SMARTSIM

DL SMART–MA

MACHINE
AUTOMATION COURSE

DE LORENZO

SMART SIMULATOR FOR LEARNING AUTOMATION WITH PLC

The DL SMART–MA is a software that has been developed to teach industrial automation and PLC programming in a unique and effective way.

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

Students will be able to carry out several experiments dealing with the following topics:

- ✓ Main concepts related to logic control;

- ✓ State machine (SFC) approach;

- ✓ Electric diagram interpretation;

- ✓ Electric commands for motor engines and pneumatic systems and their interfaces to PLCs;

- ✓ Programmable logic controllers: hardware and software structure, technical characteristics and specifications, programming languages, main ladder instructions, data handling, maths, numeric formats, comparisons, timers and analog interfaces.
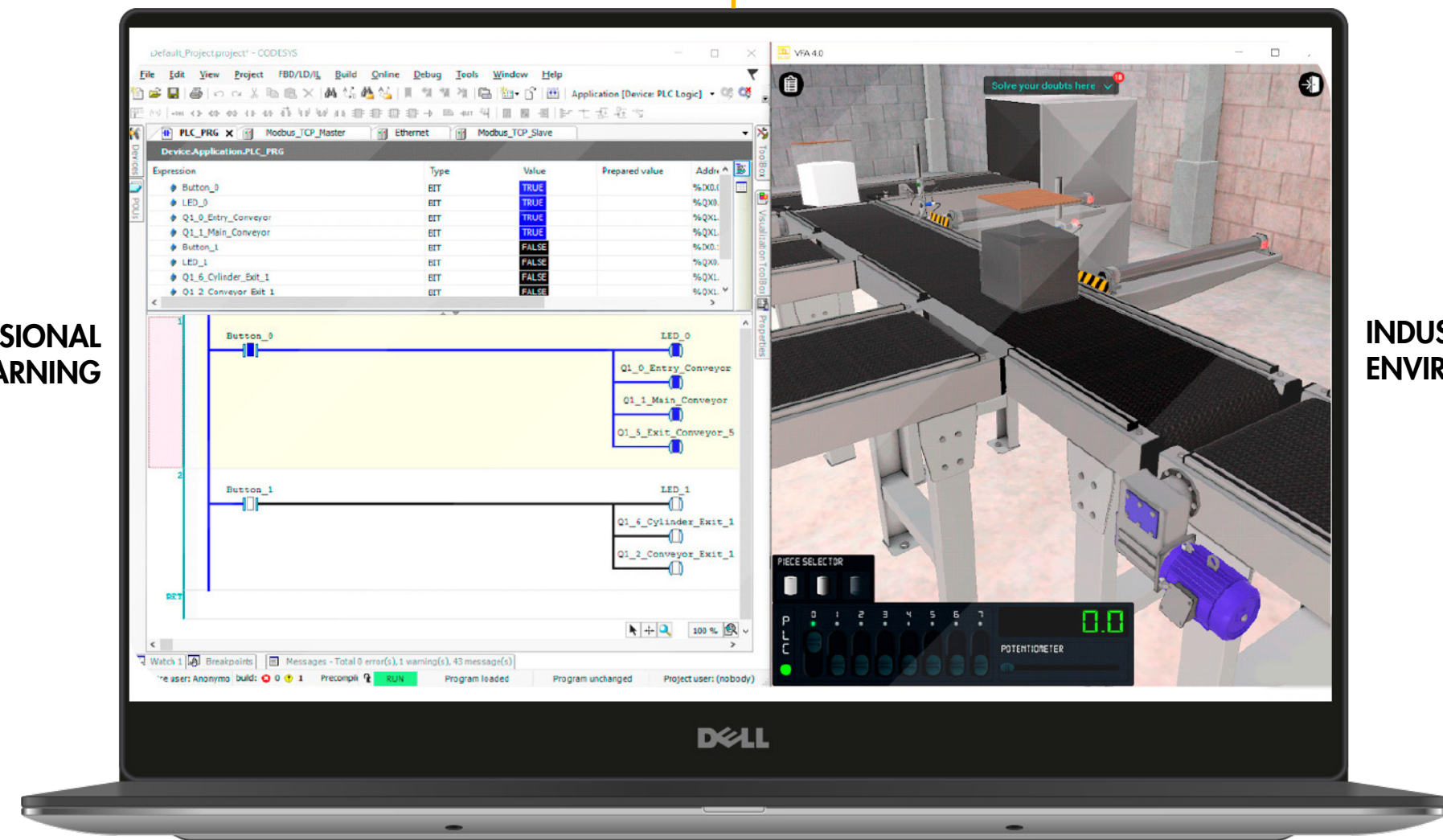
This software works integrated to a softPLC (not included) which can be: The Siemens PLCSIM or Codesys Control.

INDUSTRIAL PLC PROGRAMMING TOOLS

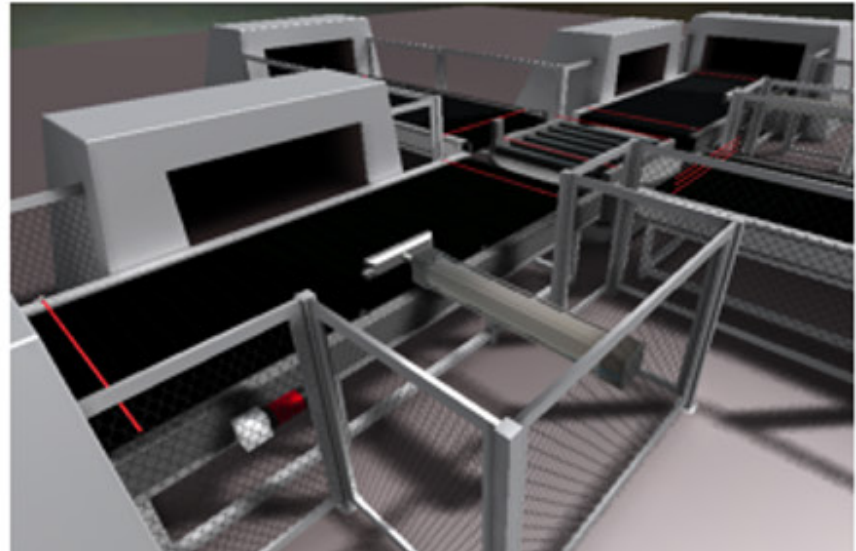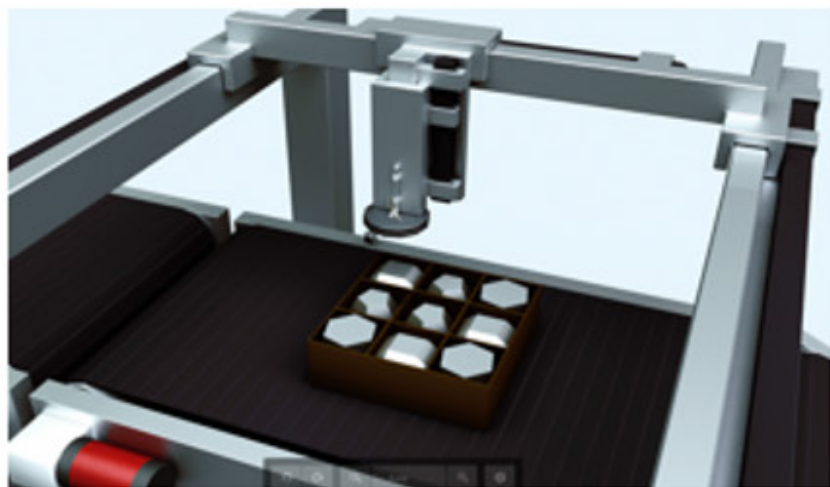**POWERFUL 3D SIMULATOR**
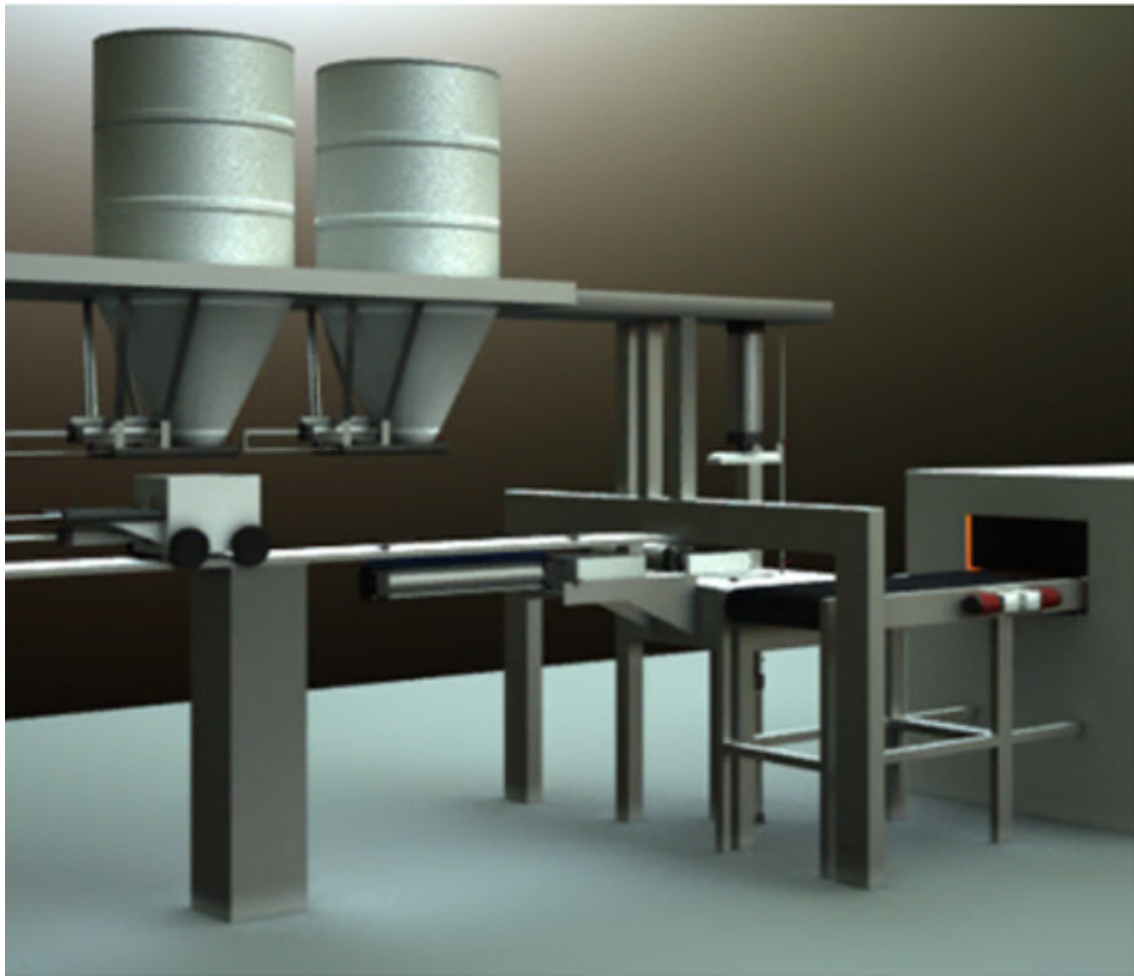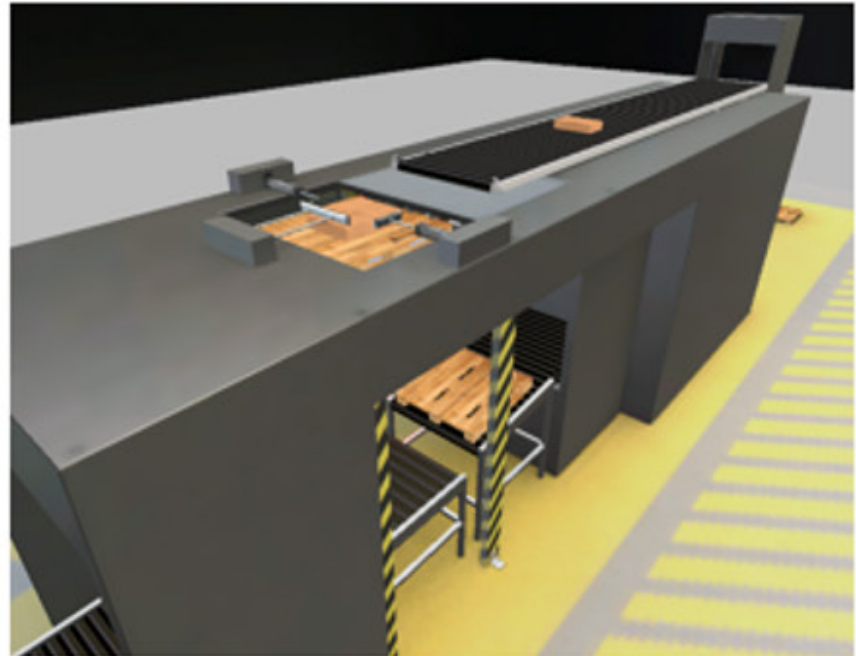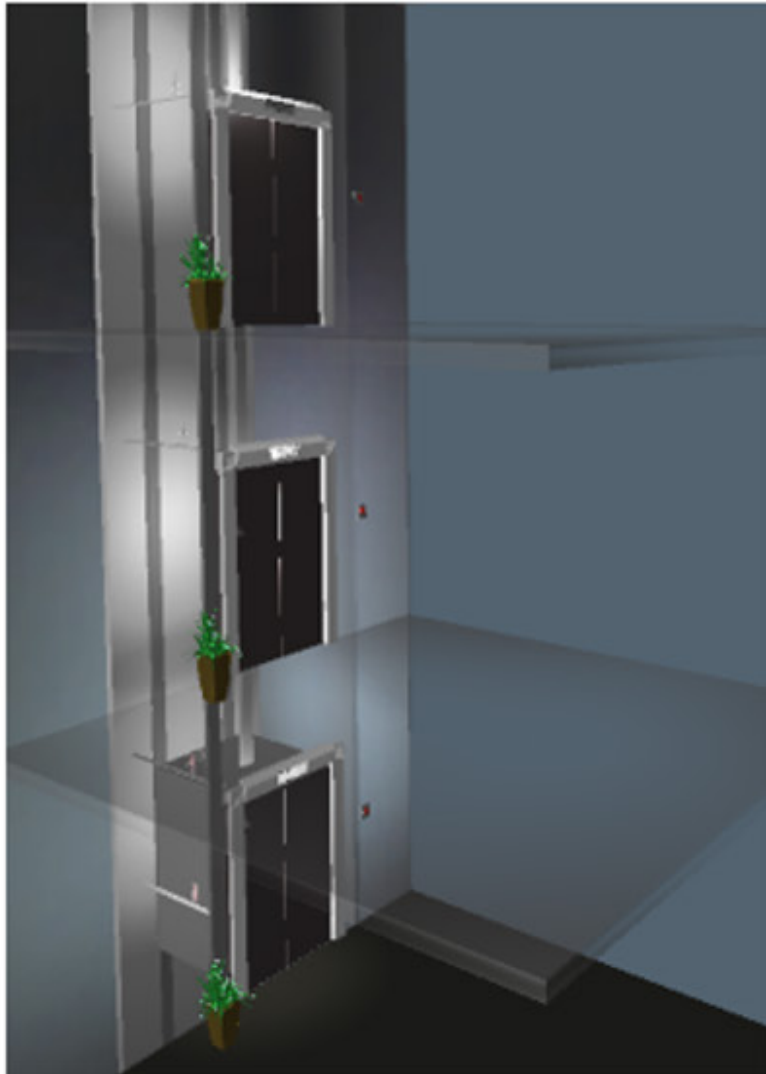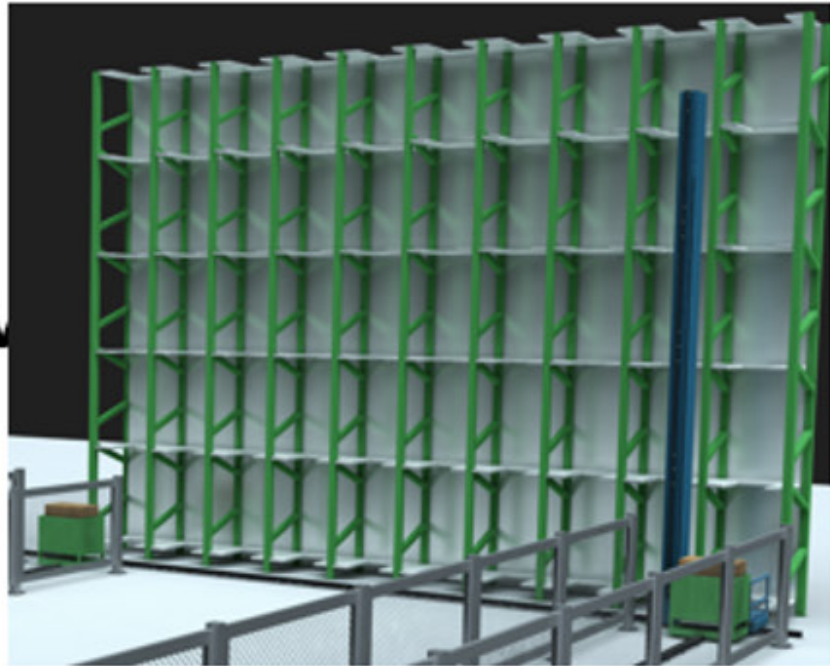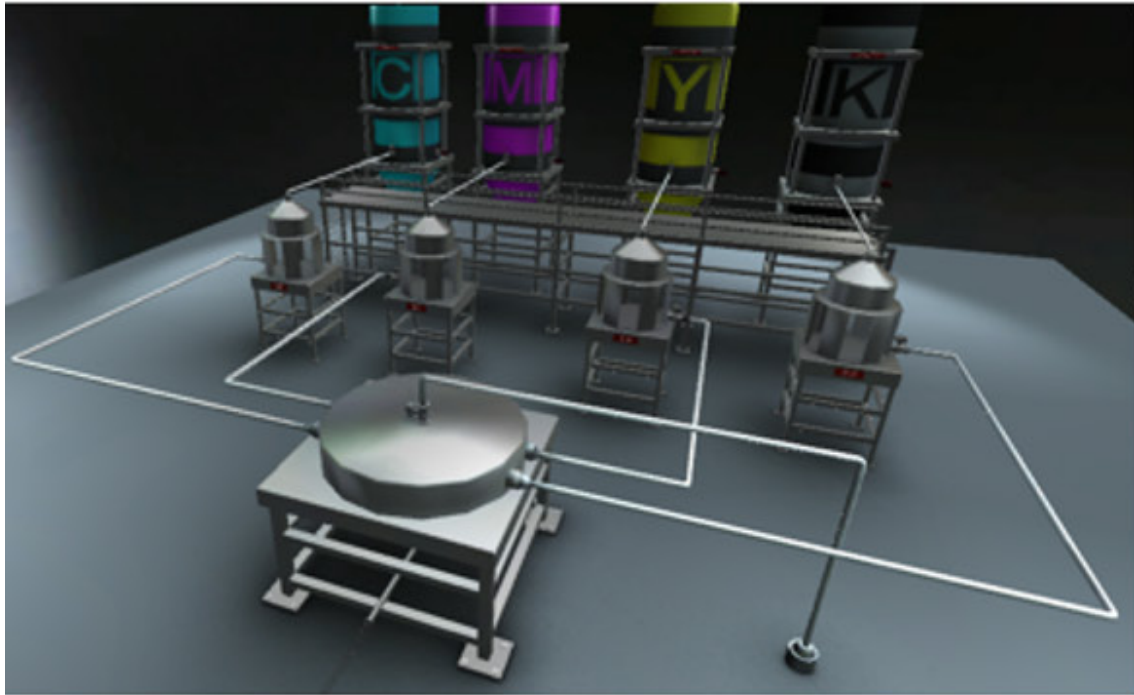
PROFESSIONAL LEARNING

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

AUTOMATING THE GATE OF THE FACTORY

Project: The student is required to automate the door gate of the factory's facilities. The reason is that the factory has plans to implement remote control for all its accesses.

Automation contents: Automation and PLC basics, input and output, sensors and actuators, ladder language, basic ladder Boolean instructions: NO/NC contacts and simple coil, direct engine start and interlocks, edge detection instructions, implement commands from impulse/pushes.

Electricity contents: Basic electric automation panel, electric motor protection and command.

2

GYPSUM DOSING AND MIXING LINE

Project: The student receives a line from another factory but the PLC program is lost. Therefore, it is necessary to study the electric diagram and the description of how the machine works in order to develop a new system.

New automation contents: Memory and image memory, PLC scan cycle, interlocks, retentive command instructions, sequencing techniques using interlocks and memories, timers, counters, analog input signal reading and scaling, guidance on the use of memories and retentive commands, state machines, SFC, implementation of SFC in ladder logic.

New electricity contents: Complete automation and motor command electric panel, interpretation of the whole electric diagram, mapping the IO from the electric diagram.

3

AUTOMATING THE FACTORY ELEVATOR

Project: The factory has vertical operation and needs to increase the number of elevators but instead of buying a new one, the factory decided to build it.
The student is required to develop the elevator's PLC software.

New automation contents: When not to use state machines, linear movement with origin and destiny memory approach.

New electric contents: Safety relays and circuit, interface between PLC and frequency inverters.
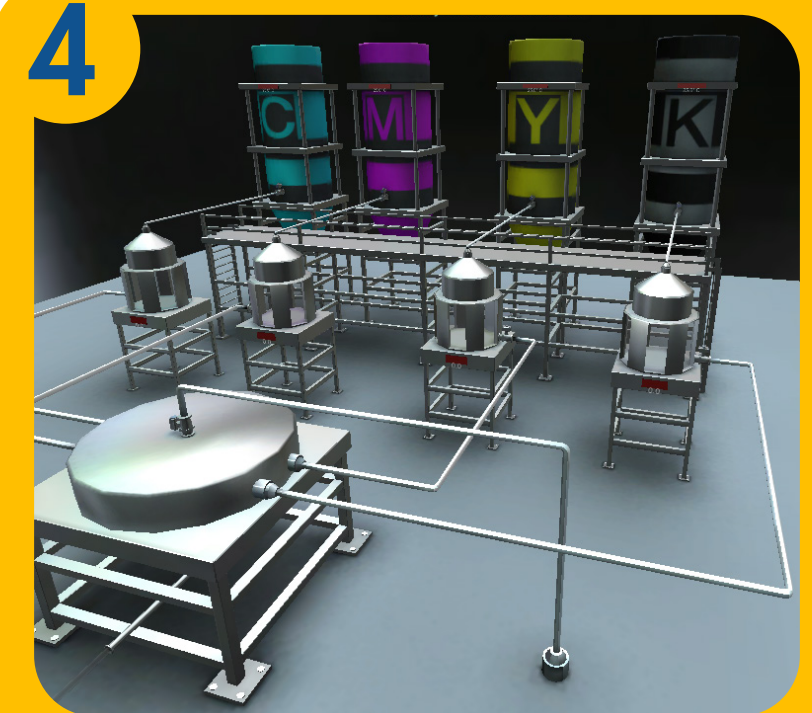
4

AUTOMATING THE BATCHING SYSTEM

Project: The student is required to develop a solution to automate color formulation in its ink factory.
The student must use all the knowledge and skills developed to get this job done.

Automation contents: Organization and function blocks, modularizing the project in small blocks, calling various instances of the same function block.

STUDENT CAN LEARN AND PRACTICE FROM BASIC TO ADVANCED
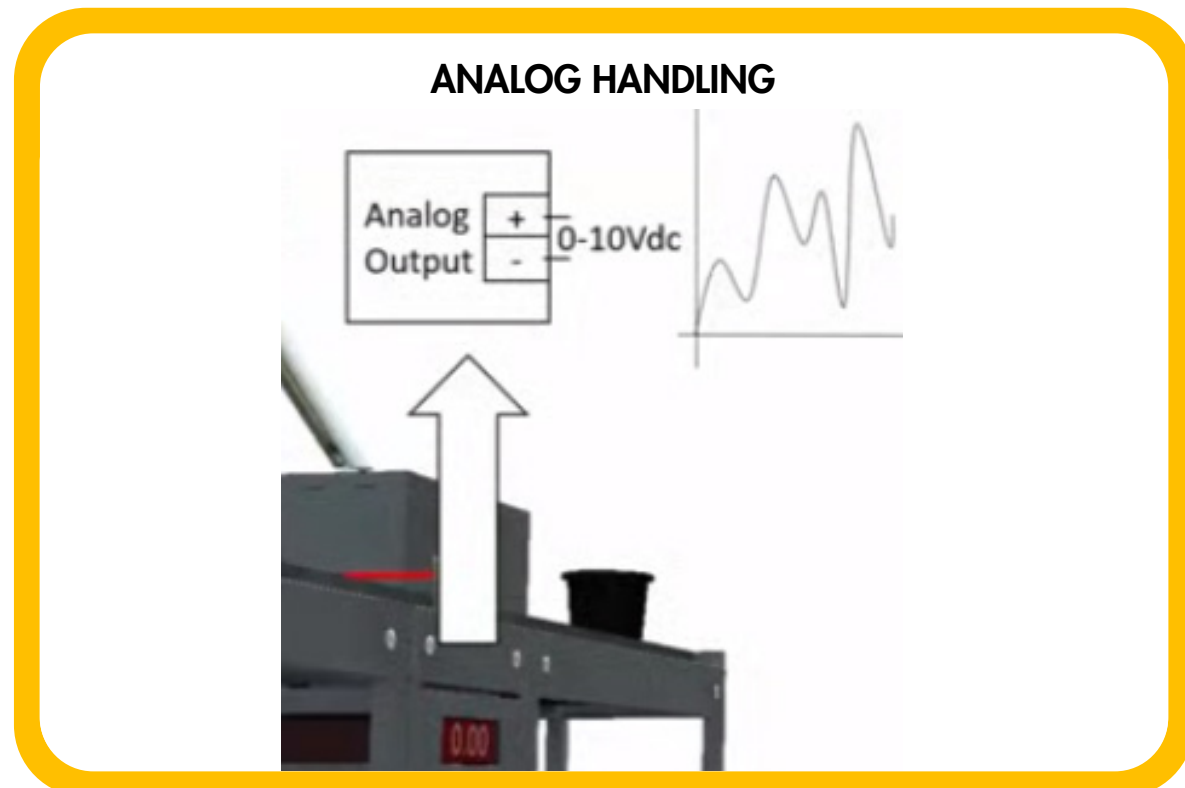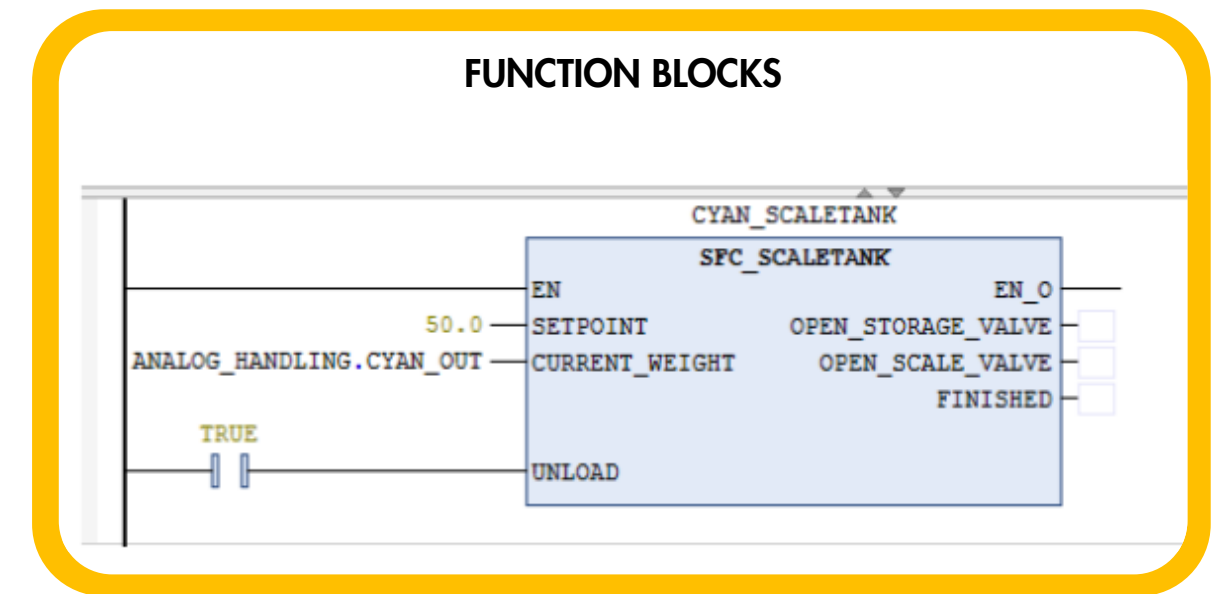## AUTOMATION WITH PLC

With the industrial 3D environments and also the built-in projects it's possible to develop solutions that evolve basic ladder logic, analog handling, math operations, comparisons, state machines, SFC, function blocks and a lot more.

BASIC LADDER LOGIC

SCALING

FUNCTION BLOCKS

ANALOG HANDLING

SEQUENTIAL FUNCTION CHART
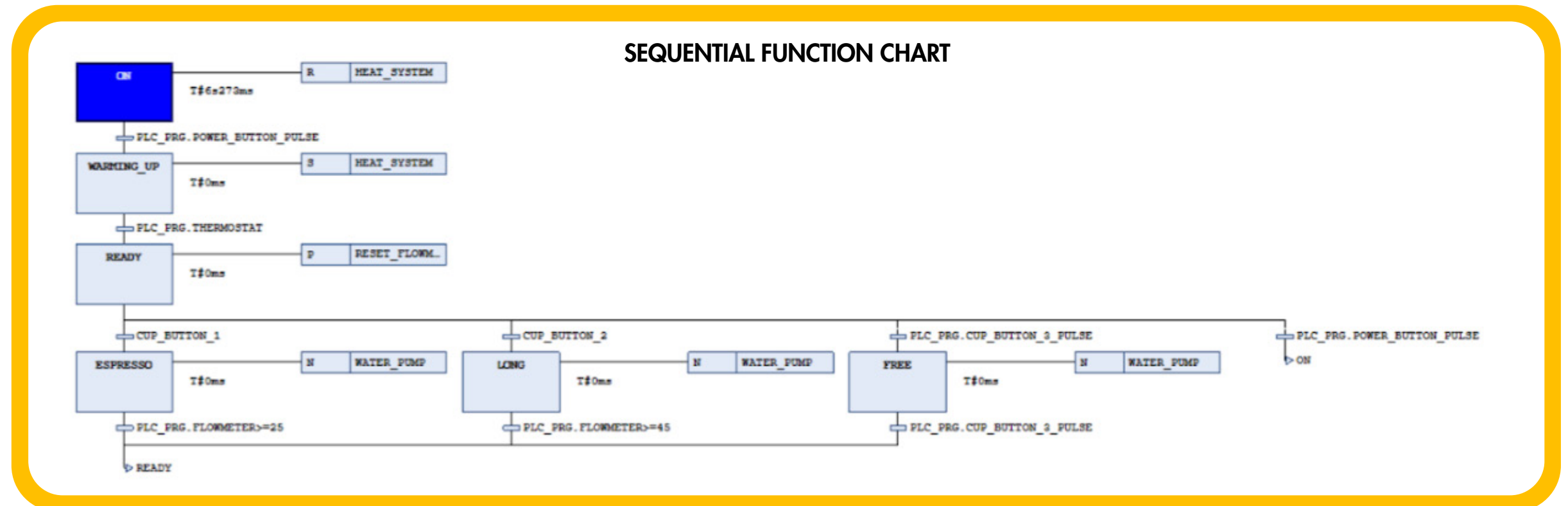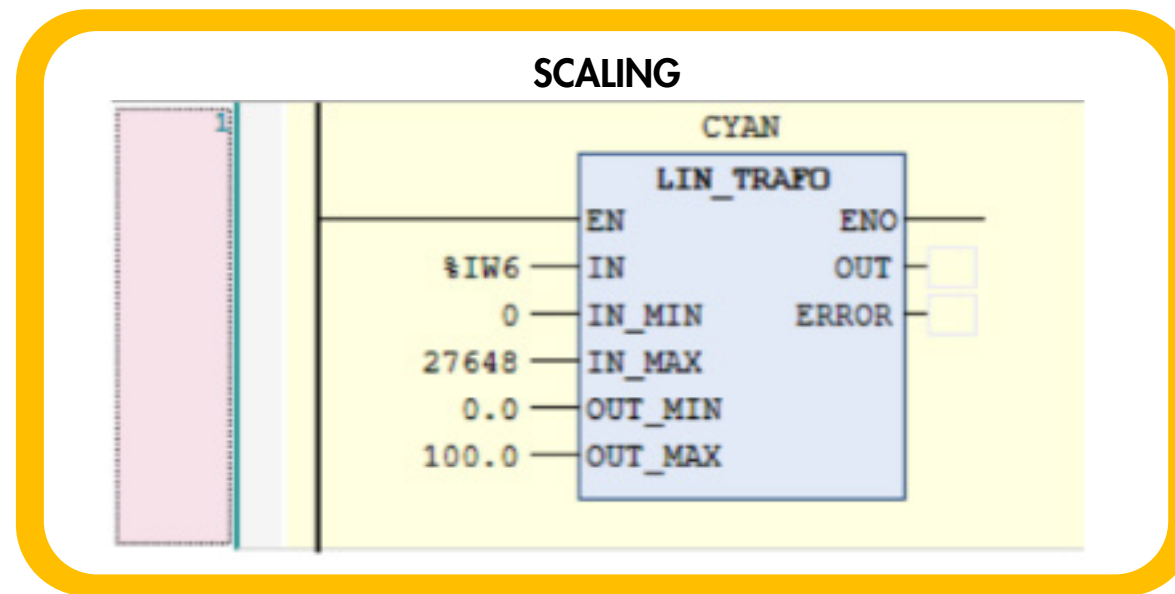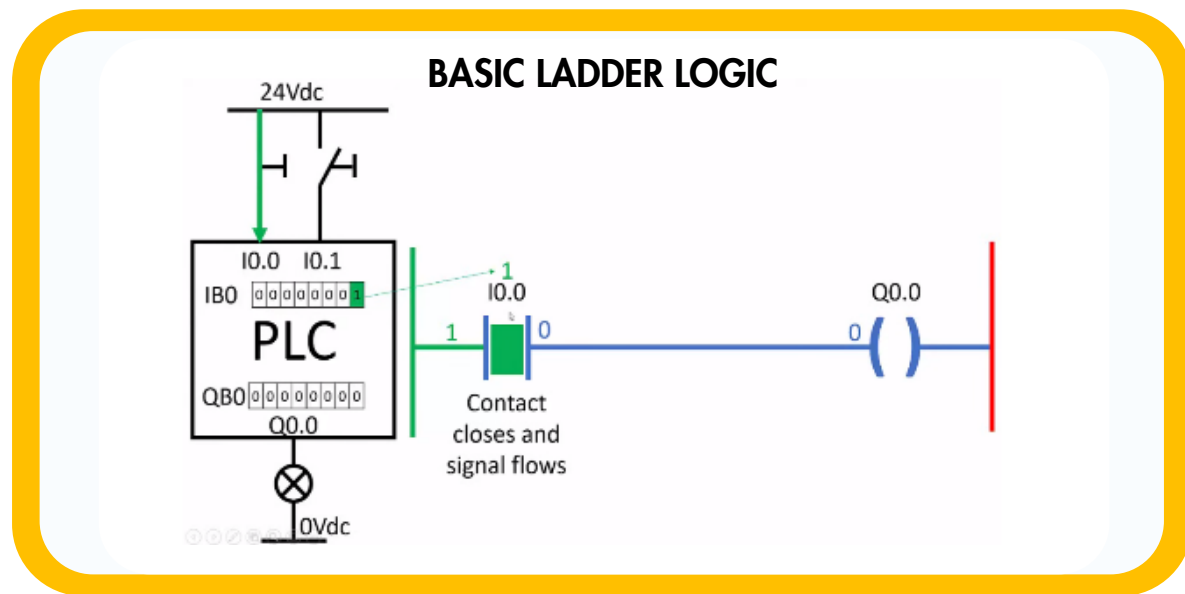
IT INCLUDES ELECTRIC PANEL, FAULT SIMULATION AND TROUBLESHOOTING

ELETRIC PANEL

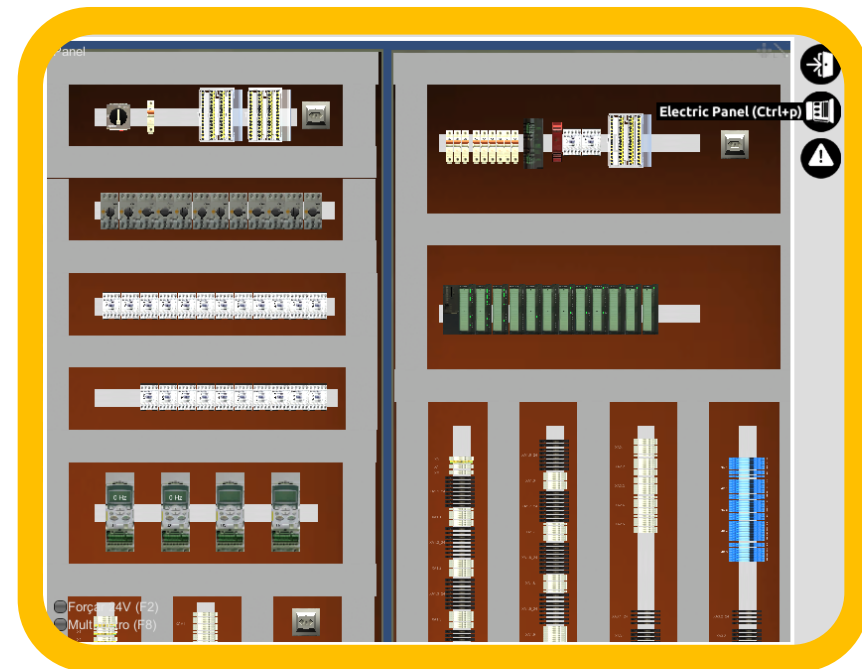You may see that it is very similar to a real electric automation and motor command panel. It has the energy supply and protection, circuit breakers, contactors, safety relay, 24Vdc power supply, PLC, interface relays, connectors, contactors, frequency inverters and so on.

ELETRIC DIAGRAM SAMPLES

As well as the electric panel, the electric diagrams are also presented to the students in industrial standard. The following images are samples of the electric diagram pages.
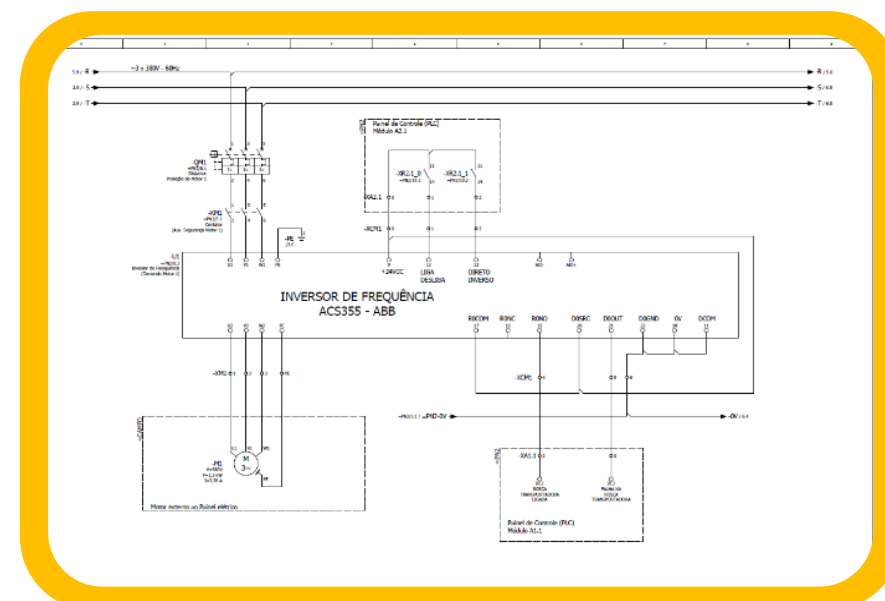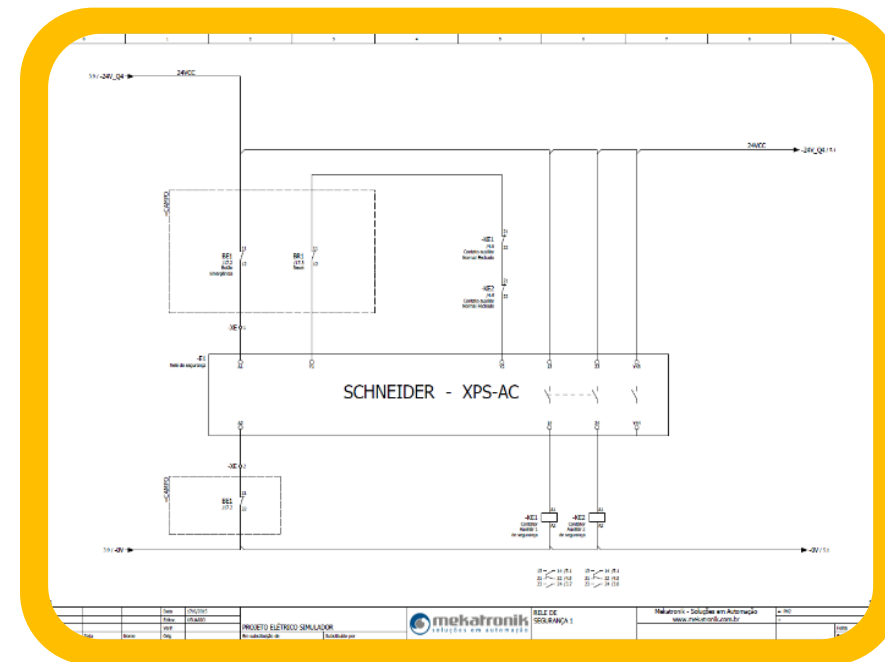
TROUBLESHOOTING

Solving problems on machinery quickly and effectively to reduce downtime is one of the most valued skills in industries. Our solution includes a resource to let the student activate a defect without knowing which defect it is. When the student does that, some component will be damaged and the machine will behave in some strange way. The student's task is to find out the root cause of the problem and replace the damaged component by using the replacement console.

In order to find out what the problem is, the student may use the virtual multimeter (left picture) to make measurements in the electric panel as well as force signal (right picture) to relay's coils in order to verify if actuators are working properly.
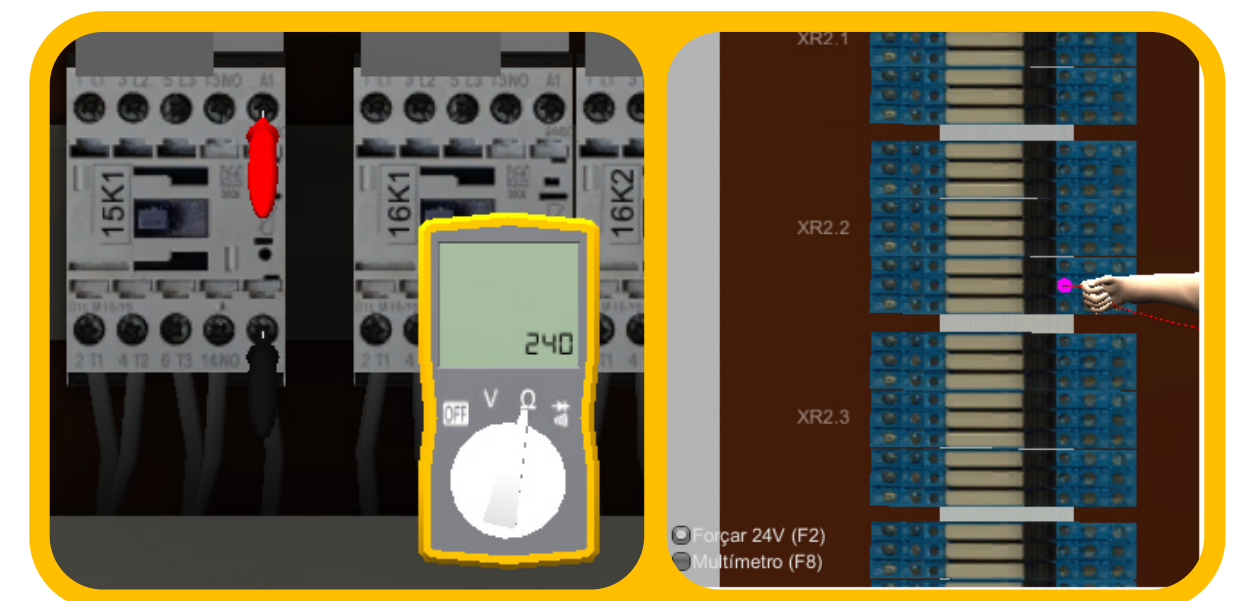
WHY IS IT A SMARTSIM?

IT CONNECTS PROFESSOR, STUDENT AND SCHOOL

COMPATIBLE WITH THE DL SMART-DASHBOARD (SOLD SEPARETLY)

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.

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 - Implementar 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.
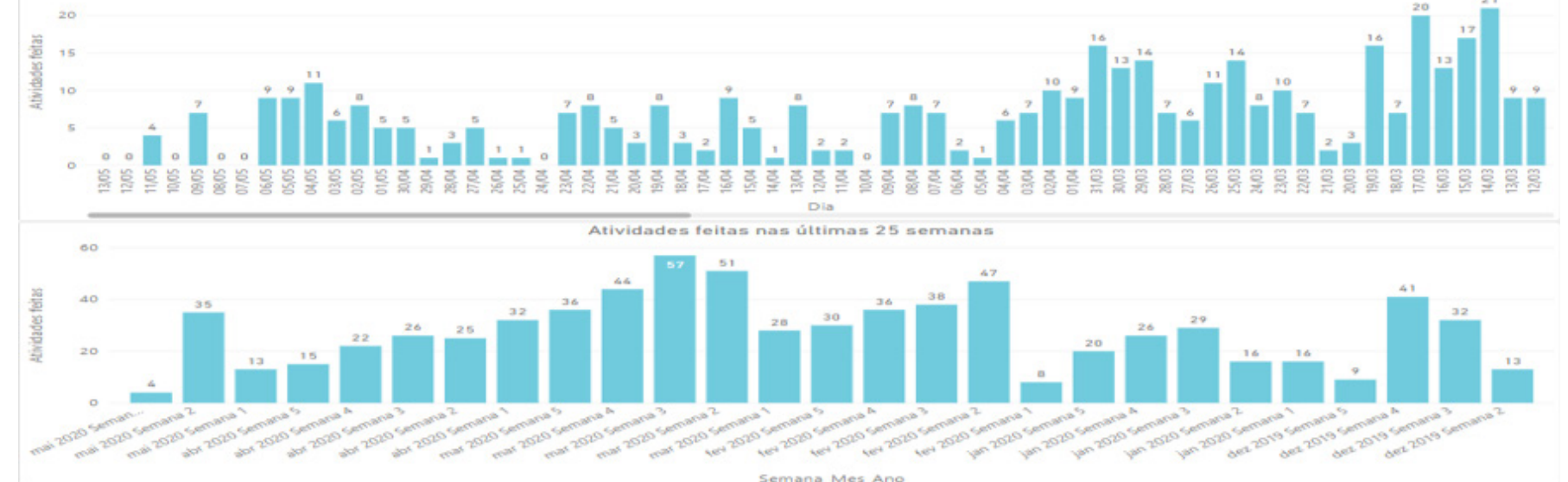
EFFORT/TASK DEDICATED TIME

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.
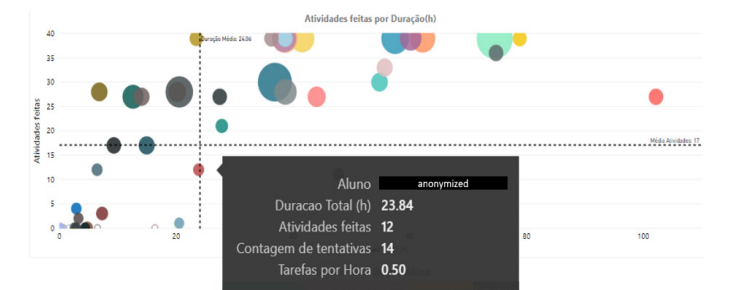
TRIALS PER TASK

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.
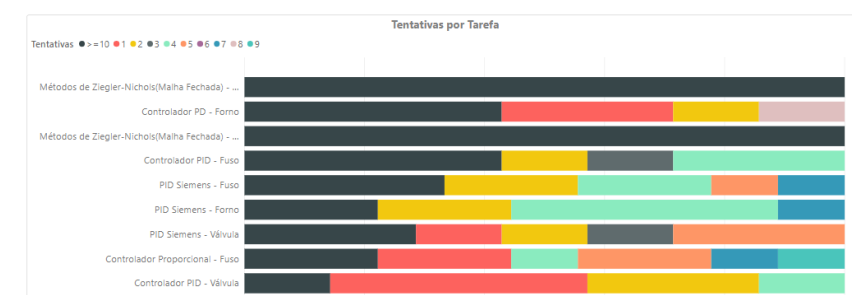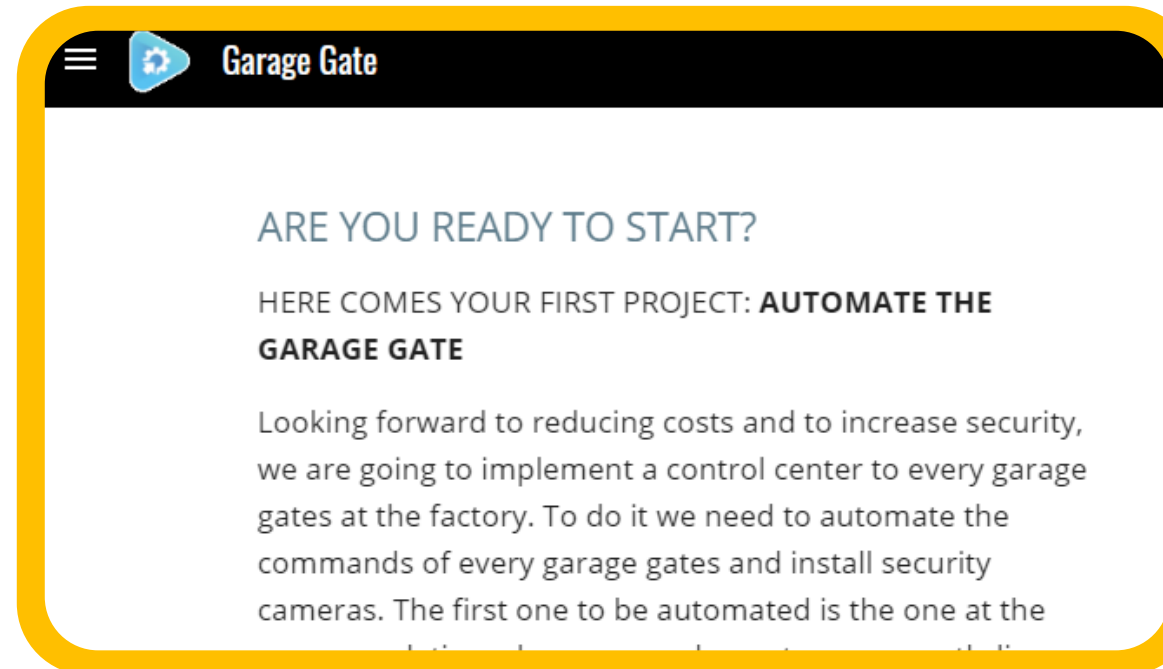
SUMMARY OF FEATURES

IT'S A 3D SIMULATOR

IT HAS BUILT-IN PROJECTS

Garage Gate

ARE YOU READY TO START?

HERE COMES YOUR FIRST PROJECT: **AUTOMATE THE GARAGE GATE**

Looking forward to reducing costs and to increase security, we are going to implement a control center to every garage gates at the factory. To do it we need to automate the commands of every garage gates and install security cameras. The first one to be automated is the one at the...

THE PROJECTS INCLUDE GUIDANCE

TASK SPECIFICATION

1. The gate must open **while** the Open Button is pressed.

2. The gate must close **while** the Close Button is pressed.

Obs.: For opening and closing the gate, it only should move while the button is pressed, then, the gate must stop moving when the user releases the finger from the button.

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

STUDY AND LEARN

Before starting, it is recommended that you access and study the following content:

- Understanding the application
- Understanding the what are inputs and outputs
- Addressing IOs (inputs and outputs)
- PLC´s programming languages
- Basic ladder language instructions

IT AUTOMATICALLY CHECKS STUDENT ACTIVITIES TO LET THEY MOVE ON, LIKE IN GAME
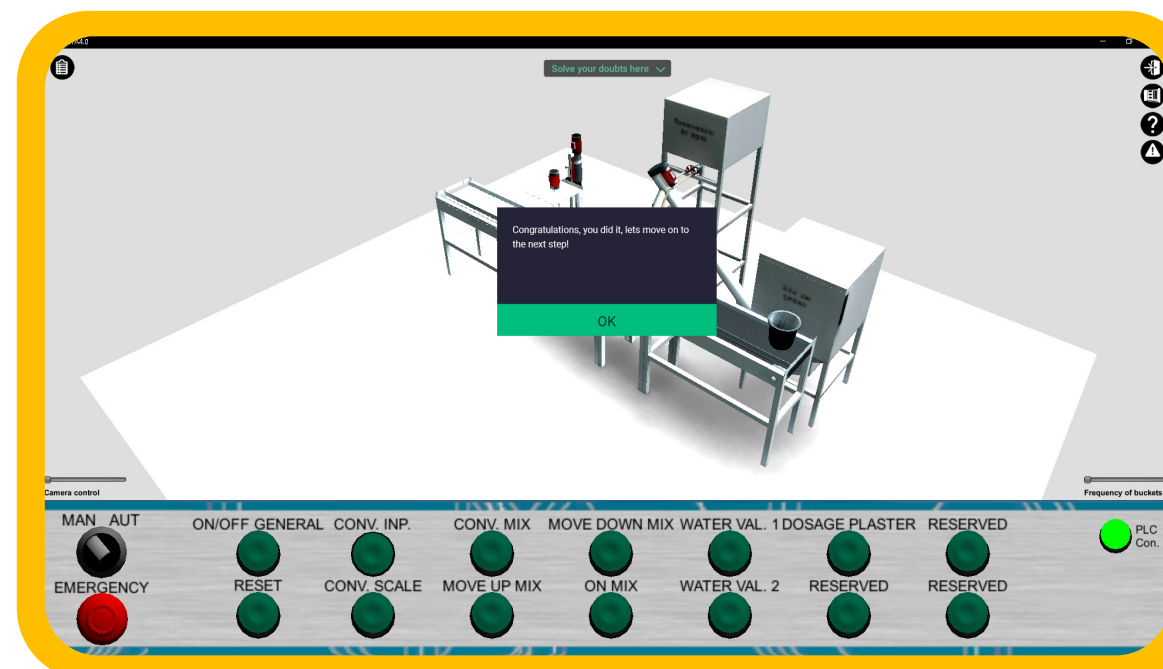
PROFESSORS CAN MONITOR STUDENTS, AND VERIFY WHICH POINT THEY NEED HELP
(Option available with Dashboard)
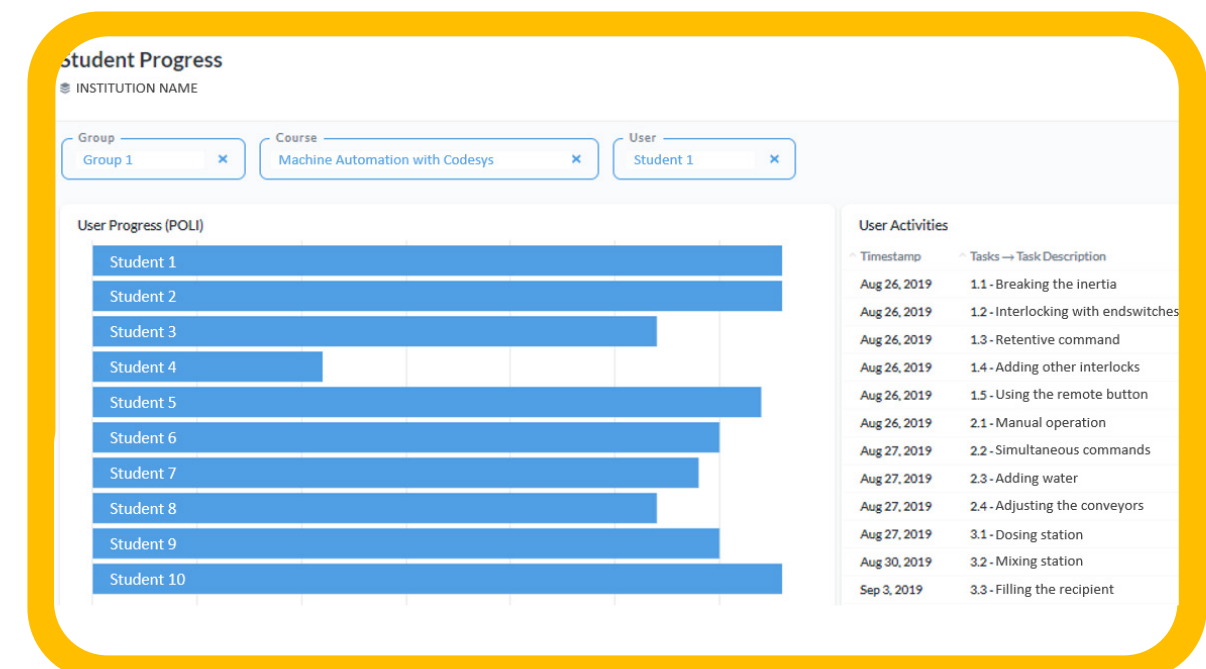
HOW ARE BUILT-IN PROJECTS STRUCTURED?

① ② ③ ④
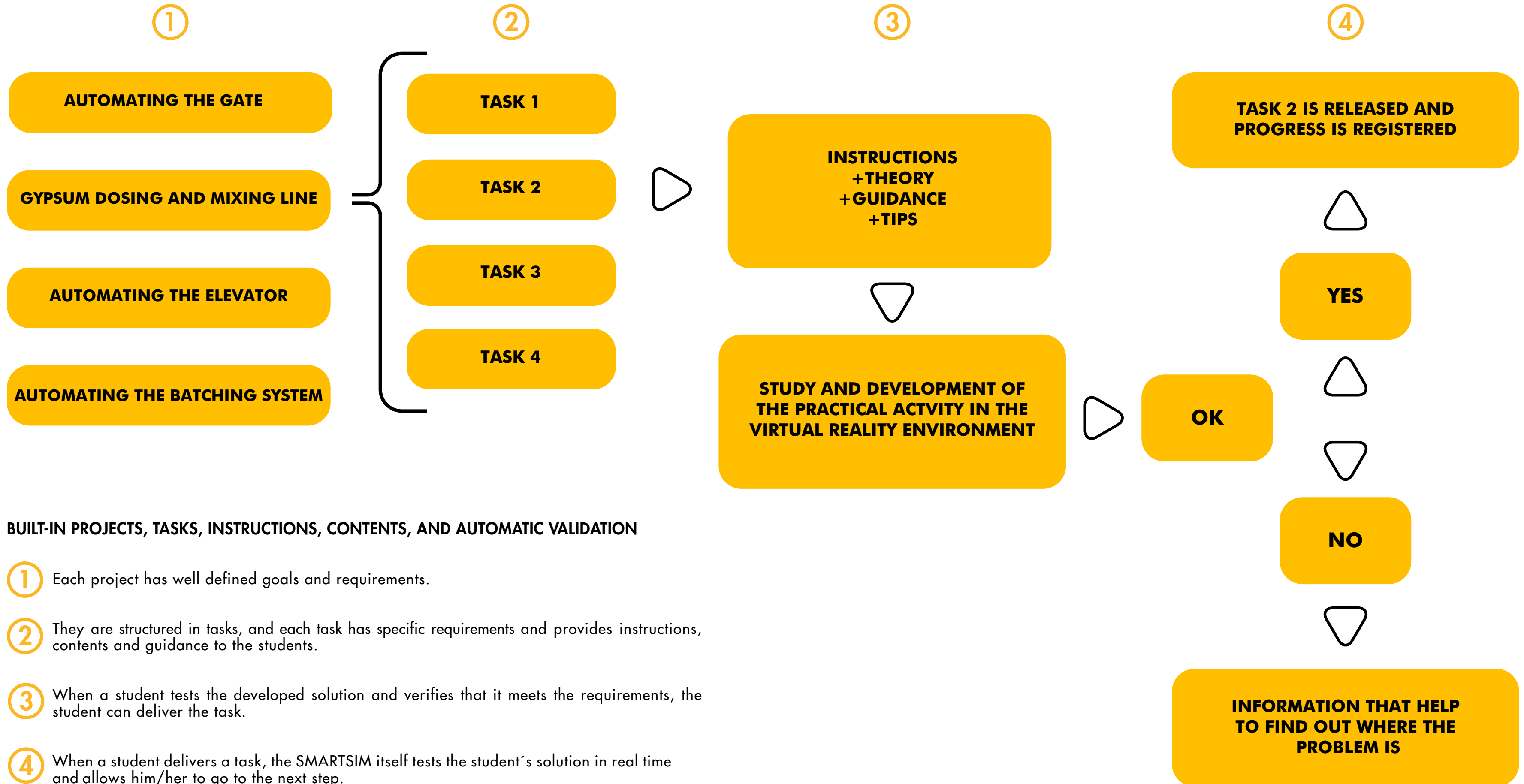
AUTOMATING THE GATE

GYPSUM DOSING AND MIXING LINE

AUTOMATING THE ELEVATOR

AUTOMATING THE BATCHING SYSTEM

TASK 1

TASK 2

TASK 3

TASK 4

INSTRUCTIONS +THEORY +GUIDANCE +TIPS

STUDY AND DEVELOPMENT OF THE PRACTICAL ACTVITY IN THE VIRTUAL REALITY ENVIRONMENT

OK

TASK 2 IS RELEASED AND PROGRESS IS REGISTERED

YES

NO

INFORMATION THAT HELP TO FIND OUT WHERE THE PROBLEM IS

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 him/her to go to the next step.

SYSTEM REQUIREMENTS

ORDER CODES

DL SMART-MAC

MACHINE AUTOMATION COURSE FOR CODESYS

DL SMART-MAT

MACHINE AUTOMATION COURSE FOR TIA PORTAL

DL SMART-DASHBOARD

CLASSROOM MANAGEMENT DASHBOARD FOR SMARTSIMS

IMPORTANT NOTE:

THESE PRODUCTS DO NOT INCLUDE ANY THIRD PARTY SOFTWARES SUCH AS TIA PORTAL, PLCSIM, CODESYS OR CODESYS CONTROL WIN SL.

TO OUR KNOWLEDGE, CODESYS DEVELOPMENT SYSTEM CAN BE DOWNLOADED FOR FREE AT CODESYS STORE.

TIA PORTAL STEP7 + PLCSIM HAVE TRIAL VERSIONS ON SIEMENS WEBSITE. AND AN EDUCATIONAL VERSION CAN BE PURCHASED BY SIEMENS.

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)