intelitek▶▶®

INDUSTRY 4.0

SmartCIM4.0

Industry 4.0 Manufacturing for Education

The SmartCIM4.0 solution is designed to introduce vocational and engineering classrooms to the industrial automation and industry applications needed in modern plants and to create skilled workers for next generation jobs. Taking a system-based approach, SmartCIM4.0 deals not only with individual components of industrial training, but also with networking and communications, systems integration and the essential employability skills students need in modern industry. Integration of cutting edge technology systems and collaboration is the core of Industry 4.0.

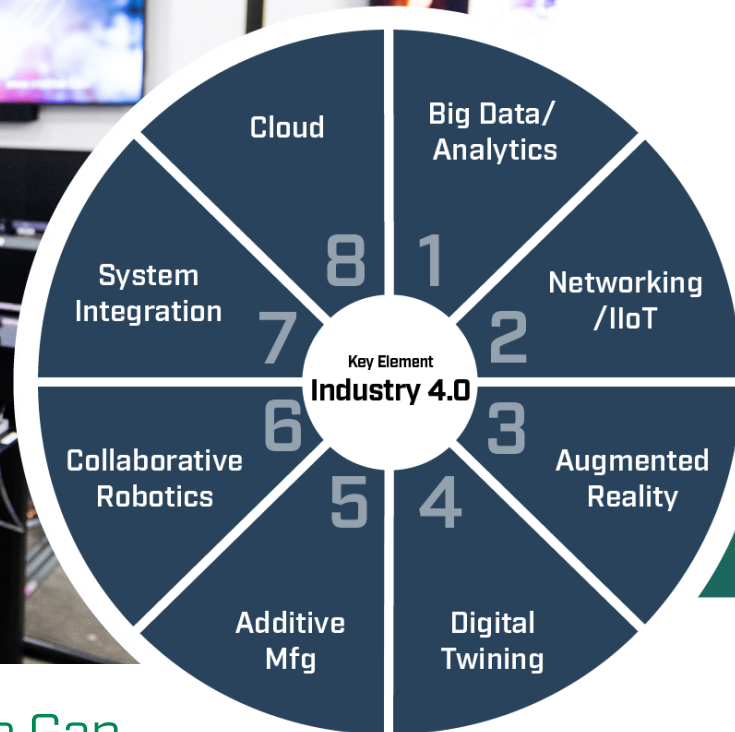| CYBERSECURITY | AI | AUTOMATION | CLOUD COMPUTING | ROBOTICS | IoT | BIG DATA |

Reshaping Manufacturing Training

As Industry 4.0 becomes more widely adopted new career options will be created in industry that do not currently exist.

Key Element
Industry 4.0

1. Big Data/Analytics
2. Networking /IIoT
3. Augmented Reality
4. Digital Twining
5. Additive Mfg
6. Collaborative Robotics
7. System Integration
8. Cloud

Industry 3.0 vs. Industry 4.0 - the Gap

Industry 4.0 introduces technology and capabilities that at the highest level take automated, manufacturing to the next level. Information collection and data analysis enable predictive maintenance, flexible manufacturing and efficient optimized factories.

- As more complex systems are integrated both physically, as well as in the cloud, system level understanding and system integration knowledge will be required. Strong skills in automation, integration, systems communications, networking and data analysis will be required.

- Industry 4.0 revolves around data collection and analysis from every part of the factory floor. Data will be the cornerstone of production planning, efficiency and predictive/preventative maintenance.

- Digital twining which is a combination of simulation and visualization of the system in action enables real-time monitoring, viability testing, will enhance safety and optimize processes

- Collaborative robots enable simplified assisted learning in a safer environment.

Intelitek's SmartCIM4.0 is an integrated, end-to-end manufacturing process with real industrial equipment capable of producing real products. The cell has all the components typical to state-of-the-art industry 4.0 factories and is used to train students of all levels about manufacturing and Industry 4.0 concepts.

SmartCIM4.0

INDUSTRIAL HARDWARE

- Built with Intelitek and leading industry vendor hardware
- Full size, real industrial equipment from end-to-end
- Manufacturing line produces real products
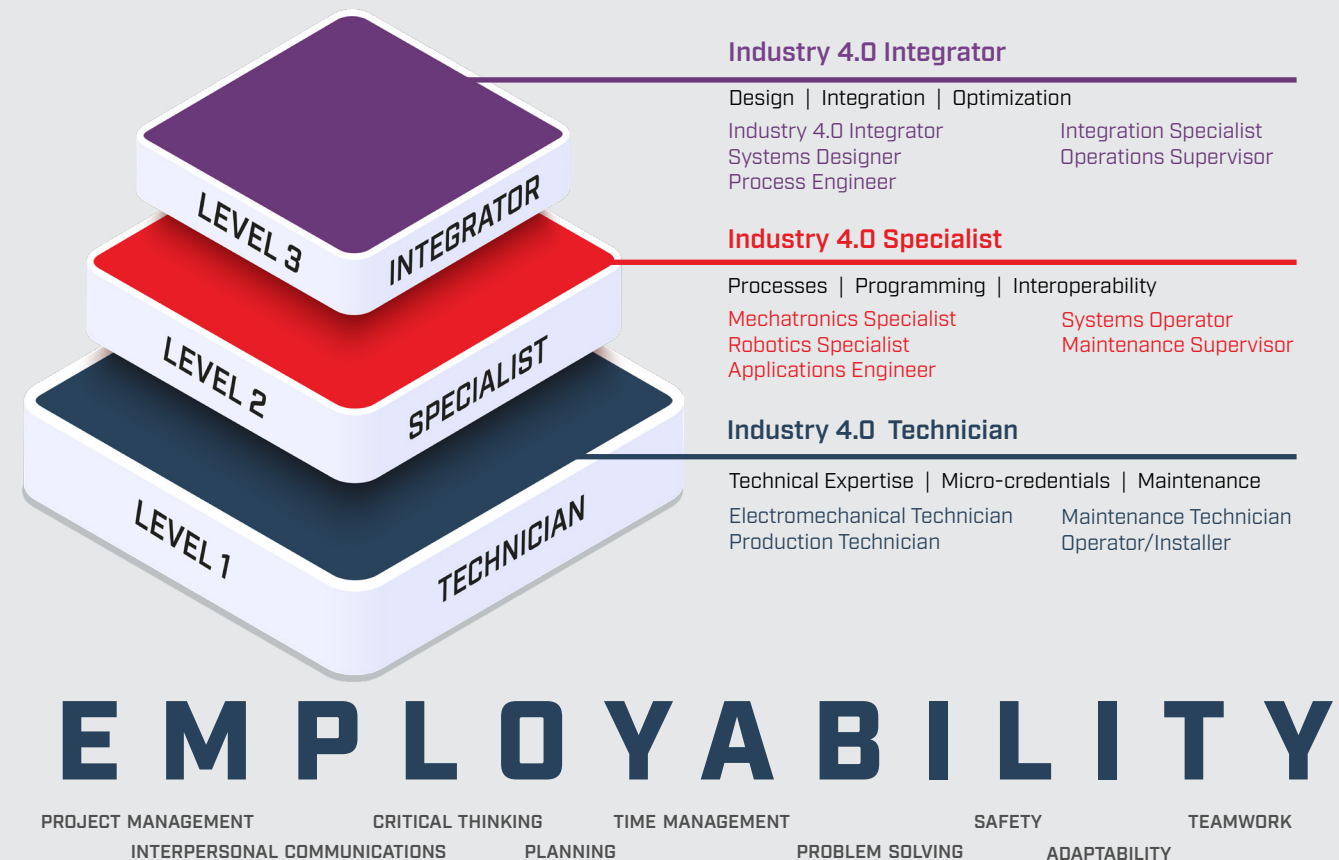
INDUSTRY 4.0 ENABLED

- Sensors on all levels and all components report real-time cell status.
- Multi-tiered IP and IIoT communications network all elements
- Central management, cloud connectivity and data analysis integrated

MULTI STATION, FLEXIBLE DESIGN

- Industrial conveyor system links workstations with a variety of manufacturing capabilities
- Pick and choose, machining, welding, assembly, storage, additive, and 3rd party components.
- Industry 4.0 sensors and communications link to central manager.

MULTI VENDOR INTEGRATION

- Partners and other vendor stations industrial equipment can easily be integrated.
- Curriculum include industry leader certifications,
- Curriculum aligned with industry standard certifications..

Industry 4.0 Integrator
Design | Integration | Optimization

Industry 4.0 Integrator	Integration Specialist
Systems Designer	Operations Supervisor
Process Engineer	

Industry 4.0 Specialist
Processes | Programming | Interoperability

Mechatronics Specialist	Systems Operator
Robotics Specialist	Maintenance Supervisor
Applications Engineer	

Industry 4.0 Technician
Technical Expertise | Micro-credentials | Maintenance

Electromechanical Technician	Maintenance Technician
Production Technician	Operator/Installer

LEVEL 3 INTEGRATOR
LEVEL 2 SPECIALIST
LEVEL 1 TECHNICIAN

EMPLOYABILITY

PROJECT MANAGEMENT   CRITICAL THINKING   TIME MANAGEMENT   SAFETY   TEAMWORK
INTERPERSONAL COMMUNICATIONS   PLANNING   PROBLEM SOLVING   ADAPTABILITY

SmartCIM4.0 Computer Integrated Manufacturing Industry 4.0 System

The SmartCIM4.0 Computer Integrated Manufacturing systems are complex interconnected manufacturing configurations that have several key components like automated production workstations, automated storage and retrieval systems (ASRS), assembly stations, quality control and additive manufacturing stations all linked by a continuous-loop conveyor, a central management control station, a TCP/IP communication network, and Inteliek's OpenCIM software.

Workstations can be added or removed for a variety of automated tasks as part of the production process including 3rd party machines and processes.

Stations Examples

1 AUTOMATED STORAGE & RETRIEVAL STATION

The floor-mounted or a table top ASRS) system includes a dedicated Cartesian robot that transfers parts between storage cells and conveyor pallets. The ASRS is controlled and monitored from the central management console. *The ASRS can include RFID, QR code or other inventory and location tracking devices.*

2 SUBTRACTIVE MANUFACTURING MACHINING STATIONS

A multitude of semi-independent workcells where an articulated robot arm tends the machine and performs other part manipulation and/or assembly tasks. The robot loads and unloads parts to and from the CIM conveyor. The robot can be mounted on a linear slidebase for mobility and larger work area.

Machining options include milling, turning, routing, laser engraving, etc.

All machines and robots are Ethernet connected and include multiple monitoring sensors for health and status tracking

3 ASSEMBLY & QUALITY CONTROL STATIONS

The assembly and QC station is equipped with a range of assembly and quality control options including local storage jigs, and machine vision sensors.

Typically these stations are used to collect, construct, measure and approve raw materials and finished goods.

SmartCIM4.0

- Custom tailored to your needs
- Bespoke system design - modular and expandable
- Each station is customizable and configurable
- Supports third-party components

4 ADDITIVE MANUFACTURING MACHINING STATIONS

3D PRINTING

Integrated into the process of parts production, the 3D printer can manufacture part of the finished goods or add customization to parts as they progress through production

WELDING STATION

The welding robot loads and unloads parts to and from the CIM conveyor in addition to performing arc welding and part manipulation tasks in a shielded welding cell environment.

5 REAL PRODUCTION PROCESS

The closed loop conveyor frame moves pallets carrying part templates (holders) that are loaded and unloaded at each station by robots and manipulators.

The system can manufacture a variety of complex multi-part components in materials like aluminium, brass, plastic, wood, composite, and wax. Some examples of student projects include pen holders, games, chess pieces, etc.

### 6 PROGRAMMABLE LOGIC CONTROLLER AUTOMATION

The PLC system controls and monitors the flow of pallets on the conveyor with the help of sensors and actuators that are built into the stations. PLCs also control safety devices, participate in intra device communications and control and report via Ethernet to the management station.

7 SENSORS AND IIOT

A series of advanced sensors are used for monitoring, tracking, quality control and maintenance of the many devices and the products in the system The sensors connect via a multi protocol IIoT configuration via wired (digital and analog), wireless, IoT protocols and Ethernet. The system provides a diverse learning environment for students.

8 MANAGEMENT STATION

Integrating the system can be simple to extremely sophisticated. Using Intelitek OpenCIM software, 3rd party MES and ERP packages, Siemens PLM applications, Intelitek and other vendor design tools, cloud computing and remote monitoring applications, and many other options, the System Management is an advanced learning space for level 3 system integration students.
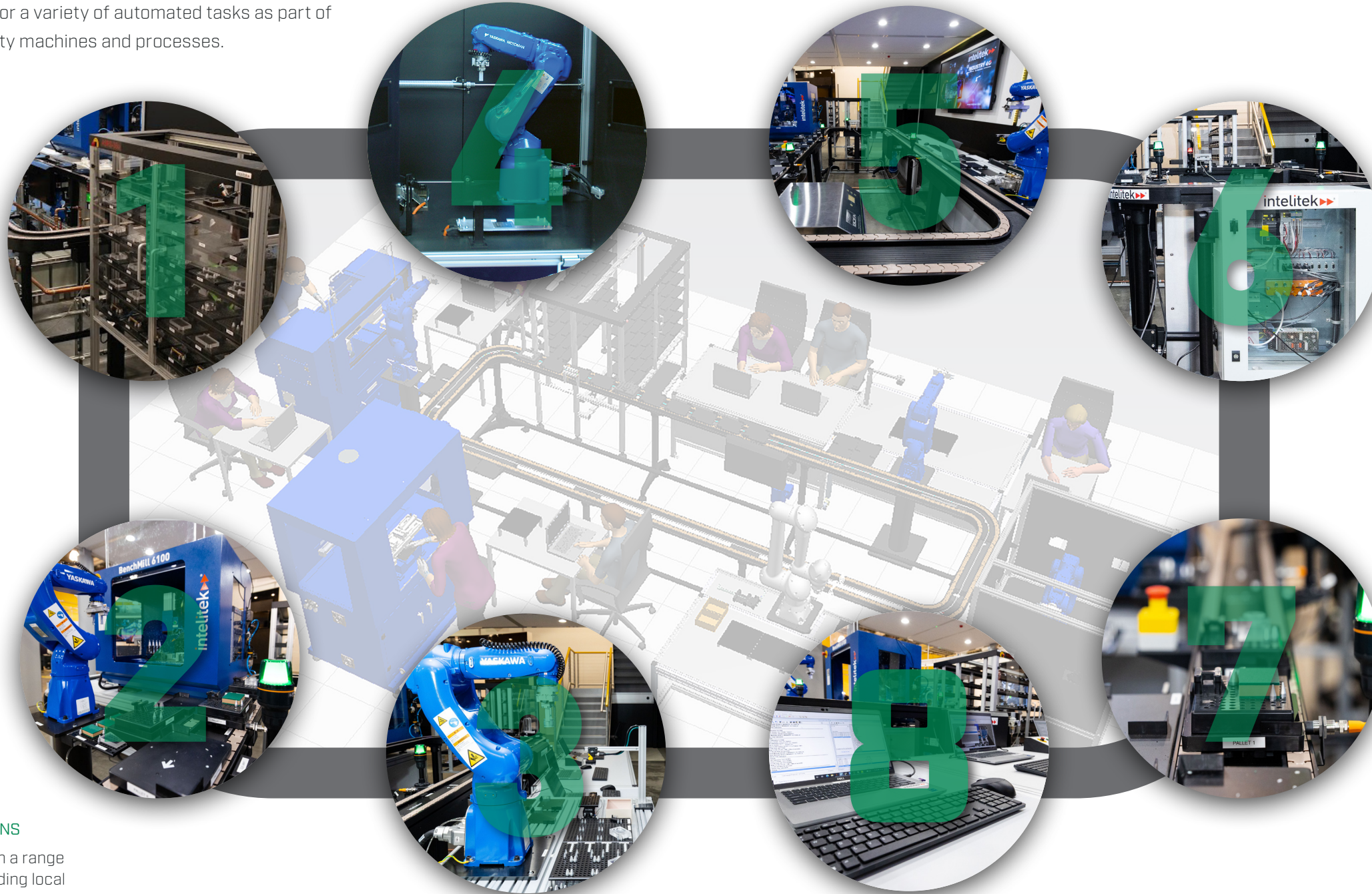
SmartCIM4.0

The Industry 4.0 Training Program outlined below is a combination of the SmartCIM4.0 Production Line, a series of standalone trainers and accompanying curriculum. The combined solution is a comprehensive program that will provide students with in-depth training on specific skills found in industry as well as the specific new skills related to Industry 4.0.

The SmartCIM4.0 is the core of the solution. SmartCIM4.0 is a full-size manufacturing production line with stations designed to manufacture parts from raw material, assemble products and test them for adherence to quality control standards. The solution above is a six station example. This is a flexible model and can be constructed with more or less stations to suit the needs of the school and the program being installed.

STANDALONE TRAINERS

The SmartCIM4.0 incorporates most of the elements of industry and much of the training is completed on the system itself, but some specific areas of expertise are served by standalone training stations. These include electrical, mechanical, hydraulics, pneumatics, PLCs, sensors, data analysis, IIoT, Virtual Reality/Augmented Reality and some of the integration packages used in the program.
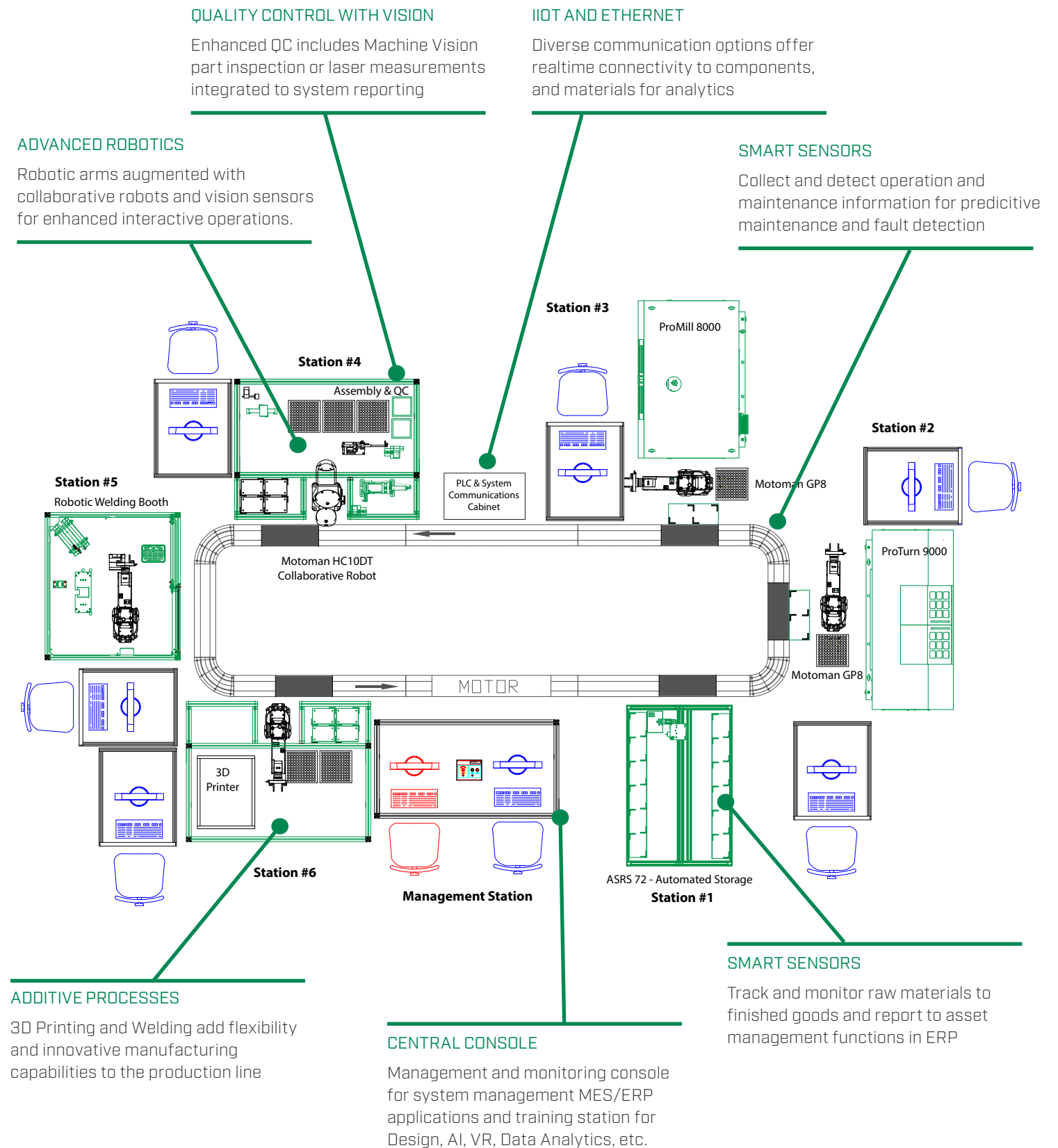
CURRICULUM

The solution is accompanied by a series of learning programs designed for education. The curriculum are integrated with the equipment in the SmartCIM4.0 and the standalone trainers and are heavily focused on hands on and project based learning. The curriculum are developed in three levels to suit the needs of novice, specialist, and expert level as students progress through the program and become more familiar with the tools and technology of a manufacturing plant and Industry 4.0.

SUSTAINABILITY

The hardware, software, applications, components and curriculum are supported by the Intelitek on-going maintenance and efforts to keep the solution updated and the educators trained. Annual train-the-trainer professional development ensures programs are maintained and educators are skilled in all aspects of the program and it's content.

Industry 4.0 Integration

SmartCIM4.0 is the latest generation of 35 years of CIM systems delivered to educational institutions for advanced training. The system has been upgraded with many enhancements to ensure the components and the content is Industry 4.0 ready and student will learn to install, operate and use the new capabilities just as they may upgrade an existing production line.

QUALITY CONTROL WITH VISION

Enhanced QC includes Machine Vision part inspection or laser measurements integrated to system reporting

IIOT AND ETHERNET

Diverse communication options offer realtime connectivity to components, and materials for analytics

ADVANCED ROBOTICS

Robotic arms augmented with collaborative robots and vision sensors for enhanced interactive operations.

SMART SENSORS

Collect and detect operation and maintenance information for predicitive maintenance and fault detection

ADDITIVE PROCESSES

3D Printing and Welding add flexibility and innovative manufacturing capabilities to the production line

CENTRAL CONSOLE

Management and monitoring console for system management MES/ERP applications and training station for Design, AI, VR, Data Analytics, etc.

SMART SENSORS

Track and monitor raw materials to finished goods and report to asset management functions in ERP

Real Manufacturing Process

SmartCIM4.0 is not a demo system or made of simulated tools and components. The industrial equipment, conveyors, tools, materials and software in the system manufactures real products and every school using the CIM environment has developed their own unique outcome. The system can support multiple product development processes at the same time and Industry 4.0 as processes can be integrated, optimized and machines shared and allocated to different processes as required. Some examples of product produced are below:

Interoperability - 3rd Party Vendor Integration

SmartCIM4.0 is an open-architecture soluton that integrates both Intelitek and many other vendor solutions. Intelitek partner with leading vendors in industry and when specific needs are defined for a solution, we have integrated multiple other vendor products and solutions into the production cycle.

Sustainability - Long Term Partnership

By collaborating with industrial vendors at the forefront of commercial production lines, SmartCIM4.0 is able to maintain an updated educational environment and constantly update and improve the solution technically. Hand in hand with the technical changes, the team working on the solution needs to be constantly retrained and expanded. Professional development and a capable support team are available to commission, train-the-trainer and help introduce new staff members to the system as the school's program grows and matures.

SmartCIM4.0 is a modular and flexible solution for educating and training students in the principles and technologies of Industry 4.0 computer integrated manufacturing.

INDUSTRY 4.0 PARTNERS

YASKAWA

COGNEX

ARM
ADVANCED ROBOTICS
FOR MANUFACTURING

AB QUALITY **Allen-Bradley**
by ROCKWELL AUTOMATION

SIEMENS

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