Easier Path to **Smart Manufacturing** Skills in the Workforce

CESMII
THE SMART MANUFACTURING INSTITUTE

- Conrad Leiva, VP Ecosystem and Workforce, CESMII

SACA
SMART AUTOMATION CERTIFICATION ALLIANCE

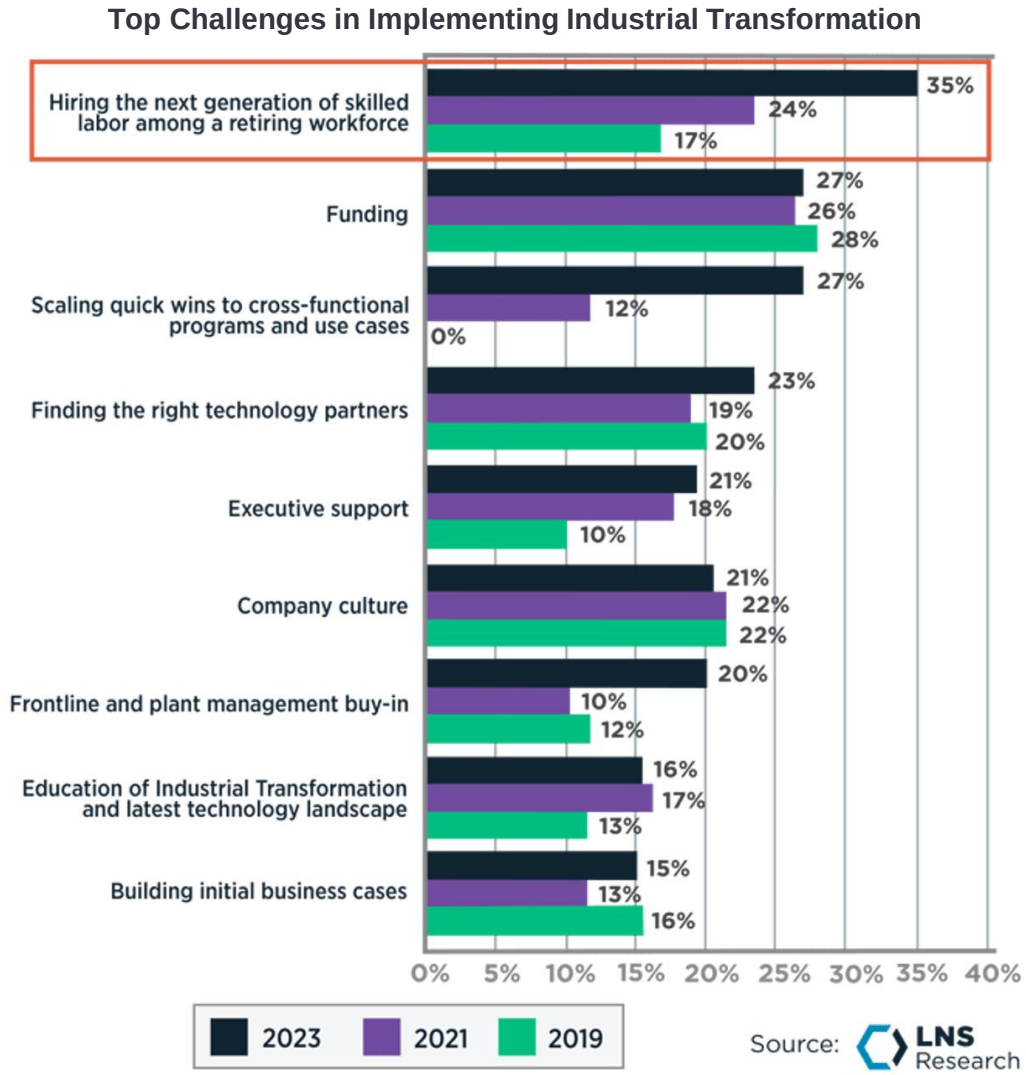
- Sue Smith, Executive Program Director, SACA

AMATROL
CERTIFIED ISO 9001:2015

- Paul Perkins, President, Amatrol

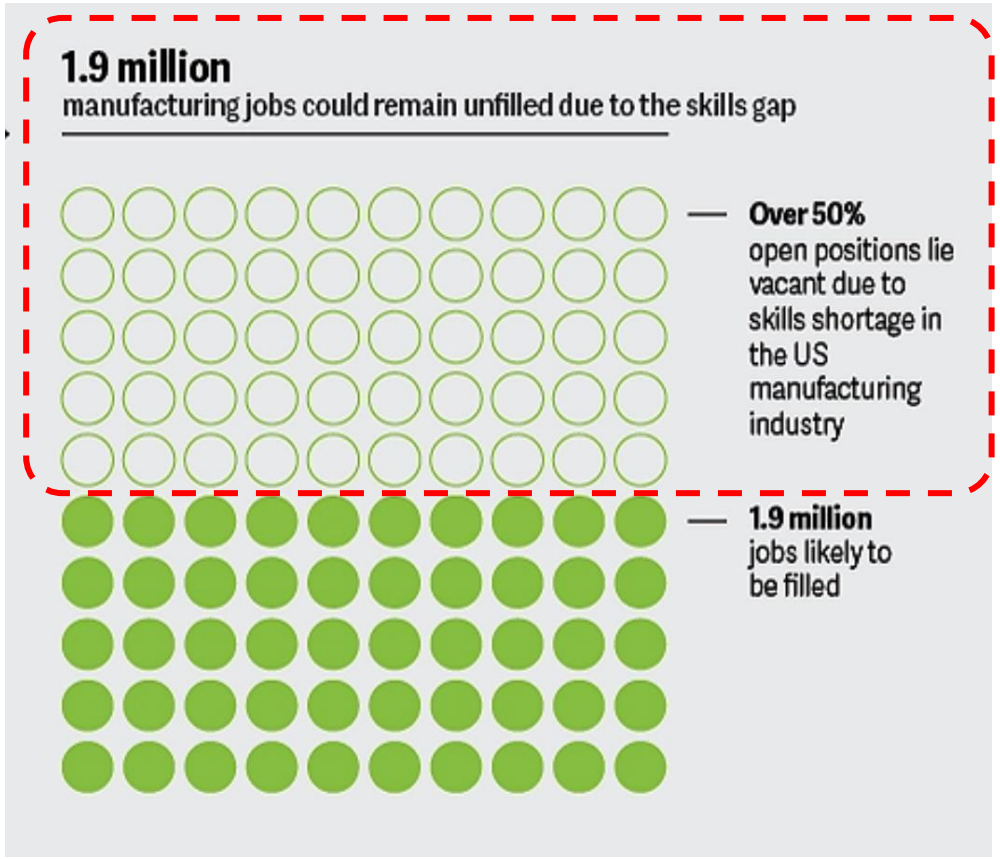
The Problem

The most significant barrier to industrial transformation and Smart Manufacturing is the **lack of a trained workforce**.



The Problem

- Sixty-five percent of respondents said **attracting and retaining talent is their primary business challenge.**
- **The U.S. manufacturing industry could see a net need for as many as 3.8 million jobs between 2024 and 2033** as significant investment continues to drive growth.
- Without significant changes, **more than 5 in 10 or 1.9 million of these jobs could go unfilled** if workforce challenges are not addressed through 2033.
- **Investments in skills and strategies that address the workforce's evolving expectations**, including flexibility and technology, **could be pivotal** to how manufacturers position themselves for success.



Deloitte. | deloitte.com/us/en/insights/research-centers/center-energy-industrials.html

Challenges to Ramping Up Skilled Workforce

- **High cost of existing pathways** to skills in 4 to 6-year university education
- **Lack of SM education programs** providing experience with SM systems and industrial equipment
- **Slow to evolve** for-credit programs must be approved through accreditation bodies.
- **Lack of alternative shorter and flexible pathways** to required SM skills
- **Lack of instructors** with skills to teach SM

Solution Strategy

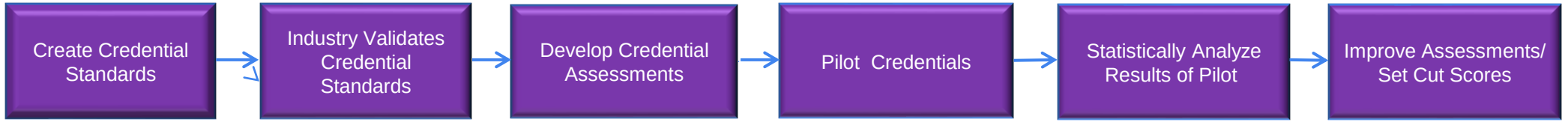
Industry-Vetted Stackable Micro-Credentials

- Provide **guidance for modular curriculum** on manufacturing skills.
- **Can be attained in a few weeks** and stacked towards higher levels of competency.
- Are **bridging educational and career pathways** from high school to stackable credentials to 2 and 4-year degrees.
- Form **basis for competency-based assessments** to enable skipping over courses for previously acquired skills.

What is a Micro-Credential?

- **Validation of competency in a skill topic**
  - Subset of skills for an occupation
- **Short Training Time**
  - 40 hours or less, rule of thumb
- **Assessment Methods**
  - Online (written) Test (e.g., SACA Silver)
  - Hands-On Demonstration Test (e.g., SACA Gold)
- **Verified by Independent Third Party**
- **Benefits**
  - Rapidly achieved
  - Targets immediate job needs
  - Easily embedded in existing for-credit courses
  - Stack credentials to achieve higher level of expertise on a career track to higher paying jobs.
  - Standardizes academic course outcomes/competencies
    - Across multiple teachers, multiple institutions
  - Applies to multiple occupations
  - Easily updated and new credentials added

What makes a High-Value Credential?



- **Follows Rigorous Process**
  - e.g., ISO 17024
  - Includes:
    - Assessment is based on a Skill Standard
    - Skill standard is vetted by industry experts
    - Assessments are developed by experts
      - Differentiate competency
    - Assessments are piloted and results statistically analyzed
      - Set scores and improve assessments
- **Highly Portable**
  - Nationally vetted
    - Applicable across entire country
    - Applicable industry wide
    - Applicable to multiple industries
  - Vendor neutral
- **Verified by Independent Third Party**
  - Proctoring
- **Multiple Assessments**
  - Hands-on and Online
- **Continuous Improvement Process**

Smart Automation Certification Alliance

- 501(c)3 Non-Profit Foundation
- Dedicated to Industry 4.0 Credentials
- Micro-Credential Structure
  - 50+ credentials and micro-credentials
- Silver and Gold Certifications levels
- Vendor-Neutral Credentials
- Over 53,000 credentials issued
- Credentials used in high schools, industry, community colleges, and universities
- Major industry adoptions,
  e.g., Amazon, Rockwell, etc.

Industry 4.0 Micro-Credentials

C-201 Electrical Systems 1
C-202 Electric Motor Control Systems 1
C-203 Variable Frequency Drive Systems 1
C-204 Motor Control Troubleshooting 1
C-205 Sensor Logic Systems 1
C-206 Electrical System Installation 1
C-207 Programmable Controller Systems 1
C-208 PLC Troubleshooting 1
C-209 Pneumatic Systems 1
C-210 Mechanical Power Systems I
C-211 Industry 4.0 TPM
C-212 Ethernet Communications 1
C-213 Smart Sensor & Identification Systems 1
C-214 Smart Factory Systems 1
C-215 Robot System Operations 1
C-216 Robot Systems Integration 1
C-217 Smart Manufacturing Fundamentals
C-218 Smart Manufacturing Data Acquisition
C-219 Smart Manufacturing Visualization and Data Analytics
C-220 Smart Manufacturing Cyber Security
C-257 Process Control Systems 1
C-258 Process Control Troubleshooting 1
C-302 Laser Shaft Alignment 1
C-303 Electric Motor Troubleshooting 1
C-304 Pneumatic Troubleshooting 1
C-305 Industrial Electronic Systems 1
C-306 Industrial Electronic Systems 2
C-307 Electronic Systems Installation 1
C-311 Data Analytics 1
C-308 Variable Frequency Drive Systems 2
C-309 Programmable Controller Systems 2
C-310 Ethernet Communications 2
C-312 Robot Systems Integration 2
C-313 Smart Factory Systems 2
C-351 Predictive Maintenance 1
C-356 Process Control Systems 2
C-358 Autonomous Mobile Robot Systems 1
C-359 Programmable Controller Systems 3
C-360 Motion Control Systems 1
C-361 Programmable Conveyor Systems 1
C-362 Machine Vision Systems 1

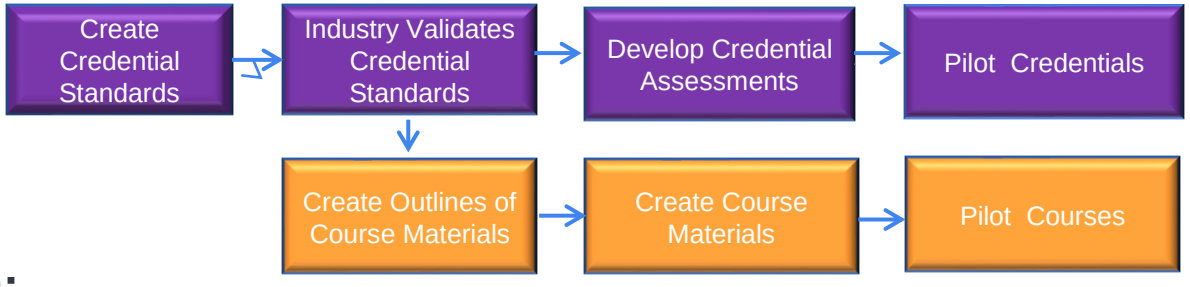
Plus around 25 new micro-credentials in-process…

CESMII Project

Modular Smart Manufacturing Credentials

Objective:
Create micro-credentials and modularized hands-on curriculum for smart manufacturing energy efficiency skills and small-medium business needs, which builds on an existing foundation of Industry 4.0 SACA micro-credentials and curriculum.

Process:



Deliverables:
- Standards for 4 new credentials
- Online assessments for 4 new credentials
- Online lessons, instructor and study guides aligned with new credentials
- Hands-on skill procedure manual for IIoT kit
- Pre and post assessments for curriculum

Team:

SACA SMART AUTOMATION CERTIFICATION ALLIANCE

James Wall
Executive Director of SACA

CESMII THE SMART MANUFACTURING INSTITUTE

Conrad Leiva
Vice President of CESMII

AMATROL® CERTIFIED ISO 9001:2015

Paul Perkins
President of Amatrol, Inc.

Smart Manufacturing Micro-Credentials

SACA has developed four new SM Industry Micro-Credentials that will be aligned with the CESMII curriculum guidance

C-217 - Smart Manufacturing Fundamentals

This credential certifies that individuals can:

- describe the principles, technologies, & applications of Smart Manufacturing & how they affect the competitive position of manufacturers
- safely operate basic smart automation systems that use HMI panels, monitor system operation parameters & energy usage using HMI visualization software, & connect/test to smart devices through point-to-point Ethernet communications.

C-218 - Smart Manufacturing Data Acquisition

This credential certifies that individuals can:

- identify types of manufacturing data & its function
- describe how smart manufacturing data is collected & stored
- set up & operate a dedicated cloud-based data acquisition system
- interface & test analog & discrete sensing devices
- configure & test wired & wireless Ethernet communications to sensors
- view data stored in a dedicated data acquisition system

C-219 - Smart Manufacturing Visualization & Data Analytics

This credential certifies that individuals can:

- organize & interpret data using a variety of visualization methods
- set up & operate visualization displays using dedicated & controller-based data acquisition systems
- set up programmable controllers to collect data
- configure Bluetooth technology to transfer information between devices
- use OPC server software to facilitate data exchange between a smart device & a database or another smart device
- set up Excel databases & use Excel to analyze data

C-220 - Smart Manufacturing Data Transmission & Cyber Security

This credential certifies that individuals can:

- assess potential cyber security threats to an industrial smart manufacturing system & data transmission methods
- use best practices to protect stored & transmitted data against cyber security attacks
- respond effectively to cyber security attacks
- set up secure industrial local area networks & firewalls

The new micro-credentials are being piloted in industry & schools with SACA members & CESMII members.

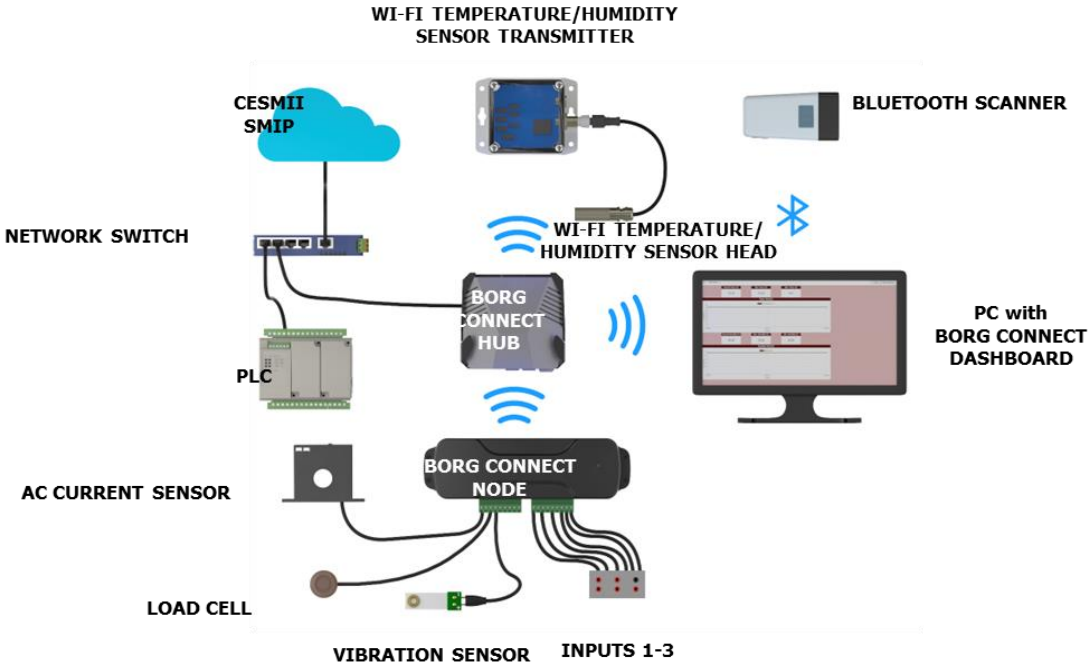
Interactive Multimedia Courses

- Online multimedia courses
- Competency-Based
- SACA Silver Credentials
- Interactive with simulation

12

990-SM10 - Smart Manufacturing Learning System

- Hands-On Skills Development:
  - IIoT Devices and Protocols
  - Edge Devices and Cloud Data
  - Visualization
  - Data Analytics
- SACA Gold Credentials
- Hands-On Embedded in Online Courses



CESMII Project Leveraging Micro-Credentials

Smart Manufacturing College Instructor Academy at Texas A&M

- Collaborative Community Network
- Instructor Academy and Hub for SM Skills in the region
- SACA Certification-Based Instructor Courses
  - Hybrid online and in-person
- Smart Factory, SM Learning System, and Digital Twin VR software
- Training Assessment for fast tracking worker learning

TEXAS A&M UNIVERSITY

AMATROL

CESMII THE SMART MANUFACTURING INSTITUTE

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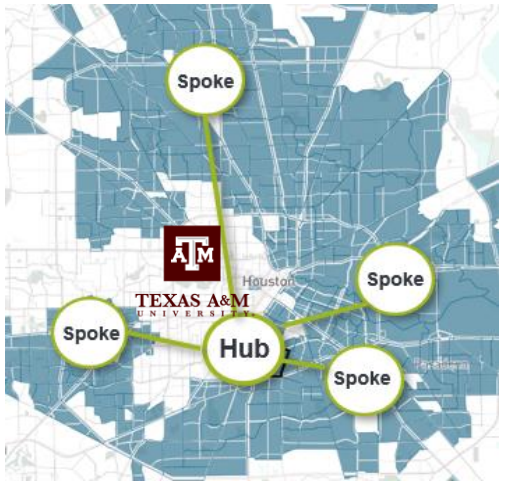
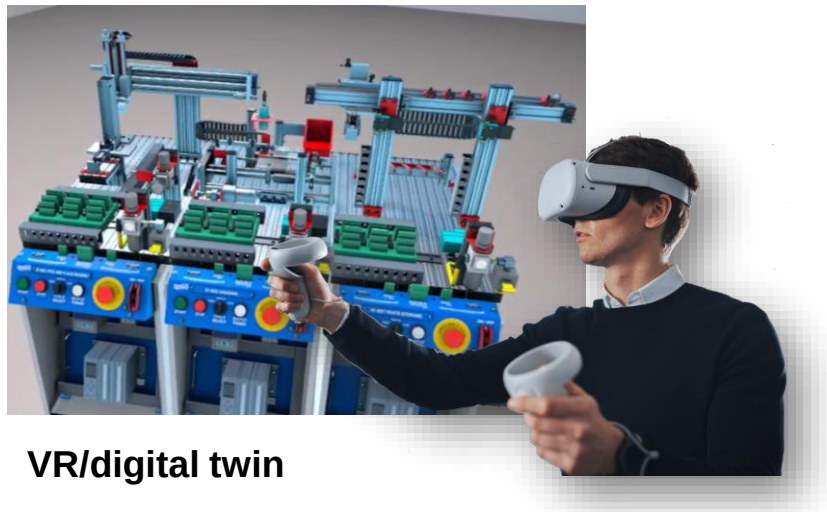


Smart Factory

SM Learning System

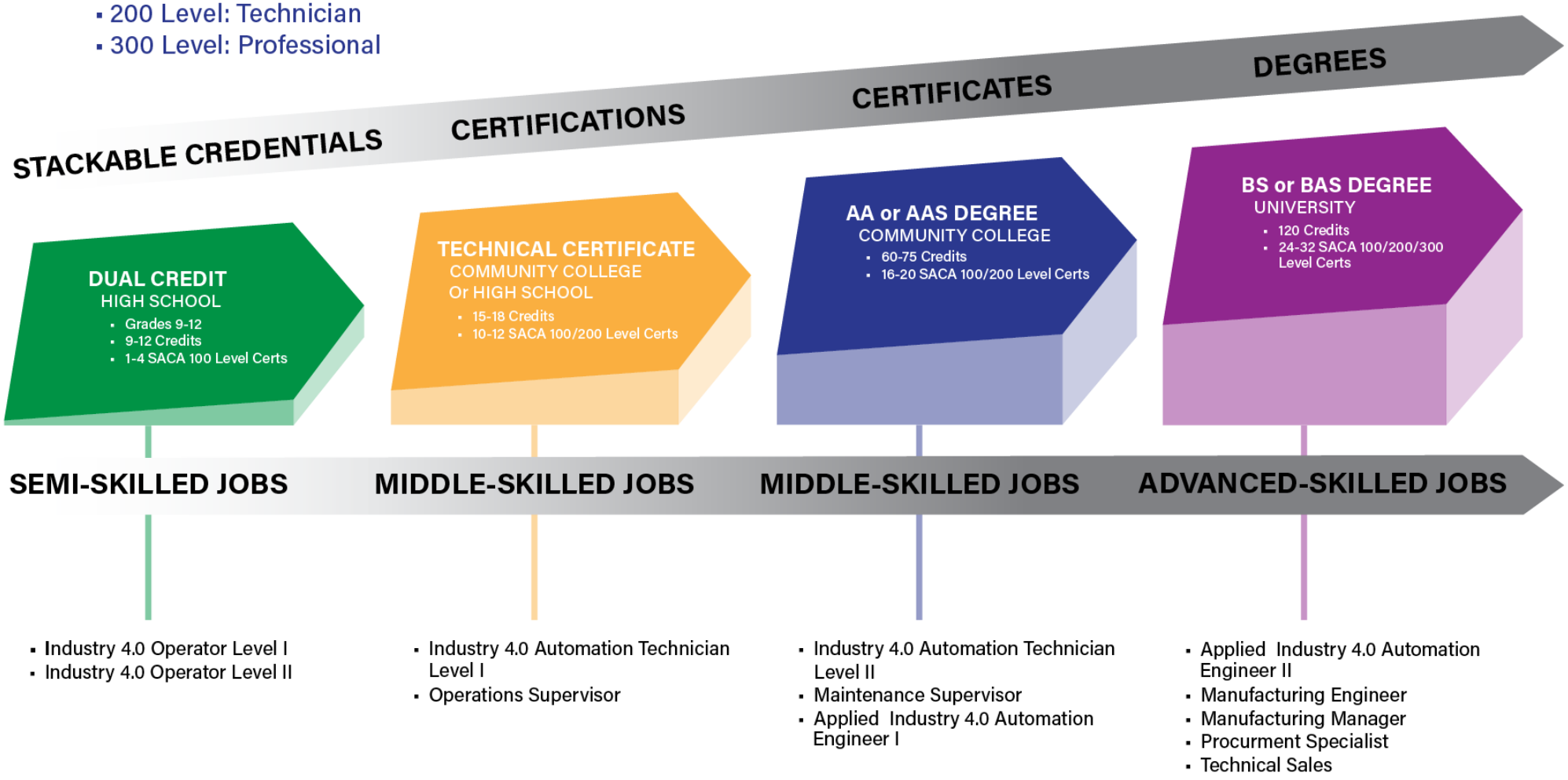


VR/digital twin

Education/Career Pathway with Micro-Credentials

SACA Credential Levels

- 100 Level: Operations
- 200 Level: Technician
- 300 Level: Professional



Example: Indiana CTE Industry 4.0 Pathway

WHAT IS IT?

Manufacturing is the process of designing, making, installing and maintaining various products, whether cars or medical devices, furniture or electronics, or even food. Manufacturing has become much more automated today because of advancements in technology. Career paths now require more technology and computer skills, but are in very high-demand.

WHAT WILL I DO?

Manufacturing careers vary depending on the industry and skill level. Automotive and medical products are more automated, where automation technicians are leveraging computers to manage the assembly line. Installers are performing more manual work, assembling products directly with their hands as they move through the assembly line.

LEADS TO THESE JOBS:

- App Developer
- Automation Engineer
- Electrical Engineer
- Industrial Engineer
- Interface Developer
- Mechanical Engineer
- Production Engineer
- PLC Programmer
- Quality Engineer
- Systems Integrator
- Test Engineer

EMPLOYER SPOTLIGHT:

BERRY GLOBAL
Evansville, IN
www.berryglobal.com

Berry

Berry Global is a leading global supplier of a broad range of innovative rigid, flexible, and non-woven products used every day within consumer and industrial end markets.

With headquarters in Evansville, Indiana, and over 290 locations around the world, we are continually recruiting energetic and innovative individuals who are passionate about their skills, and ready to grow with us to create a positive impact on the future.

INDUSTRIAL AUTOMATION AND ROBOTICS

Industrial Automation and Robotics are two of the fastest growing career paths today in the manufacturing industry, using computer-aided design, drafting and manufacturing systems to produce materials and products more efficiently.

LEADS TO THESE JOBS: Certified Production Technician, Automated Equipment Technician

INDUSTRY 4.0 – SMART MANUFACTURING

Industry 4.0 marries advanced production and operations techniques with smart digital technologies and represents the ways in which smart, connected technology will become embedded within organizations, people, and assets. It is marked by the emergence of capabilities such as robotics, analytics, AI and nanotechnology.

LEADS TO THESE JOBS: Automation Engineer, Industrial Engineer, Mechanical Engineer

STUDYING ADVANCED MANUFACTURING LEADS TO THESE

Industry 4.0 Smart Manufacturing Pathway							
Principles		Concentrator A		Concentrator B		Pathway Capst	
7220	Principles of Industry 4.0 and Digital Manufacturing	4728	Robotics Design and Innovation	7100	Digital Manufacturing Systems	7222	Advanced Manufacturi 4.0 Capston
	SACA C-101 Industry 4.0 Associate 1		SACA C-102 Industry 4.0 Associate 2		SACA C-104 Industry 4.0 Associate 4		SACA C-215 C-205 Sens Programmal Controllers

	Technician			
Associate Degree	Electrical and Electronics Drafter	$60,870	12%	315

Source – Hoosier Data, 2020

TO LEARN MORE ABOUT ADVANCED MANUFACTURING VISIT:

INDIANA CAREER EXPLORER FIND YOUR PATH — www.indianacareerexplorer.org

LEARN MORE — www.learnmoreindiana.org

Example: Ivy Tech Community College

IVY TECH COMMUNITY COLLEGE

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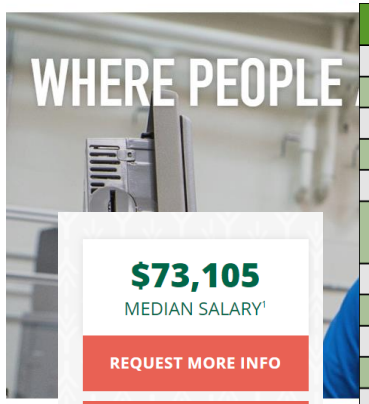
IVY TECH SCHOOL OF ADVANCED MANUFACTURING, ENGINEERING & APPLIED SCIENCE

Smart Manufacturing & Digital Integration



SACA CERT. NUMBER	SACA DESCRIPTION	IVY TECH COURSE NUMBER	IVY TECH COURSE NAME
C-101	Certified Industry 4.0 Associate – Basic Operations	SMDI 110	Introduction to IIoT
C-102	Certified Industry 4.0 Associate – Advanced Operations	SMDI 111	Technology in SMDI
C-103	Certified Industry 4.0 Associate – Robot System Operations	ADMF 226	Industrial Robotics III
C-104	Certified Industry 4.0 Associate – IioT, Networking and Data Analytics	SMDI 279	Smart Manufacturing and Digital Integration Capstone
C-201	Electrical Systems I	INDT 113	Industrial Electrical I
		SMDI 130	Electrical Systems in Manufacturing
C-202	Electric Motor Control Systems I	INDT 103	Motors and Motor Controls
C-203	Variable Frequency Drive Systems I	SMDI 130	Electrical Systems in Manufacturing
C-204	Motor Control Troubleshooting I	NOT USED AT THIS TIME	
C-205	Sensor Logic Systems I	ADMF 205	Sensors in Manufacturing
C-206	Electrical System Installation I	INDT 125	Industrial Wiring Principles
C-207	Programmable Controller Systems I	INDT 205	Programmable Automation Controls I
C-208	PLC Troubleshooting I	INDT 206	Programmable Automation Controls II
C-209	Pneumatic Systems I	INDT 104	Fluid Power I
		SMDI 150	Fluid Power Systems in Manufacturing
C-210	Mechanical Power Systems I	ADMF 112	Mechanical Drives I
		SMDI 140	Mechanical Systems in Manufacturing
C-211	Industry 4.0 TPM	SMDI 225	Big Data Acquisition and Analysis
C-212	Ethernet Communications I	SMDI 271	Projects for Smart Manufacturing and Digital Integration
C-213	Smart Sensor & Identification Systems I	ADMF 205	Sensors in Manufacturing
C-214	Smart Factory Systems I	NOT USED AT THIS TIME	
C-215	Robot Systems Operations I	ADMF 116	Industrial Robotics I
C-216	Robot Systems Integration I	ADMF 226	Industrial Robotics III

NATIONALLY RECOGNIZED PROGRAM

The Ivy Tech Industrial Technology program is proud to hold various industry certifications and accreditations from nationally recognized organizations. The program includes a Smart Automation Certification Alliance (SACA)-certified testing location and is accredited by the Association of Technology, Management, and Applied Engineering (ATMAE). Additionally, many Ivy Tech instructors are certified by the American Welding Society (AWS), Fuji Automatic Numerical Control (FANUC), Siemens, MSSC and SACA.

Together, these recognitions provide students with training in the best of environments with highly qualified instruction.

SACA SMART AUTOMATION CERTIFICATION ALLIANCE

AWS American Welding Society

ATMAE LEAD • INNOVATE • COLLABORATE

Example: Wisconsin Smart Manufacturing Pathway

ASHLEY FURNITURE INDUSTRIES, LLC

The Beginning of a Movement

The movement began this fall when over 30 high school programs adopted Industry 4.0 curriculum to introduce students to advanced manufacturing technology and processes.

Kenosha Unified, Gateway Technical College's high school consortium, and the Trempealeau Valley Co-op are among the school districts implementing this curriculum. The latter made headlines this fall for their state-of-the-art mobile skills lab, the result of an investment by Ashley Furniture's Education Foundation.

Expanding Education Opportunities in Pontotoc with Ashley's Mobile Skills Laboratory, Offering Cutting-Edge Education in Industry 4.0

ECRU, Miss. – Ashley Furniture Industries, LLC (Ashley) is partnering with Pontotoc County Schools and Pontotoc City School District to provide cutting–edge equipment and curriculum in electronics, manufacturing

High School Course Sequence:

Course 1: Industry 4.0 Associate 1 (SACA C-101)

→ Course 2: Industry 4.0 Associate 2 (SACA C-102)

→ Course 3: Robotics Operations 1 (SACA C-103)

→ Course 4: IIoT, Data Analytics and Networking (SACA C-104)

→

Example: Wisconsin Technical Colleges

13 Wisconsin Technical Colleges accepting SACA Credentials from over 30 High Schools

WISCONSIN TECHNICAL COLLEGE SYSTEM

Example: Wisconsin Technical Colleges

13 Wisconsin Technical Colleges accepting SACA Credentials from over 30 High Schools

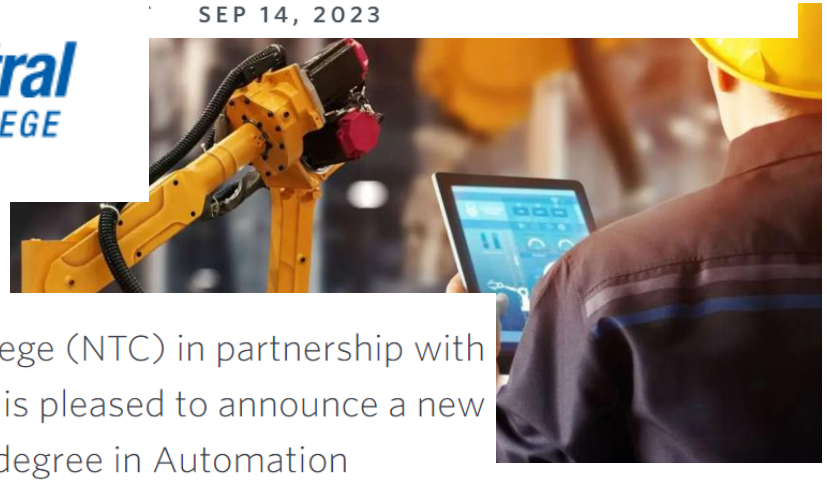
WISCONSIN TECHNICAL COLLEGE SYSTEM

NTC NEWS

Automation Leadership Partnership with the University of Wisconsin-Stout

Northcentral TECHNICAL COLLEGE

SEP 14, 2023



(WAUSAU, Wis.) – Northcentral Technical College (NTC) in partnership with the University of Wisconsin-Stout (UW-Stout) is pleased to announce a new opportunity for those interested in pursuing a degree in Automation Leadership. This one-of-a-kind degree features industry-backed credentials from the Smart Automation Certification Alliance (SACA), a non-profit organization whose mission is to develop and deploy modular Industry 4.0 certifications for a wide range of industries.

Example: 4-year degree program

University of Wisconsin-Stout
Wisconsin's Polytechnic University

SACA
SMART AUTOMATION CERTIFICATION ALLIANCE

B.S. in Automation Leadership

Take your education and experience in automation and mechatronics to the next level. UW-Stout's B.S. Automation Leadership provides technology-driven, future-focused students a pathway to leadership in Industry 4.0.

The only degree of its kind, offering courses aligned with Smart Automation Certification Alliance (SACA) standards plus leadership and management training to enhance your industry-recognized credentials.

Credits	
40	SACA TECHNICAL YEAR 1-2
40	
19	
21	
120	

YEARS 1-2 REQUIRED CREDENTIALS (15 credentials)

- C-101 Certified Industry 4.0 Associate-Basic Operations
- C-102 Certified Industry 4.0 Associate-Advanced Operations
- C-103 Certified Industry 4.0 Associate - Robot System Operations
- C-201 Electrical Systems 1
- C-202 Electric Motor Control Systems 1
- C-203 Variable Frequency Drive Systems 1
- C-204 Motor Control Troubleshooting 1
- C-205 Sensor Logic Systems 1
- C-207 Programmable Controller Systems 1
- C-208 Programmable Controller Troubleshooting 1
- C-209 Pneumatic Systems 1
- C-212 Ethernet Communications 1
- C-213 Smart Sensor and Identification Systems 1
- C-214 or C-104 Smart Factory Systems 1
- C-216 Robot Systems Integration 1

Year 1-2 Electives (choose 2 of 4)

- C-206 Electrical System Installation 1
- C-210 Mechanical Power Systems 1
- C-304 Pneumatic Troubleshooting 1
- C-255 Hydraulic Systems 1

Example: 4-year degree program

University of Wisconsin-Stout
Wisconsin's Polytechnic University

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	Credits
	40
General Education Courses (Transfer up to 27 credits)	40
	21
	19
	120

Example: 4-year degree program

University of Wisconsin-Stout
Wisconsin's Polytechnic University

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	Credits
	40
	40
	21
	19
	120

SACA TECHNICAL YEARS 3-4

YEARS 3-4 REQUIRED CREDENTIALS (choose 7 OF 14)

- C-211 Industry 4.0 Total Productive Maintenance Management (C-101, 102)
- C-305 Industrial Electronic Systems 1 (pre-req: C-201, 205)
- C-308 Variable Frequency Drive Systems 2 (pre-req: C-203, 204)
- C-309 Programmable Controller Systems 2 (pre-req: C-207, 208)
- C-310 Ethernet Communications 2 (pre-req: C-212)
- C-312 Robot Systems Integration 2 (pre-req: C-216)
- C-313 Smart Factory Systems 2 (pre-req: C-214 or 104)
- C-359 Programmable Controller Systems 3 (pre-req: C-309)
- C-362 Machine Vision Systems 1 (pre-req: C-201, 216)
- C-306 Industrial Electronic Systems 2 (pre-req: C-305)
- C-307 Electronic Systems Installation 1 (pre-req: C-206)
- C-358 Autonomous Mobile Robot Systems 1 (pre-req: C-212, C-207)
- C-360 Motion Control Systems 1 (pre-req: C-359)
- C-361 Programmable Conveyor Systems 1 (pre-req: C-214 or 104)

Example: 4-year degree program

University of Wisconsin-Stout
Wisconsin's Polytechnic University

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	Credits
	40
	40
	21
	19
	120

UW-Stout Automation Leadership Courses

- Digital Transformation
- Internet of Things in Operations
- Project Management
- Organizational Leadership
- Lean Manufacturing
- Automation Leadership Internship
- Automation Leadership Capstone

SACA - Member Colleges (220+ and growing)

- Vincennes University
- Ogeechee Technical College
- Truckee Meadows Community College
- Ivy Tech Community College
- Eastland Fairfield Career and Technical Schools
- Dallas College
- Hawkeye Community College
- Oakland Community College
- Lehigh Carbon Community College
- Lakeshore Technical College
- Northwood Technical College
- Savannah Technical College
- Central New Mexico Community College
- Chippewa Valley Technical College
- North Dakota State College of Science
- Mid-State Technical College
- Texas State Technical College
- Macomb Community College
- Jamestown Community College
- Rock Valley Community College
- College of Lake County
- Western Nevada College
- Amarillo College
- Mountainland Technical College
- Parkland College
- Washtenaw Community College
- Pima Community College
- Essex County Community College
- Parkland College
- Wake Technical Community College
- Indiana River State College
- Central Pennsylvania Institute of Science and Technology
- Vaughn College of Aeronautics and Technology
- Gateway Technical College
- Waukesha County Technical College
- River Parishes Community College
- National Park College
- Arkansas Tech University
- Vallencia College
- Rhodes State College
- Columbus State Community College
- Lemoore College
- Montcalm Community College

- Conrad Leiva, VP Ecosystem and Workforce, CESMII, conrad.leiva@cesmii.org, www.cesmii.org
- Sue Smith, Executive Program Director, SACA, sue.smith@saca.org, www.saca.org
- Paul Perkins, President of Amatrol, paul@amatrol.com, www.amatrol.com