INDUSTRY 4.0

DE LORENZO

DL I4.0-ST3

DIDACTIC EQUIPMENT FOR THE TRAINING OF PROFESSIONALS OF THE FOURTH INDUSTRIAL REVOLUTION

4.0

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INTRODUCTION

With the new industrial revolution, software, hardware, and processes are integrated so that a “Push” production (manufactured first and then sold) becomes a “Pull” production (only what the consumer requests is manufactured).

The digital transformation applied to the industry is characterized by the total interaction between the elements and processes that constitute a production unit.

Our didactic system is designed to integrate the knowledge of different areas or departments within a company. Therefore, students from different careers can interact, learn, and apply concepts from their specialization area “hard skills” and study concepts from other knowledge areas.

The students can carry out practices form different disciplines allowing the development of “soft skills”, that is, the development of skills for the professionals of the fourth industrial revolution such as:

- Critical thinking
- Coordination between work teams
- Cognitive flexibility
- Emotional intelligence
- Teamwork
- Leadership
- Self-learning
- Creativity
- Negotiation

SELECTION AND LABELING

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This station communicates with de DL I4.0-ST2.

The assorted containers enter by means of a conveyor belt.

The part numbers for a PO are selected and packed for final delivery, using an industrial type Scara robot.

1

PROCESSES. Key elements of every industry that allow the correct operation of a company. For the student, their understanding and assessment is important for a successful professional life. In the trainer, the processes are based on the study of Lean Six Sigma.

2

HARDWARE. The equipment consists of a Sor and Packaging station, where we can find technologies such as: IoLink, PLC, RFID, SCARA Robot, Smart Sensors, IoT.

3

SOFTWARE. Essential for the industry and the student's life, its use will allow him, in addition to knowing the processes, to obtain specific technical skills in the management of WMS-type systems, Warehouse Management System, MES, Production execution system. As well as: Software for Data Analysis, Augmented Reality and Virtual Clone.

1

PROCESS

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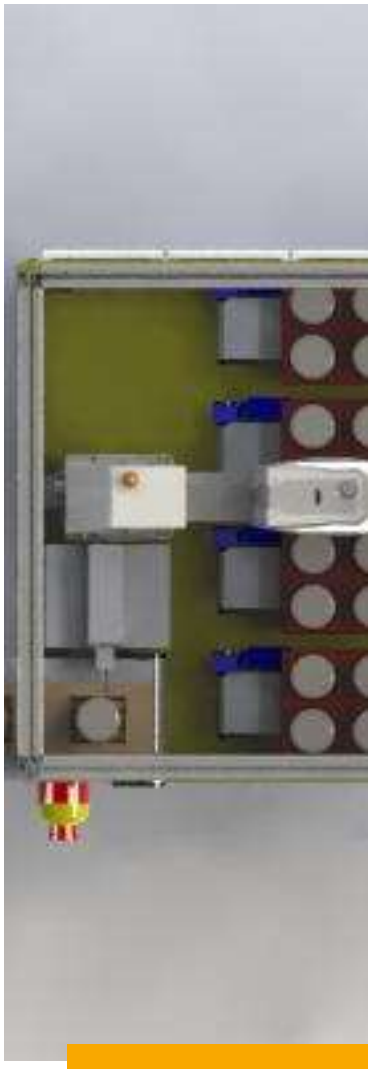
FOR THE DEVELOPMENT OF THE
COMPETENCIES OF THE 21ST CENTURY

PROCESS

The containers generated in the Solids Filling and Closing station pass to this station by means of a conveyor belt.

The Scara Robot will select the product, place it on a pallet for packaging, and place a label identifying the packaging along with its contents.



The specific processes for the management of finished product warehouses are illustrated:

01 SALES ORDER

02 PRODUCT MANAGEMENT IN THE FINISHED PRODUCT WAREHOUSE

03 PRODUCT DELIVERY

2

HARDWARE

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HARDWARE

Cabinet

- With banana plug connections.

Supply

- Power supply 110/220 V, Frequency 50/60HZ, Single-phase and Biphase.

PLC

- CPU.
- Power Supply: 24VDC.
- Slot for memory expansion.
- Support for DB, FB, FC, OB blocks.
- RJ45 connection.
- UA OPC support.

Master I/O Link

- Connection of conventional and IO Link sensors.
- Monitoring of the sensors integrated in the station.
- Web browser access for monitoring.

SCARA Robot

- Recognizes the production that is being generated and segments it according to the purchase order coming from a customer.

RFID

- Reader and antenna for HF reading of embedded tags.

Communication with software

- Allows communication with SCAP.

All station components are industrial grade

HARDWARE

Air supply, pistons, and pneumatic gripper

- They make the entry and exit of the warehouse.
- Fingers to hold the containers.

Visual recognition sensor

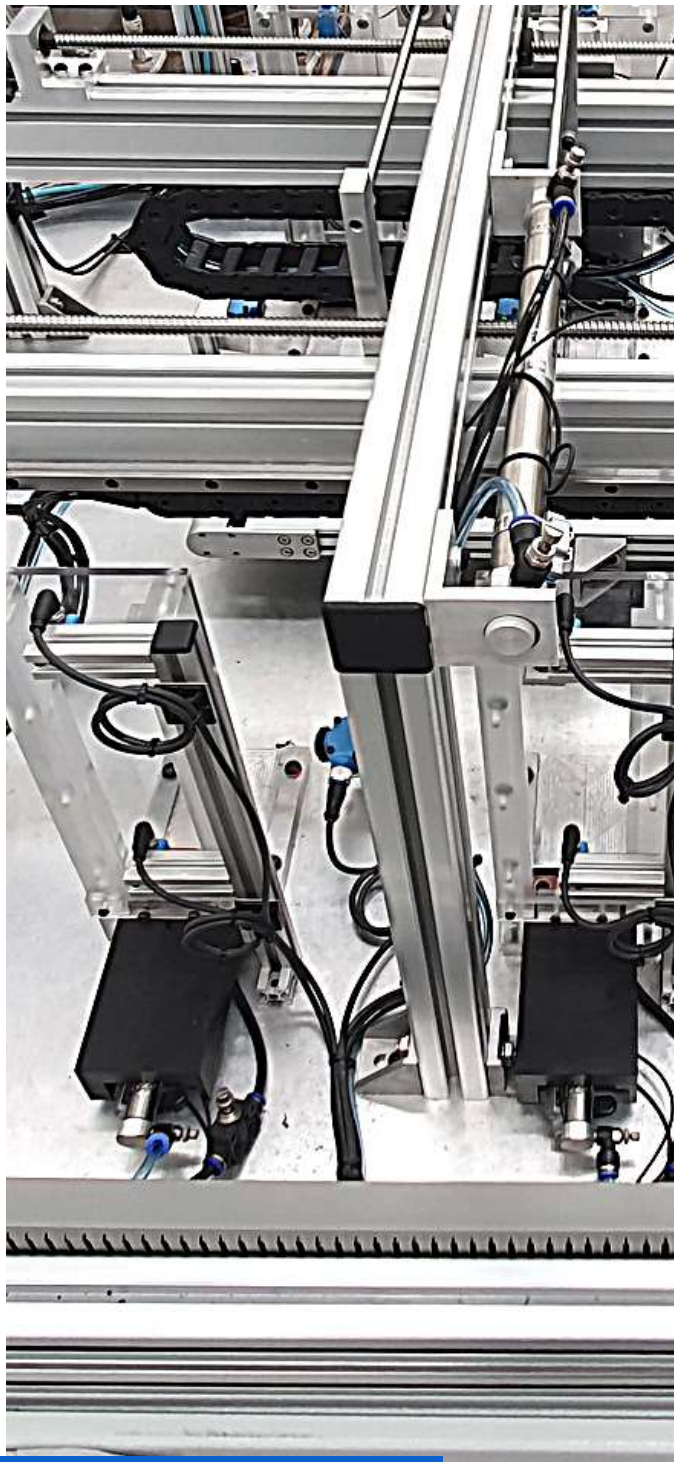
- Pattern recognition.
- Takes the measurements to feed the database and the traceability scheme.

IoT

- Humidity and temperature measurement sensors.
- Deliver information to the database using HTTP or MQTT protocol.

Multiport switch

- Allows communication to the database.
- Allows linking of processes to the Feeding and Storage Station.



Additional features:

- **D**imensions: 1.40m x 1.20 m x 1.90 m.
- Built with aluminum profile.
- Wheels for easy movement.
- Safety grills with clear acrylic walls for student safety and visibility of processes carried out inside the station.
- Emergency stop button.

3

SOFTWARE

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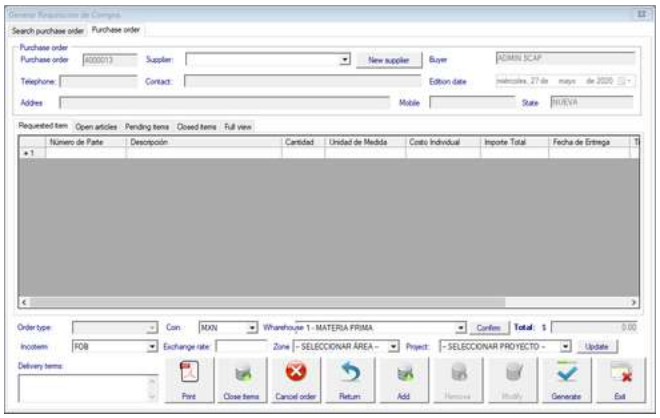
SCAP

WAREHOUSE AND PRODUCTION CONTROL SYSTEM

- Unlimited number of devices or users.
- Intuitive and natural use.
- No subsequent licensing costs.
- Multiple languages.
- Information backups.
- Monitoring of system inputs.
- Safety is controlled by the teacher.
- Monitoring of what happens in the station.
- Practice resume function.*

**The teacher can resume the information of the practice carried out in a previous session.*



SCAP MODULES

1. Warehouse Control System (multi-warehouse)

- Purchase requisition.
- Sales request.
- View stock.
- Inventory management.
- Kardex.
- Purchase suggestion.
- Product reception.
- Product return to inventory.
- Warehouse transfer.
- Dispatch warehouse.
- Production order dispatch.

2. Traceability Control

3. Production Control System

- Production order generation.

4. Environmental Variables Monitoring System

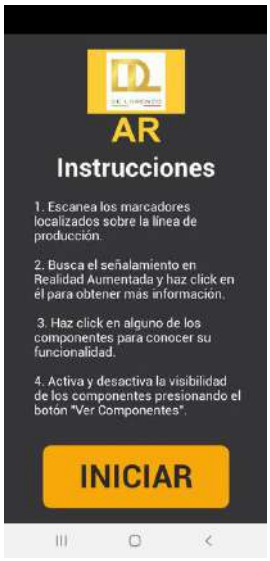
- Environmental variables monitoring (Humidity, Temperature).

5. Quality Capture

- Customizable screens to take different captures.
- Interface with the trainer to integrate quality metrics into product traceability and process performance calculations.

6. SCADA

- Supervision, Control and Data Acquisition of each of the modules that make up the line.



- Interaction with the PLC and the implemented sensors.
- Reading/Writing information in the Database, which is the principal element within the architecture.

- Execution of web services that interact with the peripheral applications of the cell and where the applications can be developed on various platforms such as: LABVIEW, CVI, VS.NET and JAVA.
- Provide the infrastructure needed by careers that require information exploitation.
- Allow augmented reality to exploit information on the elements contained in the cell.

BACKGROUND PROCESSES

Processes running in the background for station monitoring:

Includes APP's for Android mobile devices

It allows analyzing the processes that are carried out when moving through the warehouse and the “time and motion” involved in the management of the warehouse.

Warehouse:

Implements the basic functions of Cycle Inventory, Warehouse Input, Warehouse Output, Environmental Monitoring and Alerts.

Virtual clone

It is an augmented reality environment that displays information through an app developed for Android operating system. Pointing to markers positioned on the equipment, the application will allow the user to access information from the following two levels:

1. Display of administrative and process information.
2. Information display.

With this interaction the student will learn how industrial processes work and their impact on hardware performance, allowing information to be generated in the virtual environment without affecting real indicators. This way, the student will be able to generate a virtual manufacturing, to make decisions on the viability of the production. Additionally, he will understand the use of technology implemented in the cells and the functionality of each technological aspect.

Data analysis

DATAMINING TOOL

The SCAP (Warehouse and Production Control System) software provides mechanisms for extracting information that allow it to be integrated into the “Orange” software in a very simple way, developing the following knowledge:

- **Machine Learning**
- **Data Display**
- **Interactive Data Analysis**

“Systems for the training of professionals in the 4th Industrial Revolution”.

PRACTICES

INFORMATION TECHNOLOGIES ENGINEERING

- Database design and modeling.
- Development of desktop, web and mobile applications that interact with the system in real time, taking information from sensors and processes.
- Development of model indicators.

AUTOMATION AND CONTROL

- Development of PLC programming and its conditions against the process.
- RFID technology operation and its use in processes.
- IO Link operation with strengths and weaknesses analysis.
- SCARA robot programming management.
- Use of web services to collect information in applications development.

INDUSTRIAL ENGINEERING, LOGISTICS AND BUSINESS MANAGEMENT

- Quality Management.
- Indicators analysis.
- Incoterms management.
- Transportation.

Includes:

- User manual for each software item.
- User manual for each station.
- Technical and maintenance manual for the elements in the cell.
- Predefined practices (do not limit the ability to perform additional practices suggested to teachers).

DIDACTIC SYSTEMS FOR PROFESSIONAL TRAINING OF THE 21ST CENTURY

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