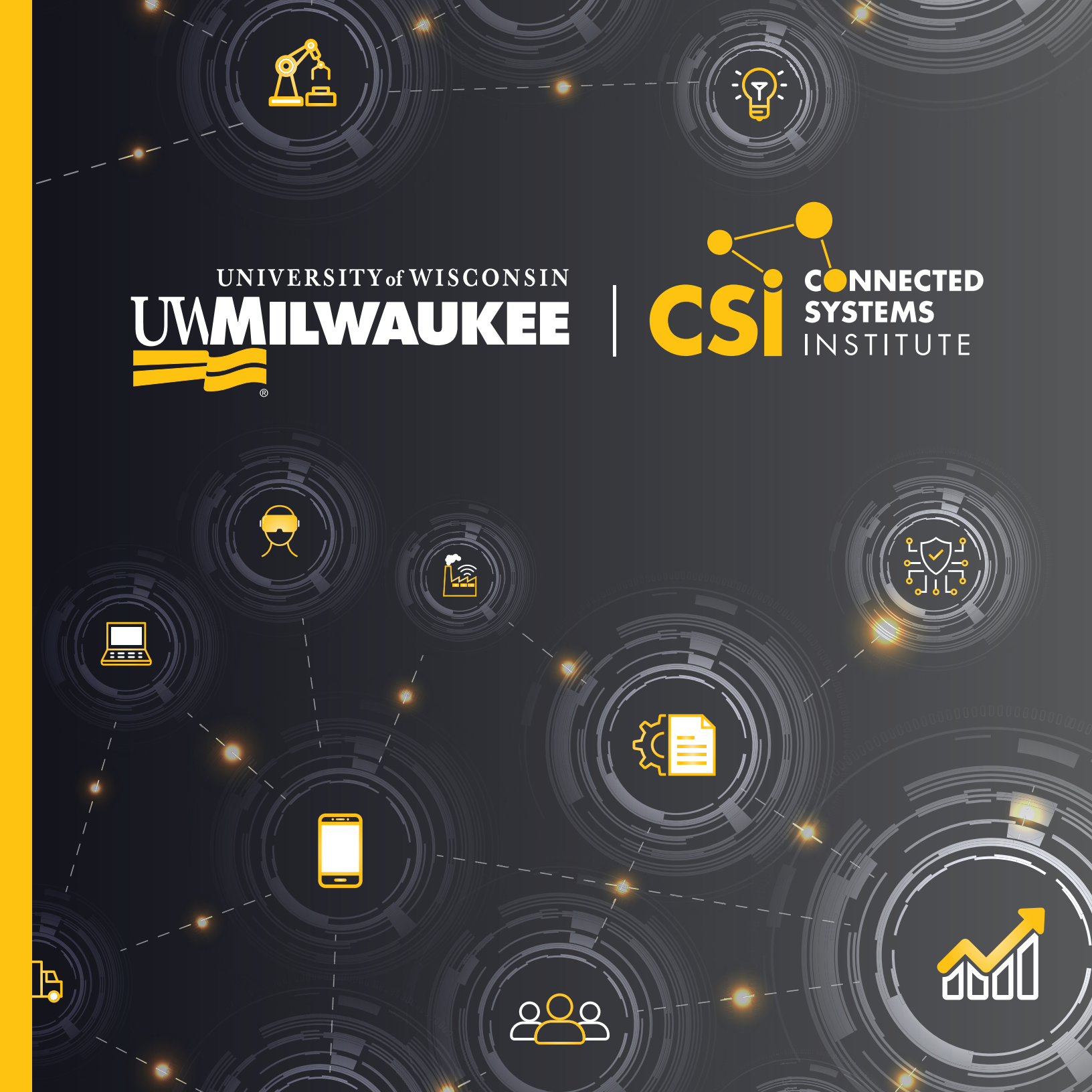

UNIVERSITY of WISCONSIN
UWMILWAUKEE
CSi
CONNECTED
SYSTEMS
INSTITUTE

CONNECTED SYSTEMS INSTITUTE

Harnessing the POWER OF DIGITAL TRANSFORMATION

Introduction

Digital technology is fueling what is often called the fourth industrial revolution, enticing manufacturers to develop new production processes that harness the power of artificial intelligence (AI), robotics, and the Industrial Internet of Things (IIoT).

AI, in particular, is blurring the boundaries between the physical and digital worlds, and transforming how human workers interact with connected systems. These systems — which run on self-learning software platforms — have the power to process unlimited data from sensors and devices, and to respond autonomously to ever-changing environmental conditions and system requirements.

Manufacturing businesses must fundamentally transform strategies and organizational cultures in order to leverage this new AI-powered ecosystem. The challenge is to embrace the IIoT in order to evolve into a more customer-centric and service-oriented organization. Companies that successfully transform today — connecting people, technology, and data — will position themselves as more productive and more profitable market leaders.

Benefiting from this new wave of technology requires knowledge, skills, and the ability to form collaborative partnerships. That's why the University of Wisconsin-Milwaukee (UWM) established the Connected Systems Institute (CSI). The Institute was founded in partnership with Rockwell Automation, with additional support from Microsoft, WE Energies, the Wisconsin Economic Development Corporation, and other contributing partners.

UWM is home to internationally recognized faculty who have extensive expertise in IIoT-related disciplines, giving CSI a rich reservoir of talent experienced in using digital tools to accelerate innovation. This enables the Institute to help drive economic growth by supporting the development of innovative production solutions and by filling the talent pipeline with digital manufacturing specialists.

"As part of our long standing relationship with Satya Nadella and Blake Moret, we founded the Connected Systems Institute to help Wisconsin companies accelerate innovation, meet demand for skilled workforce, and drive economic growth through market disruption. As CEOs of two of industry's largest technology providers, Rockwell Automation and Microsoft, they recognize the value that partnering with UW-Milwaukee brings: We are located in a crucial industrial and manufacturing hub. We have extensive corporate partnerships, industry relationships and are the home base for internationally recognized faculty who have extensive expertise in IIoT-related disciplines. Join us and become part of our Connected Community!"

– Mark A. Mone, PhD
Chancellor
University of Wisconsin-Milwaukee

What Is a Connected System?

The IIoT is the quintessential connected system, in which machines, technology, and people converge. IIoT systems generate massive amounts of data that can be analyzed to deliver valuable insights about everything from production processes to marketing effectiveness.

The immense amount of data and analytics from IIoT devices and networks is driving the fourth industrial revolution or Industry 4.0. AI is enabling the development of cyber-physical systems in which human workers interact with automated systems — often in real time. The optimization potential of this connectivity is still in its infancy, and its impact on manufacturing is just beginning. But as the IIoT grows, enterprises need integrated networks that seamlessly connect people, machines, and processes. Many companies are using technology to both disrupt markets and optimize manufacturing productivity. The ability to analyze massive amounts of data for return-on-investment also gives manufacturers reliable metrics for making mission-critical business decisions.

The move toward smart factories requires that manufacturers implement systems to connect smart devices, machines, and processes with operations and analytics tools. Manufacturing enterprises also need to ensure that workers are trained to meet the technological demands of an increasingly digital production environment.

Connected systems provide the framework for building safe and efficient networks that optimize productivity. Industry 4.0 connected networks must be able to handle everything from data management to cybersecurity. CSI provides a framework for understanding and developing connected systems, including:

- Sensors, Hardware, and Devices
- Network Controls and Data Science
- Business Platforms
- Supply Chain Management
- Advanced Facilities
- Workforce Training

Vision, Mission, and Value Proposition

Vision

CSI is an internationally recognized, multidisciplinary R&D facility based at UWM. Its primary focus is on academic programming, workforce training and advanced research, focused on the Manufacturing domain. The Institute's vision is to serve as a trusted resource for technology, research, collaboration, education, thought leadership, and community outreach – with a focus on emerging IIoT technologies.

Mission

The Institute's mission is to develop the workforce of the future through education and training. CSI works to support the development of a tech-savvy workforce, to spearhead cutting-edge IIoT research, and to help small- and medium-sized businesses harness the power of the IIoT for greater productivity.

Value Proposition

CSI serves as a center of excellence for a global community of practitioners that are transforming manufacturing processes using advanced digital technologies. The Institute brings together the best of industry and academia to deliver education and research opportunities focused on the unique needs of advanced manufacturing, and on the challenges of transforming the internal culture that facilitates the evolution of the IIoT.

Key Drivers:

- Accelerating innovation by bringing together industry experts and academic researchers.
- Facilitating digital transformation for small- and medium-sized manufacturers.
- Developing an educational curriculum to better prepare the workforce of the future.

THE CSI ECOSYSTEM

Business Managers:

- Small- and Medium-Sized Business Owners
- C-Suite Executives Operations Management
- IOT Practioners
- Students & Faculty
- CSI Corporate Partners

CSI Specialization:

- Factory Systems Integration
- Integrated Motion Control
- Fluid Flow Management
- IOT Connectivity
- Integration of Robotics
- Digital thread/twins

Foundations and Public Sector:

- Wisconsin Economic Development Corporation (WEDC)
- WMEP
- CSMP
- Other organizations seeking to support economic development, executive education, and workforce training

Preparing for Digital Manufacturing

Workforce Training and Executive Education

The rise of the "smart enterprise" is happening at the same time that large numbers of older workers are retiring. Younger employees must prepare for the next wave of automation, which will use more sophisticated forms of AI. Moving to connected systems requires a significant culture change for manufacturers. To prepare for the future, companies of all sizes need to proactively invest in workforce training to ensure they have employees with the requisite skillsets for an increasingly automated production environment.

In order to help streamline the training of new employees, CSI is helping to ensure that college graduates start their careers armed with a fundamental understanding of connected systems and IIoT technology.

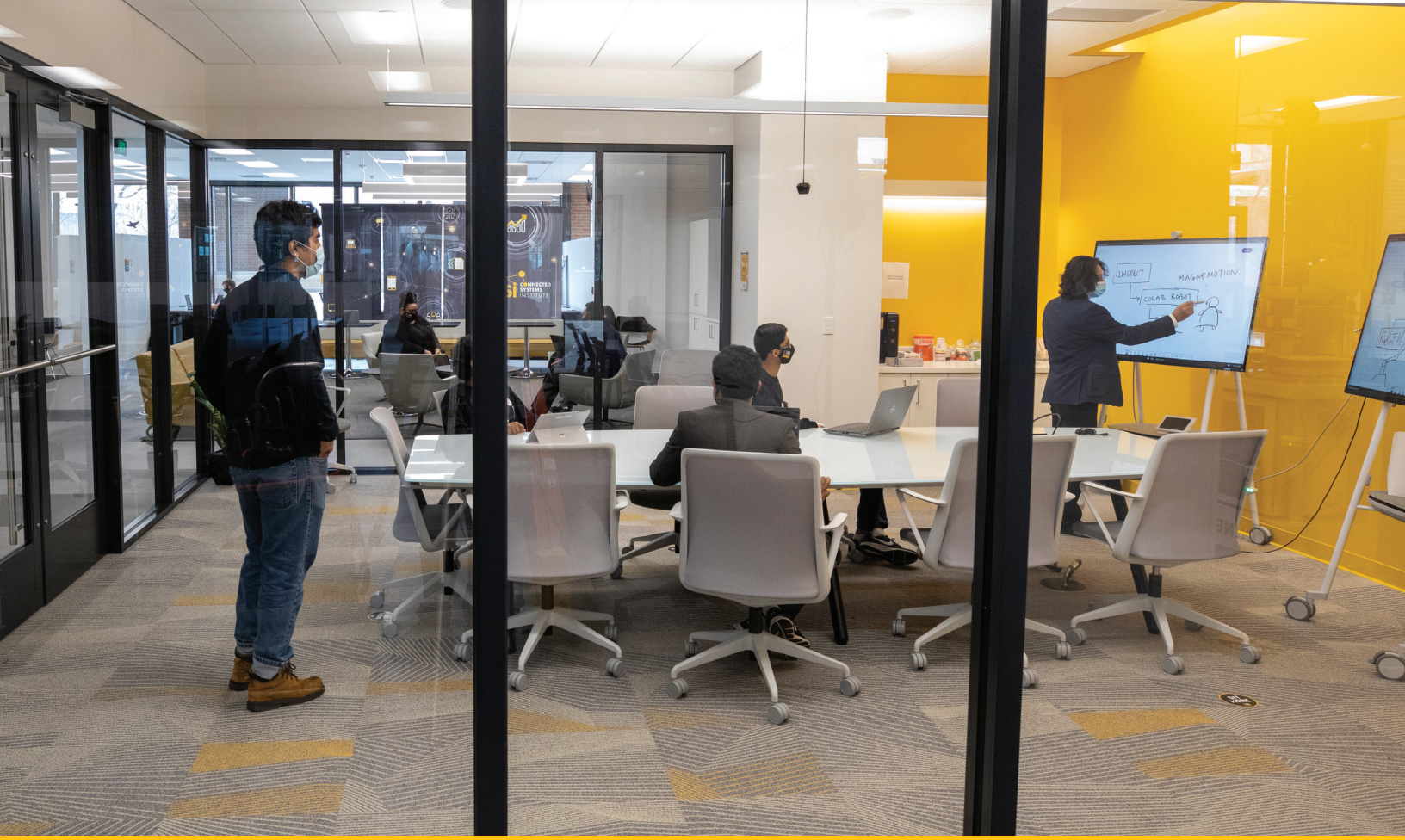
CSI also offers employee training and executive education programs designed to help managers explore the benefits and challenges of IIoT-connected systems. Continuing education programs are also available to prepare managers to navigate the culture shift that accompanies structural organizational changes, such as digital transformation.

Among the programs offered by CSI are:

- Micro coursework designed for students to succeed while supporting jobs and families.
- Certificate programs to enhance academic degrees with manufacturing domain knowledge.
- Executive workshops.
- Graduate-level programs for students who want to specialize in one of the engineering sciences necessary to support advanced manufacturing.

"Technological advancements and global crises are two key drivers transforming our world today. With the challenges created by the pandemic, aging populations, and financial constraints, we'll not be able to achieve recovery and growth without using technology to augment diminishing human resources. In combination with the transformative power of today's IIoT, the business reasons for exploring how to use technology in your business could not be more urgent. At CSI, we are committed to being your partner on the journey ahead. Please join us to learn, experiment, and grow your skills, capabilities and opportunities."

– Mary Bunzel
Executive Director, CSI

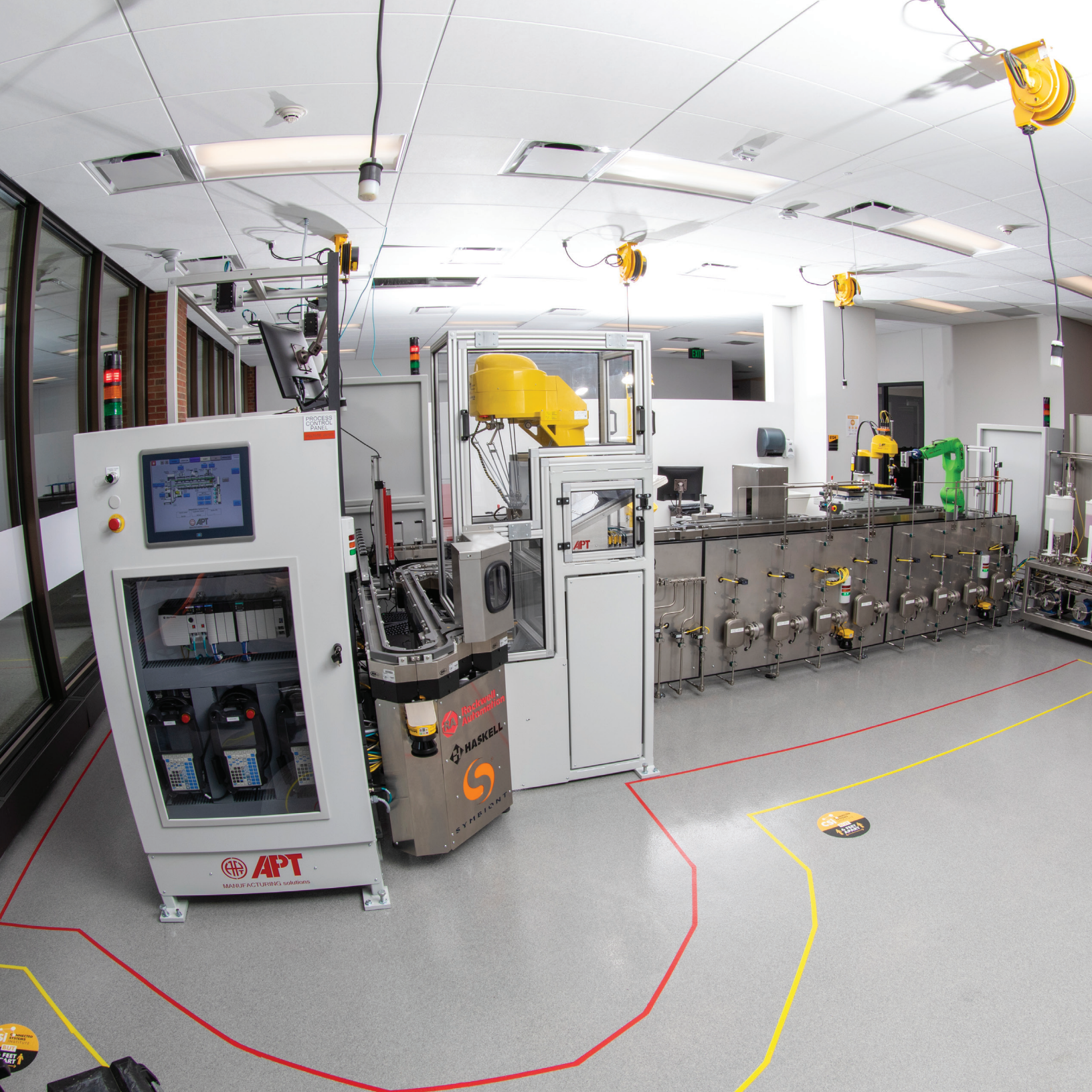


ACADEMIC PROGRAMMING

CSI Academic Programming is designed to address four emerging areas of concern in education and training the workforce of the future due to the transformational Impact of Industry 4.0.

1. Meet student needs for education, training, and research focused on Industrial IOT.
2. Teach systems thinking, ethics, social consciousness, and personal responsibility.
3. Build a rich, diverse community of learners, practitioners, followers, and members.
4. Create innovative learning elements by combining the best of academia and industry subject matter experts.

Our academic programs are specifically designed to meet these goals. Our graduate program in smart manufacturing will help to prepare academic scholars and smart manufacturing experts who can lead efforts in the digital transformation of manufacturing in Wisconsin and beyond. The program has a well-balanced curriculum, including professional training, testbeds, digital twins, and industry internship.


PROCESS CONTROL PANEL
APT
MANUFACTURING solutions
Rockwell Automation
HASKELL
SYMBIONT

Advanced Manufacturing Research

CSI provides an environment in which teams of researchers from industry and academia can work together to explore concepts related to the application of research in integrated business and manufacturing processes.

The Institute features a fully functional manufacturing cell that utilizes advanced systems, including:

- Lot size of 1
- Full track-and-trace per item
- Use of AI for quality and performance tracking
- Use of AI for raw materials tracking
- Robotics and mechatronics programming
- OT cybersecurity
- High- and low-order modeling
- Digital twin simulation, both locally and remotely
- Remote access to data generated in the lab

This research environment is designed to nurture an understanding of IIoT manufacturing principles. It also integrates the disciplines of engineering, physics, and business with software, hardware, and firmware solutions. The goal is to provide a place in which creative ideas can be tested and proven – inspiring new functionality and scalability in real-world business applications.

UWM's world-class faculty contributes expertise in combination with some of the world's most respected talent from diverse fields. This includes experts in everything from advanced manufacturing systems to the social and business impacts of technology.

R&D FOCUS

Research at CSI is focused on a wide range of advanced technologies, including:

Digital Twins: Digital representations of advanced manufacturing systems that enable real-time simulation and analysis of sensor data from production processes.

Data and Sensor Networks: The study of data and sensor networks used for cloud-based analytics.

Data Analytics: Platforms that ingest data from sensors and IIoT networks in order to measure key performance indicators (KPIs).

Machine Learning Integration: Creation of machine learning algorithms to improve KPIs in industrial systems.

OT Cybersecurity: Research aimed at developing techniques that identify and address security weaknesses and vulnerabilities in production systems.

ERP Integration: Design of a tri-directional link between the manufacturing lab environment, SAP, and Microsoft Azure data layers — enabling the use of analytics to automate laboratory tests.

Facilities at the Connected Systems Institute

Research and Laboratory Test Environments

The Institute occupies a 10,000-square-foot space in the UWM Libraries — a highly visible, central location on campus. State-of-the-art research and laboratory facilities within CSI set it apart from other university-industry consortiums studying IIoT connectivity.

CSI research facilities includes four on-campus manufacturing labs used for research, testing, and education. These test facilities give industry partners a place for experimental analyses and validation. For example, manufacturers can use the lab to test potential IIoT solutions in a simulated production environment.

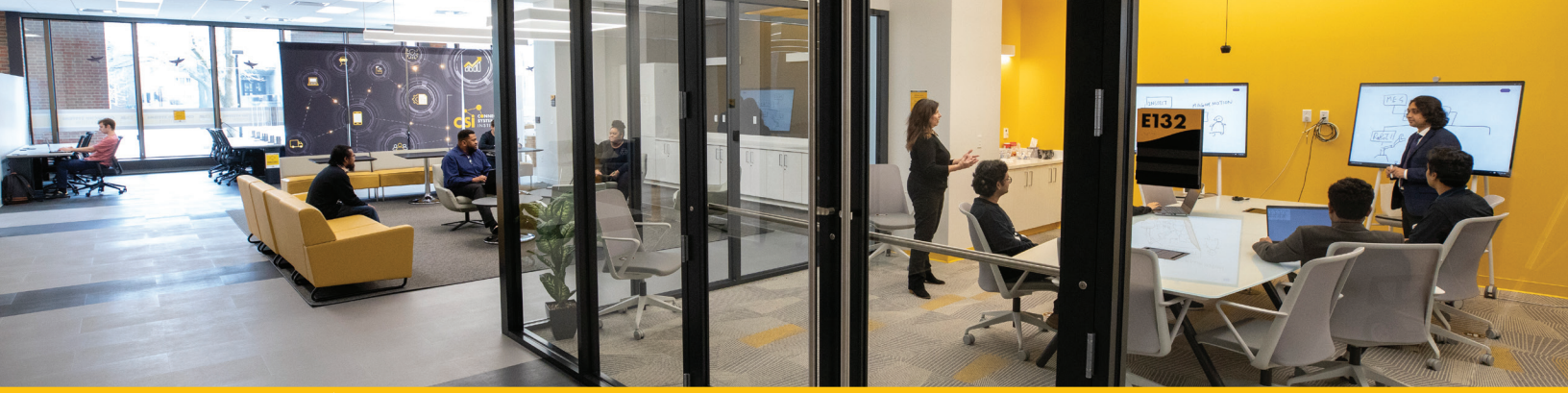
The test bed at CSI can be used for experimental research to test new manufacturing processes. Data generated from the live test bed, which is an IIoT-connected environment, can be shared with researchers located anywhere in the world.

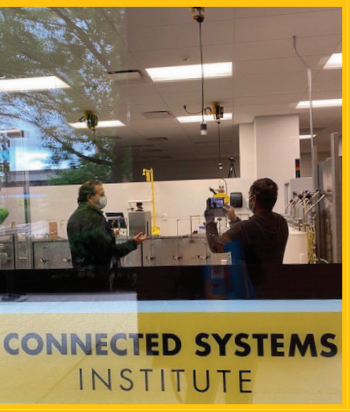
CSI's facilities are designed to test IIoT solutions across domains specific to manufacturing. Resources include:

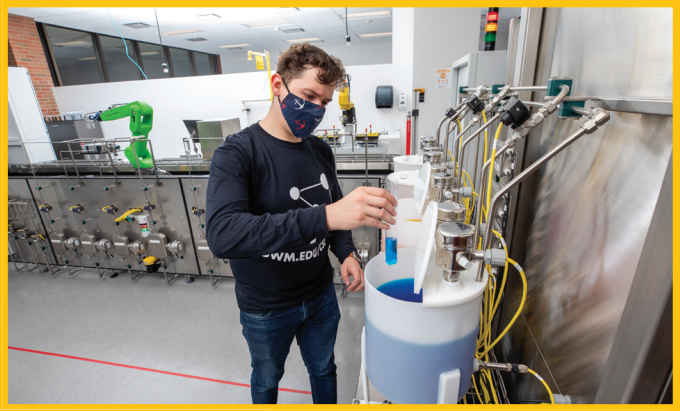
- **Manufacturing Test Bed 1,** featuring a fully functional production environment in which students produce and fulfill orders. This simulated manufacturing facility gives students hands-on experience in a live production environment. The test bed provides exposure to Industry 4.0 technologies, including robotics and AI. The test bed features plant and automation control tools from Rockwell Automation, OT security systems from Fortinet, data management and switching controls from Cisco, hardware from Dell, and cloud storage from Microsoft.
- **Digital Twin Lab,** which features the digital replica of the Manufacturing Test Bed. Using software simulation for mechatronics and robotics programming, students can simulate processes before executing them in the test bed production environment. The lab uses simulation software from Ansys and digital manufacturing solutions from PTC.
- **OT Cybersecurity Lab,** which focuses on the unique security needs of connected systems in manufacturing production environments.

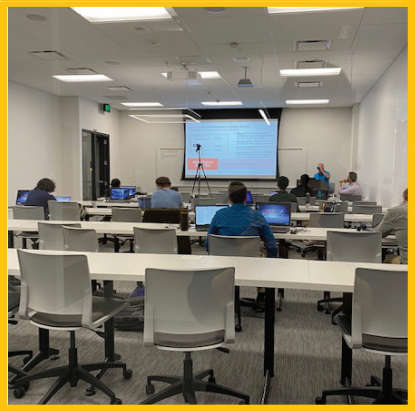
CSI facilities feature a fully connected system of IIoT components. The simulated manufacturing plant provides a work environment for students and researchers to experiment with new concepts and solutions.

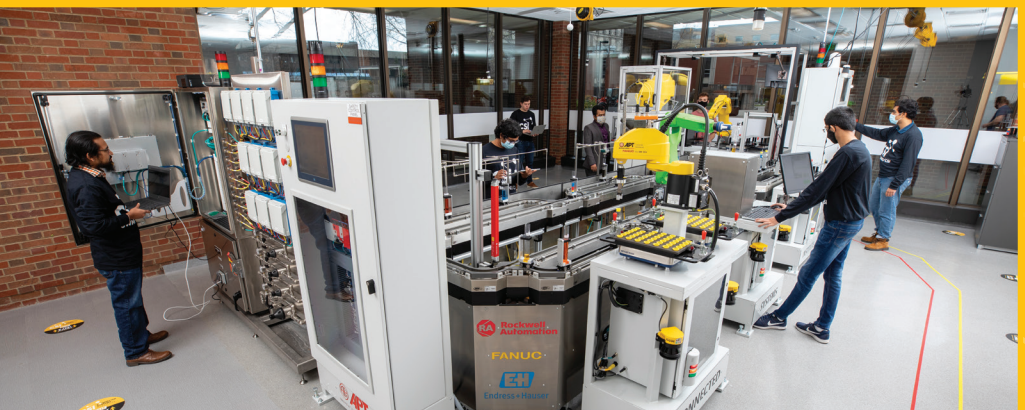
The facilities are designed so that small- and medium-sized businesses can partner with CSI to test their own use cases. The Institute also supports innovation by providing a low-cost test facility with state-of-the-art technology and a highly trained staff.











"The Institute's research will leverage the next wave of technology, enabling significant advantages in productivity, efficiency, and sustainability across a variety of complex systems, from manufacturing to healthcare. It will form a foundation for educating the engineers who design and operate these systems – vital skills that are needed now!"

– Brett Peters
Dean, College of Engineering
& Applied Science, UWM

FOUNDING MEMBERS:

Rockwell Automation

SUSTAINING MEMBERS:

We Energies

Wisconsin Economic Development Corporation

Microsoft

ASSOCIATE AND GENERAL MEMBERS:

EATON

HEARTLAND BUSINESS SYSTEMS

COLLABORATORS & GIFTING PARTNERS:

MKE Tech
PTC Technologies
Cisco
Dell
Fanuc
LAB Midwest
WMEP
WCMP

Contributing Partners

Industry partnerships are a core part of the work at CSI. With the support of its industry partners, the Institute is helping academic scholars and students become more knowledgeable multidisciplinary collaborators. This, in turn, is helping CSI develop new business processes based on current and new technologies. Industry partners ultimately benefit from strategic insights to help make their own production environments and processes more productive.

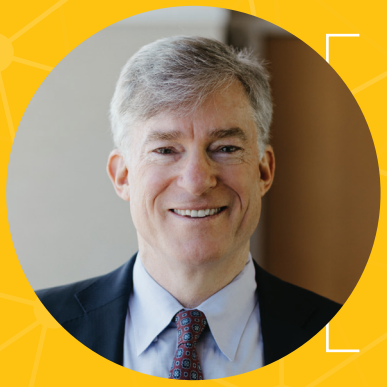
Investing in a more connected production environment requires a significant culture change for companies, affecting how employees think about their work, and how they are rewarded. CSI provides a community forum for learning more about these changes. The Institute also mentors students to help prepare them for jobs in high tech manufacturing environments. By working with students, faculty, and private sector partners, CSI is helping to ensure that industry has the talent it needs to benefit fully from IIoT connectivity.

With 75 billion devices expected to be connected to the internet by 2025, the work of CSI has the potential to transform how products are designed, produced, and sold. The connected systems models that CSI is developing can help manufacturers extract more business insights from the huge volume of data flowing in from IIoT devices and networks.

Ultimately, CSI helps its industry partners determine the right mix of connected IIoT systems to yield the best return on investment. The Institute also helps to train the talent that digital manufacturers will need in order to fully benefit from the IIoT and Industry 4.0 connected systems.

IIoT is fast becoming a key strategy for companies of all sizes, yet there still exists a gap in cloud skills and training to develop connected solutions. The Connected Systems Institute helps bridge that gap by combining advanced research with training for the next wave of innovation with IoT."

– Sam George
Director of Azure IoT, Microsoft

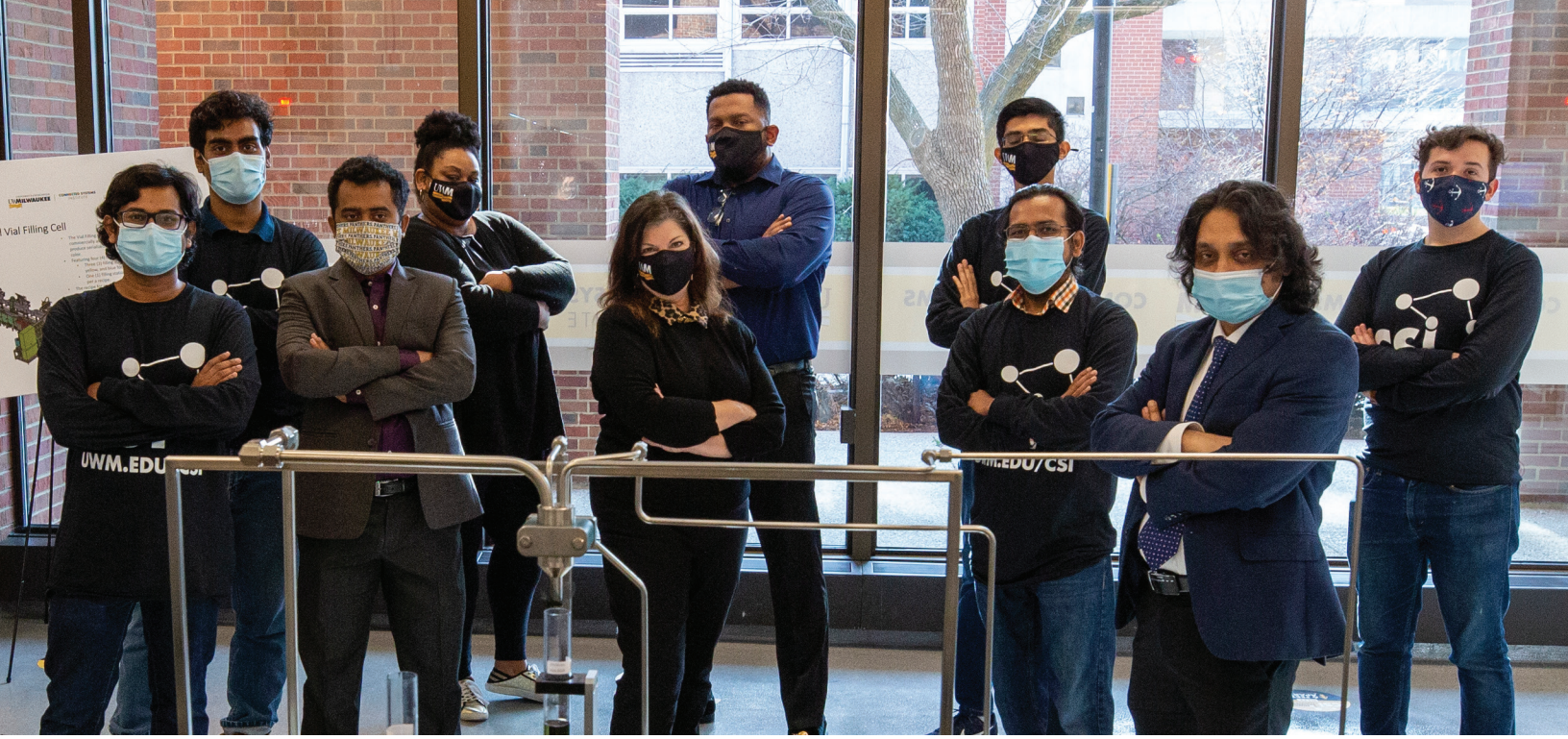


"The Connected Systems Institute offers a multidisciplinary program that will enable students to learn skills not only in technology, but also in business. The breadth of courses and research at the UWM makes it a perfect fit"

– Blake Moret
President and CEO, Rockwell Automation

"The IIoT and what we now call Industry Infinity.0 are bringing exponential change to industry and manufacturing. From the smart sensors at the device level to the complex analytics at the enterprise and cloud levels and everything in between, incredible career advancement and industrial growth opportunities abound for those who match their continuing learning to this pace of change. UWM's Connected Systems Institute hits the sweet spot, matching innovation and highly advanced smart manufacturing technology with experiential pedagogy that will drive these concepts home in ways that industrial learners can immediately put into practice in the workplace."

– Matt Kirchner
President of Lab Midwest



Contact

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Connected Systems Institute

The Connected Systems Institute

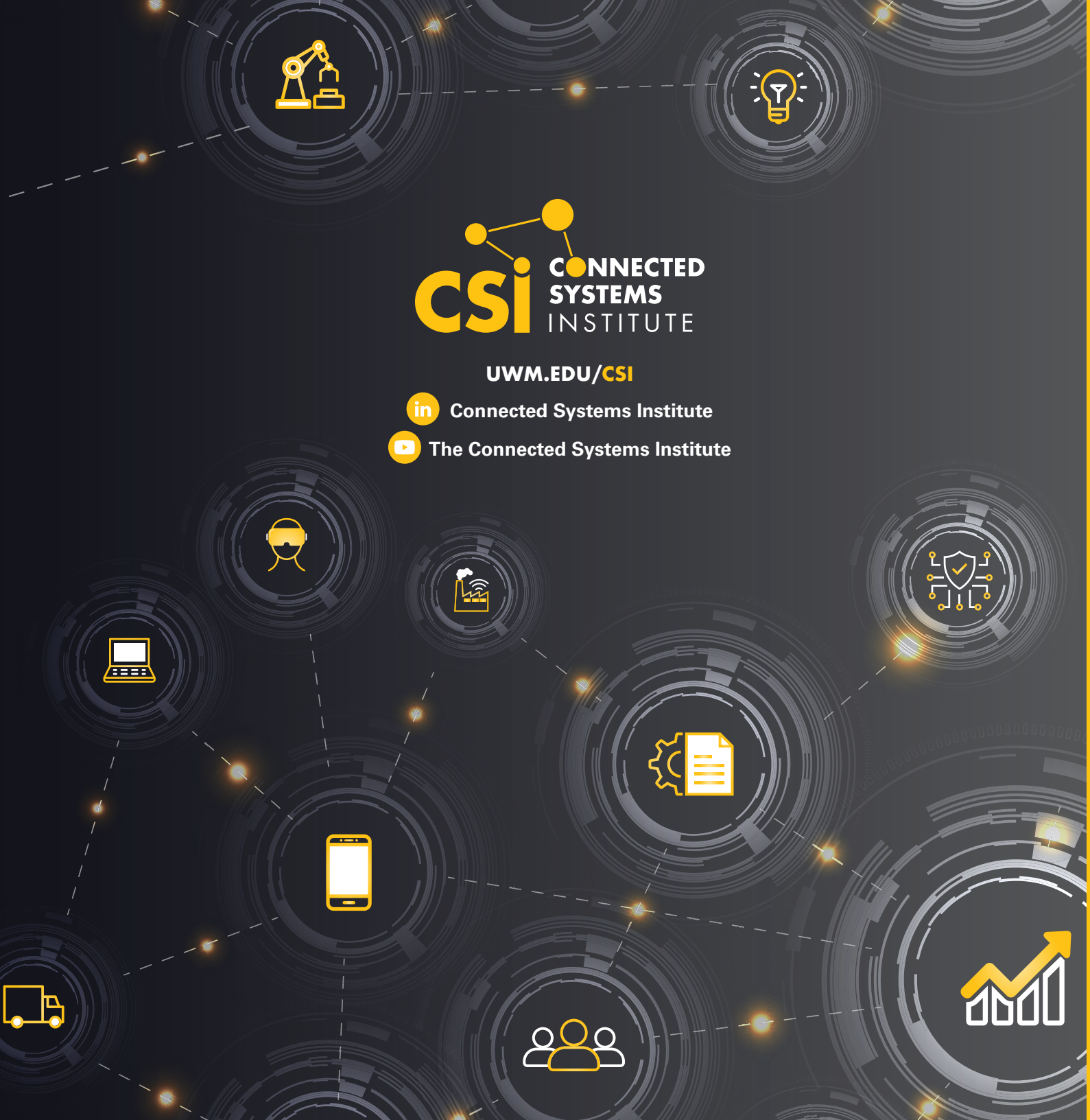
UWM.EDU/CSI

Connected Systems Institute (CSI) Industry Membership Advantages

Membership Category	Founding Member	Sustaining Member	Associate Member	General Member
Membership Contribution *	$500,000/yr or $2,500,000over 5 yrs	$200,000/yr or $1,000,000 over 5 yrs	$50,000/yr or $250,000 over 5 yrs	$15,000/yr or $75,000over 5 yrs
Upstream and downstream industry networking	✓	✓	✓	✓
Quarterly CSI workshops†	✓	✓	✓	✓
General facility use/access	✓	✓	✓	✓
Participation in Industry Executive Day†	✓	✓	✓	✓
CSI Roundtable: pre-competitive research/results	✓	✓	✓	X
Non-exclusive license for intellectual property on pre-competitive research†	✓	✓	✓	X
Enhanced voting rights on CSI Roundtable projects	5 votes	3 votes	1 vote	X
Participation in Industry Advisory Board	✓	✓	✓	X
Membership credit for new or existing members in CSI-affiliated organizations†‡	50% credit on 2 memberships for 5 years	50% credit on 1 membership for 5 years	X	X
Participation in CSI Catalyst Grant Program	✓	✓	X	X
I-Corps Site Training (4 weeks)†	✓	✓	fee-based	fee-based
Exclusive one-day member session to discuss specific connectivity needs	✓	✓	X	X
Membership on CSI Steering Committee	✓	✓	X	X
Participation in CSI conferences and webinars†	✓	✓	fee-based	fee-based
Priority scheduled use of facilities and equipment†§	✓	✓	X	X
Virtual factory setup: mutually proprietary simulation and emulation on specific product†	✓	X	X	X
Named CSI Catalyst Grant Program	✓	X	X	X
UWM CSI Executive Education (4-day program)†	✓	fee-based	fee-based	fee-based
UWM Career Fair with prime placement†	✓	fee-based	fee-based	fee-based
On-site CSI Executive Education	fee-based	fee-based	fee-based	fee-based
CSI-sponsored research contracts	fee-based	fee-based	fee-based	fee-based
Professional MS program on Connected Systems	fee-based	fee-based	fee-based	fee-based
UG Certificate on Connected Systems	fee-based	fee-based	fee-based	fee-based

See footnotes below.

*With UWM's approval, Founding and Sustaining Members may use in-kind support for up to 50% of total membership contributions. Associate Members may substitute in-kind support valued at $500,000 for its membership contributions. Substitution of in-kind support for General Member contributions shall be reviewed on a case-by-case basis. In-kind support is generally considered to be the donation of tangible assets. †Depending on a Member's selected membership level, a significant portion of a Member's contribution may be considered a philanthropic gift to UWM in support of the CSI. However, these advantages may provide a Member with a good or service that may reduce the value of its charitable gift. With its contribution receipt, UWM will provide Member with a disclosure statement, which will include a good faith estimate of the fair market value of such goods or services. This valuation may be subject to change from year-to-year. ‡CSI Affiliated Organizations include: Supply Chain Management Institute, Grid-Connected Advanced Power Electronics I/UCRC, Water Equipment & Policy I/UCRC, Center for Technology Innovation and others as may be reasonably determined by UWM. §Additional fees or service agreements may apply. Note: Fees for any fee-based items will be set by UWM consistent with its internal policies and practices for similar fees. The Executive Director will consult with the Steering Committee, as appropriate, on such fees.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