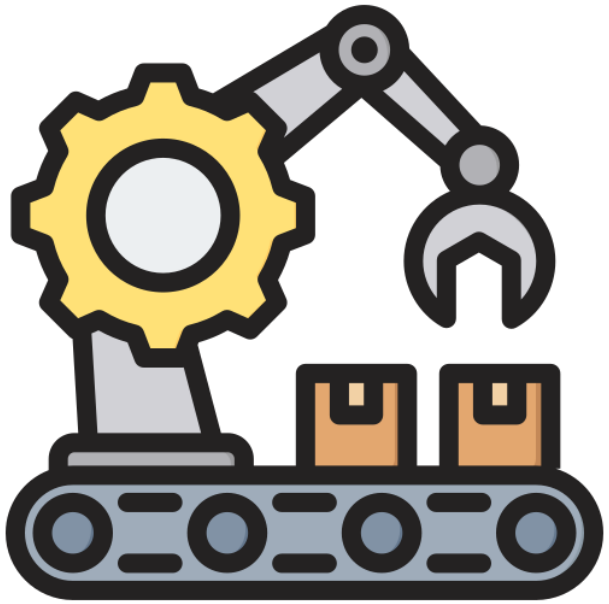


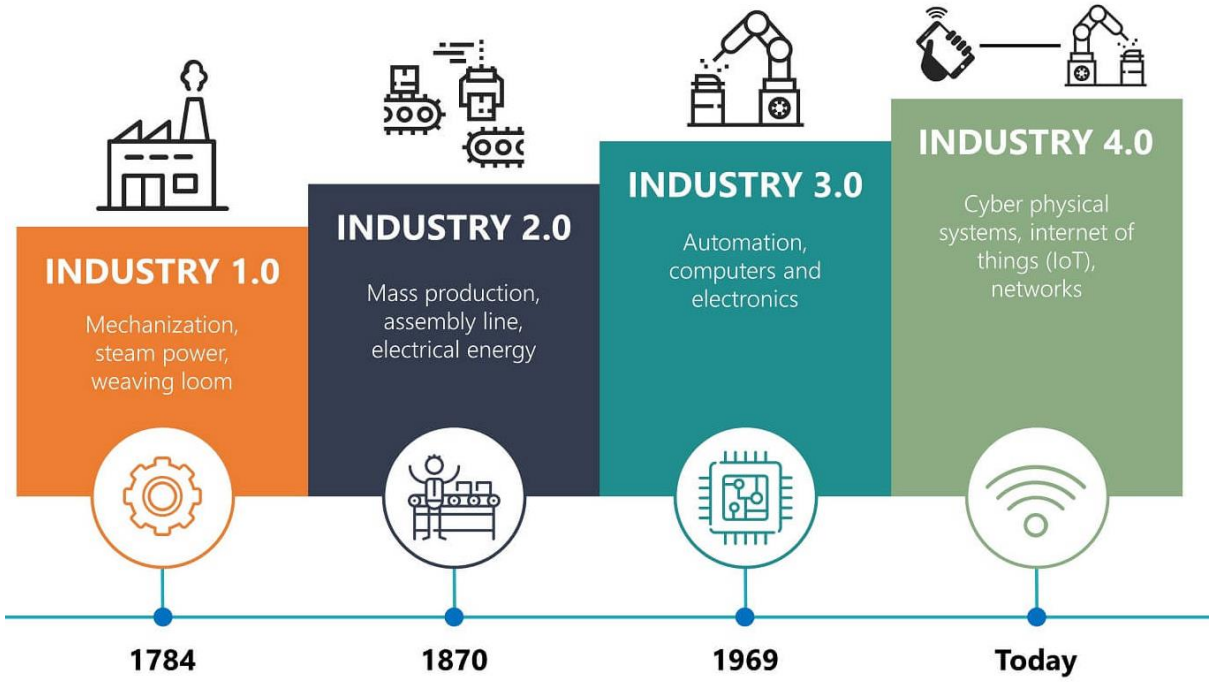
Industrial 4.0

Agenda

1. Industrial introduction
2. What is the industrial 4.0
3. Profit of 4.0 generation
4. Denso innovation
5. Festo example system

Industrial introduction

This term is mainly applied to the industry and marks one of the main steps of the Fourth Industrial Revolution production automation and robotization. The latest IT developments come to factories and plants, and they gradually turn the competition of modern technologies into the struggle for technologies.
To put it shortly, we are talking about a high-tech industry development strategy. Nowadays, the company's success is assessed by its ability to make the production process more autonomous and self-replicating.



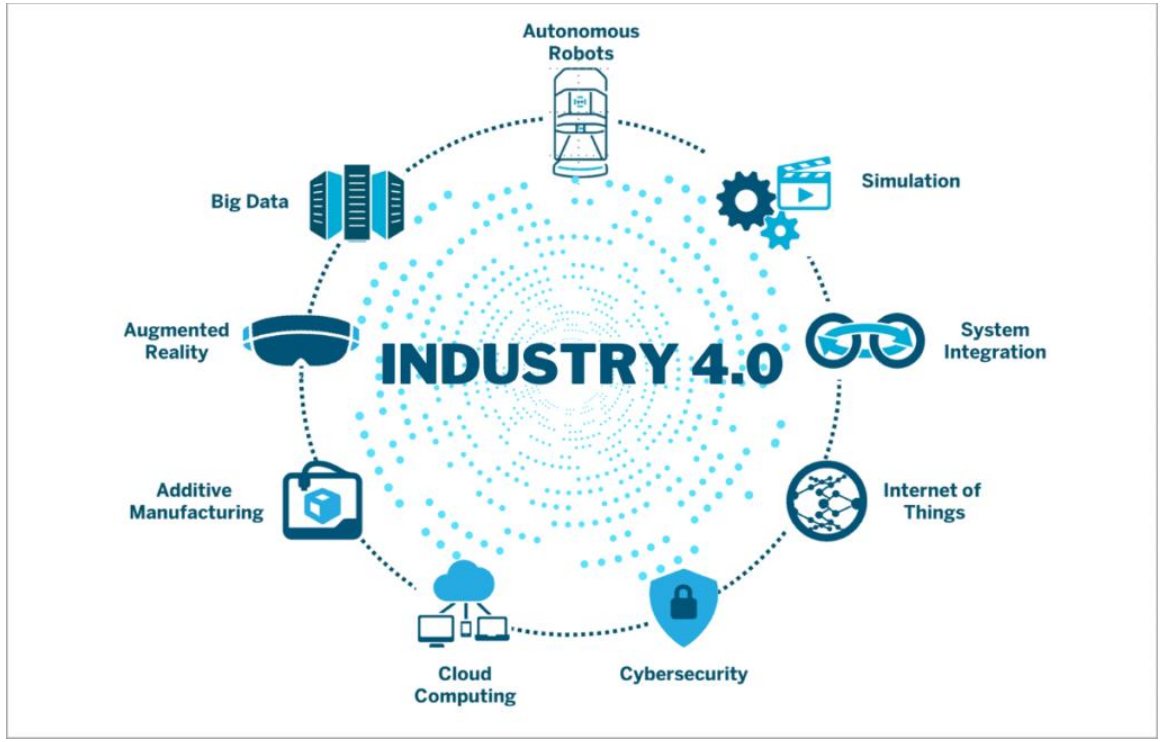
Businesses will get the following main advantages of implementing Industry 4.0

- enterprise productivity enhancement
- production cost reduction
- process optimization and downtime minimization
- competitive growth on the market
- the can easier to experiment with products and test new prototypes
- their final product becomes more sophisticated and efficient.

What is the industrial 4.0

What is the industrial 4.0

Industry 4.0, or the Fourth Industrial Revolution, refers to the integration of advanced digital technologies into manufacturing and industrial processes, transforming traditional factories into smart factories. This shift involves automation, data exchange, and machine learning, with a heavy emphasis on real-time communication and Internet of Things (IoT) devices.

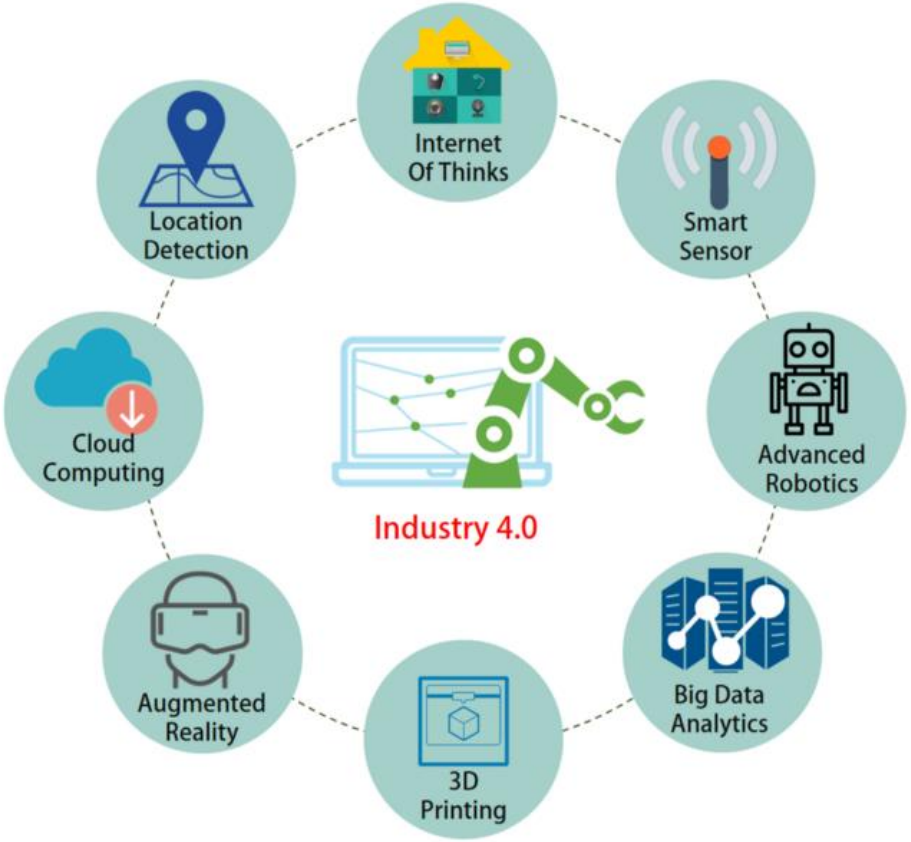


Industrial 4.0 technology

Industry 4.0 technologies together create **"smart factories"**, where machines, people, and data work together in a more synchronized, efficient, and data-driven manner.

list of key Industry 4.0 Technologies

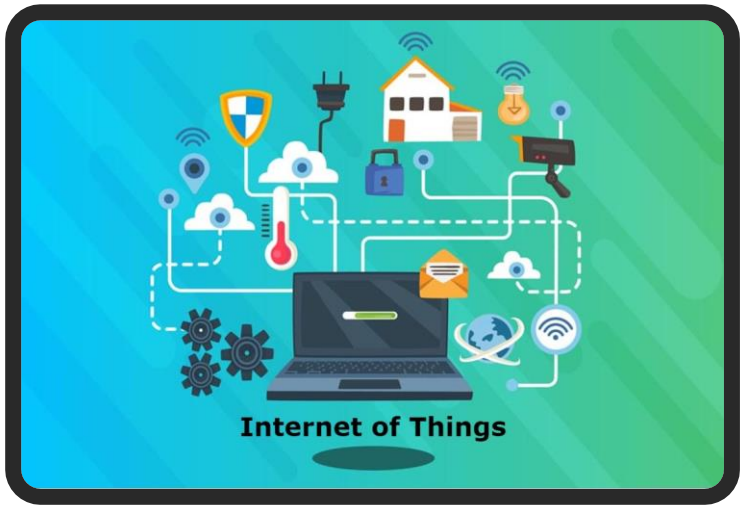
1.Internet of Things (IoT)
2.Big Data & Analytics
3.Artificial Intelligence (AI) & Machine Learning (ML)
4.Cloud Computing
5.Cyber-Physical Systems (CPS)
6.Augmented Reality (AR) & Virtual Reality (VR)
7.Advanced Robotics & Automation
8.Digital Twin Technology
9.Edge Computing



Industrial 4.0 technology

Internet of Things (IoT)

IoT involves embedding sensors and devices throughout manufacturing systems to continuously collect and share data. Each sensor or other data can communicate and share data
(e.g., temperature, pressure, speed) in real time, providing visibility across the production floor.



Role in factory: Improves process transparency, enhances preventive maintenance, and allows remote monitoring and control of production equipment

Industrial 4.0 technology

Big Data & Analytics

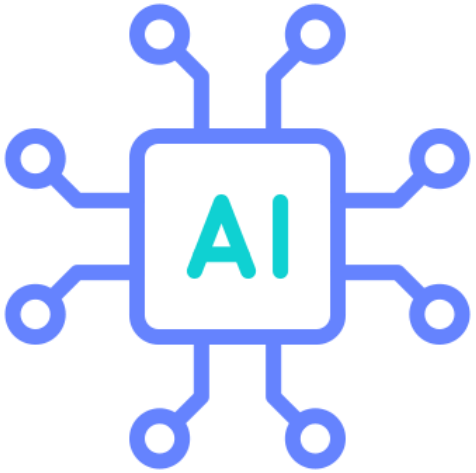
Manufacturing generates vast amounts of data, which are stored and analyzed using advanced data processing techniques. Big Data analytics algorithms extract actionable insights by identifying patterns and trends from large datasets.

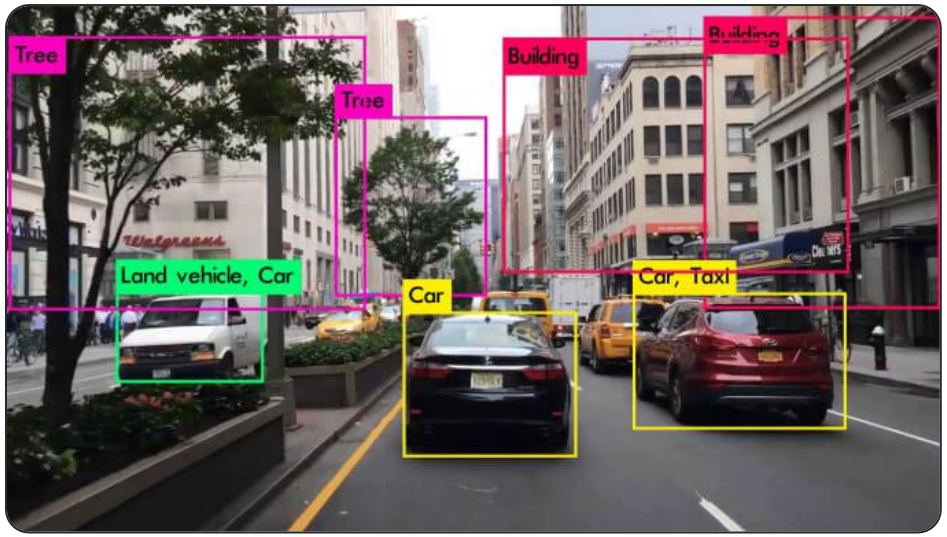
Role in factory: Facilitates data-driven decisions, predictive maintenance, and optimizes resource usage by analyzing and responding to real-time data.

Industrial 4.0 technology

Artificial Intelligence (AI) & Machine Learning (ML)

AI and ML systems learn from data to recognize patterns, make predictions, and improve over time without being explicitly programmed. In factories, AI applications can assess quality, optimize schedules, or even control autonomous robots.



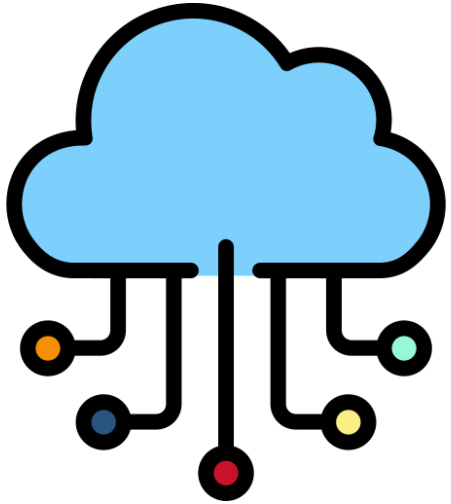


Role in factory: Enables automation of complex processes, improves quality inspection accuracy, enhances production planning, and powers predictive analytics for maintenance.

Industrial 4.0 technology

Cloud Computing

Cloud computing provides remote data storage and processing capabilities, making data accessible from any location. Manufacturers can store vast amounts of data and use cloud-based applications for advanced analysis and collaboration.



Role in factory: Centralizes data access, reduces infrastructure costs, and allows for flexible scaling as data demands increase, supporting collaboration across locations.

Industrial 4.0 technology

Cyber-Physical Systems (CPS)

CPS integrates physical machinery with digital control systems that can communicate, monitor, and control processes autonomously. Machines with CPS can adjust settings based on real-time data without human intervention.

Role in factory: Creates smart systems that can self-optimize, respond to changes, and even communicate with other machines, which improves agility and adaptability in production.

Industrial 4.0 technology

Augmented Reality (AR) & Virtual Reality (VR)

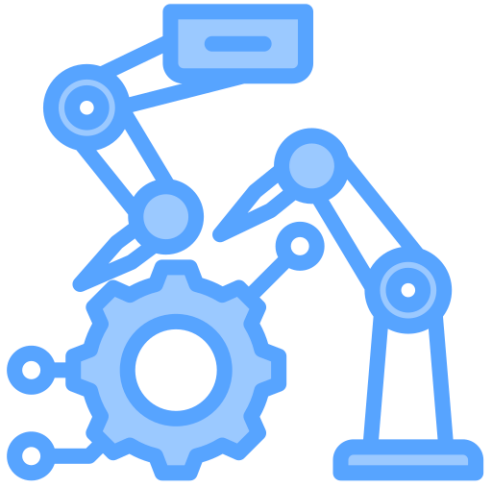
AR overlays digital information in the real world through devices like smart glasses, while VR creates fully immersive digital environments. Technicians can view assembly instructions in real-time using AR, and trainees can use VR to simulate production tasks.

Role in factory: Supports training, maintenance, and quality inspection with digital overlays or simulated environments, improving efficiency and accuracy in complex tasks.

Industrial 4.0 technology

Advanced Robotics & Automation

Robots equipped with AI and sensor technology automate repetitive or dangerous tasks, improving speed and precision. Collaborative robots, or “cobots,” can work alongside human workers for complex tasks.



Role in factory: Increases production speed, enhances safety, and reduces labor costs by automating tasks like assembly, welding, and packaging.

Industrial 4.0 technology

Digital Twin Technology

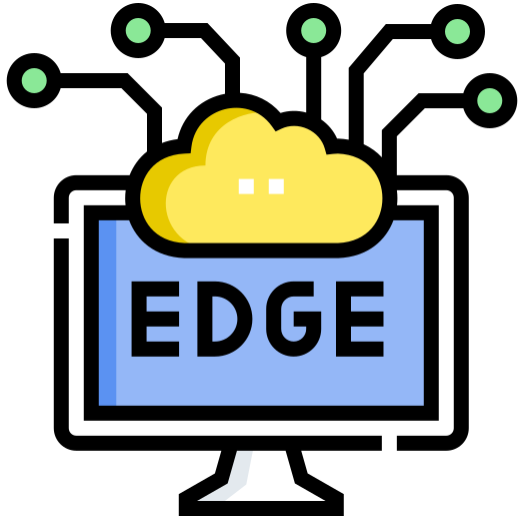
A digital twin is a virtual model of a physical object or system, updated in real-time with data from its real-world counterpart. Manufacturers can use this model to simulate and optimize production processes without risking actual downtime.

Role in factory: Supports predictive maintenance, process optimization, and scenario testing, leading to improved decision-making and reduced downtime.

Industrial 4.0 technology

Edge Computing

Edge computing processes data closer to where it is generated (on the factory floor), reducing the need to send everything to the cloud. By handling data locally, it enables faster decision-making for time-sensitive tasks.



Role in factory: Reduces latency in data processing, ensures reliability in real-time applications, and enhances data security by minimizing data transfer.

Profit of 4.0 generation

Profit of 4.0 generation

the potential profit and efficiency gains of Industry 4.0 versus Industry 3.0

Aspect	**Industry 3.0** (Automation)	**Industry 4.0** (Smart Automation & IoT)
Efficiency	Moderate efficiency with traditional automation	High efficiency through interconnected smart systems and real-time data
Data Utilization	Limited data collection, mainly for reporting	Extensive data analytics for predictive maintenance and process control
Customization	Low to moderate customization	High customization with flexible, on-demand production
Downtime & Maintenance	Reactive maintenance, frequent unplanned downtime	Predictive maintenance, reduced downtime with IoT monitoring
Labor Costs	Reduction in repetitive tasks	Reduction in both repetitive tasks and high-skill tasks through AI
Quality Control	Manual quality checks and reactive adjustments	Automated quality control with real-time error detection and adjustments
Supply Chain Management	Limited visibility and flexibility	End-to-end supply chain visibility, allowing just-in-time inventory
Environmental Impact	Higher energy consumption and waste	Reduced energy usage, waste, and optimized resource use
Profit Margins	Moderate increase in profits from automation	Potential for high profit margins through cost savings, efficiency, and faster response times to market changes

Summary

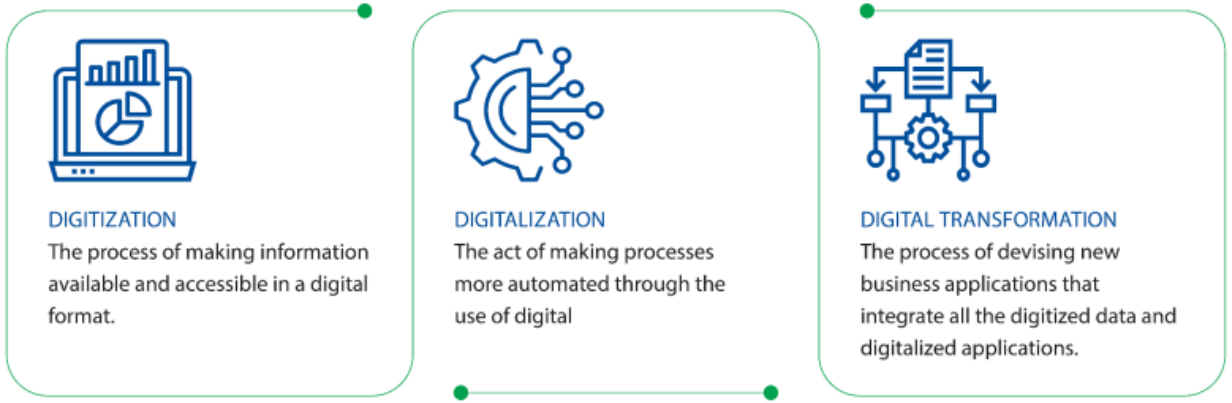
Industry 3.0 often saw incremental profit increases from reduced labor costs and improved production speeds.

Industry 4.0 brings exponential profit potential by optimizing the entire production lifecycle, reducing waste, minimizing downtime, and enabling faster adaptation to market demands.

Denso innovation

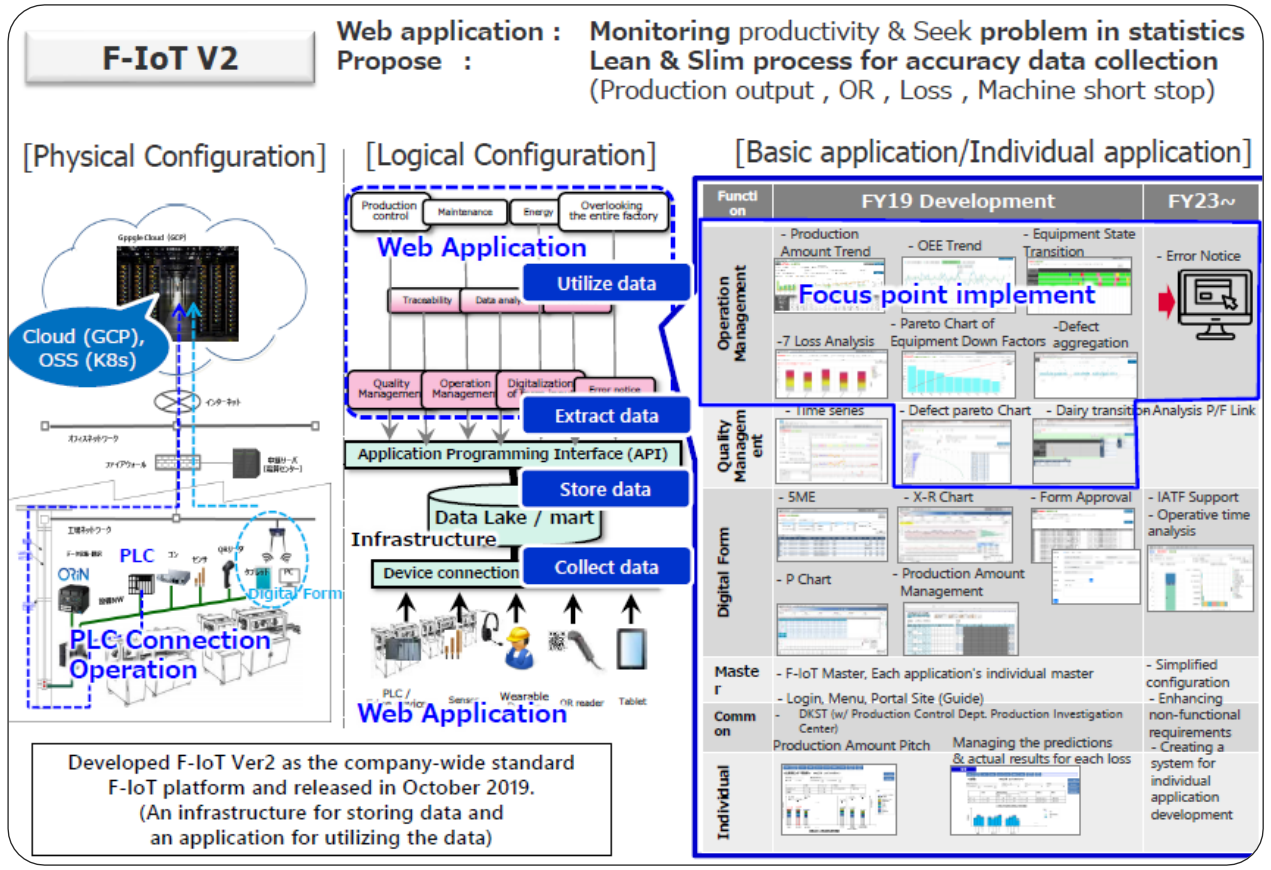
Denso innovation : F-IOT Concept

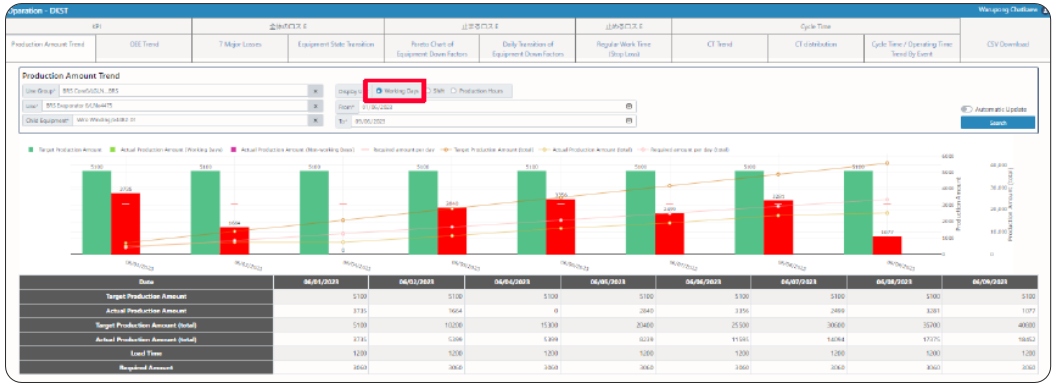
Digital transformation : Creating new value includes organizational change and new ways of working



Hand order → Order on web → Order on web → Integrate orders with delivery system → Integrate orders with delivery system → Be supplied

Denso innovation : V2 platform

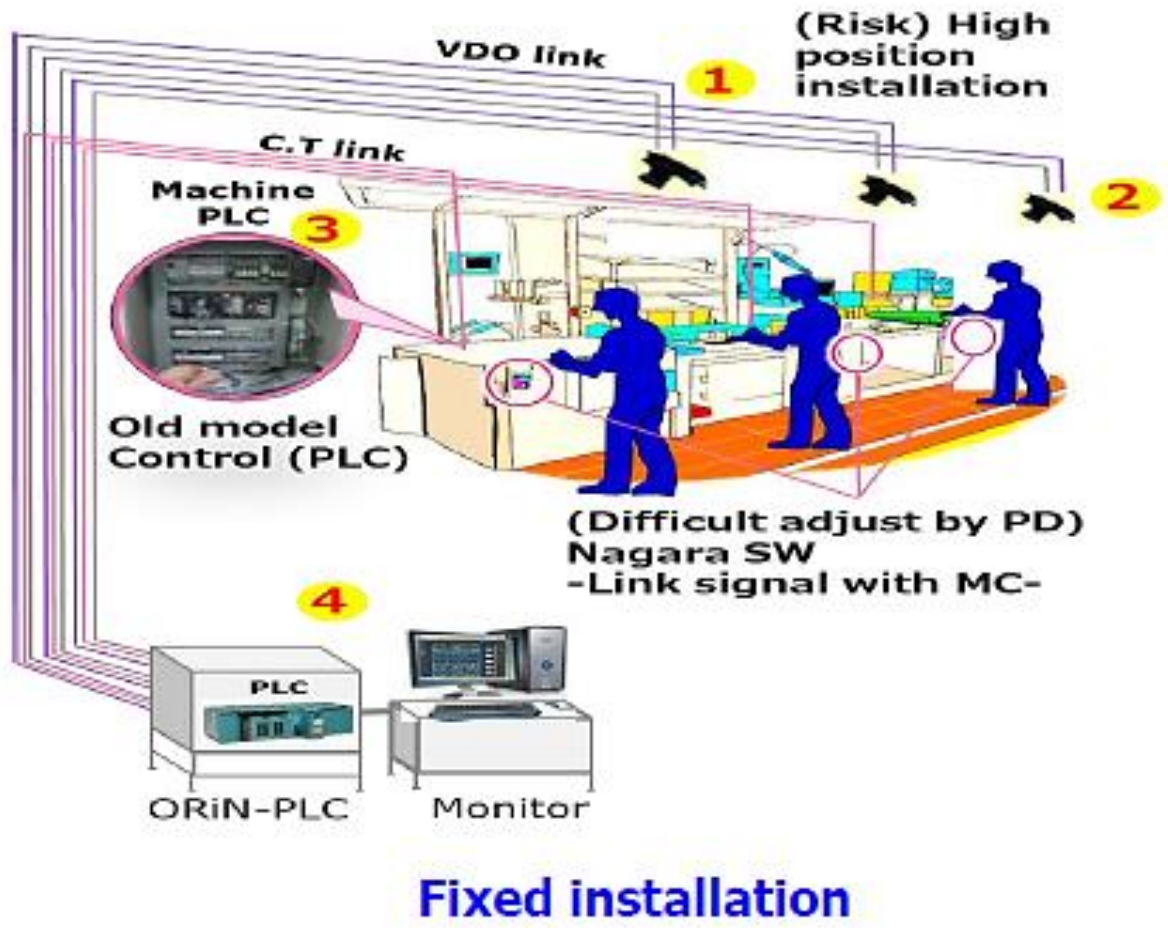




*Platform V2 is the new Denso F-IoT system released in Oct.2019
*Platform V2 is based on Cloud Services.

Industry 4.0 topic : IOT & Big data

Denso innovation : D-Qits

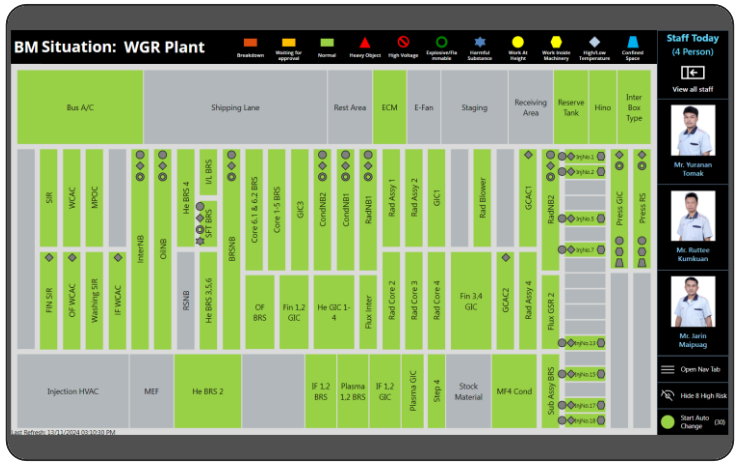


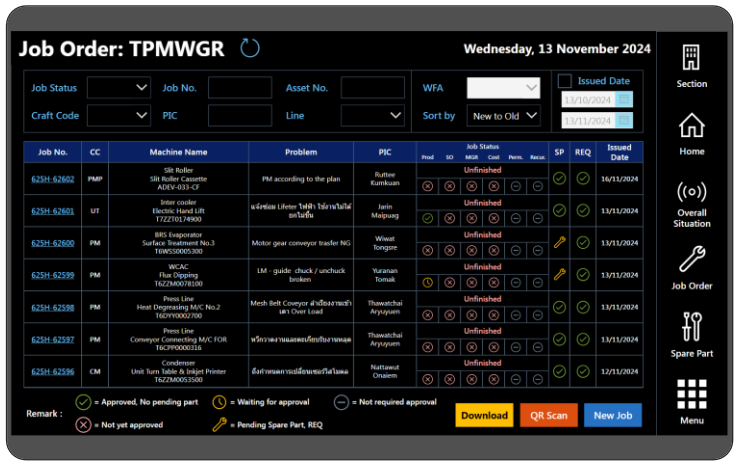
*D-Qits(Denso quick kaizen iot system) , it was developed by DNJP to collect the data and video recording on manufacturing

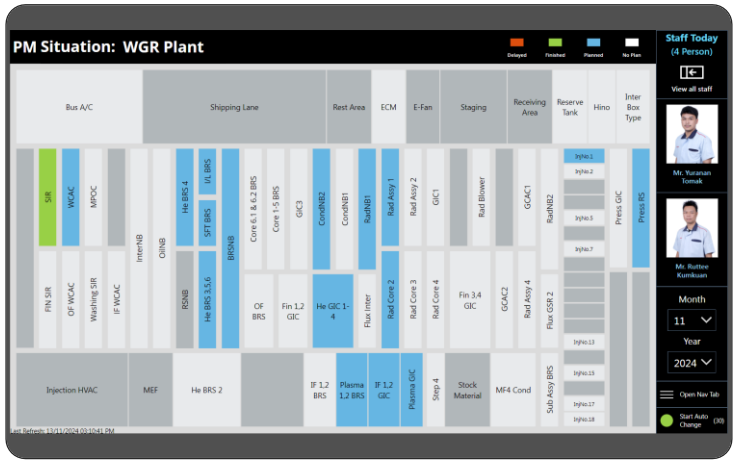
Industry 4.0 topic : IOT & Data Analysis

Denso innovation : Machine & tool maintenance

WRG Plant : Power app for manufacturing maintenance



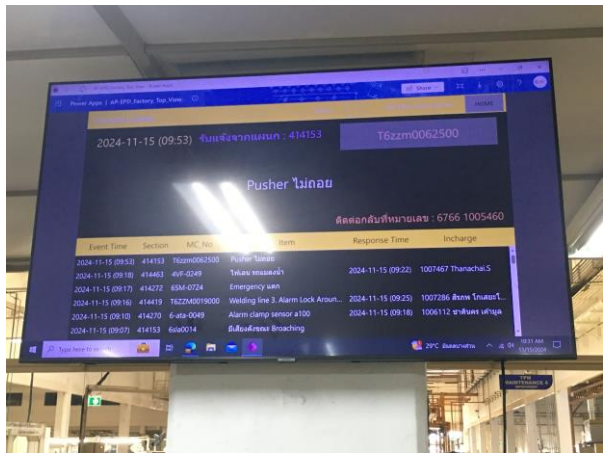


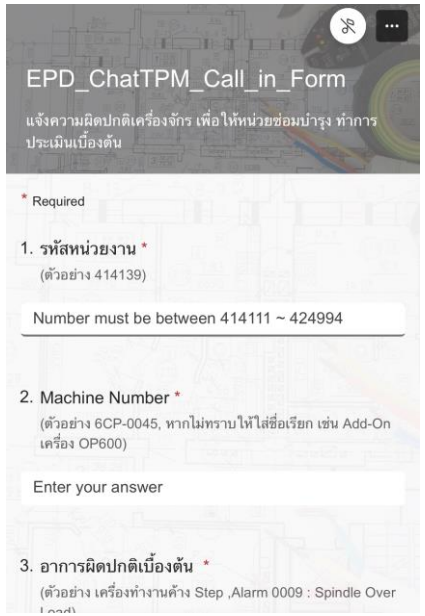


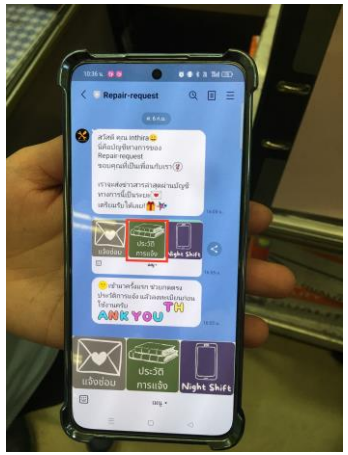
Industry 4.0 topic : IOT (Dash board & E-form)

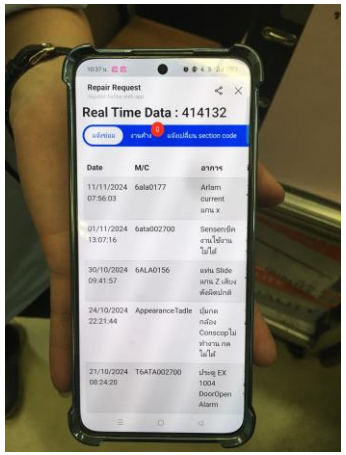
Denso innovation : Machine & tool maintenance

BPK Plant: Power app for manufacturing maintenance





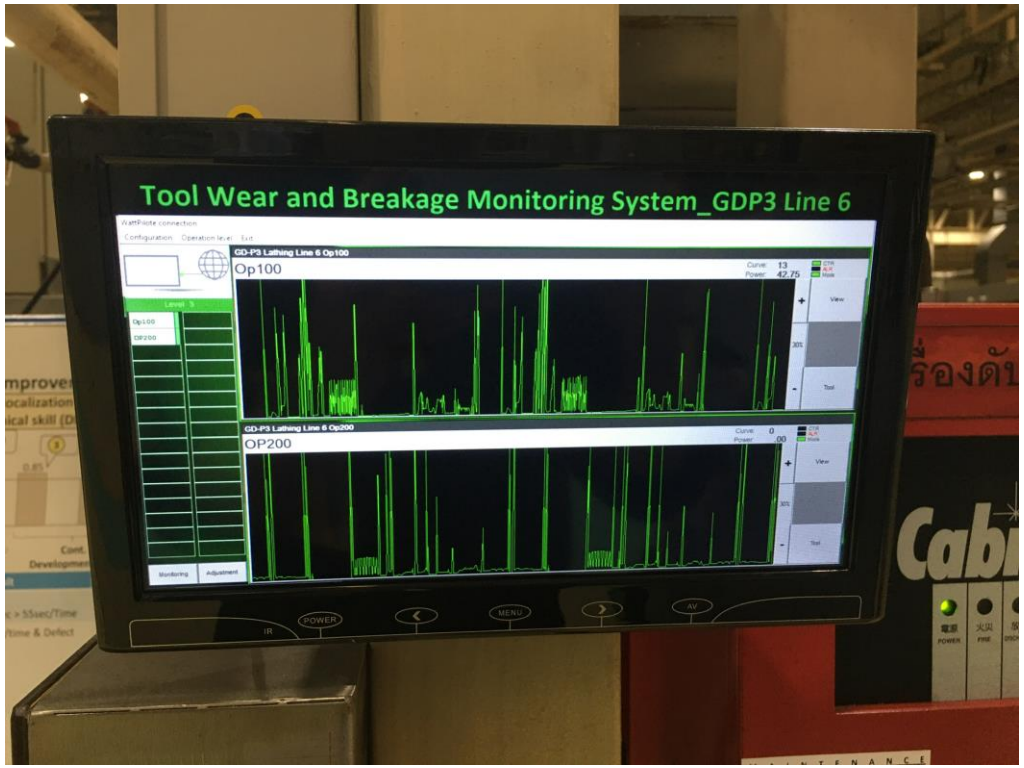




Industry 4.0 topic : IOT (Dash board & E-form)

Denso innovation : Machine & tool maintenance

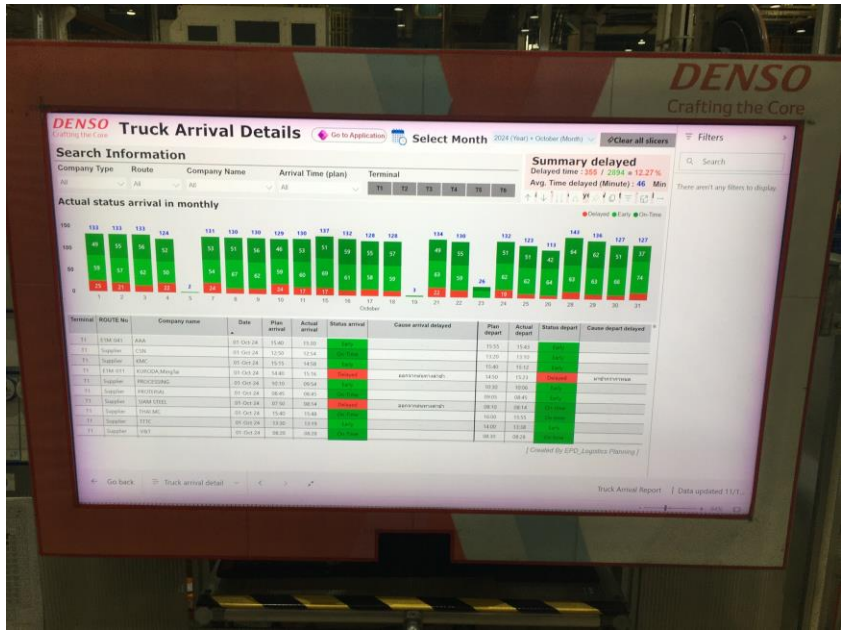
BPK Plant: Predictive maintenance (Breakage tool)

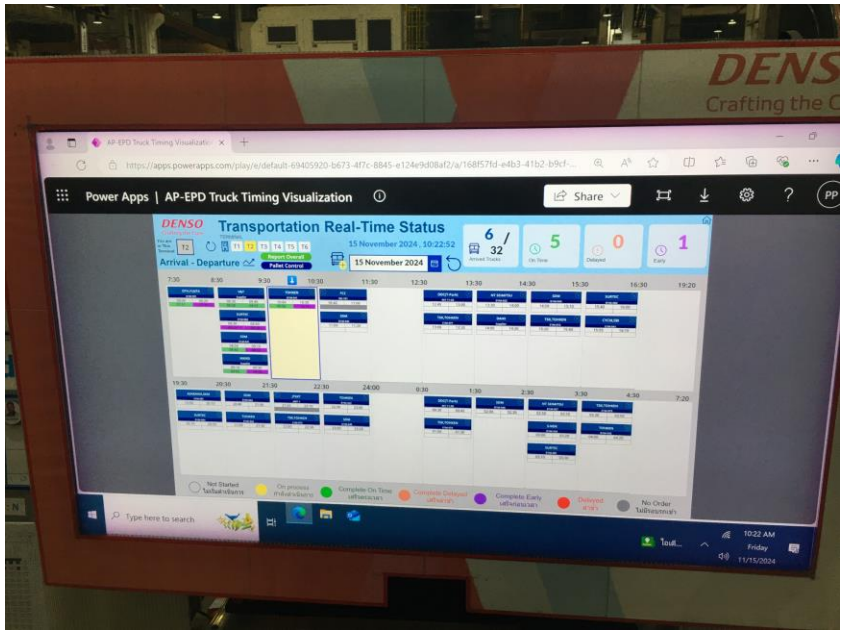


Industry 4.0 topic : IOT & Data Analysis

Denso innovation : Machine & tool maintenance

BPK Plant: Logistic data storing (Truck Arrival)

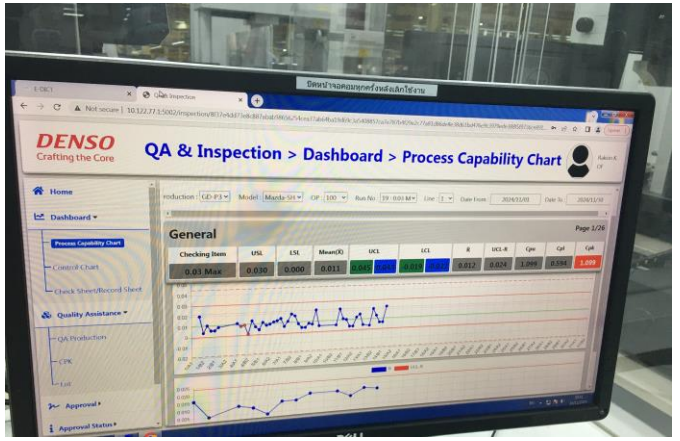


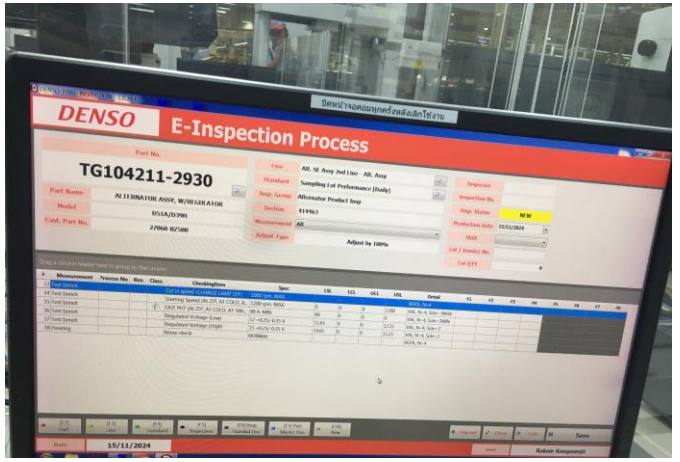


Industry 4.0 topic : IOT & Data Analysis

Denso innovation : Machine & tool maintenance

BPK Plant: Inspection





Industry 4.0 topic : IOT(E-form) & Data analysis

Example system
(Festo solution)

Festo technology

Industry 4.0 - the future of manufacturing

The factory of the future is a network of cyber-physical systems with the aim of achieving a very high degree of resilience to changing market and customer requirements and the resulting turbulence in the production area. Furthermore, this goal is to be achieved under cost and efficiency aspects.

Factory Planning and Simulation
Realistic 3D simulations allow to learn and experiment with virtual factories and develop new or optimized systems

PLC and HMI Programming
The control concept is modular: Each station comprises a PLC and a touch panel. The communication is done via modern protocols such as Profinet and OPC UA

Identification with RFID
The carriers and PLCs are equipped with RFID technology. Thus the product takes over the control of the system in Industry 4.0

Smart Sensors and IO-Link
Smart sensors with IO-Link communication enable real-time signal monitoring, collecting and transmitting data to technicians and engineers

CPS Controller
A controller in the application module takes over decentralized tasks for control and communication and makes the module a prototype of a cyber-physical system (CPS)

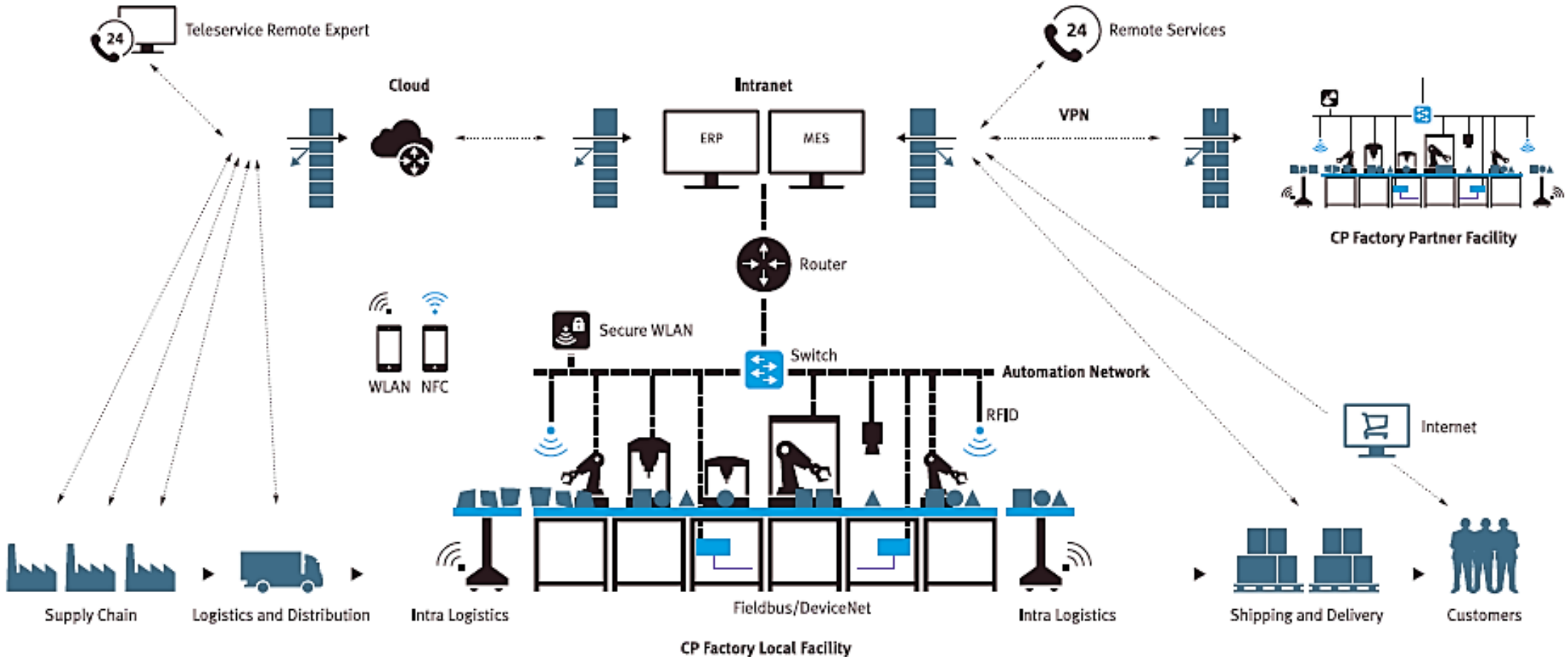
Web Shop
The web shop with open interfaces extends the system to include eCommerce topics from web presence and customer management to monitoring and analysis of orders

Industrial IoT and Dashboards
The open interfaces enable a connection to the Industrial Internet of Things (IIoT) as well as the development and operation of dashboards

MES and Data Processing
The Manufacturing Execution System (MES) with service-oriented architecture (SOA), open interfaces and an open database controls production in real time and offers extensive but intuitive operating and evaluation options

IT Security
Communication networks are the backbone of Industry 4.0 and secure communication is an indispensable component in the qualification of competent specialists in the field of I4.0

Festo technology : infrastructure



Festo technology : ERP

Enterprise Resource Planning It's a type of software used by organizations to manage and integrate the core parts of their business processes. An ERP system helps companies automate tasks like accounting, procurement, supply chain management, inventory, sales, human resources, and more, all in one platform.

The core abilities

- **Financial Management:** Tracks accounting, budgeting, and financial reporting. It often includes general ledger, accounts payable/receivable, and financial planning
- **Human Resource:** Manages employee records, payroll, performance, benefits, recruitment, and training.
- **Supply Chain Management:** Oversees procurement, inventory management, order processing, and logistics.
- **Customer Relationship Management:** Manages customer data, sales opportunities, and marketing campaigns to improve customer interactions and retention
- **Manufacturing/Production Management:** Helps plan, schedule, and monitor production activities and quality control.
- **Sales and Distribution:** Tracks orders, shipping, customer management, and invoicing.
- **Project Management:** Manages timelines, resources, budgets, and deliverables for various projects.
- **Inventory management:** Monitors stock levels, tracks inventory across multiple locations, and manages reorder points.

Festo technology : MES

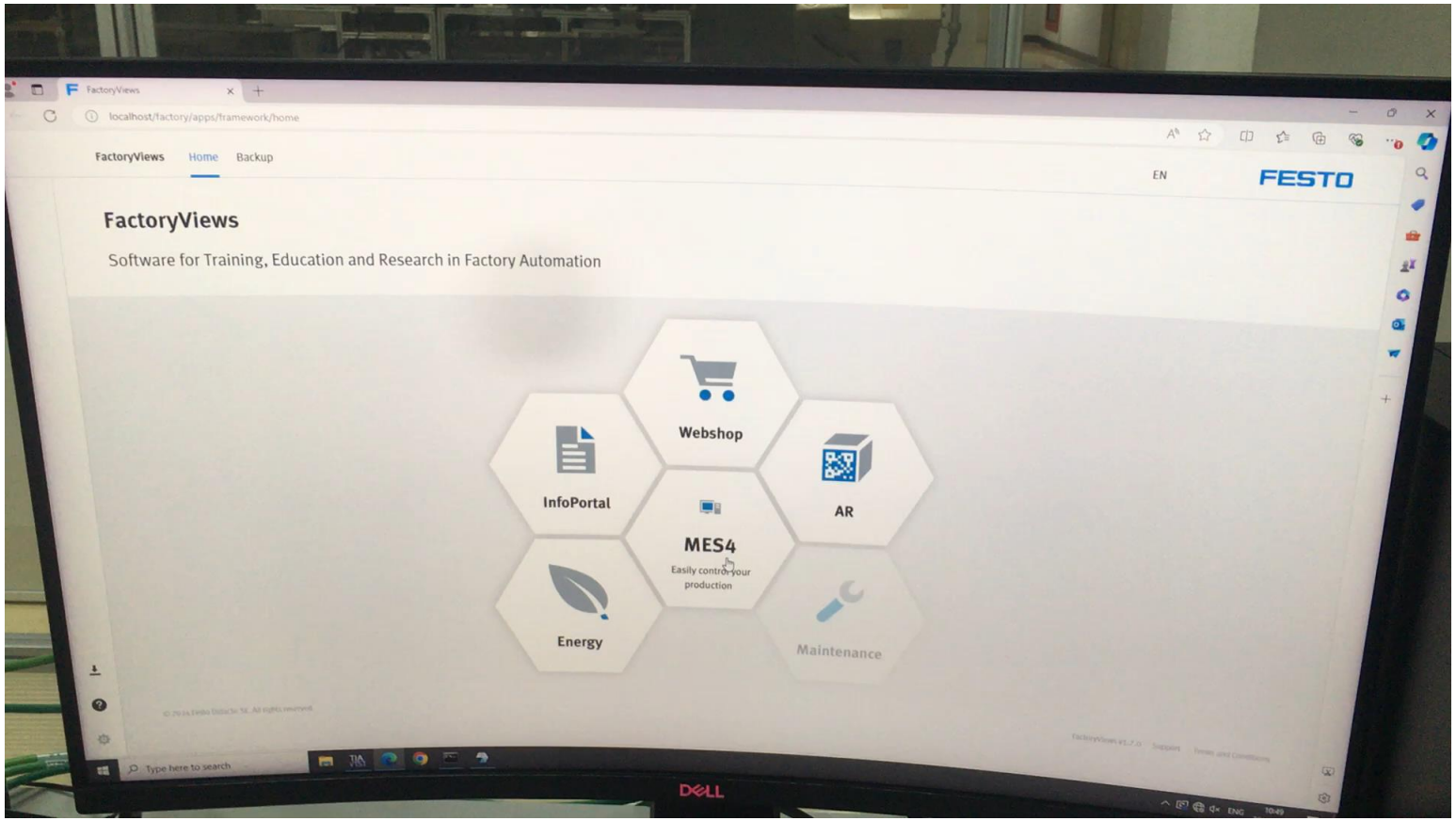
Manufacturing Execution System It's a software system that manages and monitors the production process in manufacturing environments. The MES connects different parts of the production process, allowing for real-time tracking, control, and optimization of manufacturing operations

The core abilities

- **Production Scheduling and Tracking:** It monitors the progress of manufacturing orders, tracks equipment usage, and ensures that products are produced on time.
- **Inventory Management:** The system tracks raw materials, work-in-progress (WIP), and finished goods inventory.
- **Quality Control:** It ensures that products meet quality standards by collecting data and managing inspections.
- **Data Collection and Reporting:** MES captures data from machines and operators to provide insights into performance, efficiency, and downtime.
- **Resource Management:** It manages the utilization of resources such as labor, machines, and materials.
- **Traceability:** It ensures that every product can be traced back to its materials, components, and production history.

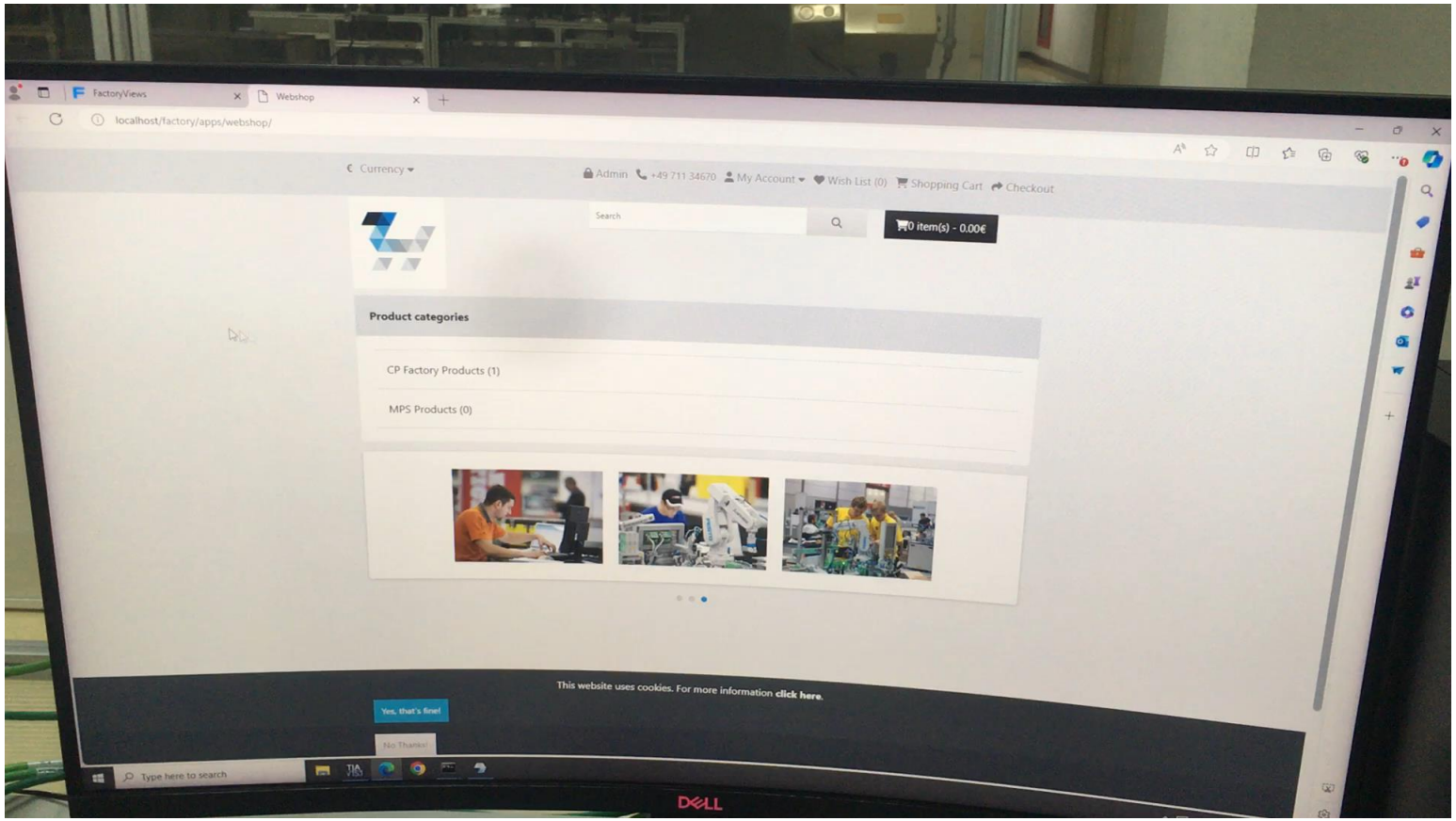
Festo technology : example

Production ordering



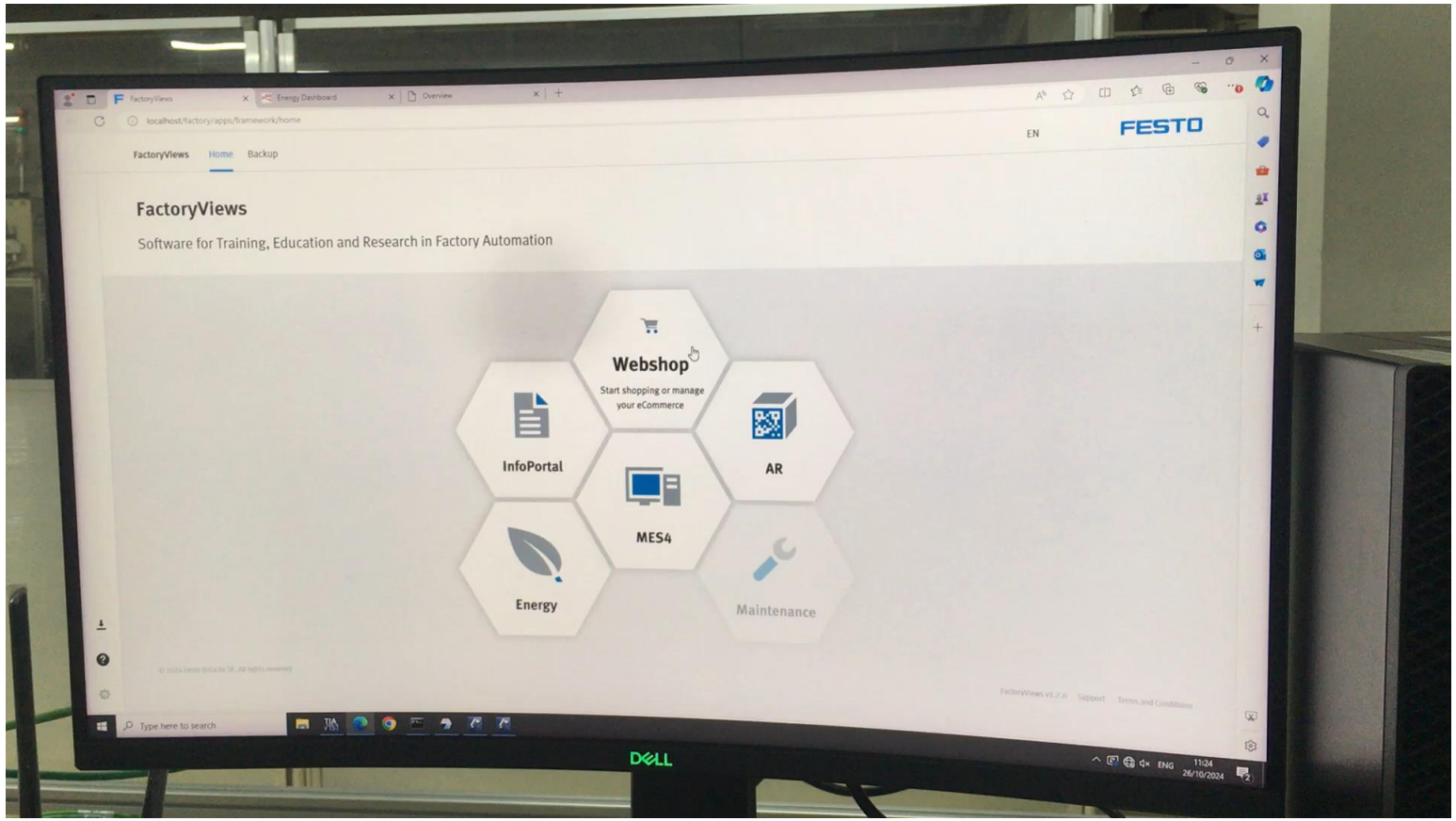
Festo technology : example

Customer ordering



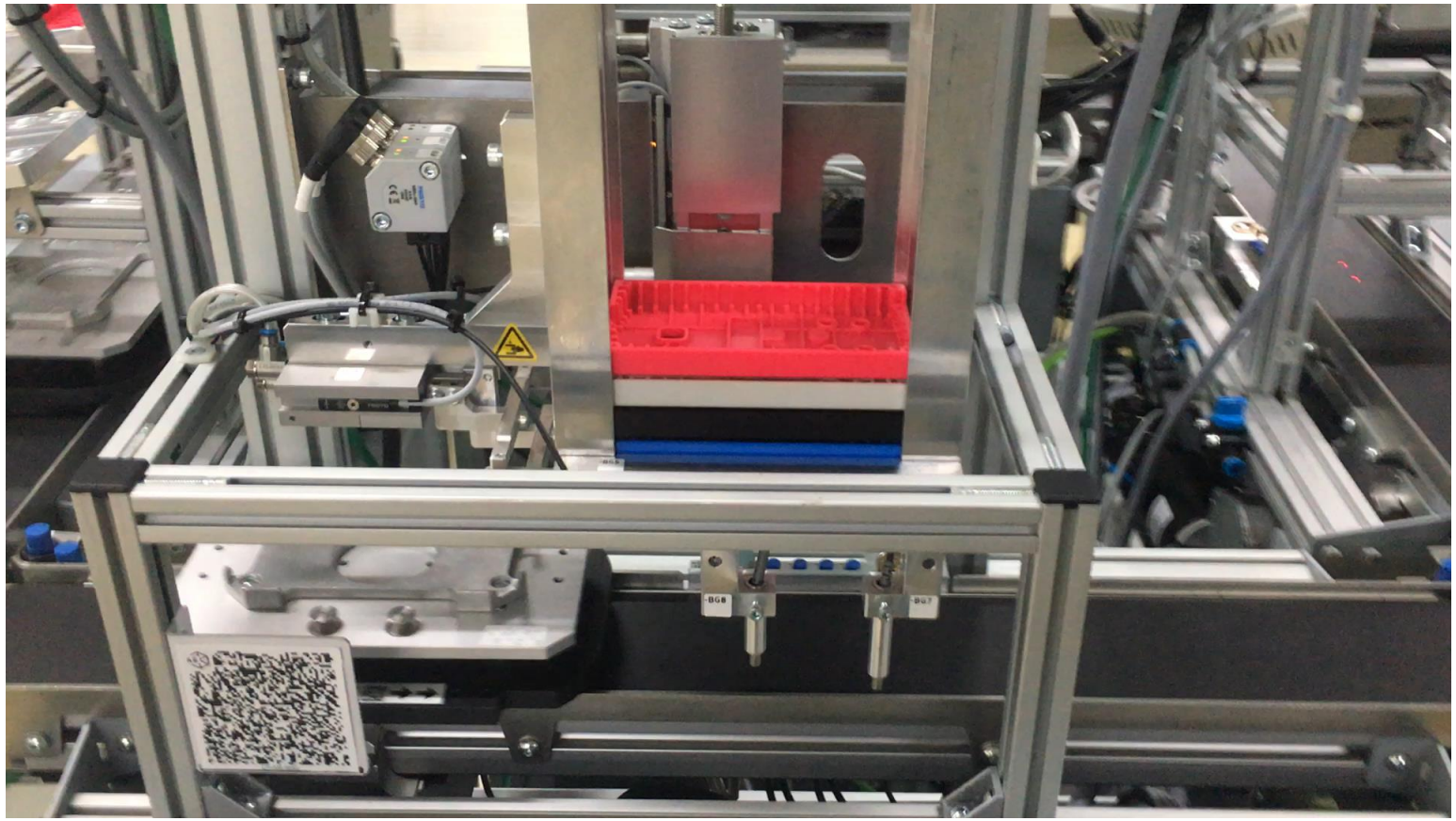
Festo technology : example

Digital twin



Festo technology : example

AI Processing



Festo technology : Technology example

Augmented Reality