

INSTITUTE OF AUTOMATION AND COMPUTER SCIENCE



Industry 4.0 Cell (I4C): A Brief Overview

Roman Parak









Content



1.	Institute of Automation and Computer Science
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- 2.1 Organization Structure
- 2.2 Industry 4.0 Cell (I4C) at the IACS
- 2.3 Educational Activities
- 2.4 Research Activities
- 3. Vision of the future
- 4. Contact

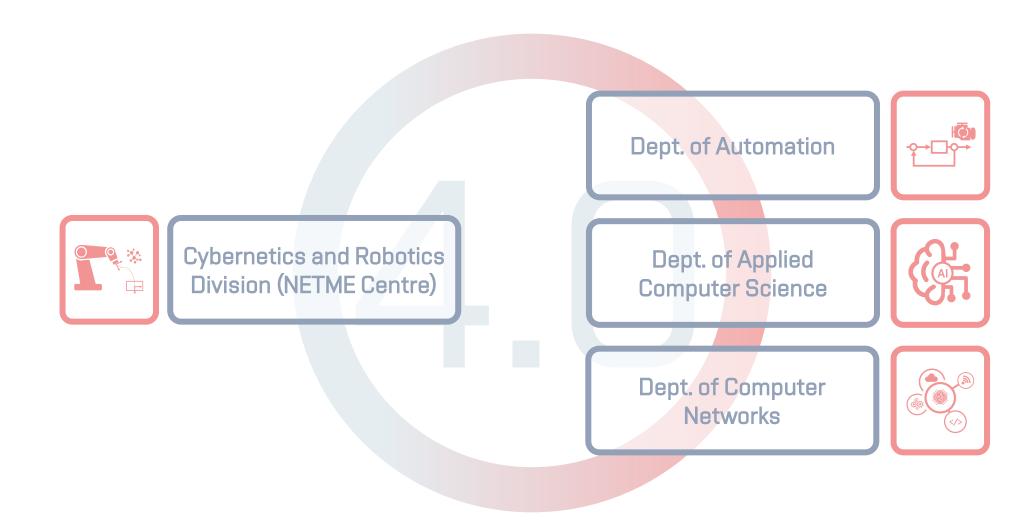




IACS

Institute of Automation and Computer Science







Research Activities





Artificial Intelligence Machine Learning



Advanced Robotics Industry 4.0



Computer Vision Image Processing



Augmented / Virtual Reality



Optimization Logistics



Cloud Computing and Cybersecurity





Partners & References

























Industry 4.0 Cell

Organizational Structure



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



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Roadmap: Design & Construction of a Robotic Cell











2019

2020

2021

2022









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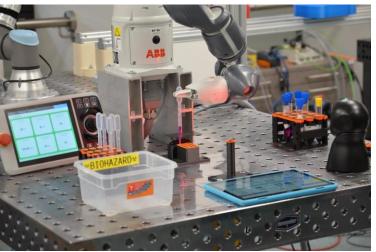










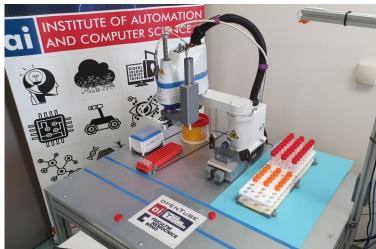


















Educational Activities



Main Activities

- Lectured courses (Programmable Logic Controllers, Machine Vision, Industry 4.0, Al 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





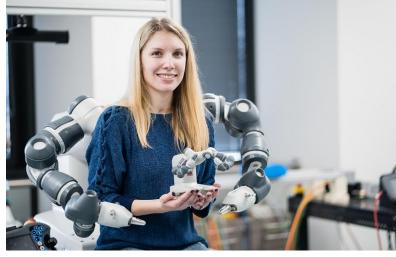
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Educational Activities





















@ IACS

Technologies



The main technologies used to teach Robotics and Artificial Intelligence

Programming Languages

















































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
- O 5G networks, IoT (Internet Of Things), Cybersecurity





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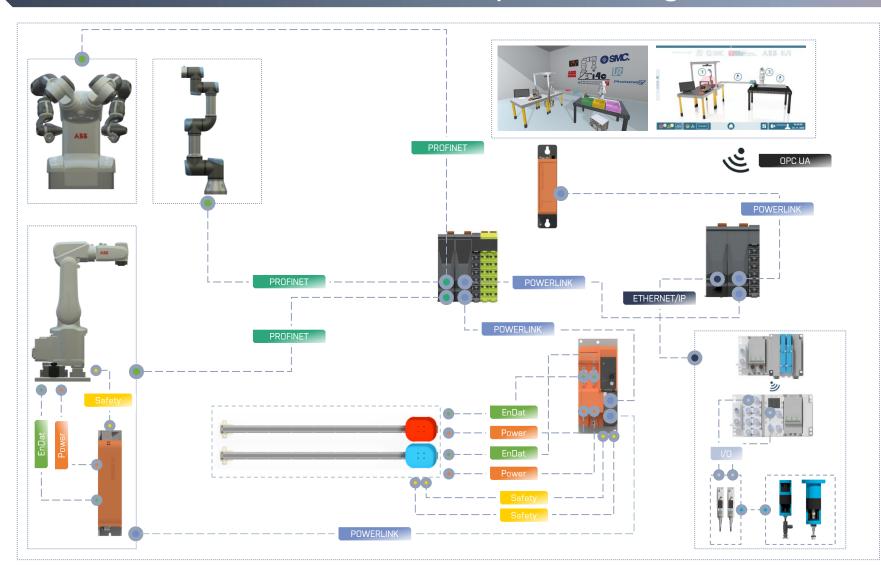




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System Integration





POWERLINK

PROFINET

ETHERNET/IP

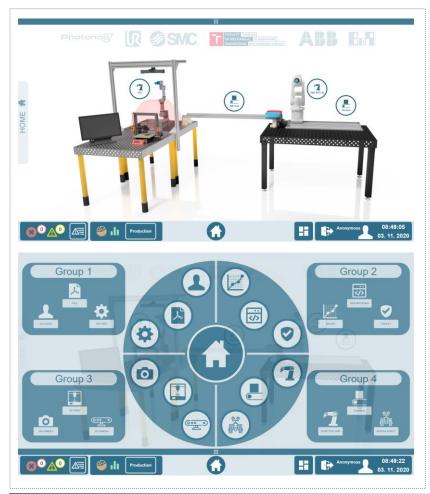
Digital/Analog I/O

OPC UA



Human – Machine Interface







OPC Unified Architecture (UA)

Platform Independence

Multi-client / Multi-user

Intuitive Operation

mapp View





Virtual / Digital Twin





Data Collection

Real / Simulation

Robot Web Services (RWS), EGM

XML, JSON and UDP

Joint/Cartesian

Unity3D Virtual / Digital Twin application





Industrial PC B&R

Data Collection

Real / Simulation

OPC UA

Digital / Analog I / 0

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)



Data Collection

Real / Simulation

TCP/IP



Axis Position







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Unity3D Application Portfolio





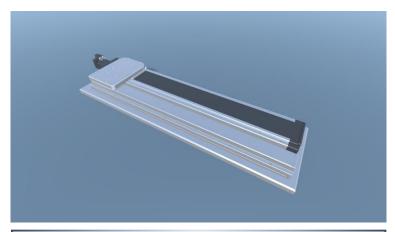
Industry 4.0 Cell: Sorting Line



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





Vision of the Future

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Vision of the Future







Contact

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Contact:

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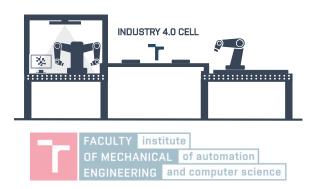
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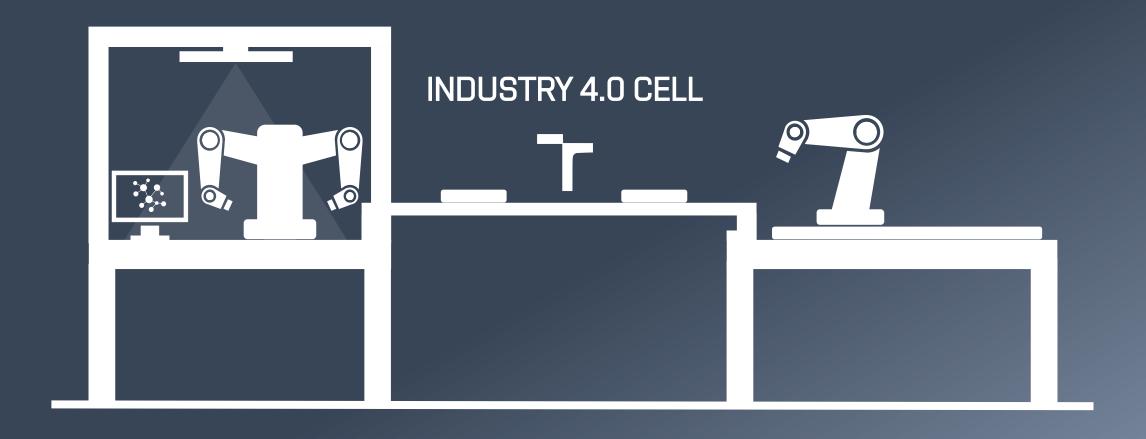


Thank You!



Questions?





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