INDUSTRY 4.0 CELL
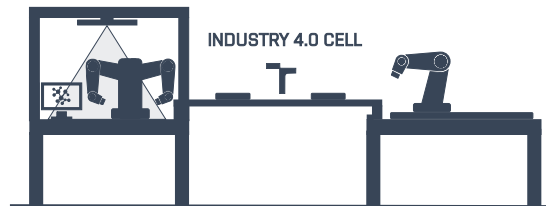
INSTITUTE OF AUTOMATION AND COMPUTER SCIENCE

Institute of Automation and Computer Science
A Brief Overview

Roman Parak

INDUSTRY 4.0 CELL

NETME Centre

FACULTY institute
OF MECHANICAL of automation
ENGINEERING and computer science

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IACS

Cybernetics and Robotics Division (NETME Centre)

Dept. of Automation

Dept. of Applied Computer Science

Dept. of Computer Networks

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Research Activities
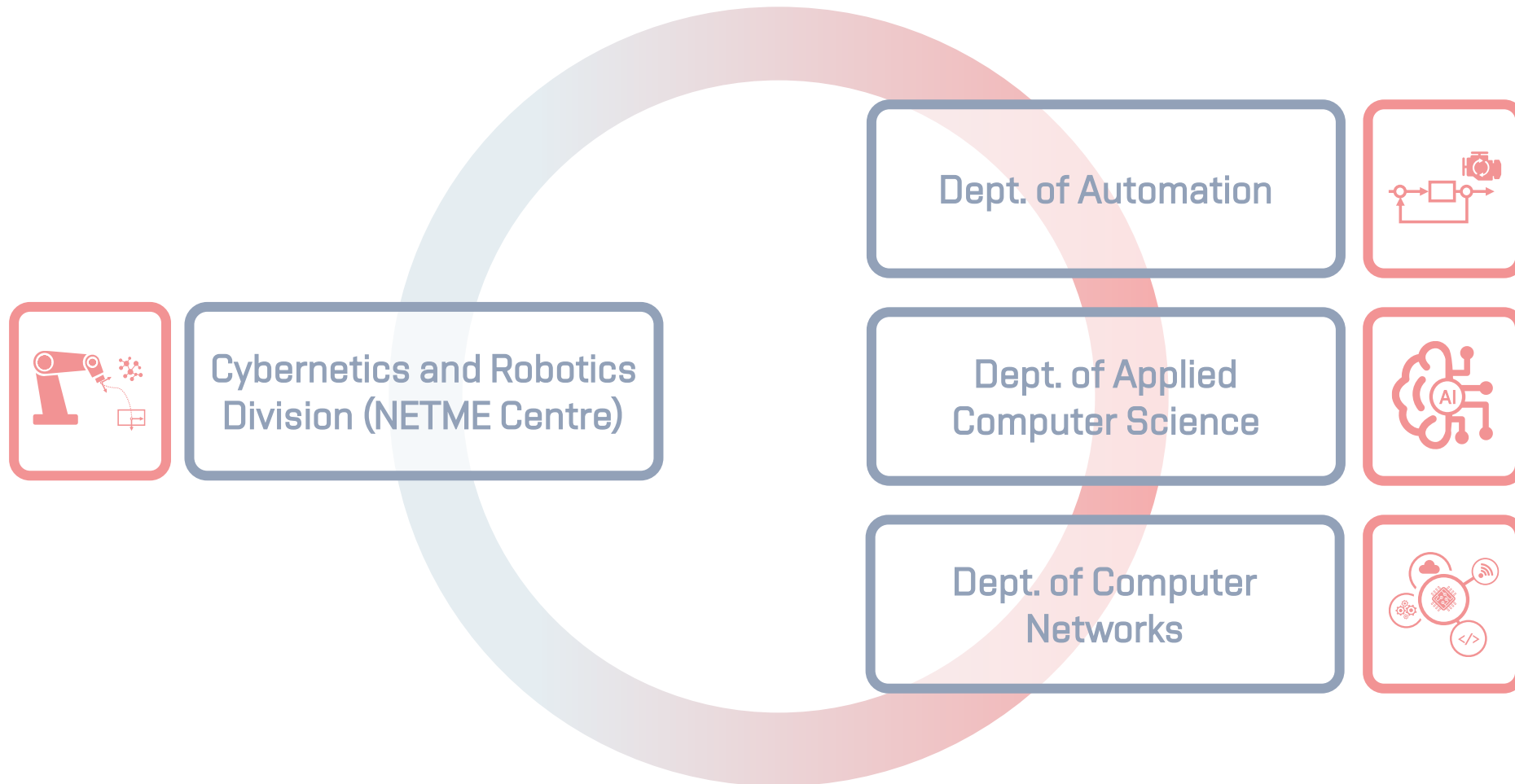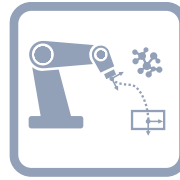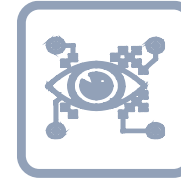
Artificial Intelligence
Machine Learning

Advanced Robotics
Industry 4.0

Computer Vision
Image Processing

Augmented / Virtual
Reality

Optimization
Logistics

Cloud Computing and
Cybersecurity

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Assoc. Prof. Radomil Matousek, PhD.

Director of Department, Head of Laboratory

Contact:
matousek@fme.vutbr.cz

MSc. Roman Parak

Head of Research and Development (R&D)

Contact:
Roman.Parak@vutbr.cz

Assoc. Prof. Branislav Lacko, PhD.

Industry 4.0 Consultant

Contact:
lacko@fme.vutbr.cz

Assistant Professor, Assoc. Prof. & Prof.:

≈ 5

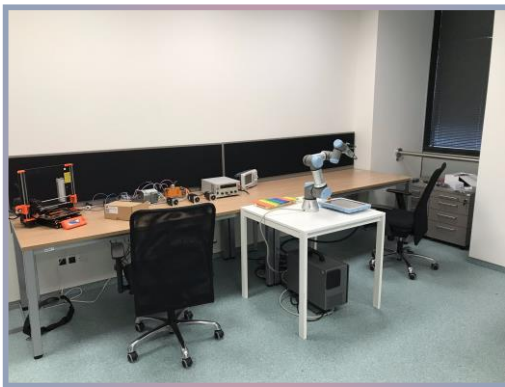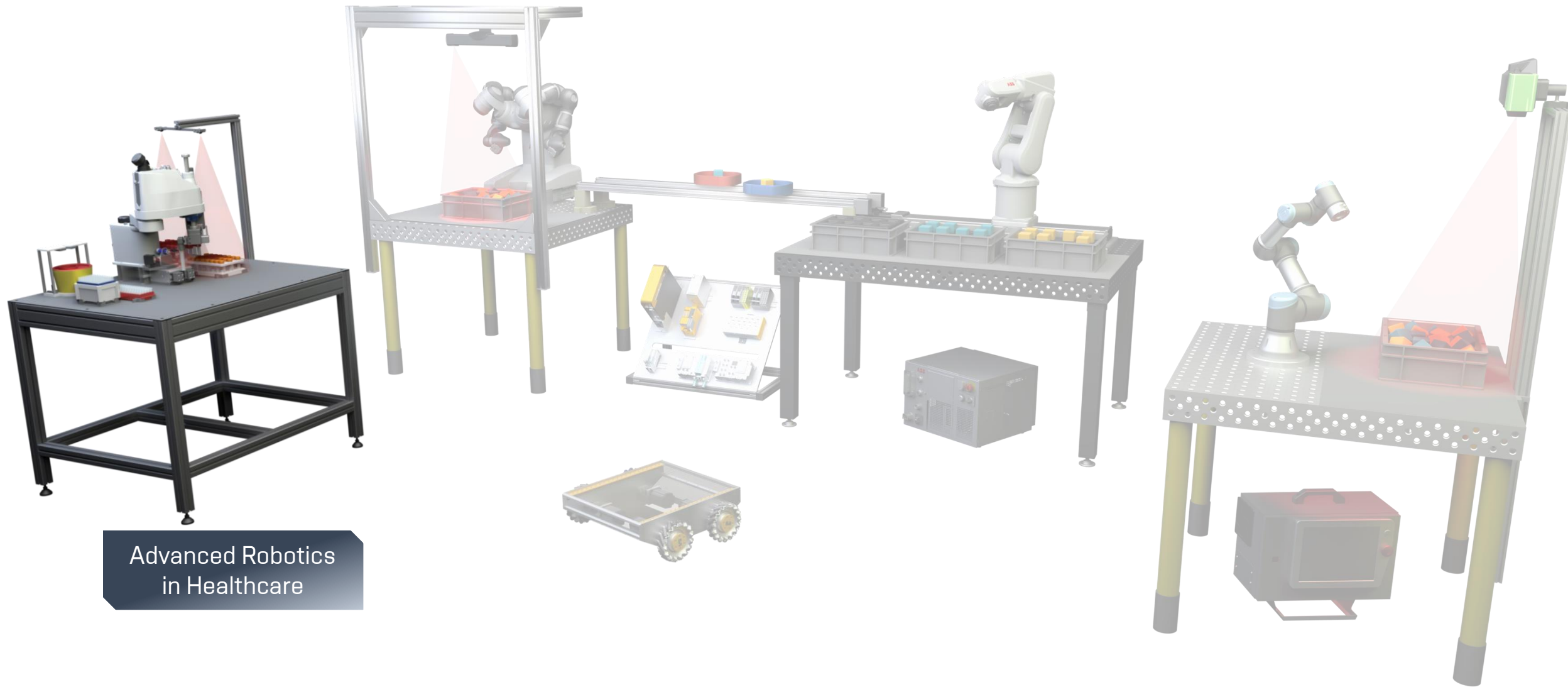**Students (PhD., MSc. & BSc.):**

≈ 20

2019 2020 2021 2022

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Versatile Intelligent Robotics

Robotics & Machine Perception

Advanced Robotics in Healthcare

Mobile Robotics

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in Healthcare

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Mobile Robotics

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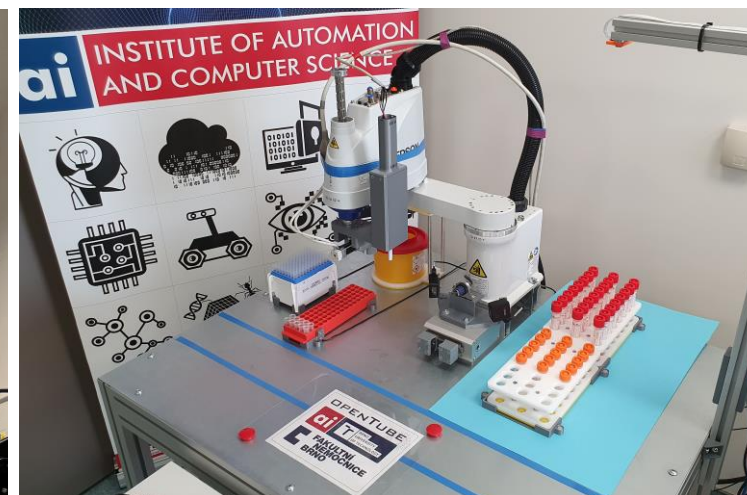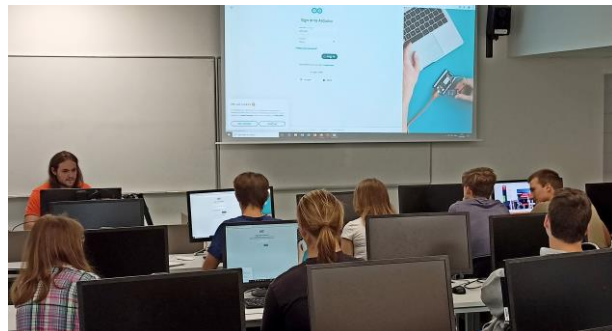ENGINEERING and computer science

Main Activities

- ◉ Lectured courses (Programmable Logic Controllers, Machine Vision, Industry 4.0, AI Algorithms, Neural Networks and Evolution Methods, Programming for robots and manipulators, etc.)

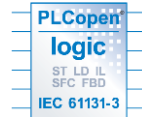- ◉ Doctoral and Bachelor's / Master's theses

Other Activities

- ◉ Workshops, Open Days, Robotics promotion (Science enjoys us, Night of Scientists, Summer University for secondary school students), Robotics Conferences, International Engineering Fair, etc.

- ◉ Brno University of Technology helps with COVID-19

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The main technologies used to teach Robotics and Artificial Intelligence

○ Programming Languages

○ Tools & Technologies

Main Activities

○ Advanced System Integration, Artificial Intelligence Techniques (ML, DL, etc.), Trajectory optimization / Motion planning, Kinematics, Data Analysis and Processing

○ Visual Inspection, Structured / Random Bin – Picking, Human – Machine Collaboration

○ Virtual / Digital Twin (Simulation), Human-Machine Interface, Functional Safety

Other Activities

○ Virtual / Augmented Reality

○ 5G networks, IoT (Internet Of Things), Cybersecurity
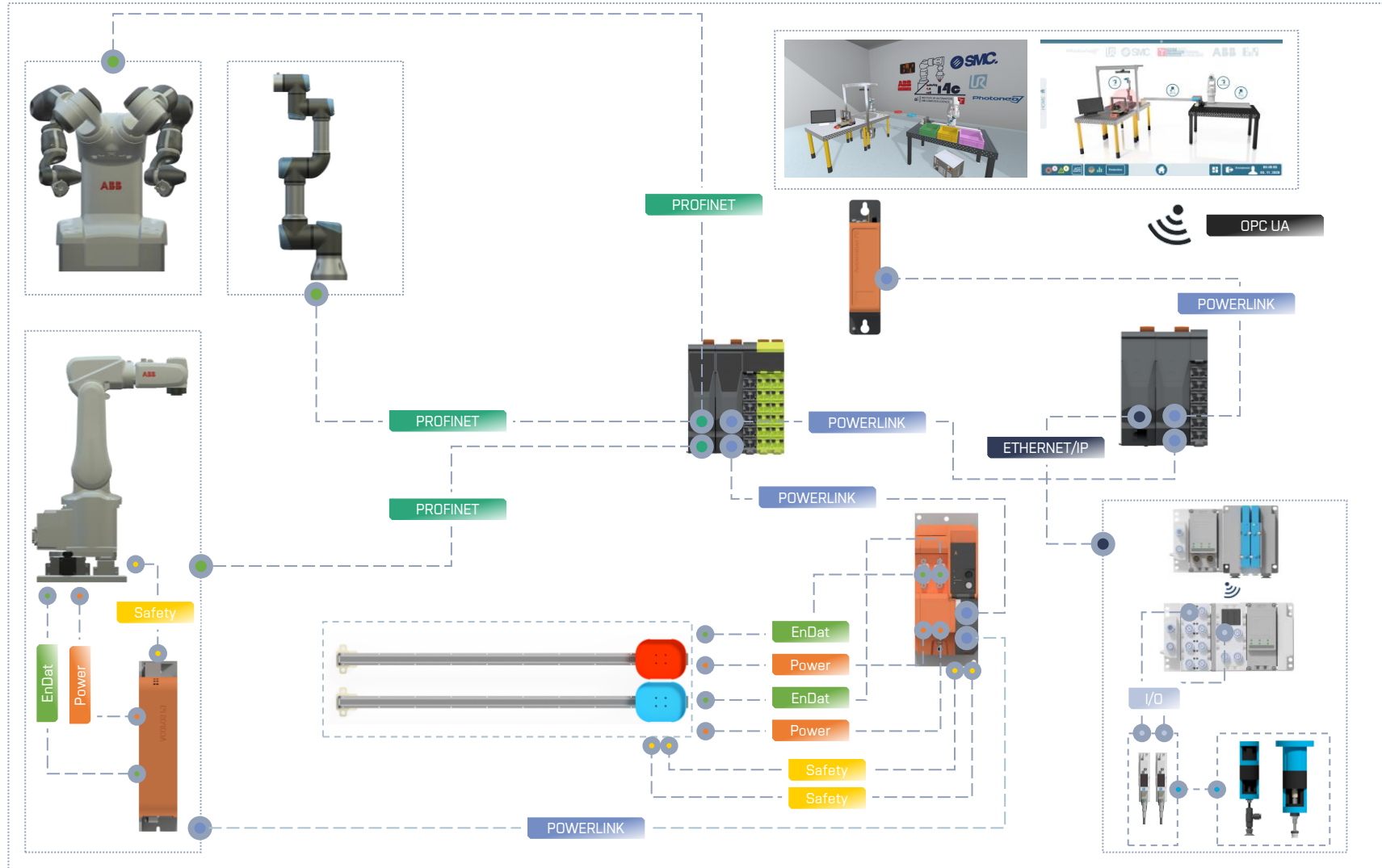
Research Activities

Main Activities

○ **Advanced System Integration**, Artificial Intelligence Techniques (ML, DL, etc.), Trajectory optimization / Motion planning, Kinematics, Data Analysis and Processing

○ Visual Inspection, Structured / Random Bin – Picking, Human – Machine Collaboration

○ **Virtual / Digital Twin (Simulation)**, **Human-Machine Interface**, Functional Safety

Other Activities

○ **Virtual / Augmented Reality**

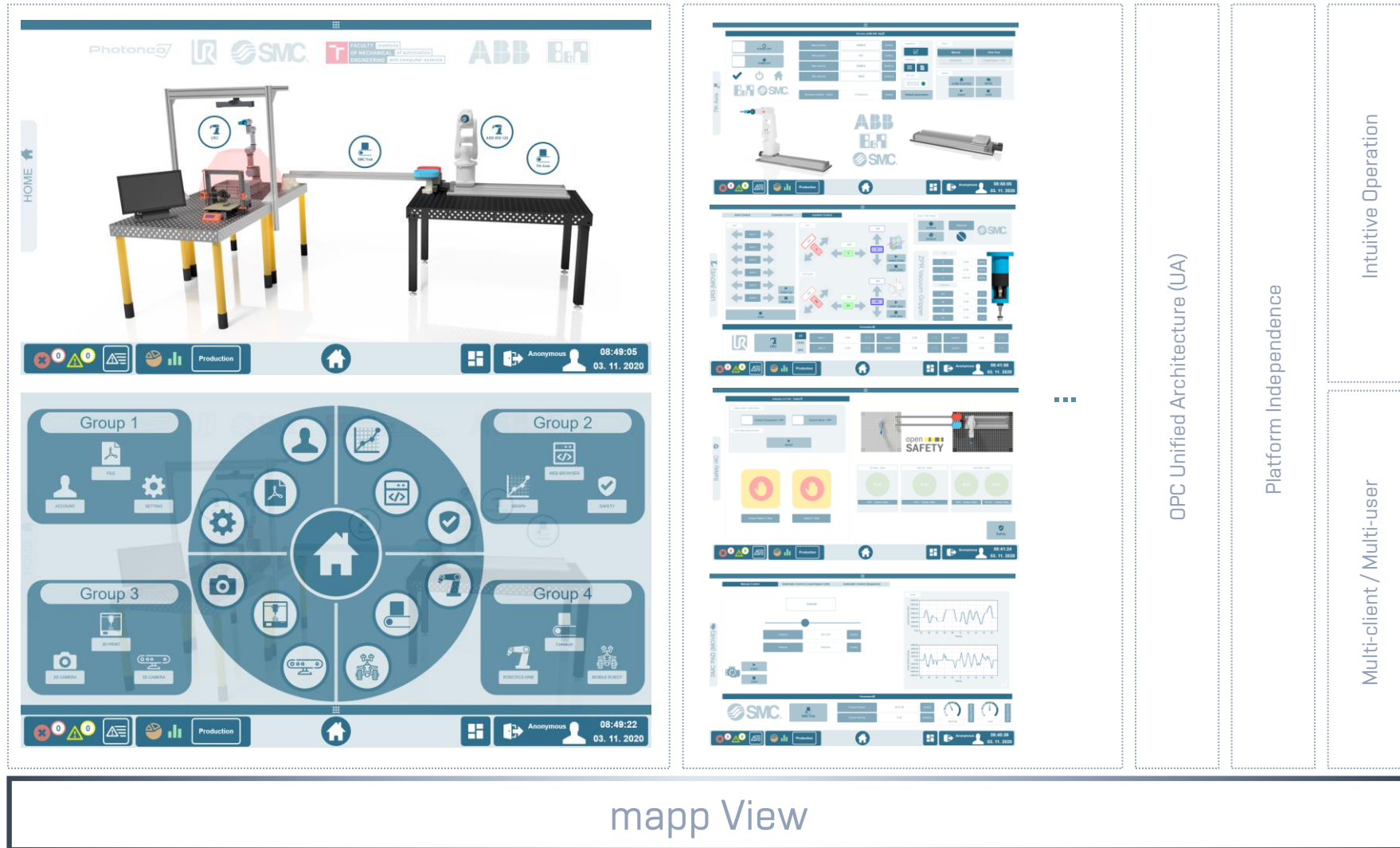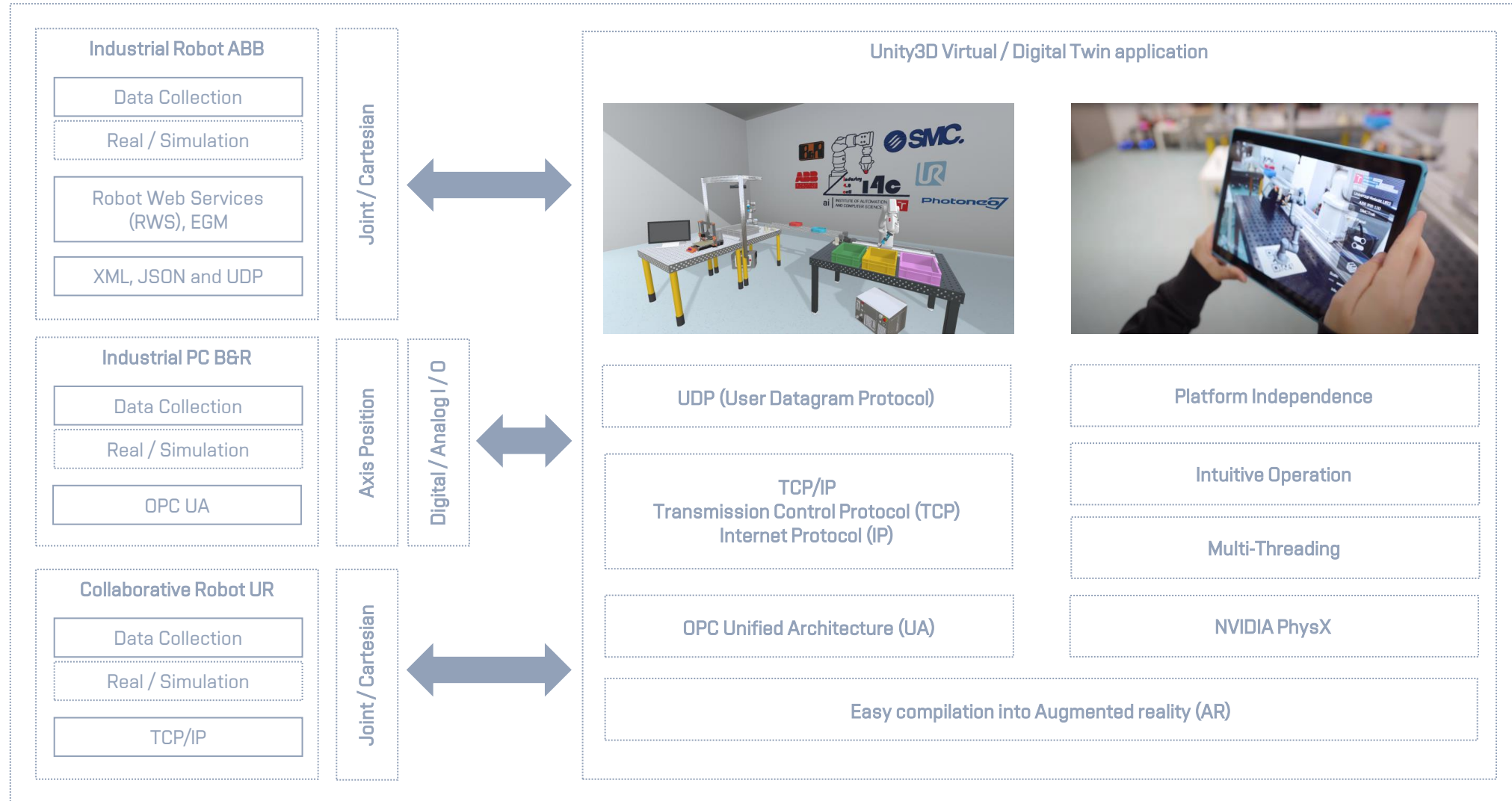○ 5G networks, IoT (Internet Of Things), Cybersecurity

System Integration

POWERLINK
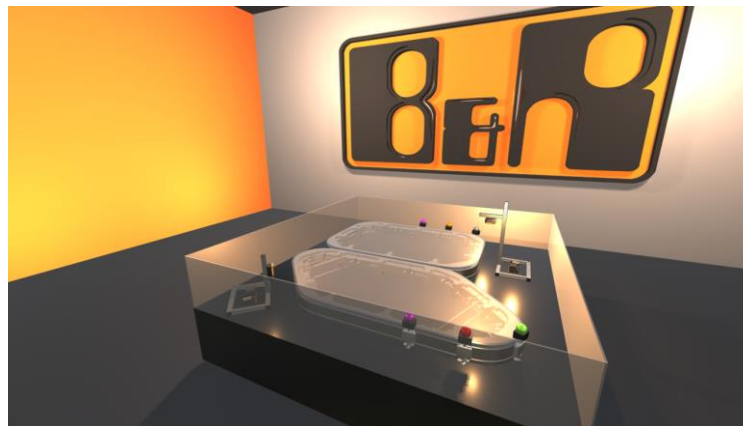
PROFINET

ETHERNET/IP

Digital/Analog I/O

OPC UA

PROFINET

PROFINET

PROFINET

POWERLINK

POWERLINK

POWERLINK

ETHERNET/IP

OPC UA

Safety

EnDat

Power

EnDat

Power

EnDat

Power

Safety

Safety

I/O

POWERLINK

OPC Unified Architecture (UA)

Platform Independence

Intuitive Operation

Multi-client / Multi-user

mapp View

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Virtual / Digital Twin

Industrial Robot ABB

- Data Collection
- Real / Simulation
- Robot Web Services (RWS), EGM
- XML, JSON and UDP

Joint / Cartesian ⟷

Industrial PC B&R

- Data Collection
- Real / Simulation
- OPC UA

Axis Position — **Digital / Analog I / O** ⟷

Collaborative Robot UR

- Data Collection
- Real / Simulation
- TCP/IP

Joint / Cartesian ⟷

Unity3D Virtual / Digital Twin application

- UDP (User Datagram Protocol)
- TCP/IP Transmission Control Protocol (TCP) Internet Protocol (IP)
- OPC Unified Architecture (UA)

- Platform Independence
- Intuitive Operation
- Multi-Threading
- NVIDIA PhysX

Easy compilation into Augmented reality (AR)

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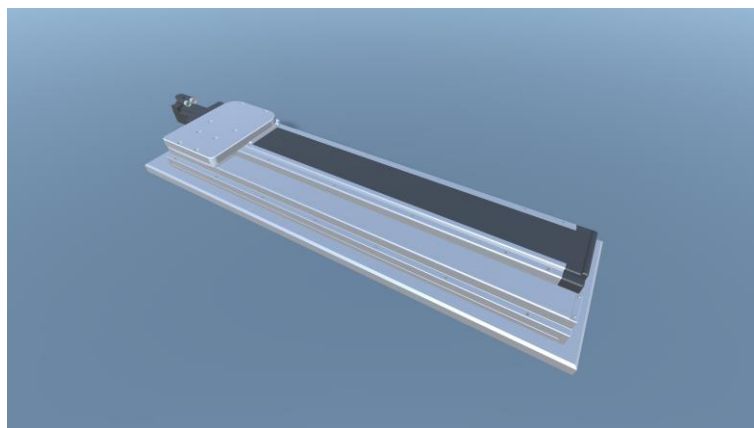ENGINEERING and computer science

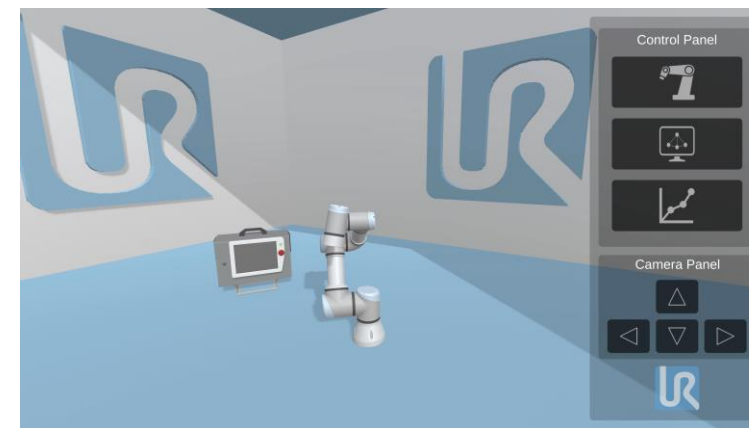Industry 4.0 Cell: Sorting Line

B&R Automation ACOPOStrak

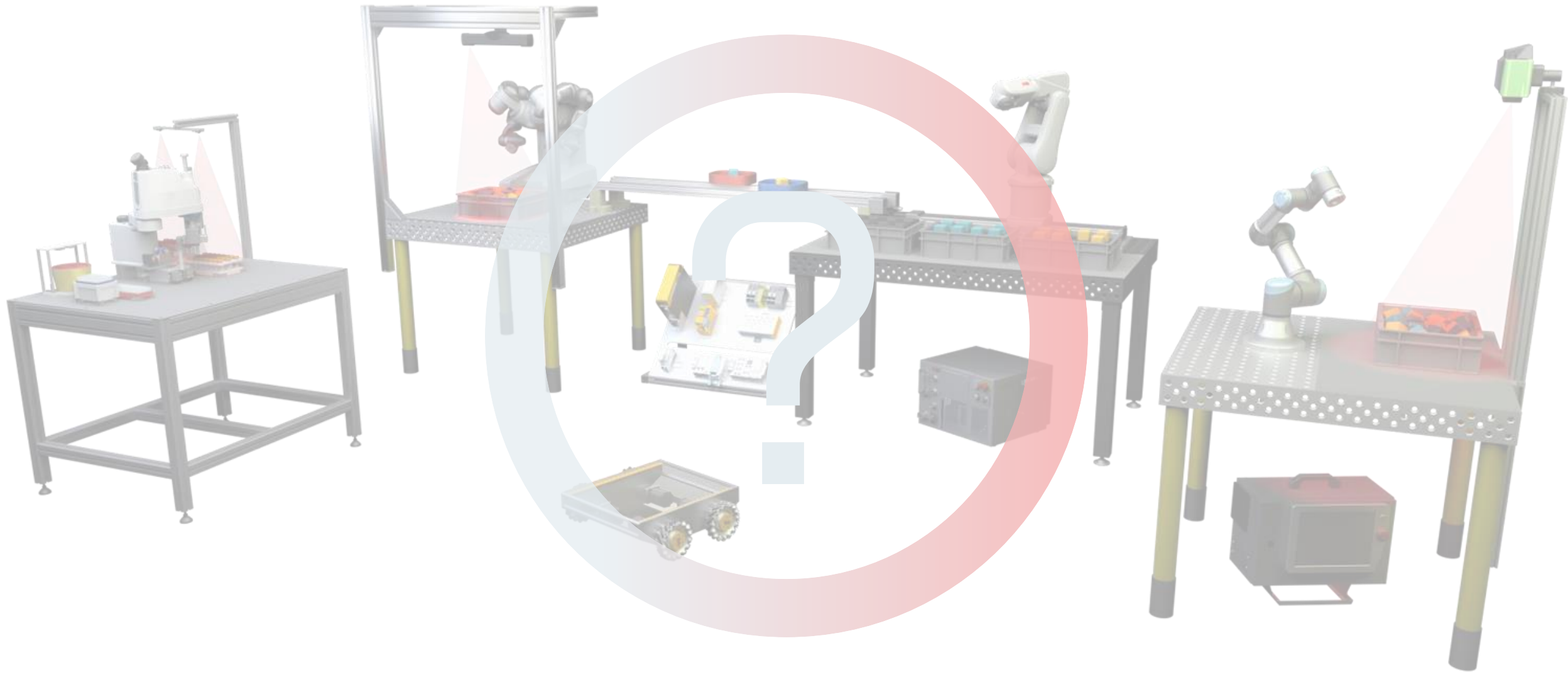Industrial Robot ABB IRB 120

Simple Linear Axis (B&R Automation, SMC)

Sorting Machine (B&R Automation, SMC)

Collaborative Robot Universal Robots UR3

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Vision of the
Future

Contact

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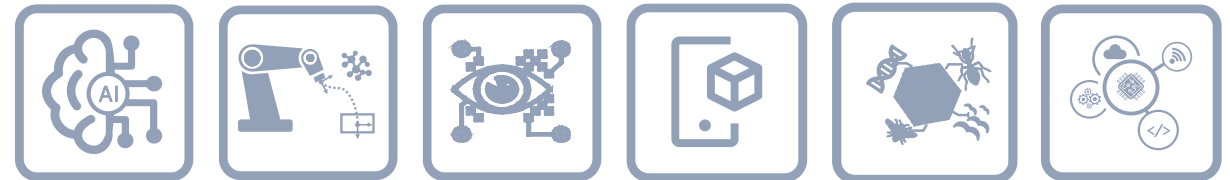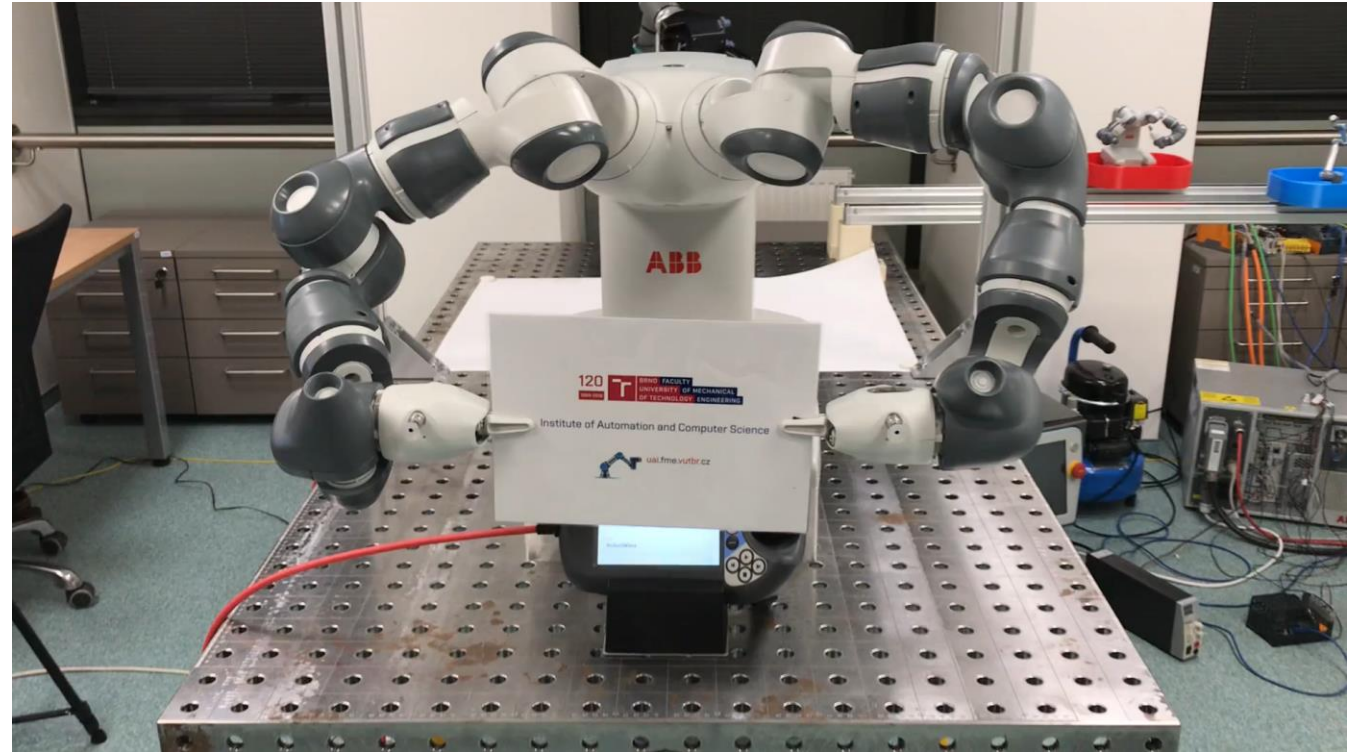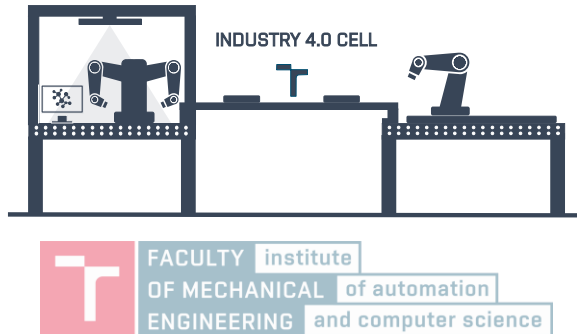**Radomil Matousek**
Director of Department

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Thank You!

Questions?

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