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.

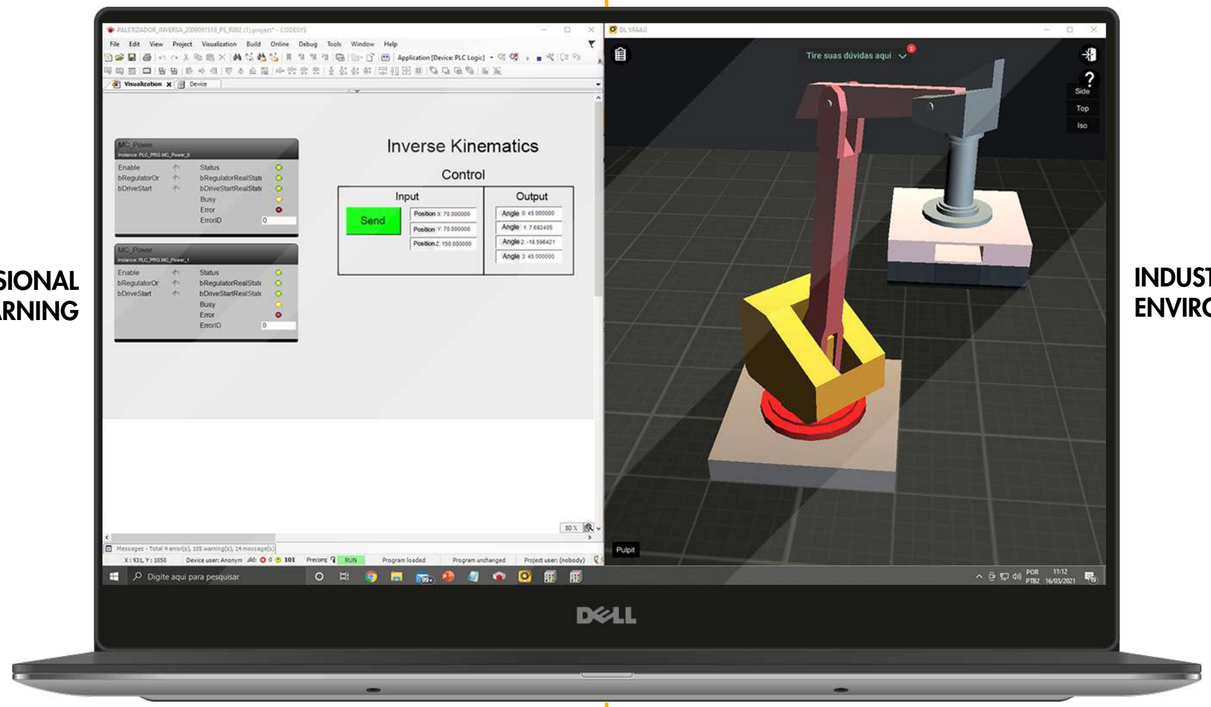
Professors can explore this trainer to provide experiments to students with the following topics:

- **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**

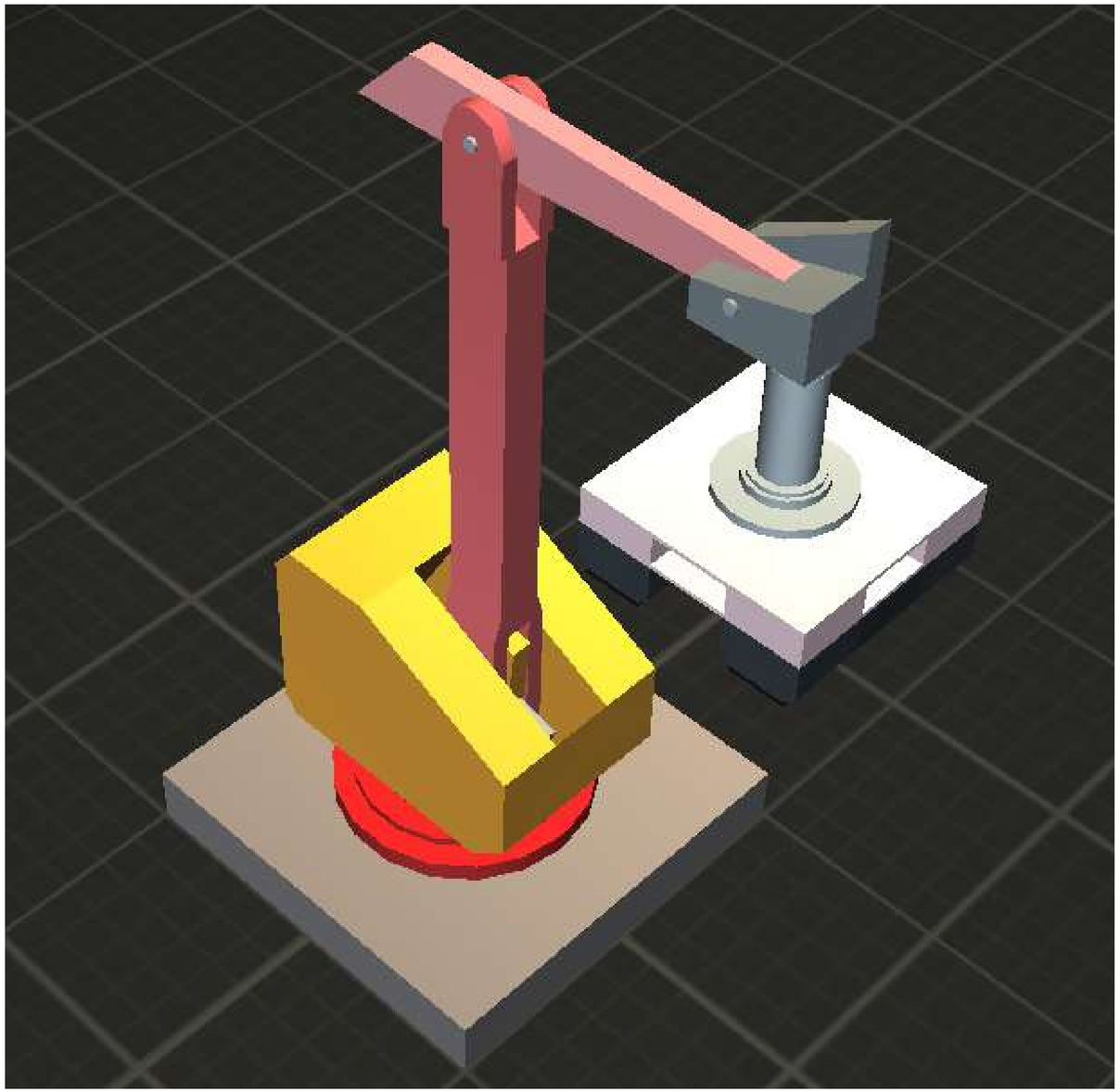
PROFESSIONAL LEARNING

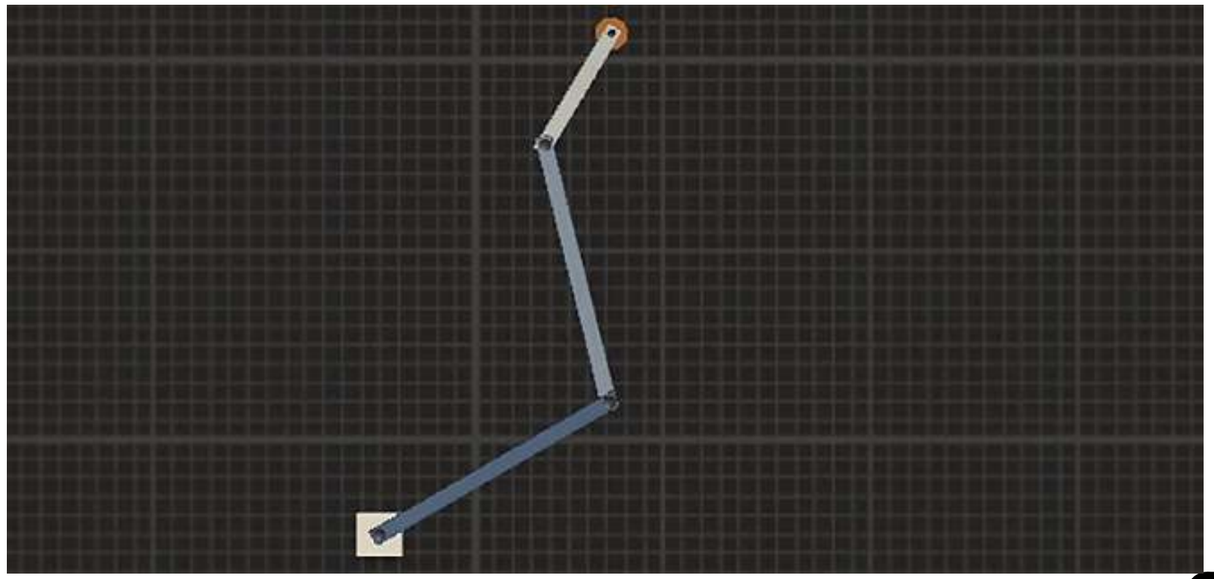


INDUSTRIAL REALISTIC ENVIRONMENTS

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

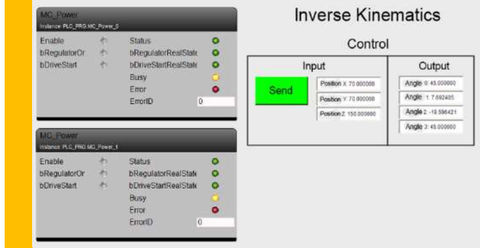
1

DIRECT KINEMATICS

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

Robotics concepts: kinematics.

2

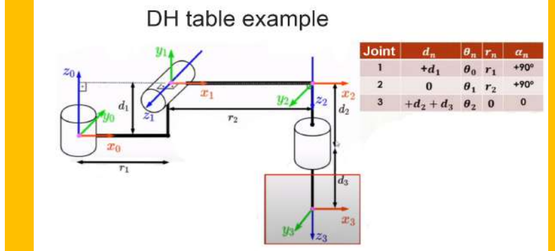


INVERSE KINEMATICS

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

Robotics concepts: kinematics.

3

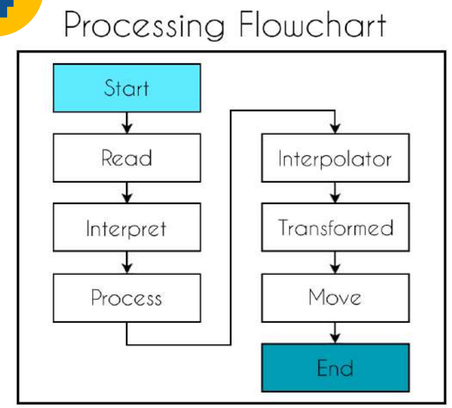


DENAVIT-HARTENBERT NOTATION

Goal: Use Denavit-Hartenberg notation in practice.

Concepts of robotics: Denavit-Hartenberg method.

4



PATH PLANNING AND EXECUTION

Goal: Implement trajectory planning, storage and execution.

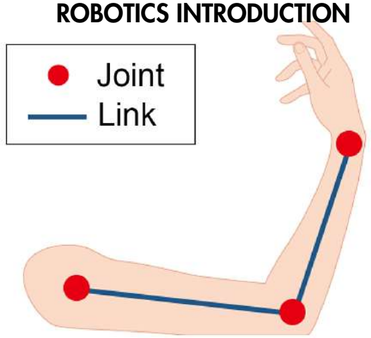
Robotics concepts: direct and inverse kinematics and trajectory

STUDENT CAN LEARN AND PRACTICE FROM BASIC TO ADVANCED
ROBOTICS TOPICS

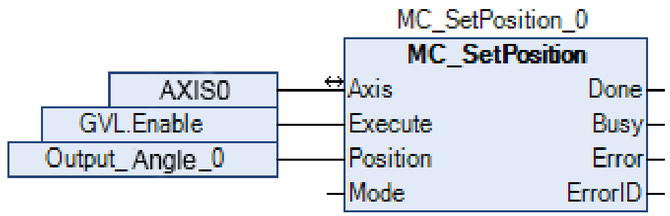
With 3D industrial environments as well as integrated projects, you can develop solutions involving direct and inverse kinematics, trajectory planning and execution, Denavit-Hartenberg notation, and a lot more.

HUMAN-MACHINE INTERFACE

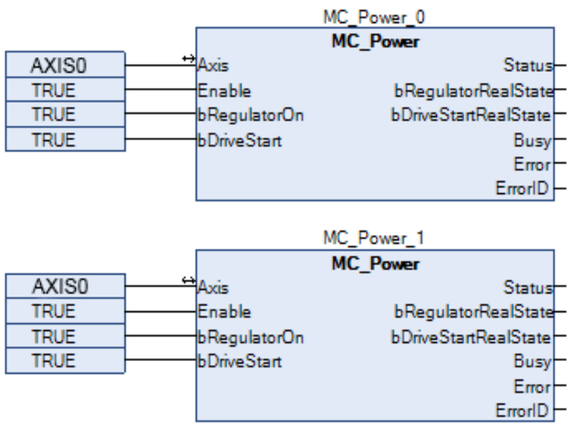
ROBOTICS INTRODUCTION



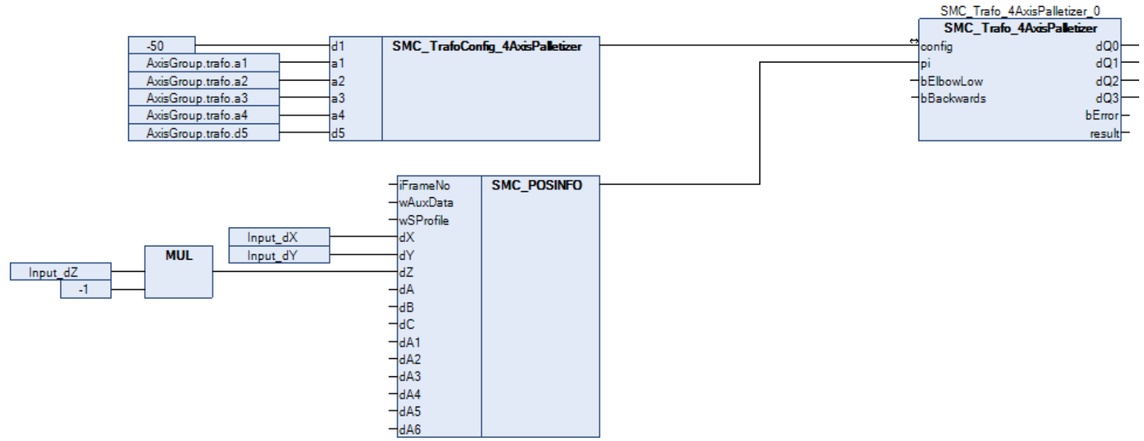
FUNCTION BLOCKS



CONTINUOUS FUNCTION CHART



ROBOT CONTROLLER

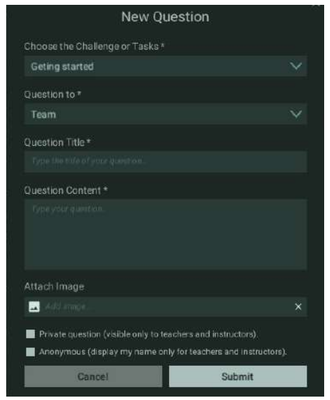


WHY IS IT A SMARTSIM?

IT CONNECTS PROFESSOR, STUDENT AND SCHOOL

De Lorenzo´s cloud server receives students activities and provides reports and analytics to professors and institutions. Besides, a student can start working at school and continue at home or vice-versa.

The platform includes a query and answer system that enables professors to support the students counting on a team of monitors. That means better support with less effort of the professors. The students can see questions asked by other colleagues too so that way if more than one student have the same doubt the professors answer will attend them all.



COMPATIBLE WITH THE DL SMART-DASHBOARD (SOLD SEPARETLY)

PROFESSORS CAN FOLLOW STUDENTS PROGRESS

The professor can do and access everything the student can. Besides, he/she can also access the dashboard's portal. It includes interesting reports and analytics that help the professor to monitor the group in real time, as well as to identify students who are doing very well, as well as those who need help, who are not working at all and who seem to be "cheating".

Tasks report

This is an important tool since it provides evidence of the activities a student worked on. That means the school has evidence of the practical activities the distance learner has done with detailed information about it.

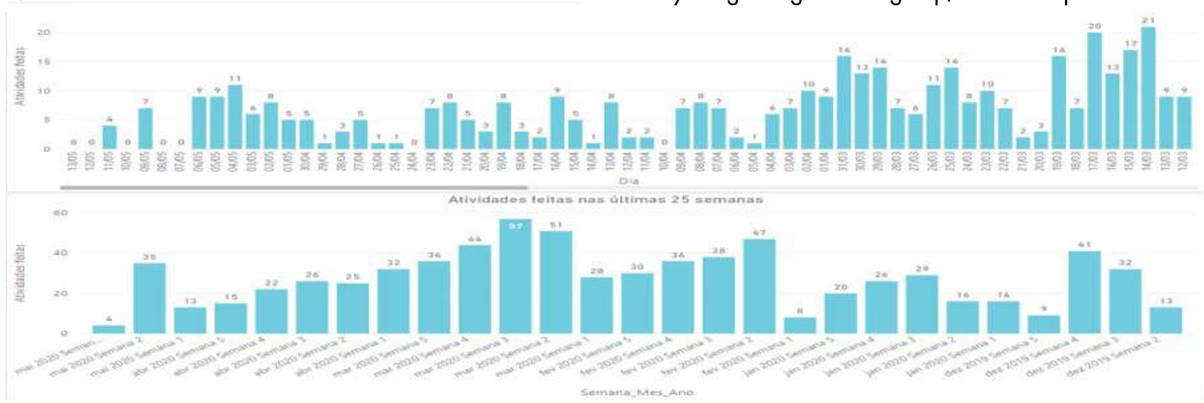
Curso	Tarefa	Timestamp	IsDon
Scripts	1.1 - Abrindo uma tela modal	3/9/2020 6:33:37 PM	False
Desenvolvimento de sistemas supervisórios	2.6 - Implementar Gráficos	11/22/2019 7:14:00 PM	False
Desenvolvimento de sistemas supervisórios	2.5 - Montar interface principal	11/18/2019 5:04:15 PM	True
Desenvolvimento de sistemas supervisórios	2.4 - Construindo os objetos da aplicação	11/18/2019 4:28:54 PM	True
Desenvolvimento de sistemas supervisórios	2.3 - Explorando Recursos	11/15/2019 5:35:44 PM	True
Desenvolvimento de sistemas supervisórios	2.2 - Conhecendo o Elipse E3	11/15/2019 5:10:00 PM	True
Desenvolvimento de sistemas supervisórios	2.1 - Comunicação OPC	11/14/2019 12:57:42 PM	True
Desenvolvimento de sistemas supervisórios	1.8 - Comandos pelo supervisório	11/14/2019 11:25:14 AM	True
Desenvolvimento de sistemas supervisórios	1.7 - Implementando alarmes	11/8/2019 7:33:30 PM	True

PROFESSOR CAN SEE WHICH STUDENTS ARE ON SCHEDULE

With this interface, the professor may choose which groups he/she wants to monitor, to verify who is on schedule, who is pending and so on. It is possible to define the expected progress percentage in relation to the tasks available in the course.

RHYTHM

This other dashboard shows the number of activities the students did daily and weekly. The professor may decide to verify it regarding a whole group/class or a specific student.



EFFORT/TASK DEDICATED TIME

If the professor selects a student, he/she may verify how much time the student took to develop and deliver each task of the course.

Tempo por tarefa

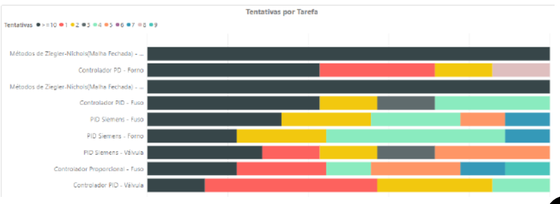
Tarefa	Duracao Total (h)
Controlador ON-OFF - Forno	4.33
Estudando a Planta - Forno	4.08
Controlador PI - Forno	3.14
Resposta transiente e estacionária - Forno	2.50
Estudando a planta - Fuso	2.45
Métodos de Ziegler-Nichols(Malha Fechada) - Forno	2.35
Controlador PD - Forno	1.99
Controlador ON-OFF - Válvula	1.88
PID Siemens - Forno	1.63
Controlador Proporcional - Forno	1.44
Controlador PI - Válvula	1.42
Métodos de Ziegler-Nichols(Malha Aberta) - Forno	1.29
Estudando a planta - Válvula	1.22

PROGRESS VS TIME TAKEN

It is also possible to verify the distribution of the dedicated time with relation to the number of tasks done by each student at any period of time. That helps to identify who is doing well, who may need help, who is doing nothing and who is trying to cheat.

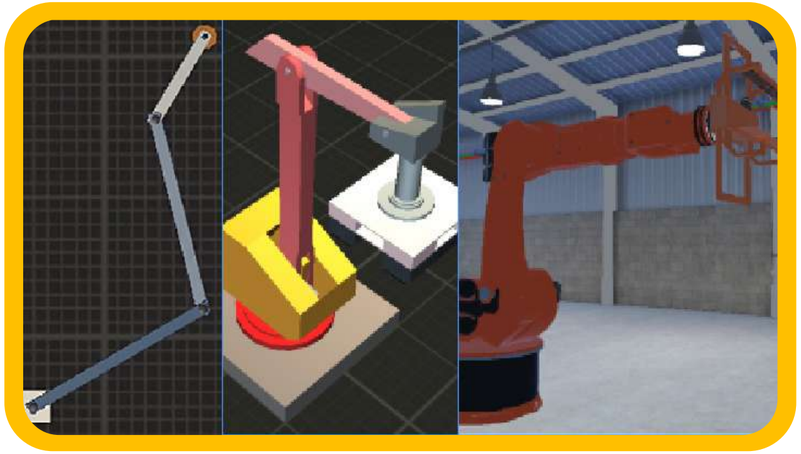
TRIALS PER TASK

This chart helps the teacher to understand which task may be the most difficult and which one may be the easiest in order to adjust the deadlines.

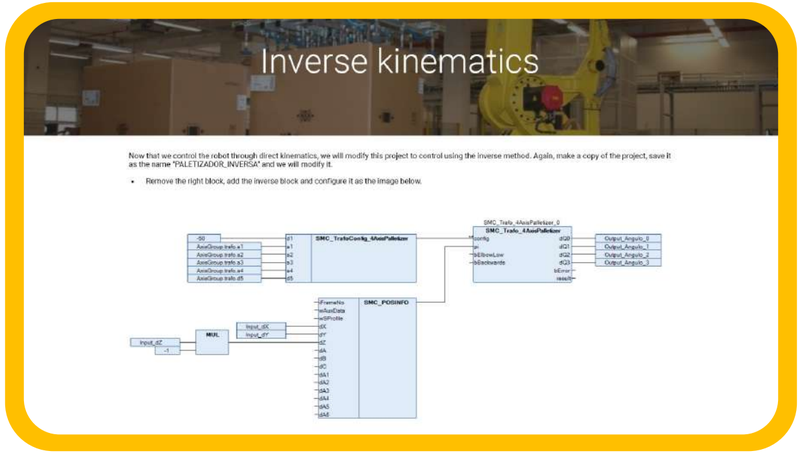


SUMMARY OF FEATURES

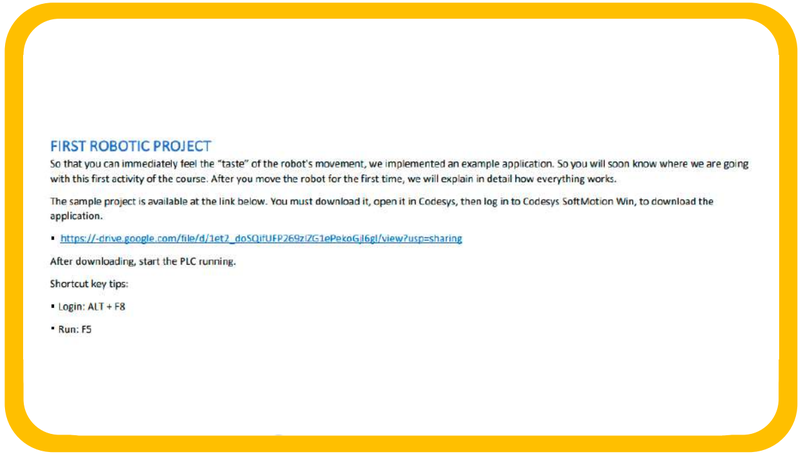
IT'S A 3D SIMULATOR



IT HAS BUILT-IN PROJECTS



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.

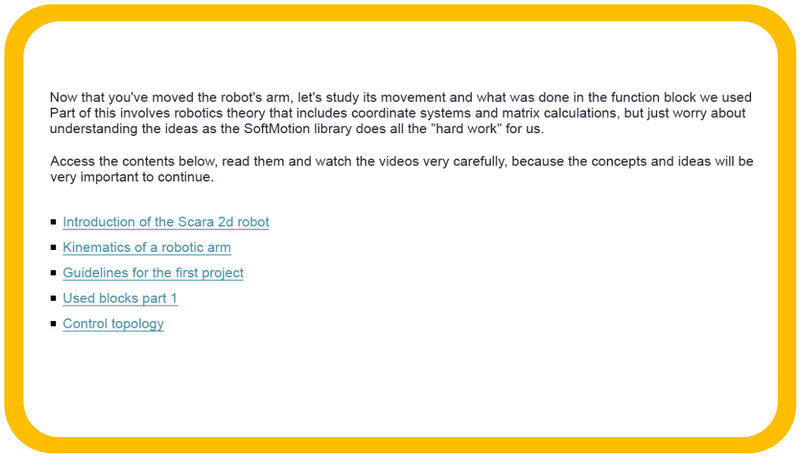
- https://drive.google.com/file/d/1et2_doSQIfUEP269zlZG1ePexoGJ6gl/view?usp=sharing

After downloading, start the PLC running.

Shortcut key tips:

- Login: ALT + F8
- Run: F5

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



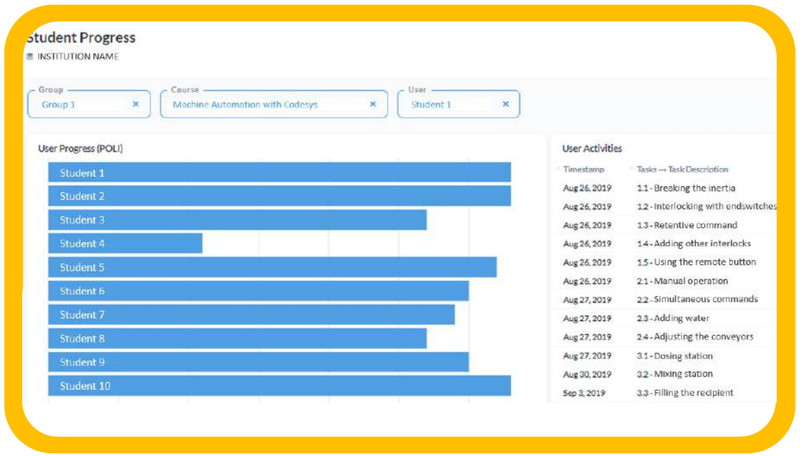
Now that you've moved the robot's arm, let's study its movement and what was done in the function block we used Part of this involves robotics theory that includes coordinate systems and matrix calculations, but just worry about understanding the ideas as the SoftMotion library does all the "hard work"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

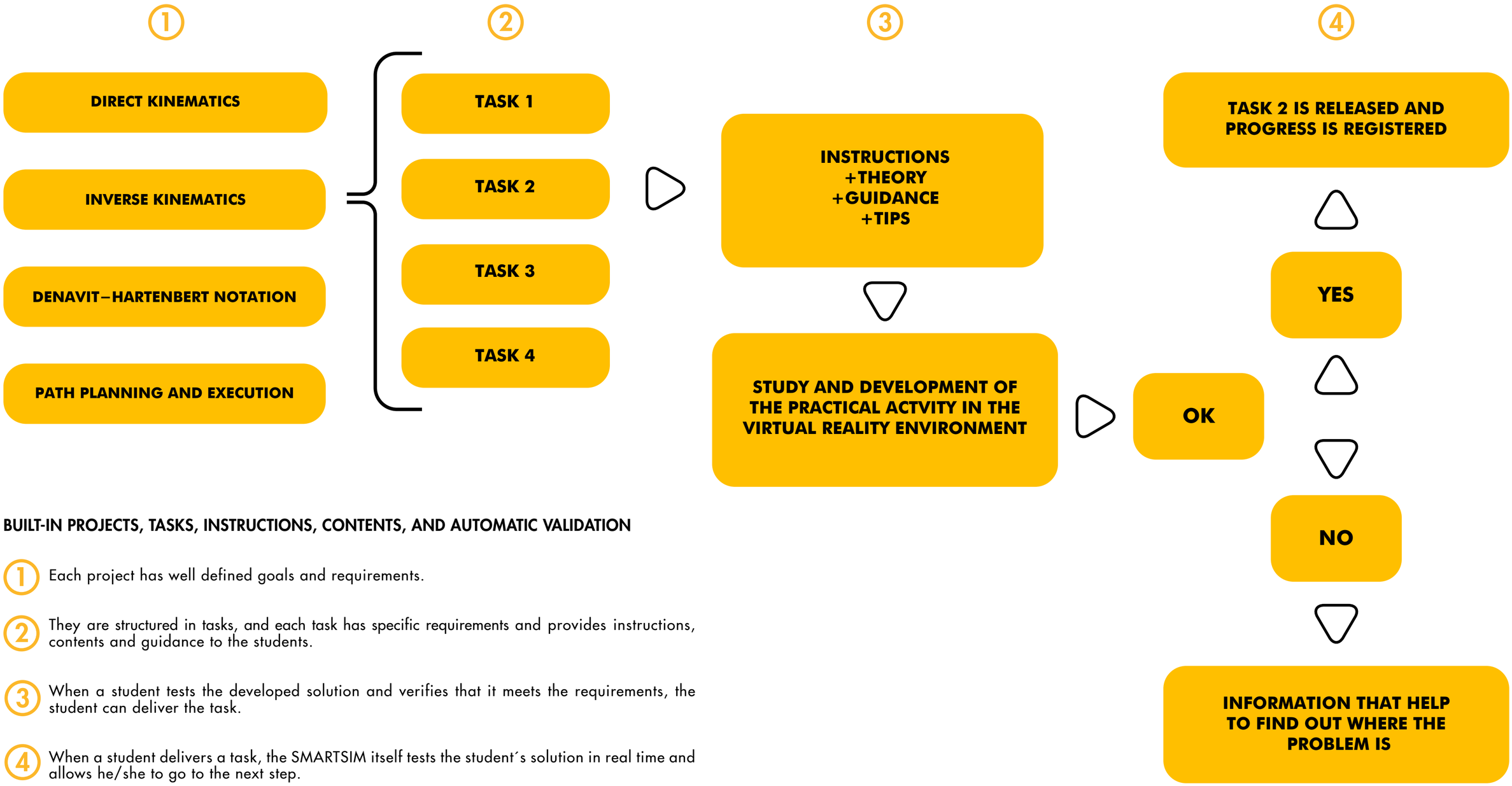
- Introduction of the Scara 2d robot
- Kinematics of a robotic arm
- Guidelines for the first project
- Used blocks part 1
- Control topology

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

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



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 PRODUTS 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 WINDOWNS 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 WINDOWNS 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)