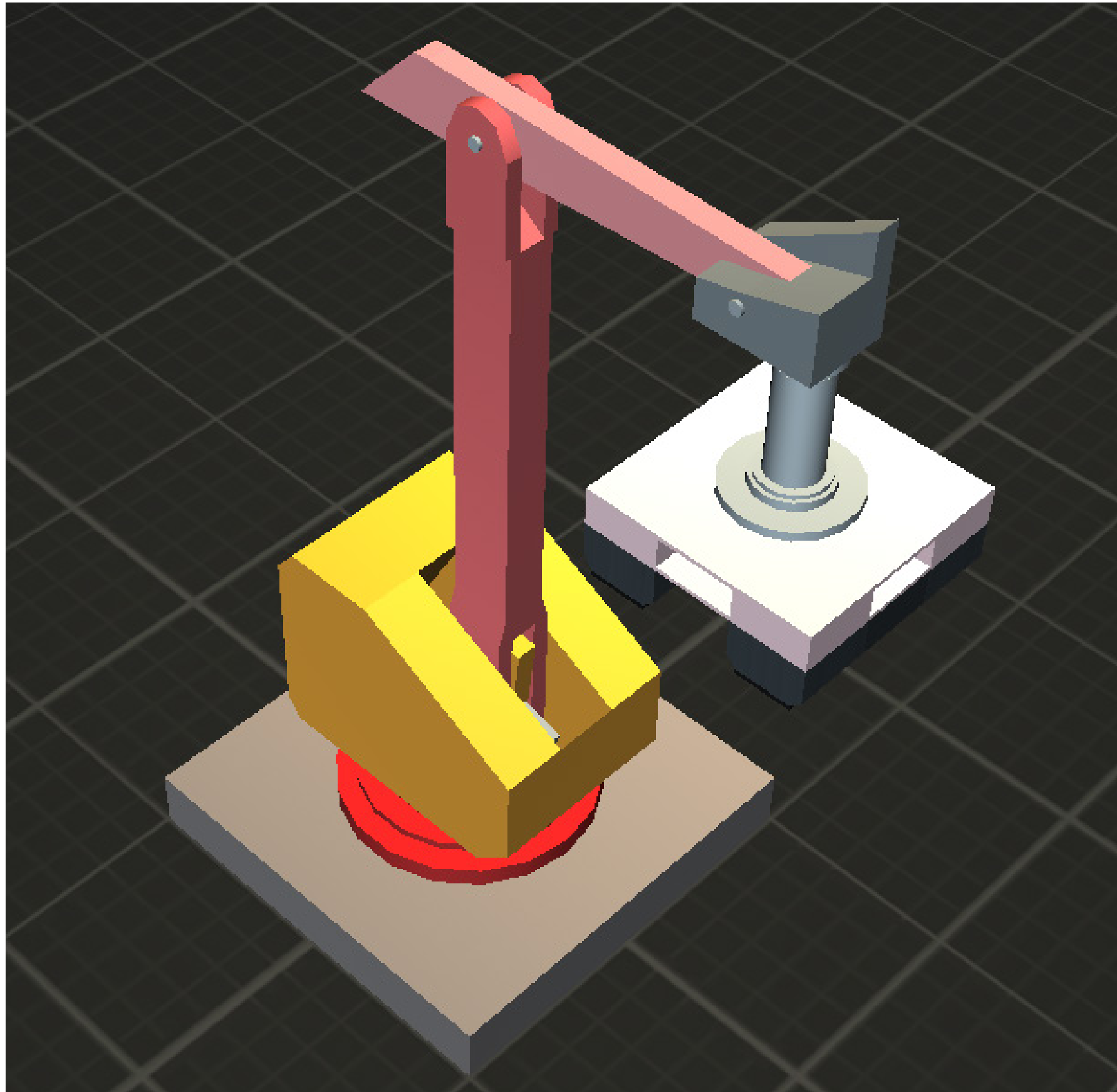
**INDUSTRIAL REALISTIC
ENVIRONMENTS**



PROFESSIONAL EXPERIENCE

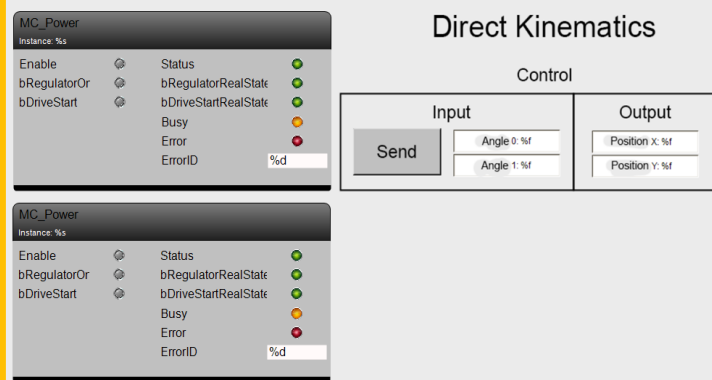
REAL-LIFE SITUATIONS

3D INDUSTRIAL ENVIRONMENTS TO PROVIDE REAL PRACTICAL EXPERIENCE TO STUDENTS



EFFECTIVE LEARNING WITH GUIDANCE, REAL-LIFE PROJECTS, THEORY AND INSTRUCTIONS FROM BASIC TO ADVANCED

1

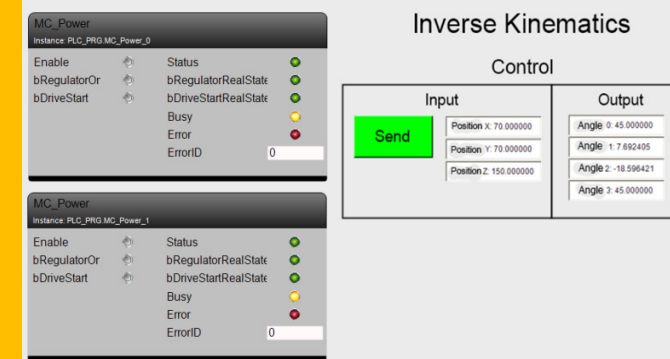


DIRECT KINEMATICS

Goal: Implement a solution to control the robots movement by defining the angles of the joints.

Robotics concepts: kinematics.

2

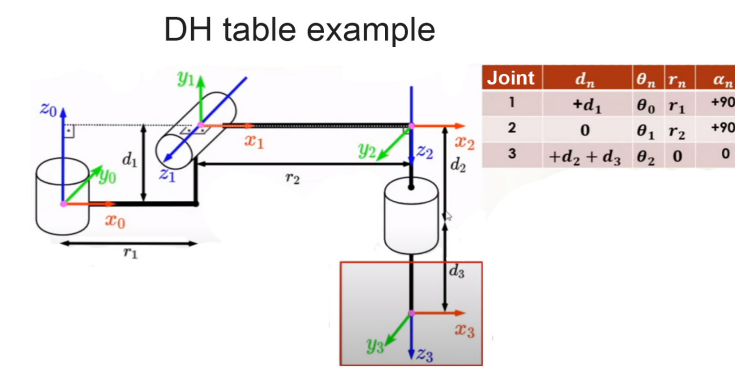


INVERSE KINEMATICS

Goal: Implement a solution to control the movement of a robot by defining the position of its endpoint.

Robotics concepts: kinematics.

3



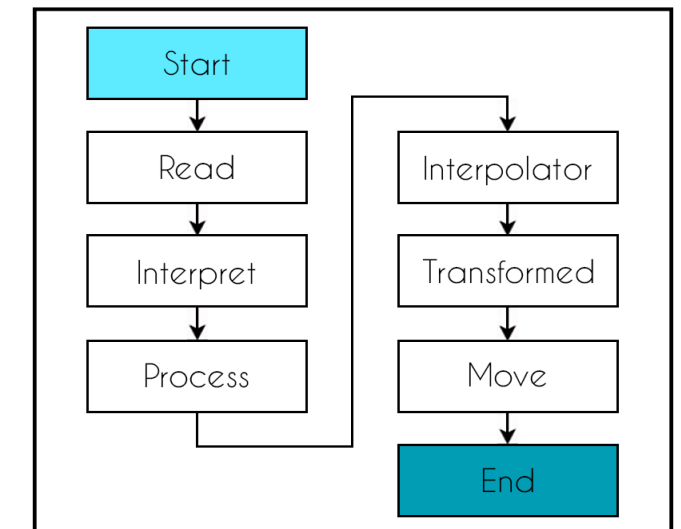
DENAVIT-HARTENBERT NOTATION

Goal: Use Denavit-Hartenberg notation in practice.

Concepts of robotics: Denavit-Hartenberg method.

4

Processing Flowchart



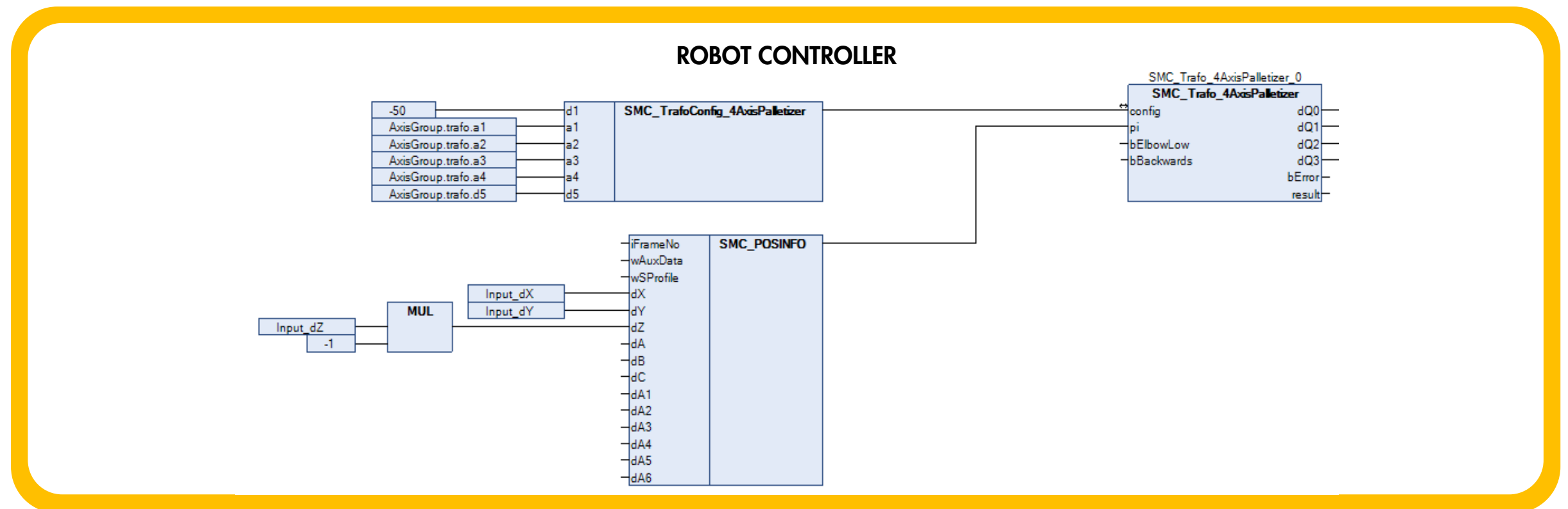
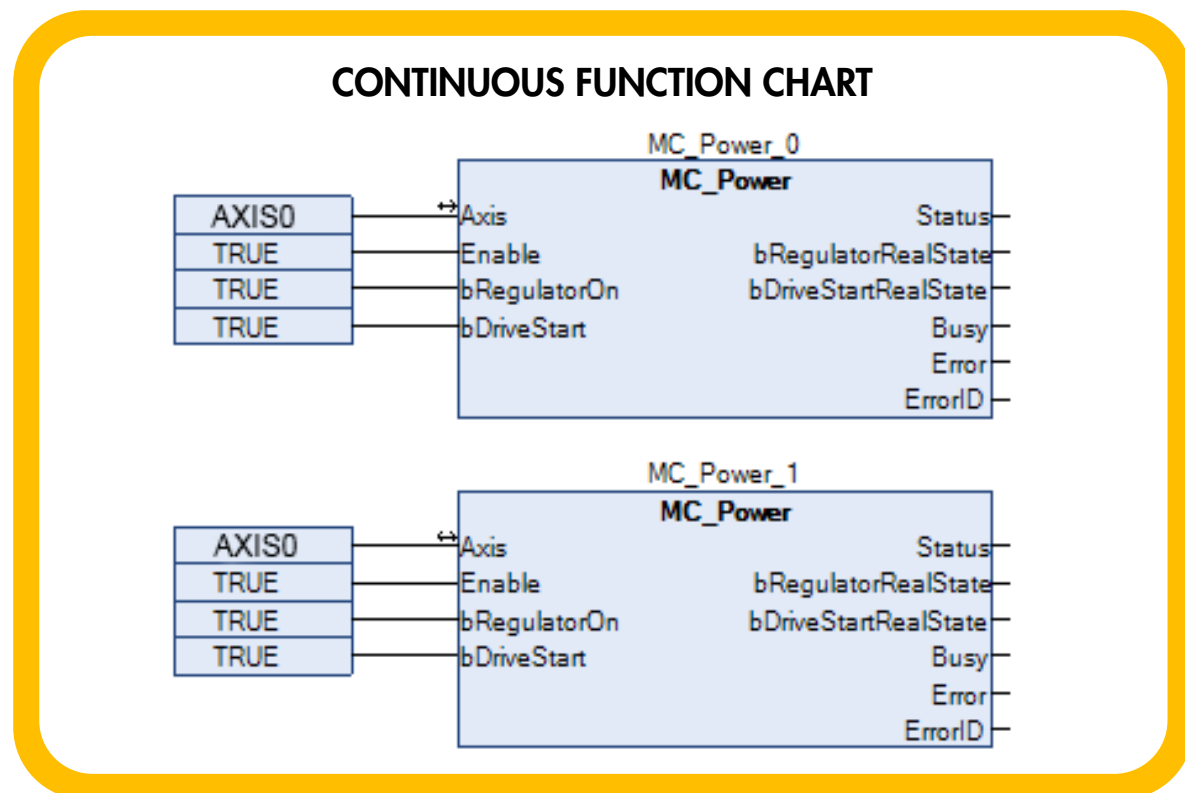
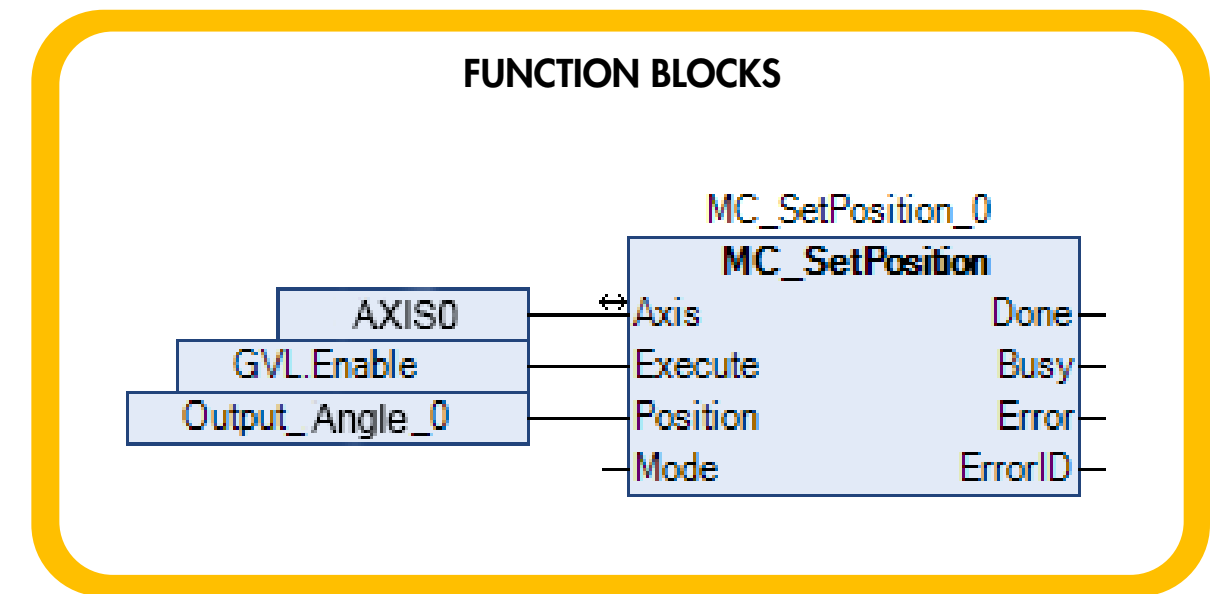
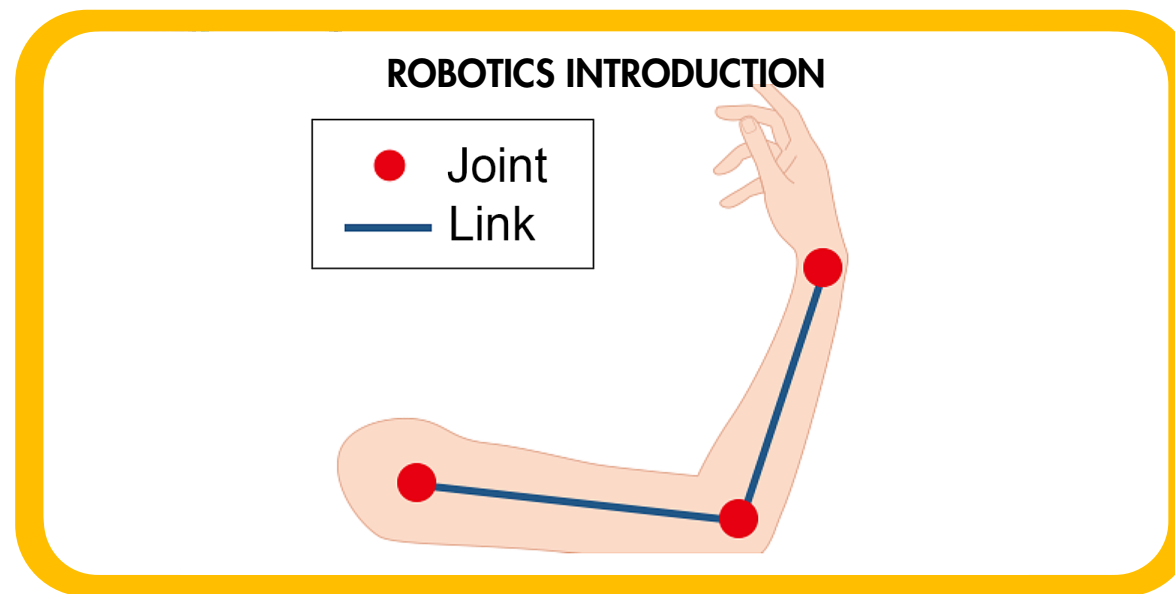
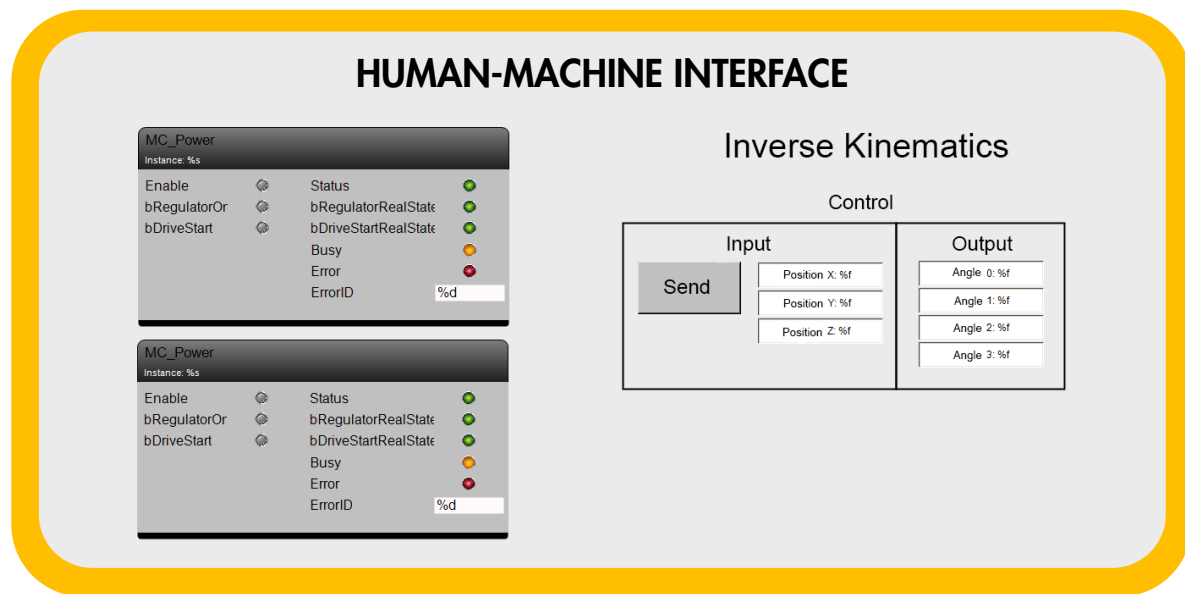
PATH PLANNING AND EXECUTION

Goal: Implement trajectory planning, storage and execution.

Robotics concepts: direct and inverse kinematics and trajectory

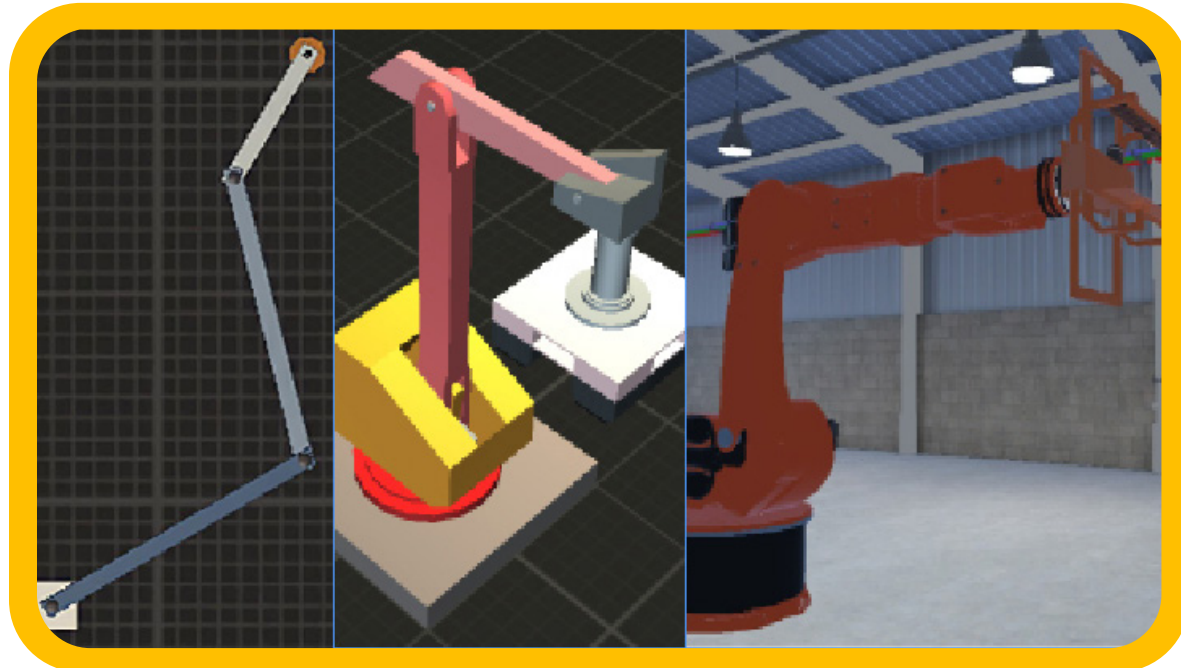
STUDENT CAN LEARN AND PRACTICE FROM BASIC TO ADVANCED ROBOTICS TOPICS

With 3D industrial environments as well as integrated projects, you can develop solutions involving direct and inverse kinematics, trajectory planning and execution, Denavit-Hartenberg notation, and a lot more.



SUMMARY OF FEATURES

IT'S A 3D SIMULATOR



IT HAS BUILT-IN PROJECTS

Inverse kinematics

Now that we control the robot through direct kinematics, we will modify this project to control using the inverse method. Again, make a copy of the project, save it as the name "PALETIZADOR_INVERSA" and we will modify it.

- Remove the right block, add the inverse block and configure it as the image below.

THE PROJECTS INCLUDE GUIDANCE

FIRST ROBOTIC PROJECT

So that you can immediately feel the "taste" of the robot's movement, we implemented an example application. So you will soon know where we are going with this first activity of the course. After you move the robot for the first time, we will explain in detail how everything works.

The sample project is available at the link below. You must download it, open it in Codesys, then log in to Codesys SoftMotion Win, to download the application.

- https://drive.google.com/file/d/1et2_doSQifJFP269z1ZG1ePekoGj16gl/view?usp=sharing

After downloading, start the PLC running.

Shortcut key tips:

- Login: ALT + F8
- Run: F5

+ CONTENTS AND SUPPORT MATERIALS, SO THEY CAN LEARN BY THEMSELVES

Now that you've moved the robot's arm, let's study its movement and what was done in the function block we used. Part of this involves robotics theory that includes coordinate systems and matrix calculations, but just worry about understanding the ideas as the SoftMotion library does all the "hard work" for us.

Access the contents below, read them and watch the videos very carefully, because the concepts and ideas will be very important to continue.

- [Introduction of the Scara 2d robot](#)
- [Kinematics of a robotic arm](#)
- [Guidelines for the first project](#)
- [Used blocks part 1](#)
- [Control topology](#)

IT AUTOMATICALLY CHECKS STUDENT ACTIVITIES TO LET THEM MOVE ON, LIKE IN GAME



PROFESSORS CAN MONITOR STUDENTS, AND VERIFY WHICH POINT THEY NEED HELP. Option available with Dashboard

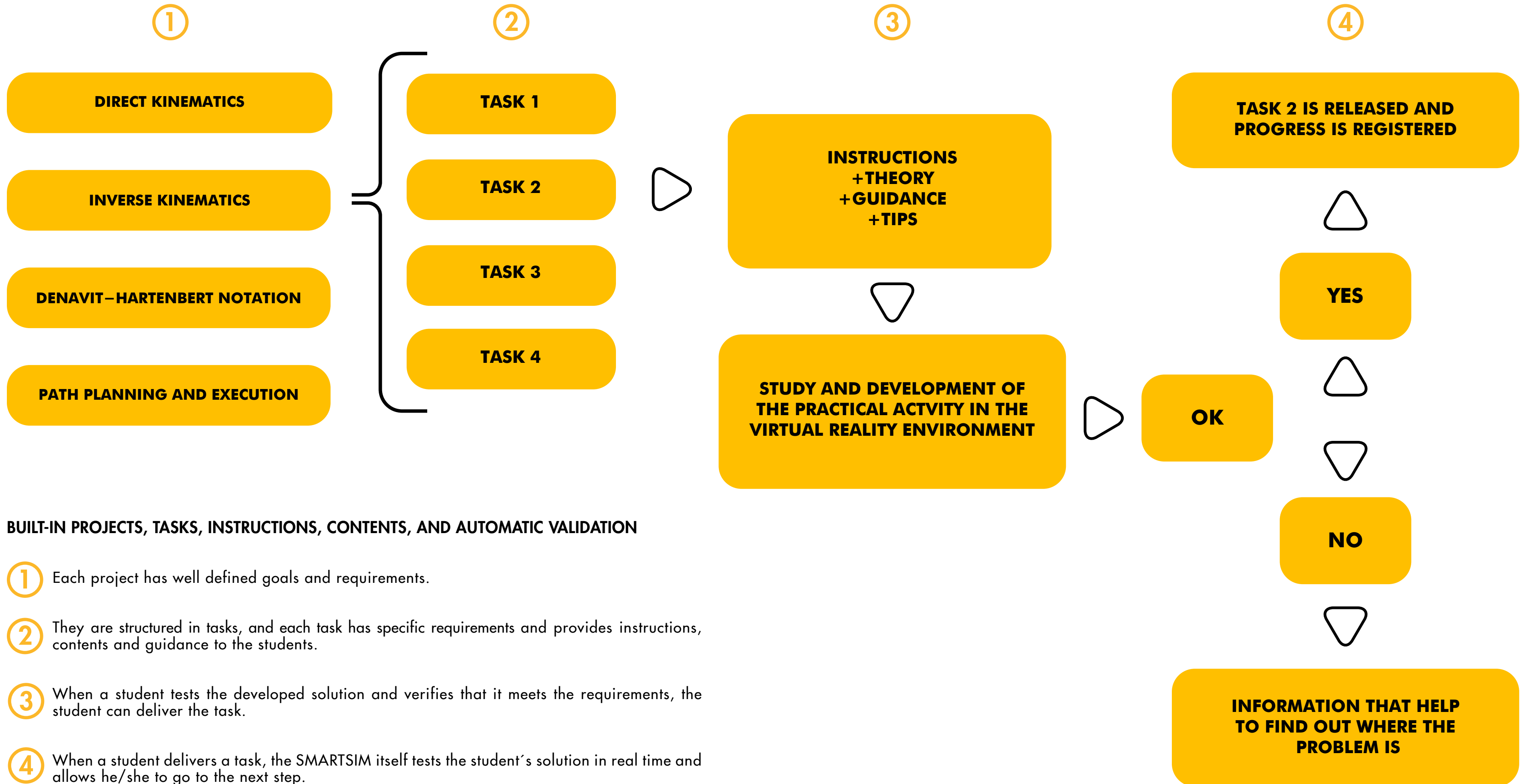
Student Progress

INSTITUTION NAME

Group: Course: User:

User Progress (POLI)		User Activities	
Student	Progress	Timestamp	Task -> Task Description
Student 1	[Progress bar]	Aug 26, 2019	1.1 - Breaking the inertia
Student 2	[Progress bar]	Aug 26, 2019	1.2 - Interlocking with endswitches
Student 3	[Progress bar]	Aug 26, 2019	1.3 - Retentive command
Student 4	[Progress bar]	Aug 26, 2019	1.4 - Adding other interlocks
Student 5	[Progress bar]	Aug 26, 2019	1.5 - Using the remote button
Student 6	[Progress bar]	Aug 26, 2019	2.1 - Manual operation
Student 7	[Progress bar]	Aug 27, 2019	2.2 - Simultaneous commands
Student 8	[Progress bar]	Aug 27, 2019	2.3 - Adding water
Student 9	[Progress bar]	Aug 27, 2019	2.4 - Adjusting the conveyors
Student 10	[Progress bar]	Aug 27, 2019	3.1 - Dosing station
		Aug 30, 2019	3.2 - Mixing station
		Sep 3, 2019	3.3 - Filling the recipient

HOW ARE BUILT-IN PROJECTS STRUCTURED?



BUILT-IN PROJECTS, TASKS, INSTRUCTIONS, CONTENTS, AND AUTOMATIC VALIDATION

- 1 Each project has well defined goals and requirements.
- 2 They are structured in tasks, and each task has specific requirements and provides instructions, contents and guidance to the students.
- 3 When a student tests the developed solution and verifies that it meets the requirements, the student can deliver the task.
- 4 When a student delivers a task, the SMARTSIM itself tests the student's solution in real time and allows he/she to go to the next step.

SYSTEM REQUIREMENTS

ORDER CODES

DL SMART-ROB

ROBOTICS COURSE

DL-SMART-DASHBOARD

CLASSROOM MANAGEMENT FOR SMARTSIMs

IMPORTANT NOTE:

THIS PRODUCTS DO NOT INCLUDE ANY THIRD PARTY SOFTWARES. TO OUR KNOWLEDGE, CODESYS DEVELOPMENT SYSTEM CAN BE FREE DOWNLOADED ON CODESYS STORE.

MINIMUM REQUIREMENTS

OPERATIONAL SYSTEM

64-BIT WINDOWS 10

DIRECTX VERSION

DIRECTX 11

PROCESSOR

INTEL i5 9400F OR AMD RYZEN 5 3600

MEMORY

8GB

GHRAPHIC CARD

STORAGE

HDD (1GB)

RECOMMENDED REQUIREMENTS

OPERATIONAL SYSTEM

64-BIT WINDOWS 10 PRO

DIRECTX VERSION

DIRECTX 12

PROCESSOR

INTEL i7 9700 OR AMD RYZEN 7 3700X

MEMORY

16 GB

GHRAPHIC CARD

NVIDIA GTX 1050 TI 4GB OR RX 550 4GB

STORAGE

HDD (1GB)