Increasing Participation of All Students in MFG/STEM Fields: Smart Manufacturing Technologies & Careers

April 20, 2022

Agenda

- CCAT and CSDE
- CCAT Introduction
- Smart Manufacturing Technologies & Careers
  - Robotics & Automation
  - Augmented & Mixed Reality
  - Industrial Internet of Things (IIoT)
- Ways for you and your students to get involved
- Resources

Who We Are

Eileen Candels

Director of Partnerships

Kristi Oki

Program Innovation Manager, Mechanical Engineer

Background

Develop and implement strategies to **attract and retain** females and those from communities currently underrepresented in manufacturing and technology industries.

Funded by a 2021-2022 SY grant from CSDE, CCAT has been offering schools, districts, and students a variety of opportunities including:

- **Workshops** on increasing recruitment, reinvention and completion of CTE students in STEM and manufacturing programs
- Connecting **Industry Ambassadors** with students
- STEM/Manufacturing **PLCs**

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CTE Manufacturing/ STEM Programs

Increasing Recruitment & Retention of all students in STEM and manufacturing clusters

- Provide statewide Professional Learning on Best Practices to CTE Educators (teachers, counselors and administrators)
- Strengthen Connections between educators and those working in STEM/MFG
- Convene year-long Professional Learning Community (PLC) with six districts
    - District self-reflection on attraction, advocacy, completion
    - Alignment of student benchmarks to workforce needs
    - Suggestions for best-practice strategies to improve high school outcomes
    - Participation in workshops on best practices
    - Connections with Industry Ambassador programs and stakeholders

A.I. PRINCE TECHNICAL HIGH SCHOOL
PART OF THE CONNECTICUT TECHNICAL EDUCATION AND CAREER SYSTEM

Bristol PUBLIC SCHOOLS

CHESHIRE PUBLIC SCHOOLS • Cheshire, Connecticut •

DANBURY • PUBLIC • SCHOOLS • A COMMUNITY OF LEARNERS •

Every Child Every Day
East Hartford Public Schools

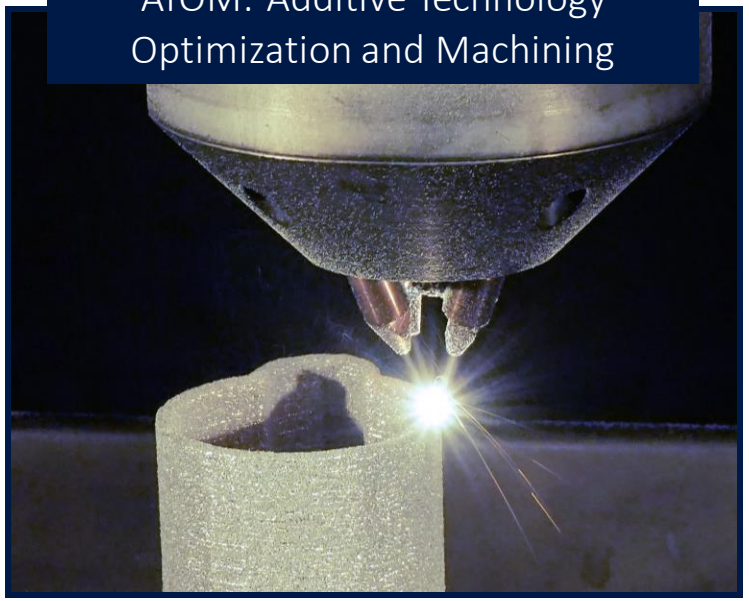
ENFIELD PUBLIC SCHOOLS
We make a difference in Enfield - every child, every day.

Who We Are

CCAT is an applied technology development, demonstration and training center that **innovates, validates**, **demonstrates**, and **assists with the adoption** of **leading-edge technologies** into Connecticut and the nation's **advanced manufacturing supply chain**, while providing vital **workforce training and upskilling** necessary to fully-utilize the technology advancement

ADAM: Advanced Design Automation and Metrology

ATOM: Additive Technology Optimization and Machining



Advanced Composite Technology Center

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Next Generation Manufacturing Center

www.nextgenmfg.org

Workforce & STEM Awareness

- Demonstrate, Train and Help Companies adopt Industry 4.0 & Digital Technologies
- Foster Industry Partnerships
- Recruitment, Assessment, Job Placement & Retention of underrepresented, young adults, Two-Gen & re-entry populations
- Increase Manufacturing/Technology Awareness

MANUFACTURE 4.0
Creating Tomorrow's Industrial Revolution Today

Middle School

High School

Post-Secondary

Workforce

01.21.21

GIRLS & MANUFACTURING

VIRTUAL CT MFG FAIR

YOUNG MANUFACTURERS ACADEMY
(In-school and Summer Programs (Robotics, Coding, CNC, Careers))

MANUFACTURING TALENT PIPELINE
- Advanced Manufacturing Employer Partnership (AMEP)
- REV-Up Your Career!
- Women of Innovation®
- CCAT/AMEP Industry Ambassador program

ADVANCED TECHNOLOGIES
- Contracted Services for Businesses
- Workshops & Professional Development
  - Entry level trainings
  - Educator Series
  - Incumbent Worker Trainings (Industry 4.0 & Digital)
- Apprentice Trainings
- Sustainable Energy
- Manufacturing Voucher Programs (CTMVP & IVP)

Funding has been provided by CT Department of Economic and Community Development's Manufacturing Innovation Fund, Workforce Solutions Collaborative of Metro Hartford, CT Health and Education Facilities Authority (CHEFA), and Capital Workforce Partners (CWP).

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Next Generation Manufacturing

Present US Workforce Challenges

In the next 10 years, **4.6 million** U.S. jobs will be open in advanced manufacturing…

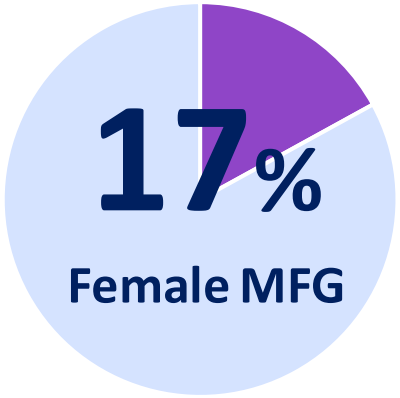
But only 2.2 million jobs will be filled!

These exciting career opportunities are a perfect fit for STEM education and STEM inspired people!

National Association of Manufacturers Manufacturing Institute, 2019

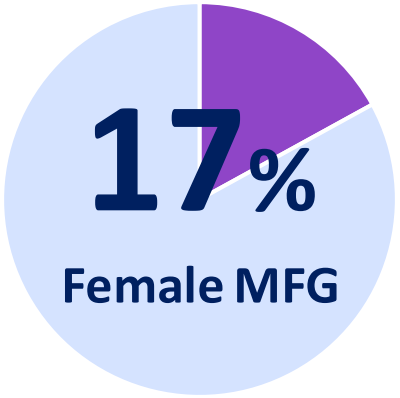
2020 Connecticut Female Enrollment

Secondary



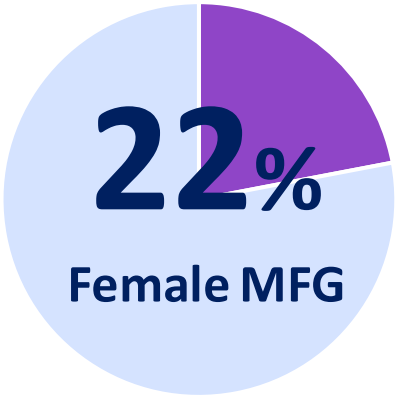
STEM 22% female

Postsecondary



STEM 39% female

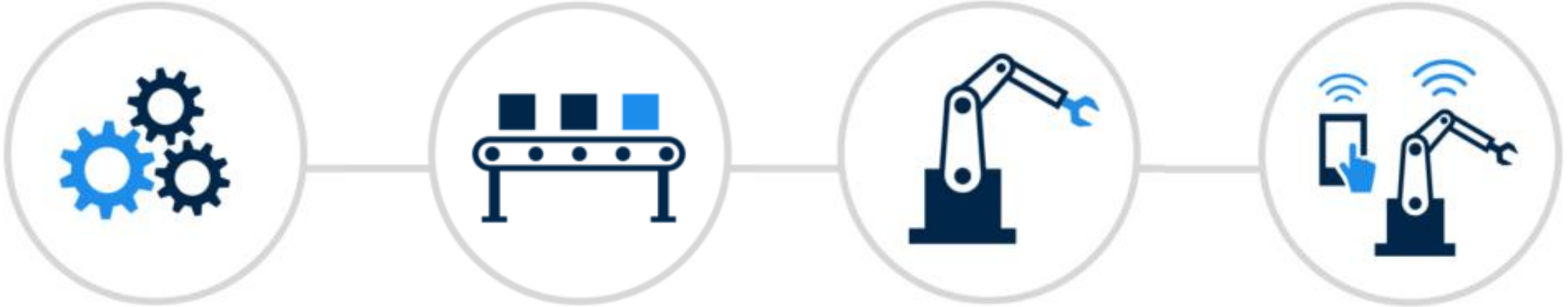
Workforce



US Workforce
51% female

The 2020 Perkins Consolidated Annual Report (CAR), student enrollment was provided by career cluster.

Manufacturing is Changing



Industry 1.0

Mechanization and the introduction of steam and water power

Industry 2.0

Mass production assembly lines using electrical power

Industry 3.0

Automated production, computers, IT-systems and robotics

Industry 4.0

The Smart Factory. Autonomous systems, IoT, machine learning

Image: https://www.spectralengines.com/articles/industry-4-0-and-how-smart-sensors-make-the-difference

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Industry 4.0

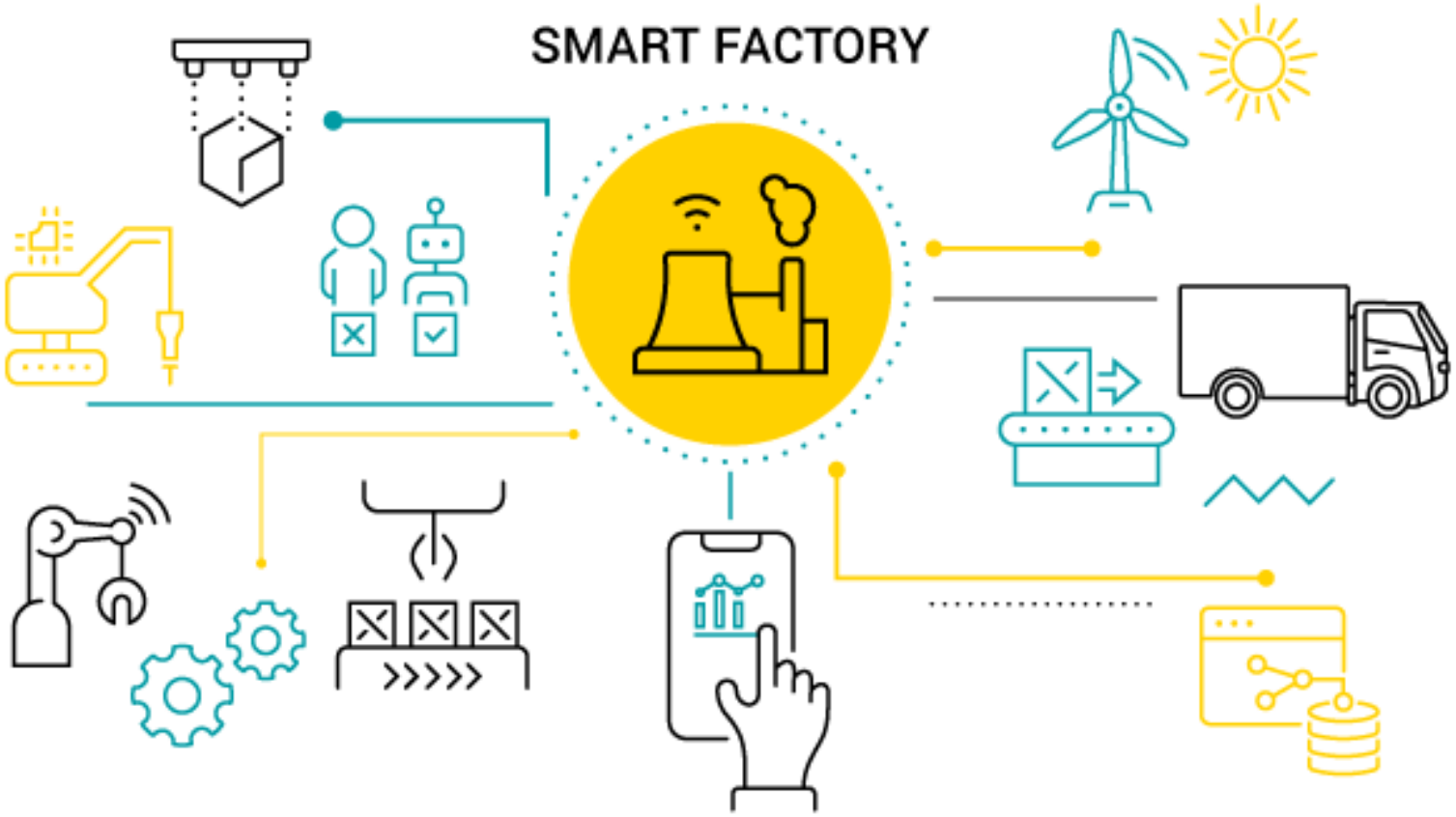
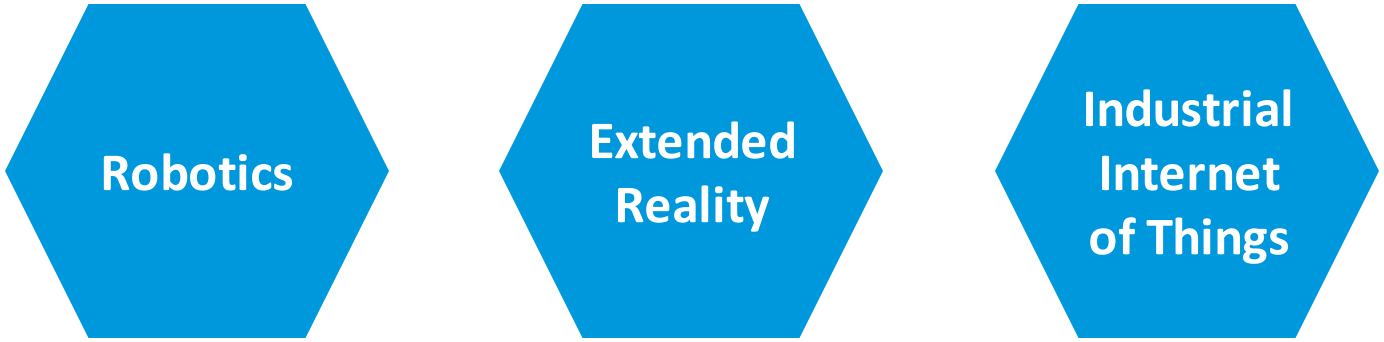


Image: https://www.avsystem.com/blog/smart-factory/

Today's Technology Focus Areas



- What is the technology?
- Examples of how it is used
- Key skills and careers
- How can we engage all students?

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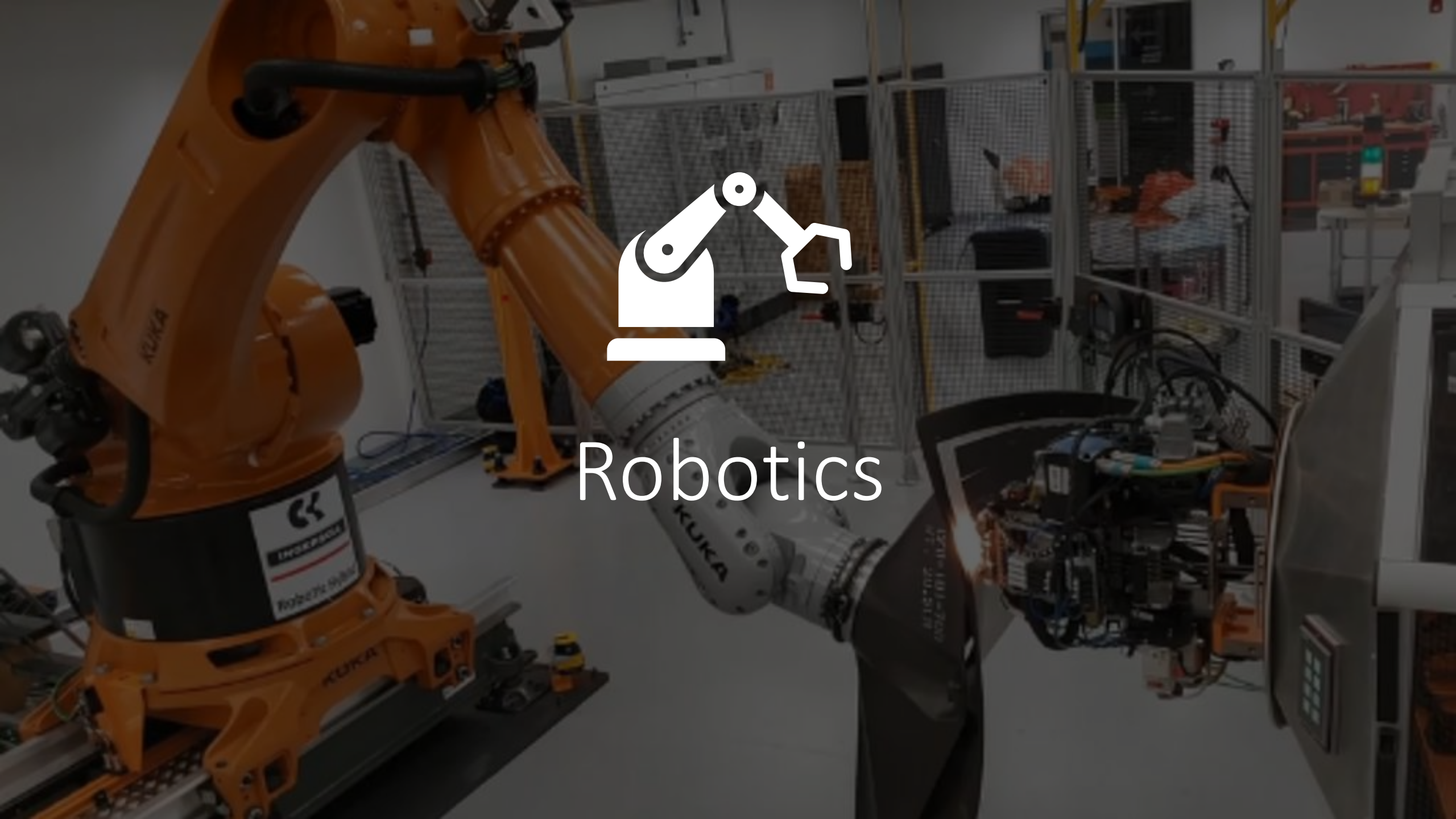
College of Technology
Next Generation Manufacturing Center

“The pace of digital transformation in the manufacturing industry will likely continue to **redefine work** for humans.
Paul Wellener et al.,
Creating pathways for tomorrow’s workforce today,
Deloitte Insights, May 4, 2021



Robotics

Robotics

Automation of repetitive tasks

Flexible and **modular** automated systems can be **reconfigured** based on need

Technology Example

Collaborative Robot - Cobot

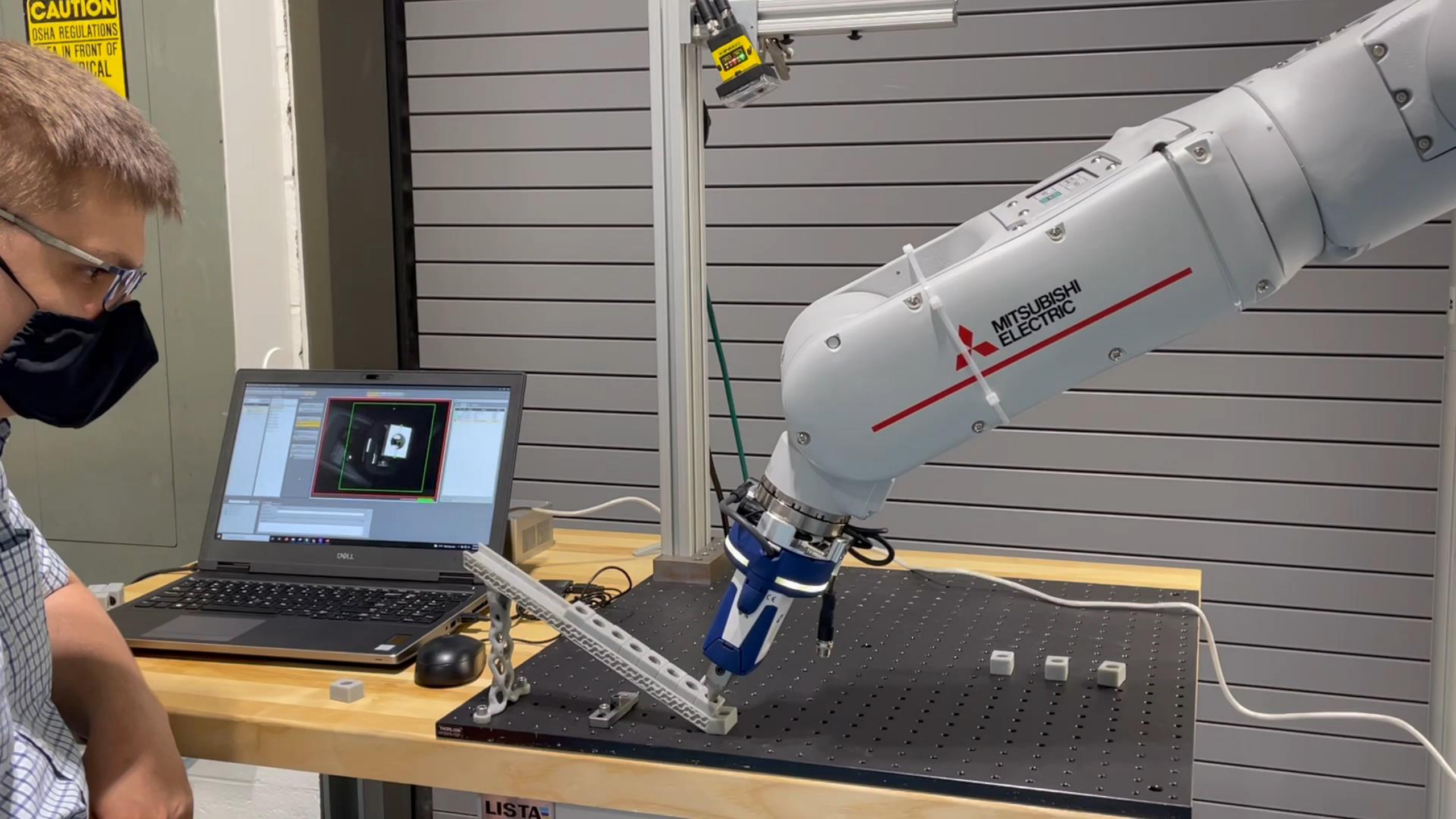
Technology Example

Collaborative Robot - Cobot

Built-in safety features

Can move around the shop floor

Programmable for multiple tasks


CAUTION
OSHA REGULATIONS
MITSUBISHI
ELECTRIC
DELL
LISTA

Skills & Careers

Key Skills

- Programming
- Mechatronics
- Troubleshooting
- Flexibility
- Collaboration
- Human-Machine interaction

Career Opportunities

- Robotics Programmer
- Robotics Technician
- Robotics Integrator

Future Career

- Robot Teaming Coordinator

The future of work in manufacturing: What will jobs look like in the digital era? , *Deloitte Insights*

Engaging all students

- Practice collaborating with robots
- Design and/or program robots for more than one task
- Adjust a robot or program to complete new tasks

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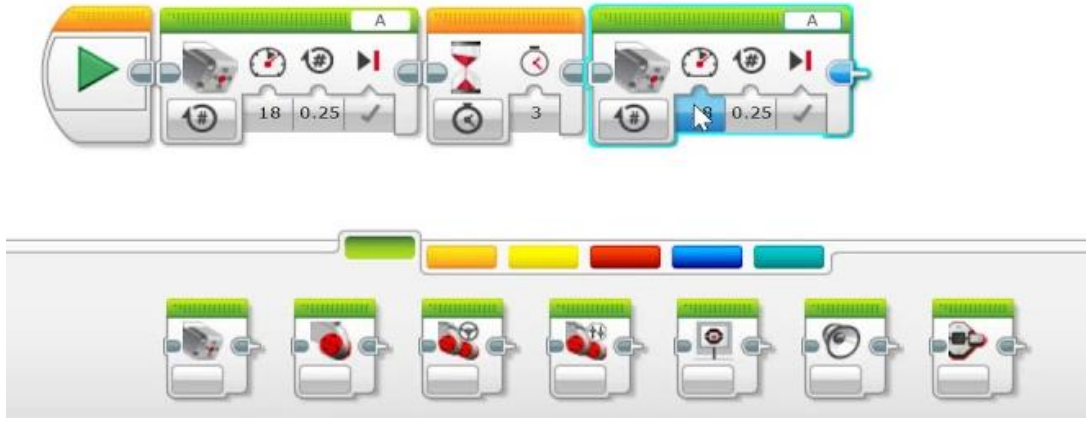
Drag and Drop Programming

Classroom Learning
Lego® Robotics



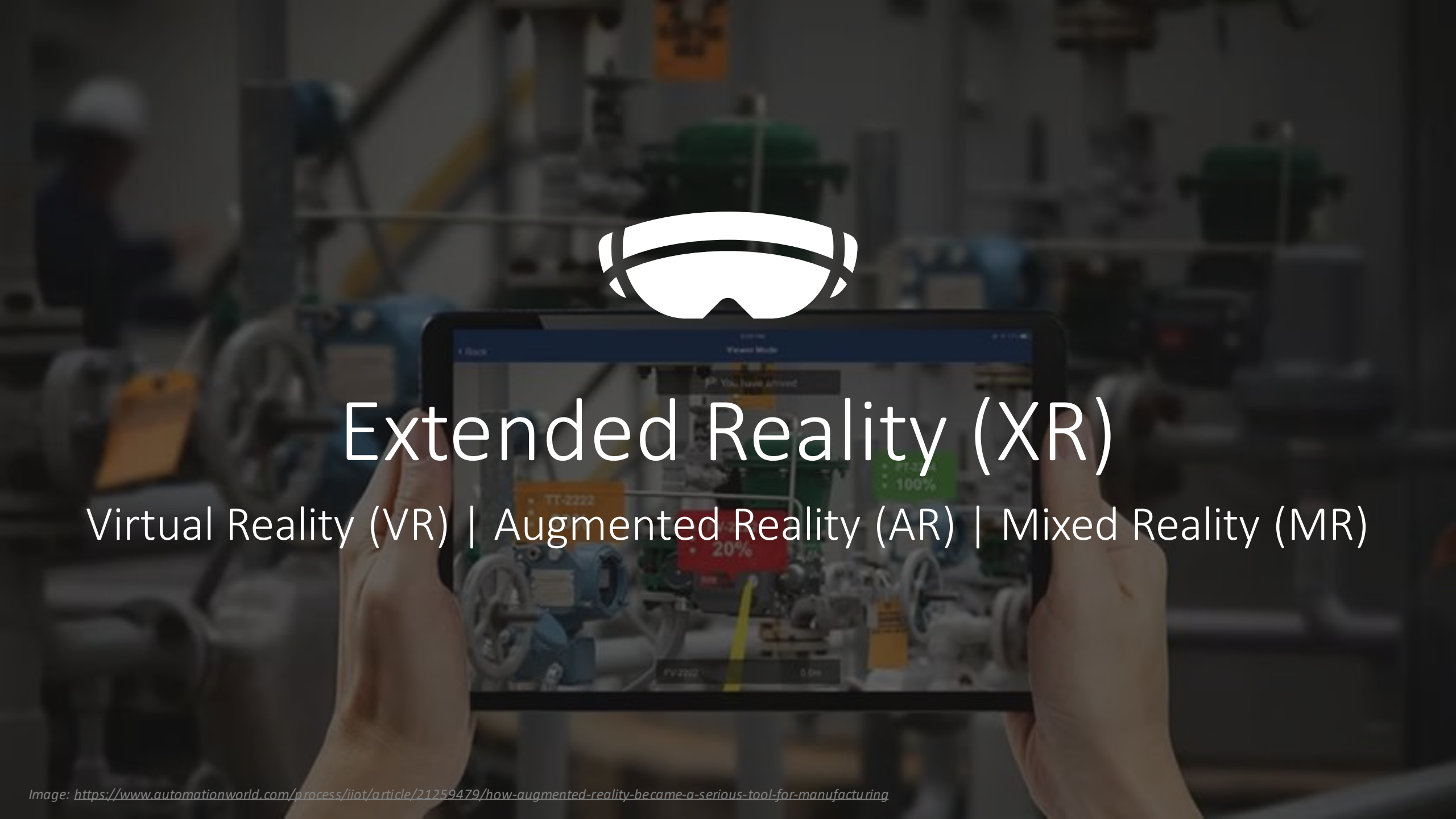
Industry
Mitsubishi Assista Cobot

Images: https://i.ytimg.com/vi/MIYX_9QC3lA/maxresdefault.jpg
https://www.mitsubishielectric.com/fa/products/rbt/robot/pmerit/assista/index.html

Our vision is we want operators to work with robots, to maintain them and to engineer and design them and ultimately, to oversee human and robotic teams.

Mark Maybury
CTO at Stanley Black and Decker

Sylvia Pfeifer, 'Factory of the future' offers new blueprint for manufacturers, Financial Times, January 18, 2022



Extended Reality (XR)

Virtual Reality (VR) | Augmented Reality (AR) | Mixed Reality (MR)

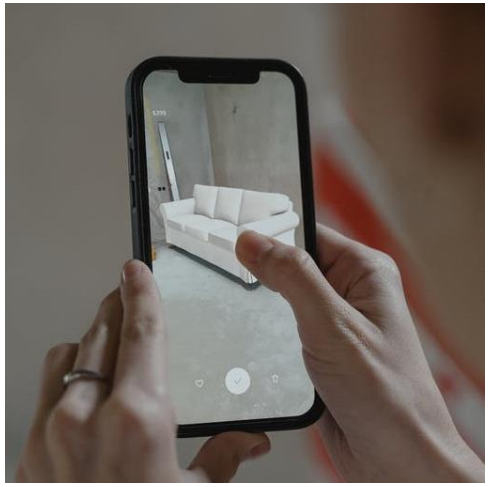
Image: https://www.automationworld.com/process/iiot/article/21259479/how-augmented-reality-became-a-serious-tool-for-manufacturing

Extended Reality: Virtual, Augmented, and Mixed Reality

Virtual Reality (VR)

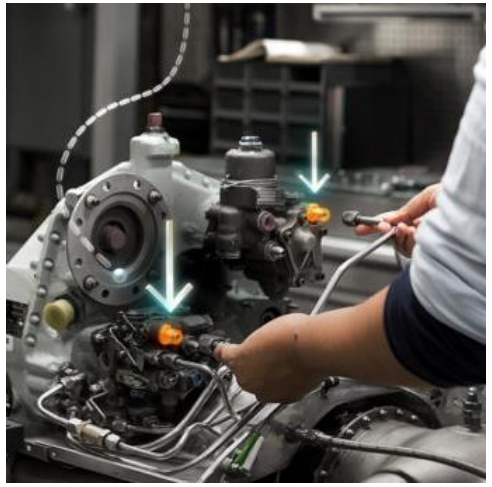
All virtual immersive experience

Augmented Reality (AR)



Digital content is overlayed onto the physical environment

Mixed Reality (MR)



Digital content is anchored to the physical environment and can interact with real-world objects

Image: https://news.microsoft.com/innovation-stories/hololens-2/

Extended Reality

Extended reality involves a simulated virtual environment or the application of digital content into the physical environment

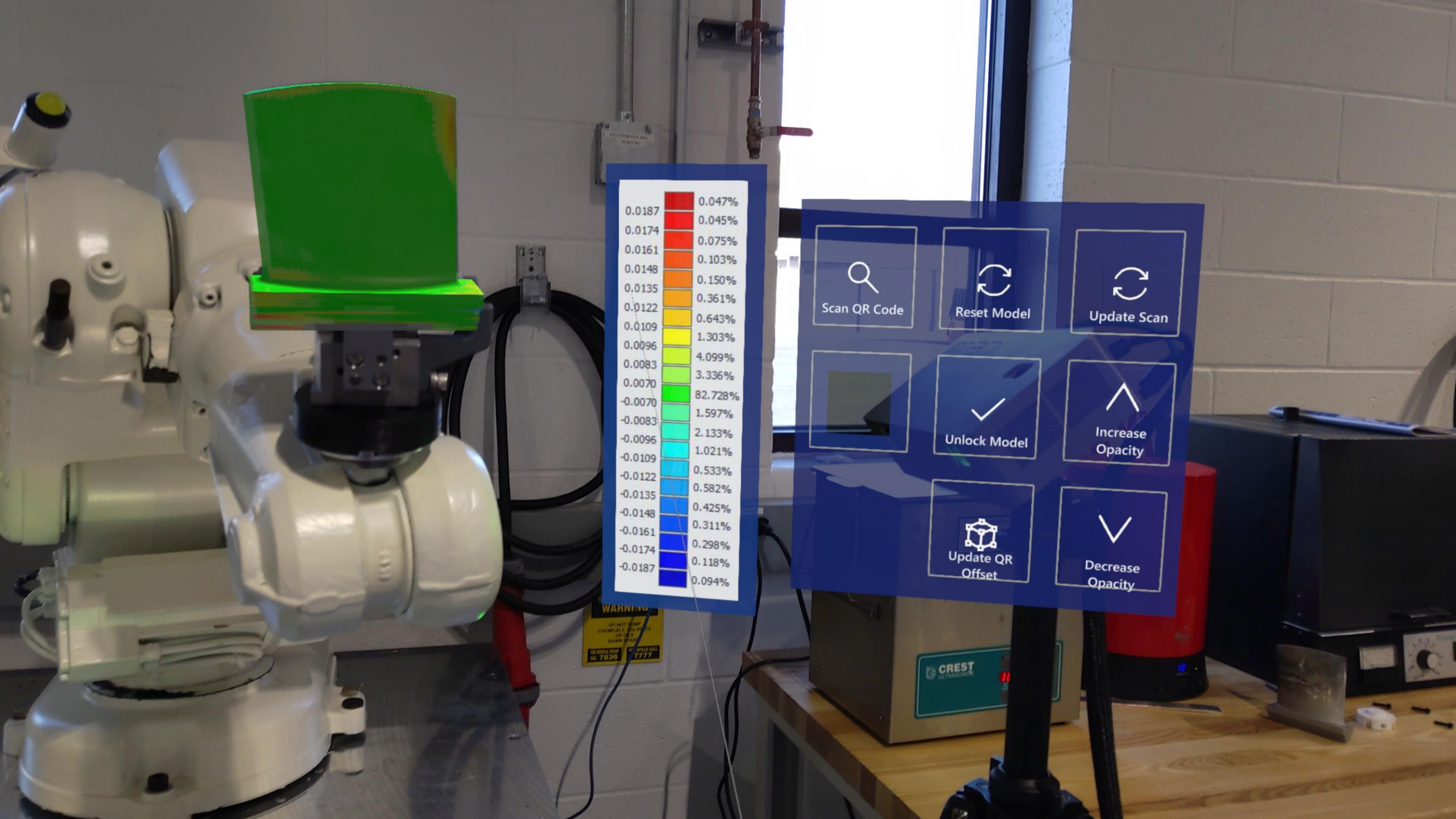
In manufacturing, XR can enhance training, technical support, and visualization of data and physical hardware/equipment

Technology Example

Mixed Reality Headset

Microsoft HoloLens

Gabriel Woods
Booking
In Progress
Gabriel Woods
Start Time
End Time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0.643%
1.303%
4.099%
3.336%
82.728%
1.597%
2.133%
1.021%
0.533%
0.582%
0.425%
0.311%
0.298%
0.118%
0.094%
Scan QR Code
Reset Model
Update Scan
Unlock Model
Increase Opacity
Update QR Offset
Decrease Opacity

Technology Example

Mixed Reality Headset

Remote Assistance

Immersive learning

Visualization

BAE Systems Leverages the Power of Mixed Reality With Microsoft and PTC

Using PTC's Vuforia Studio software, BAE easily created interactive mixed reality experiences for HoloLens in hours and at a tenth of the cost.

Share

1:20 / 2:32

Video: https://www.ptc.com/en/technologies/augmented-reality/solutions-for-manufacturing

Skills & Careers

Key Skills

- Creativity
- Problem Solving
- Communication
- 3D Modeling
- Programming (e.g., Web/Mobile)

Career Opportunities

Future Careers

- Smart Safety Supervisor
- Smart QA Manager
- Augmented Reality Specialist
- Design/Graphics Engineer

The future of work in manufacturing: What will jobs look like in the digital era? , *Deloitte Insights*

Engaging all students

- Explore digital reality headsets
- Practice 3D modeling and working in virtual, simulated environments
- Shift the conversation to AR/MR as an inspection and training tool

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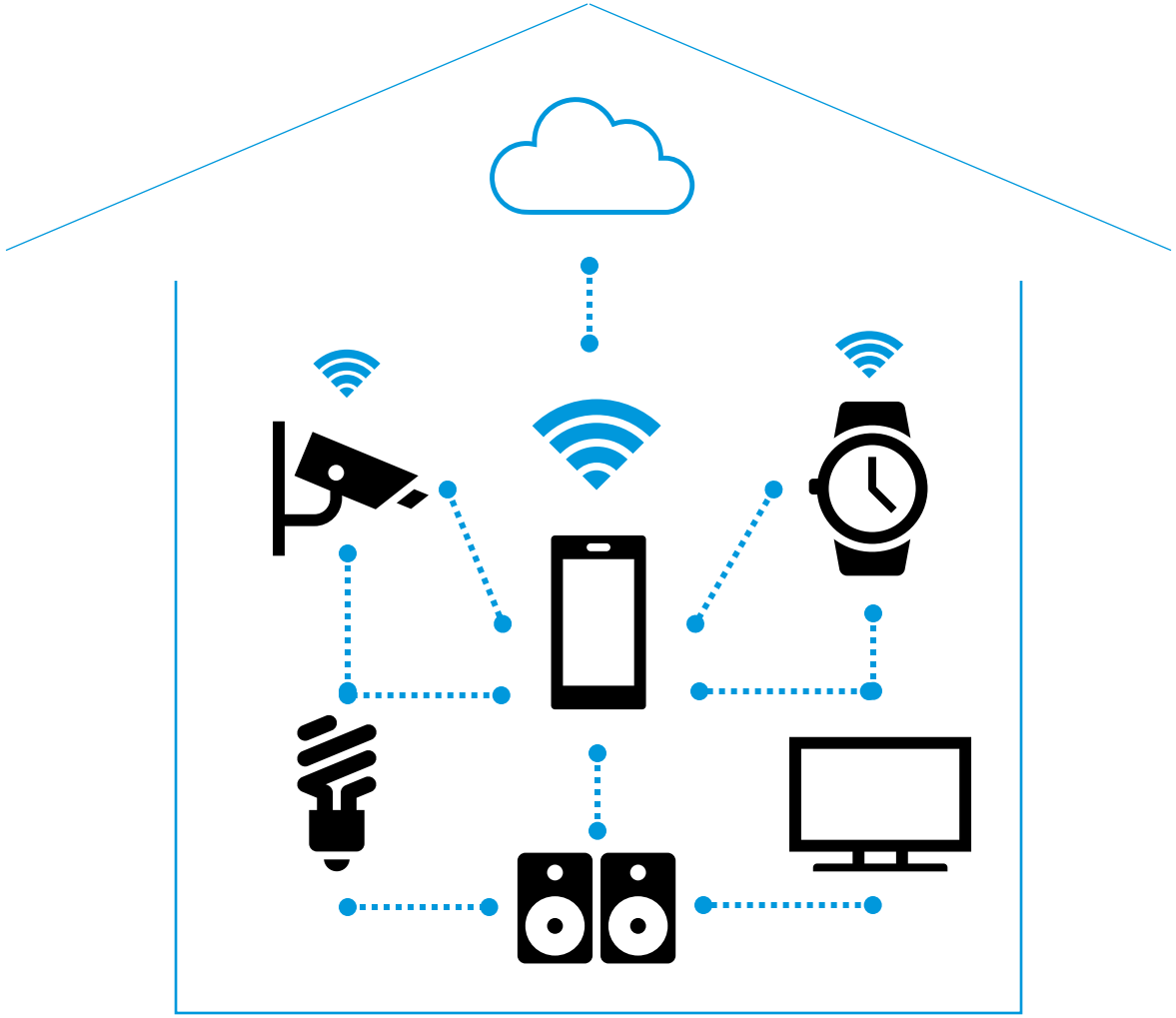
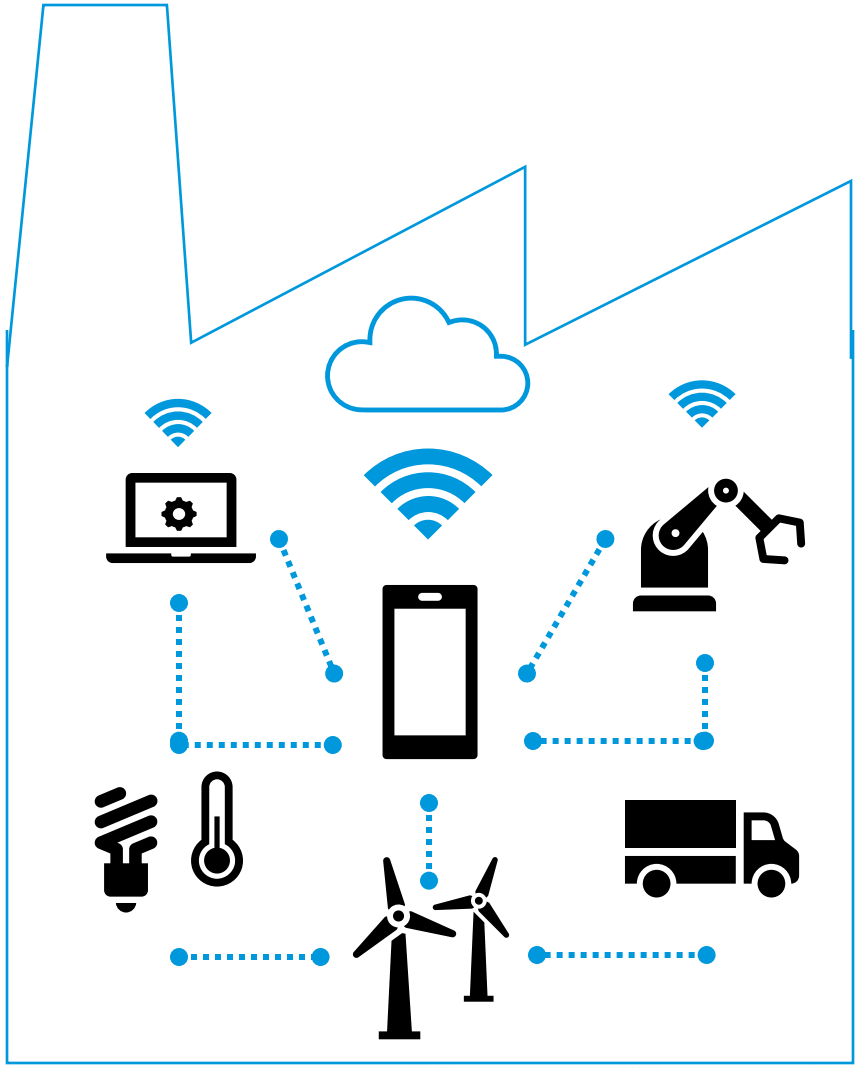
Industrial Internet of Things (IIoT)

Internet of Things (IoT)



Industrial Internet of Things (IIoT)



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www.nextgenmfg.org

Image: https://www.quartic.ai/smart-manufacturing/

Industrial Internet of Things (IIoT)

Interconnected devices in an industrial setting that make **data** available to people

»

IIoT is about turning that data into **actionable insights**: information that can be used to improve manufacturing processes

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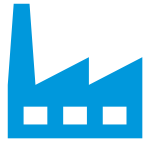
Technology Example

Vibration Sensor

Technology Example

Vibration Sensor

Remote machine monitoring



Real-time sensing

Online dashboard

HAAS MINI MILL (#1) VER. A

from *
12/23/2021, 2:00:01 PM

duration
8h

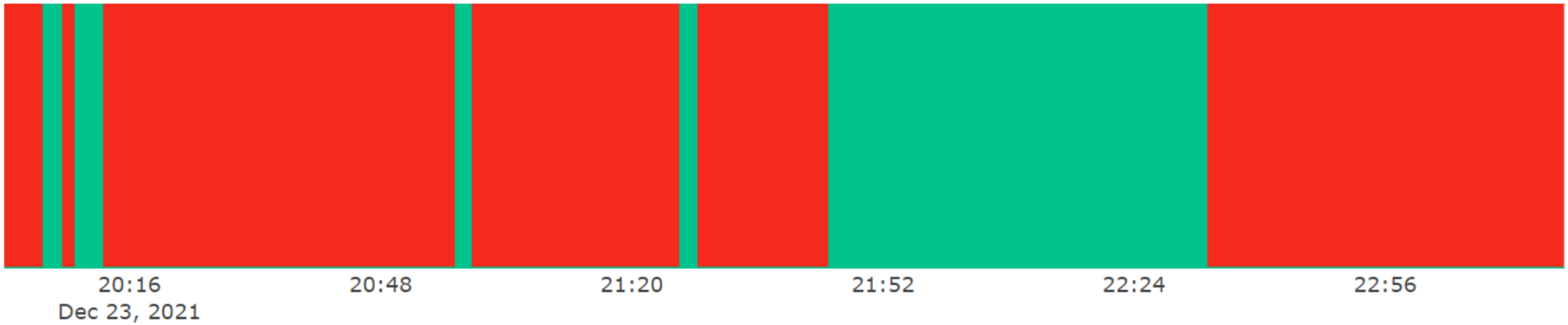
Report problem

Log reason code

LIVE MACHINE STATES

MACHINE	CYCLES	EFFICIENCY	STATUS	DOWNTIME
aas Mini Mill (#1) ver. A	-	- %	INACTIVE	18:35:50 s

ACTIVITY



Applying Artificial Intelligence

Data + Artificial Intelligence

Actionable Insights

- Predict and prevent machine failure
- Predict and prevent bad parts
- Optimize process parameters

Save time, energy, and costs

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Skills & Careers

Key Skills

- Data Analytics
- Attention to Detail
- Information Technology
- Simulation
- Software Development
- Artificial Intelligence/ Machine Learning

Career Opportunities

- Analyst
- Cybersecurity Professional
- Systems Administrator
- Developer

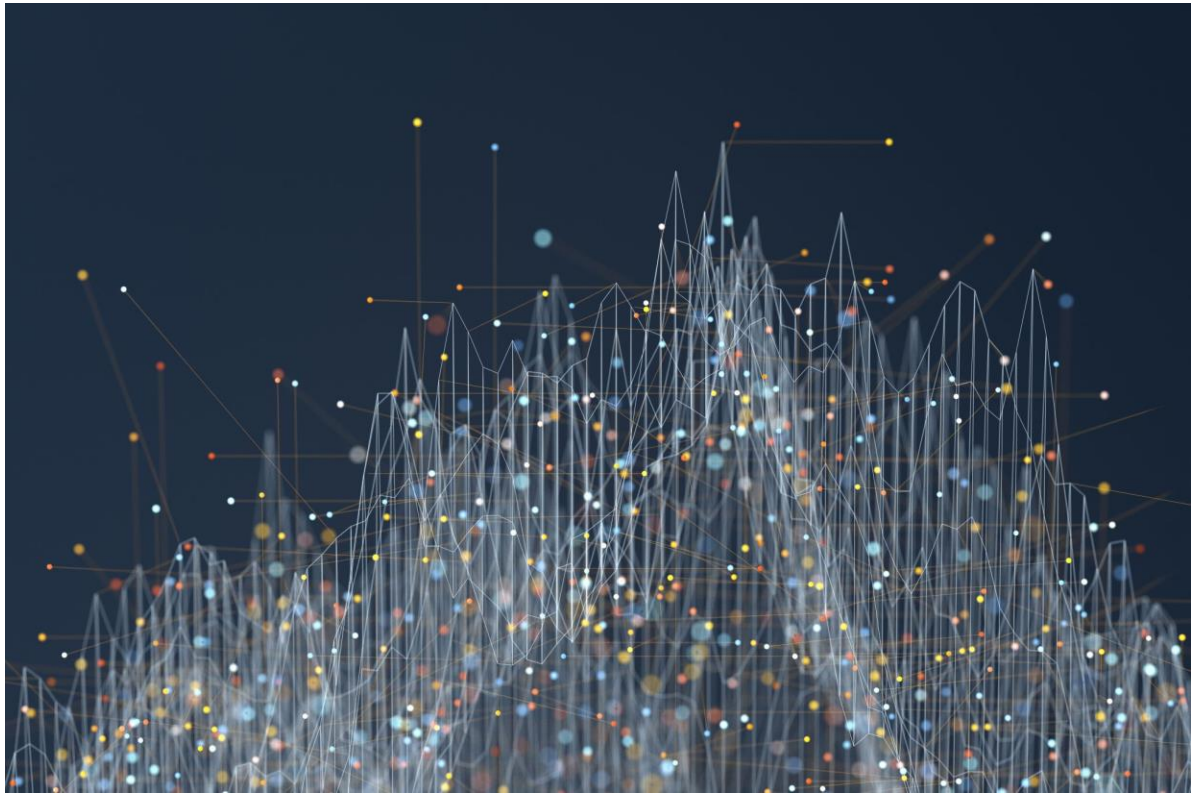
Future Career

- Digital Twin Engineer

The future of work in manufacturing: What will jobs look like in the digital era? , *Deloitte Insights*

Engaging All Students

- Practice collecting data with any type of sensor (vibration, temperature, pressure, light, etc.)
- Analyze large amounts of data for patterns/trends
- Learn about Artificial Intelligence/Machine Learning



Advanced technologies…

Robotics

Adapt based on need

Enable companies to…

Extended Reality

Enhance training, support, and planning

Industrial Internet of Things

Gain actionable insights to save time and costs

Future of Manufacturing + New Careers

Resources for you and your students

- **CTcreates.org**
  - Virtual CT MFG Tours
  - Digital Resources & activities
- **Professional Learning**
  - ATC Tours
  - Trainings for Educators
- **Industry Ambassador Connections**

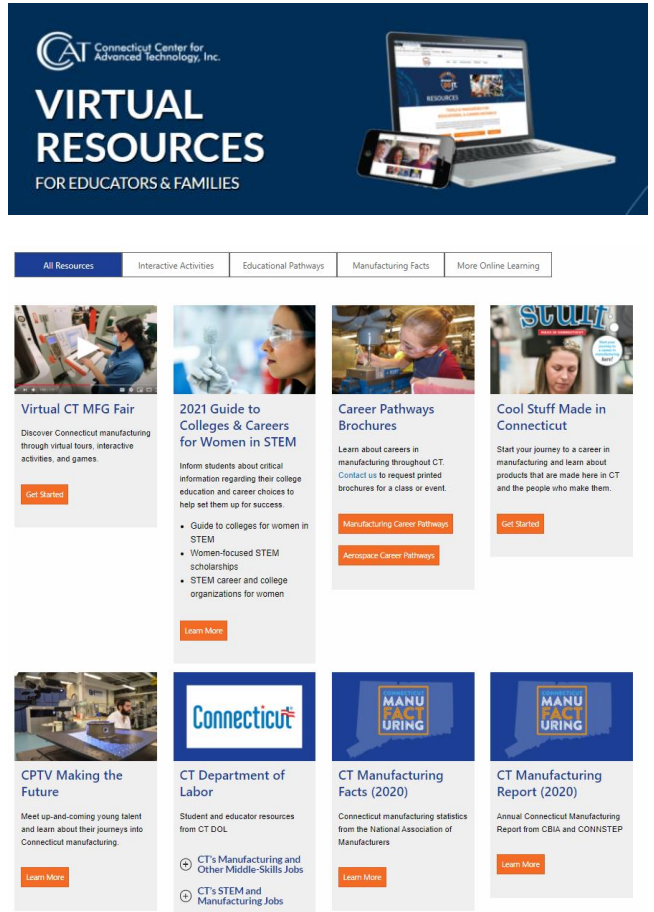
Manufacturing Resources for Educators

CTcreates.org

- Meet CT MFG Companies through recorded videos
- Access Educator Resources online including CSDE materials and Interactive Activities & Games
- Links to resources about Increasing Females in Manufacturing & STEM

Videos

Educator Resources



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Upcoming Tours and Resources

Tour CCAT's Advanced Technology Center to Inspire ALL Students

Thu. April 21, 2:30-4:30pm (In-Person)
Tue. May 17, 2:30-4:30 pm (In-Person)

Summit & Technology Showcase CCAT's Additive Manufacturing

(In-Person or Virtual)
Tue. April 19, 8am-4pm

CAD and CAM Trainings for Educators

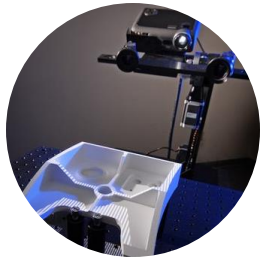
(Virtual)
Wed., April 27, 9am-11am
Wed. May 11, 1pm-3pm

Intro to Manufacturing Careers for Educators

(On-Demand)

Intro to 3D Printing Technologies for Educators

(On-Demand)



Modern Inspection Technologies for Educators

(On-Demand)

Register at *ccat.us/events*

Inspiring the Next Generation

Industry Ambassador/ Maker Multiplier Programs

ccat.us/ambassadors

ecandels@ccat.us

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www.nextgenmfg.org

Thank you!

Leading. Partnering.

… for a stronger tomorrow.

East Hartford, CT

ccat.us/events

@CCATInc

For more information, please contact:

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