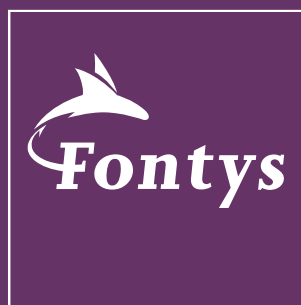




> FOR SOCIETY

System Integration in Robotics

Connexus 2026

Varna, Bulgaria

6 October 2026

Lec.Dr.Ir. Teade Punter

Professor (lector) High Tech Embedded Software &
Leading Professor Centre of Expertise AI for Society

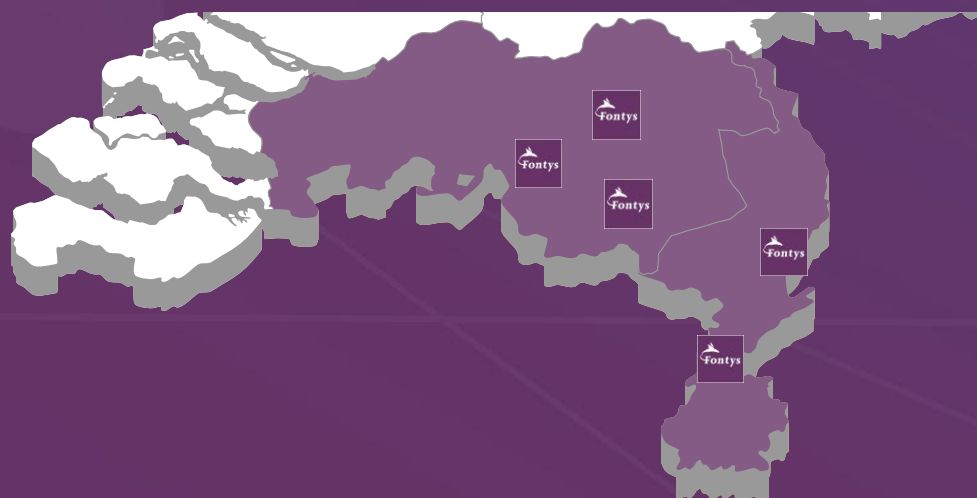


Fontys Hogeschool - University of Applied Sciences

Developing talent and knowledge

Contributing to a sustainable, inclusive and vibrant society

Partnering in Brainport with:



Applied research with education
focus on SMEs e.g., in high tech,
<https://www.youtube.com/watch?v=-uwckqtzAm8>



39.883 students, Associate Degree, Bachelor, Master



5.371 employees



39 research groups (lectoraten)



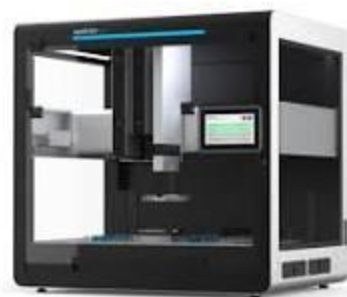
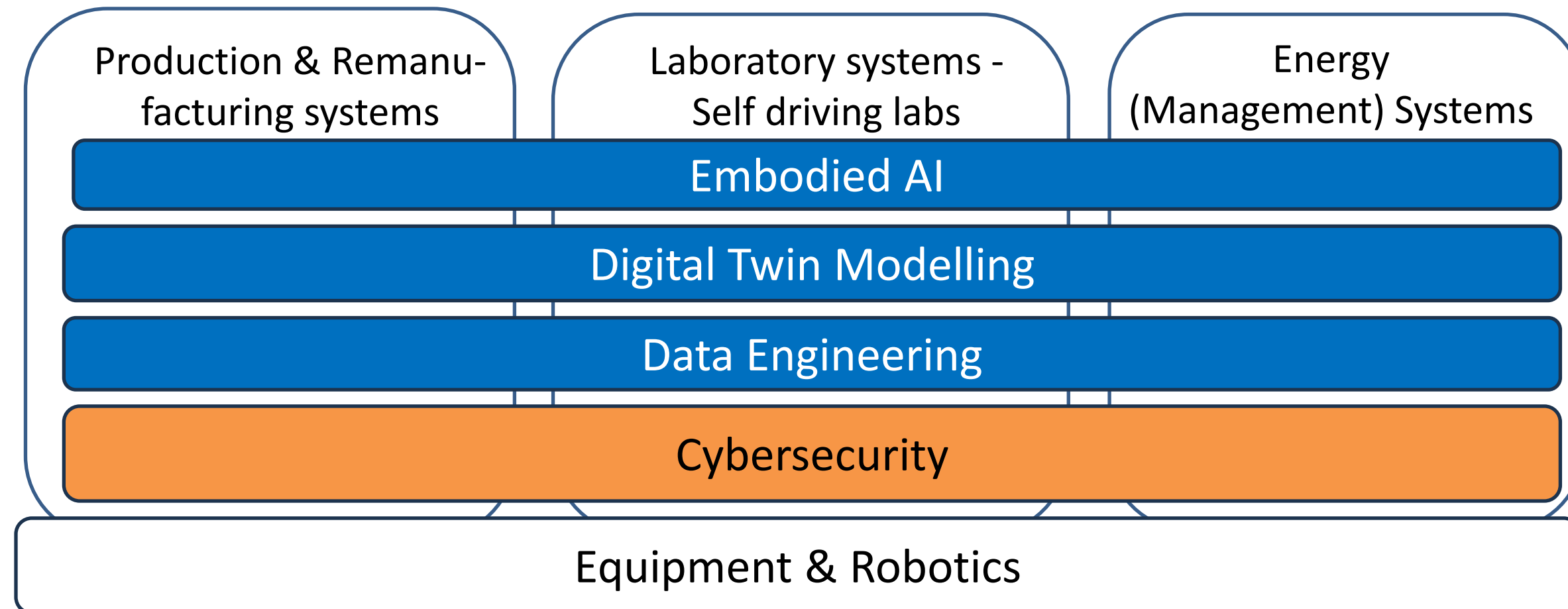
18 institutes

Brainport



Introduction HTES Research Group

'We do applied research on smart systems'



Pipetting robot



Robotarms



Delivery & Transport Robots

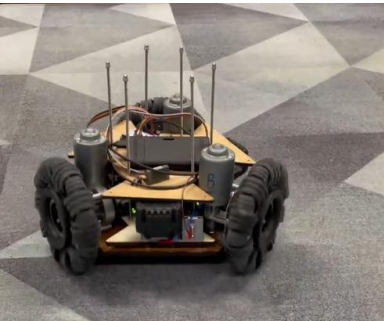


Self Driving Car

Our pathway into robotics



Soccer robot - autonomy



Self Driving Car –AI engineering



2018

2022

2026

Robocup MSL



international scientific initiative
goal to advance the state of the art of intelligent robots
mission: field a team of robots capable of winning against the
human soccer World Cup champions by 2050
Autonomous robots



Robocup MSL – student projects



Customizing the challenges
System architecture
Facilities & tooling
Knowledge management
Community of practice



TABLE I TIMELINE OF STUDENT PROJECTS FROM 2016 ON (NUMBER OF STUDENTS PARTICIPATING / NUMBER OF GROUPS)

	Curricular program		Extra curricular by team (5-6)
	Semesters 4, 6 & 7 ICT & Techn, Embedded Syst.	Graduation assignments	
2016 Fall	Robot I ⁸ – Driving (18/3)		
2017 Spring	Robot I – Camera (12/2)		
2017 Fall	Robot I – Positioning (6/1)		Camera & positioning (2)
2018 Spring		Intelligence simulator (1)	Ball handling (2)
2018 Fall		Refbox (1)	
2019 Spring	Soccer skills programming (5/1)		Continuous Integration software (2)
2019 Fall	Soccer skills programming II (4/1)	3D Simulator – Gazebo (1), Localization with AI (1)	Run own software on robot II hardware (4), RTDB (2)
2020 Spring	Game strategies (4/1)	3D Simulator – Unity (1)	Robot III hardware development (3), RTDB (1)
2020 Fall		Augmented Reality I (1)	Robot III hardware development (2)
2021 Spring		Augmented Reality II (1)	
2021 Fall			API for Robot II (2)
2022 Spring		Behavior Trees for robot II (1)	
2022 Fall			Robot III hardware development (1)
2023 Spring	Behavior Trees for robot II (4)		Robot III hardware development (1)

Punter, Robocup MSL as platform for learning and applied research, Proceedings EAEEIE 2023



RDW Self Driving Challenge



AI-Based Autonomous Driving

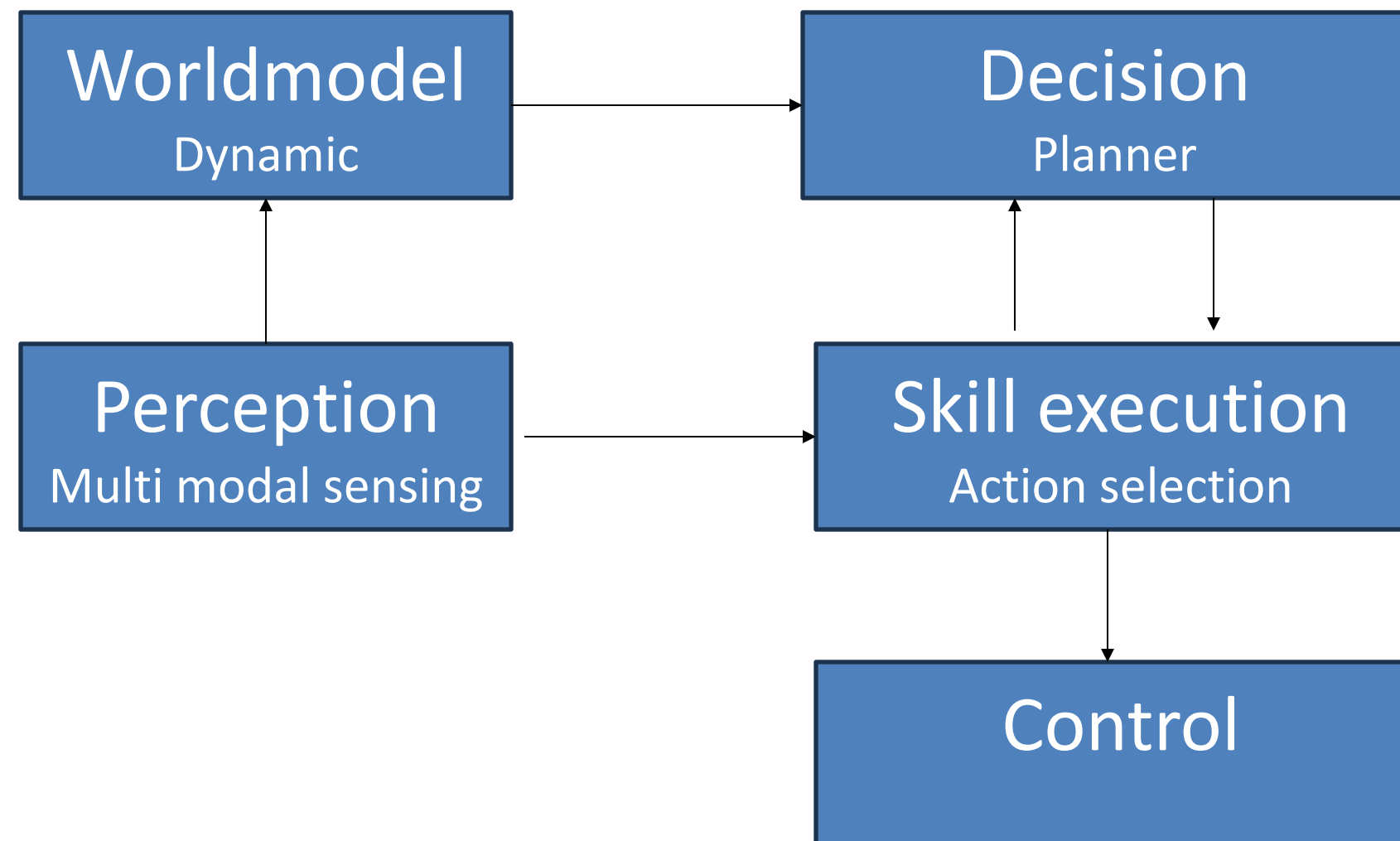
The RDW's Self Driving Challenge 2024



AI Engineering
Drone technology
Apply and testing AI-models

AI System Integration approach

- Modular architecture & implementation
- Robust behavior + explainable AI
- Layered: not only specific AI-models



Our pathway into robotics



Social robots, care



Military UGV



Delivery &
Transport Robots



UGV/UAV



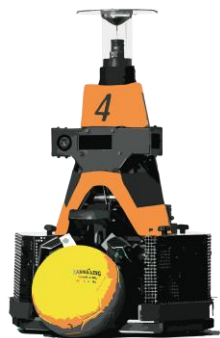
Manufacturing robots

2018

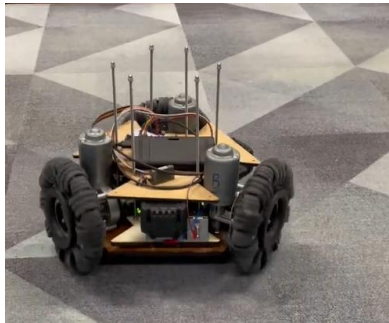
2022

2026

Our pathway into robotics



Soccer robot - autonomy



Self Driving Car –AI engineering



Social robots, care



Military UGV



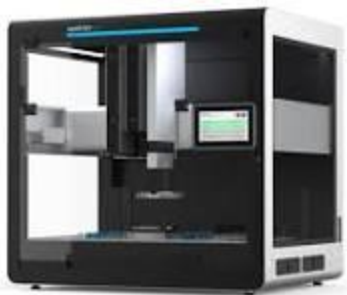
Delivery & Transport Robots



UGV/UAV



Manufacturing robots



Laboratory robots



2018

2022

2026

- Dutch chemistry research is front-runner in complex molecular systems
- The transition to circular, healthier and more sustainable economy requires a transformation of chemistry
- AI-driven approach to formulation discovery, combining autonomous experimentation with large-scale experimental data generation.
- Formulated products become increasingly complex, while development remains on experimentation and empirical optimization
- Accurate AI models require reliable and well-structured data

Big Chemistry Robotlab consortium

AMOLF
physics of
functional complex matter



rijksuniversiteit
groningen



Radboud Universiteit



noviotech
campus



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TU/e



(PhD) Researchers:

- Python, scripting language
- Direct need for the data (hot data)

ICT, Software & data engineering:

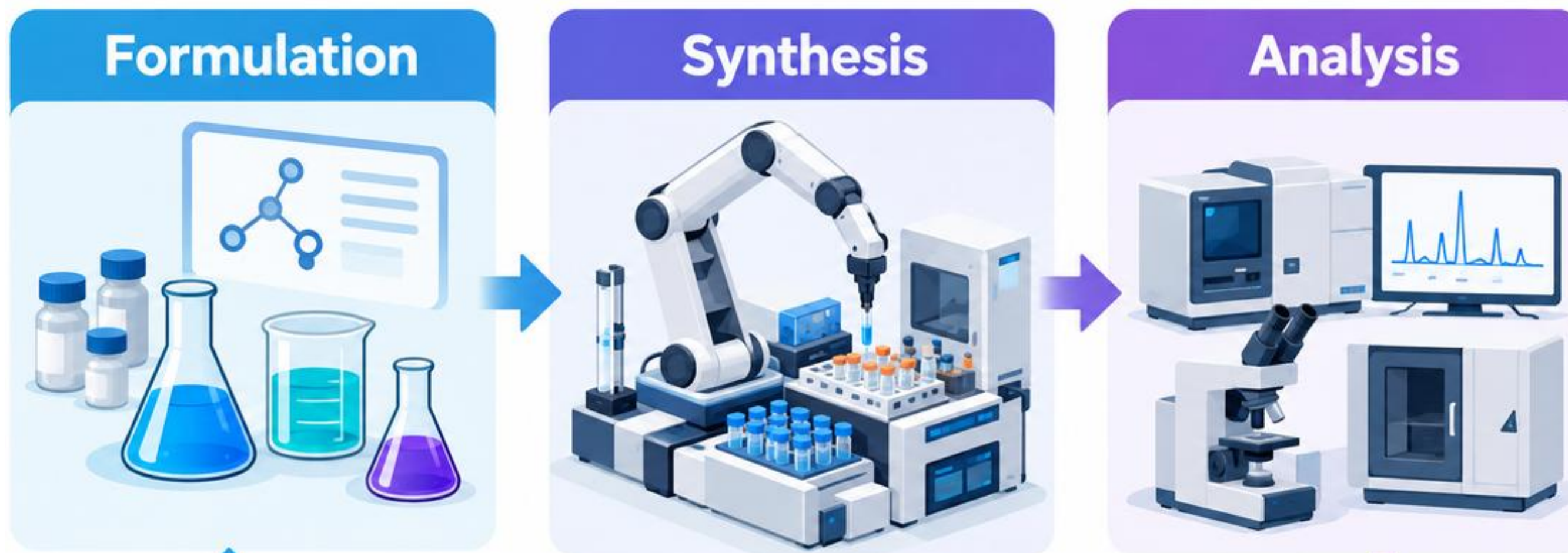
- Python, but also aim at robust & reusable system components
- Hot & cold data

Therefore, this workshop on ICT infrastructure

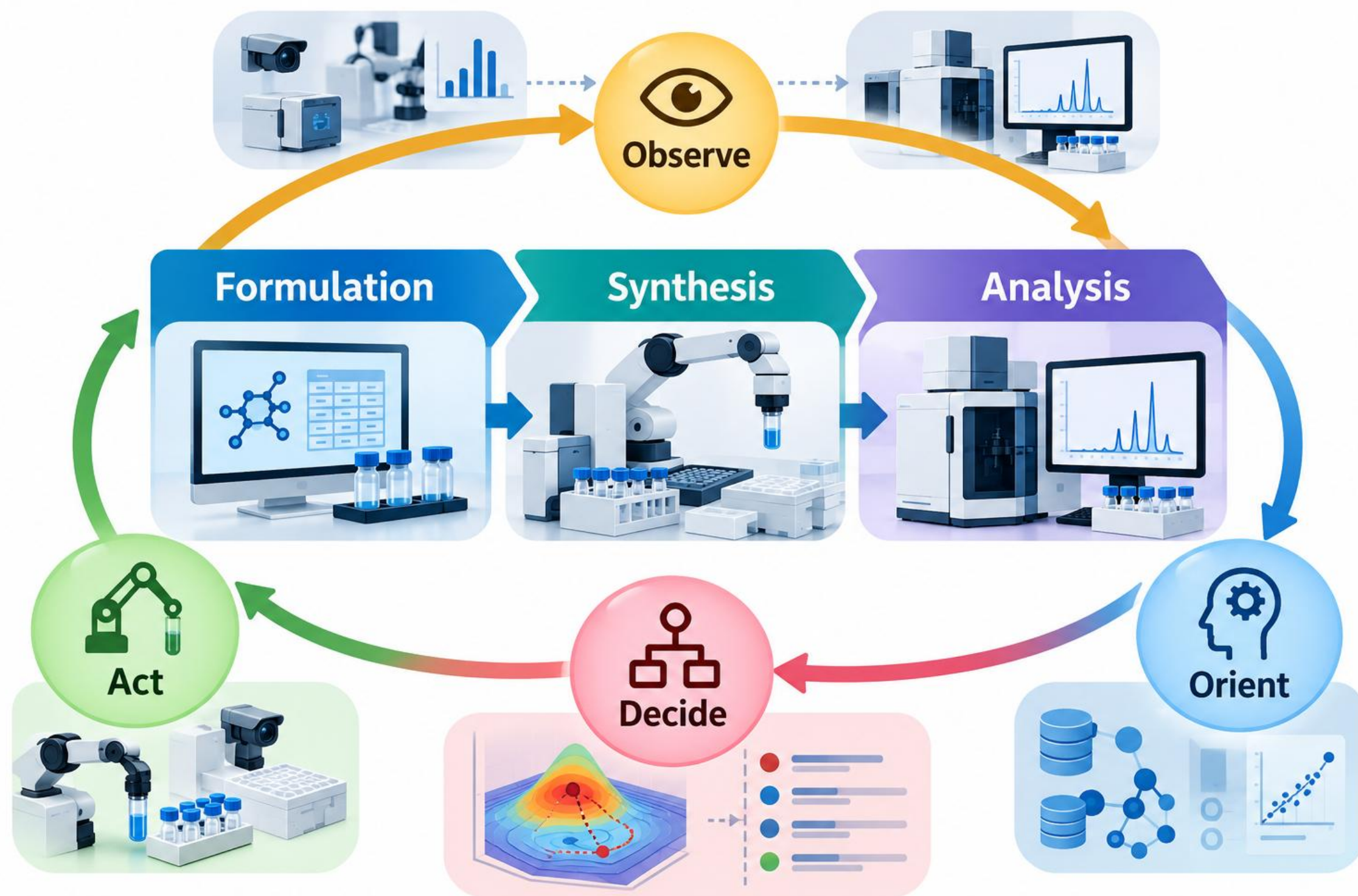
- Many aspects, e.g.,



We focus on software development, data management & cybersecurity
Need for system integration



Self driving lab – OODA loop





OpenTrons Flex - Robot
sample preparation



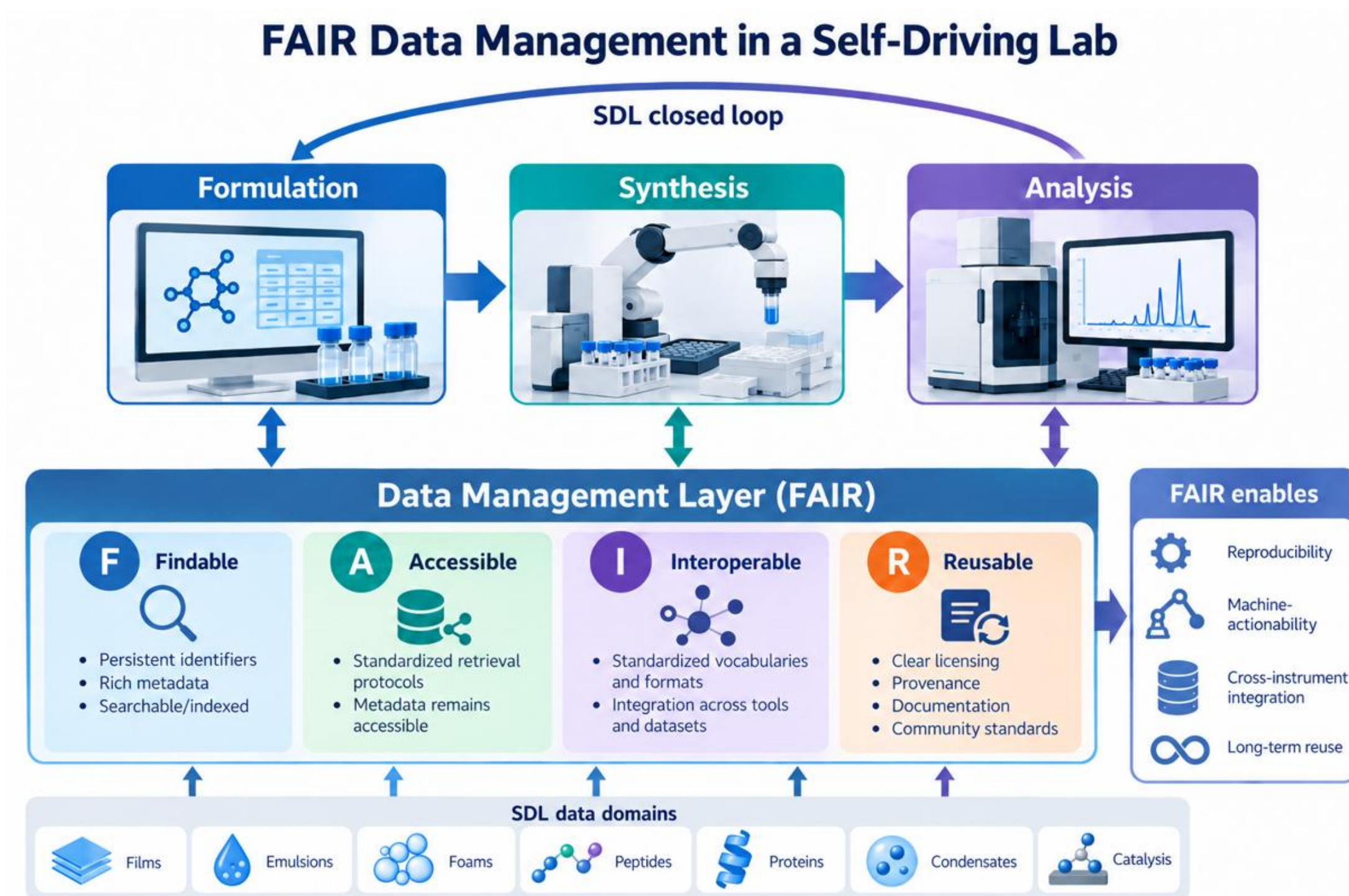
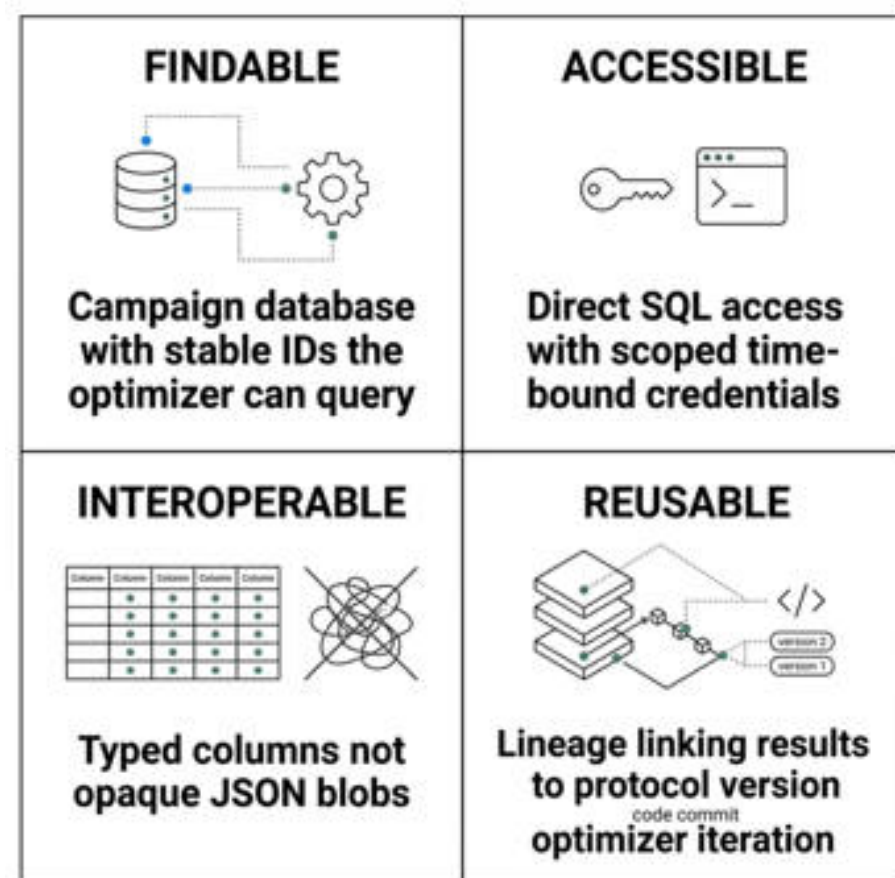
Robot arm
sample transfer



Tecan Spark
spectral analyzer

Self driving lab - robotics





Developing the SDL-infrastructure

Simulation – scheduling
Omniverse, FTI, ..

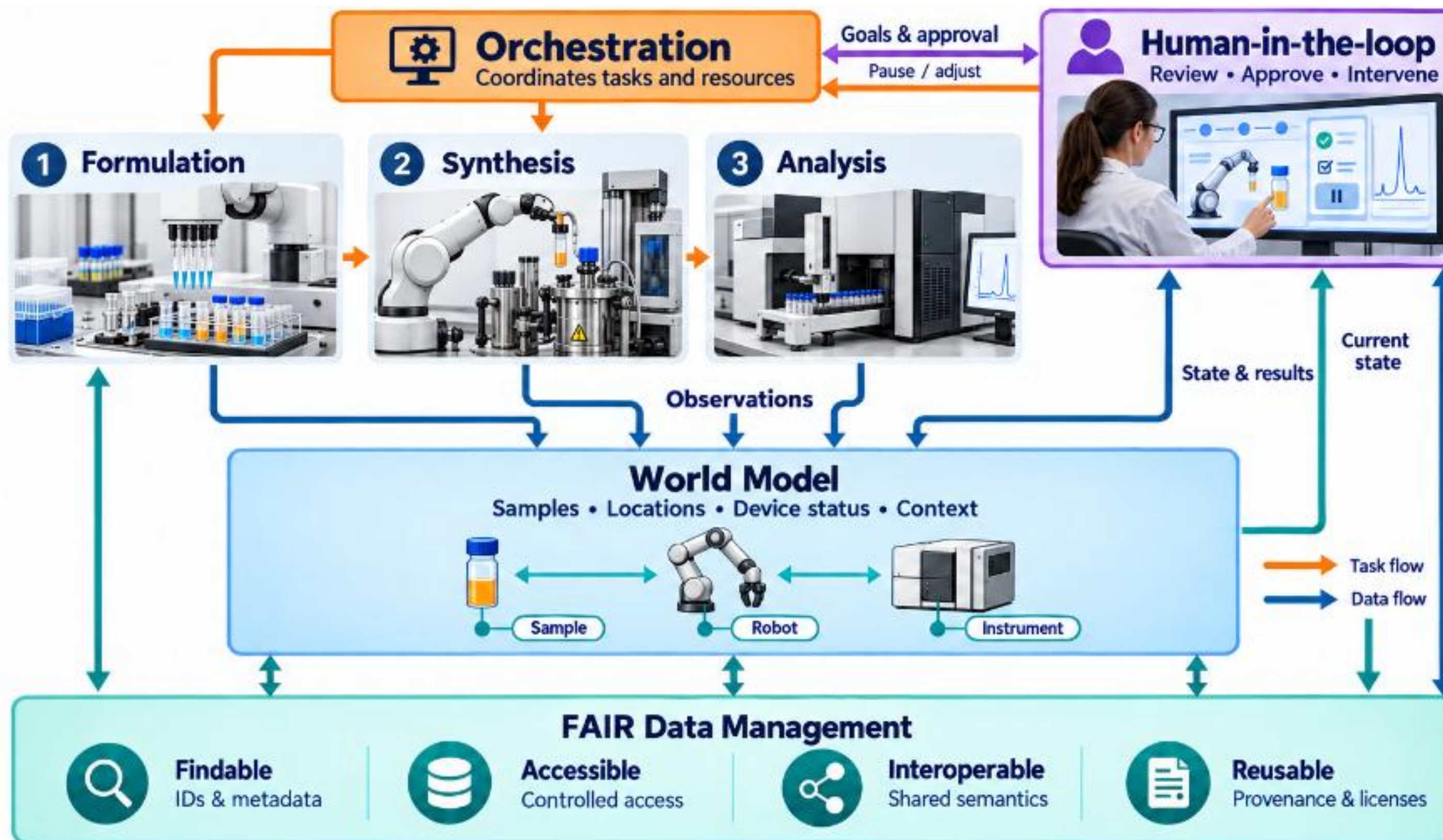
Sw development - Orchestration (OODA)
Modelbased (DSL), EOS, agent programming

Communication
for equipment – SILA2

Data management
- FAIR/NOMAD

(Modelbased) testing & Cybersecurity-by-design

Robot System integration



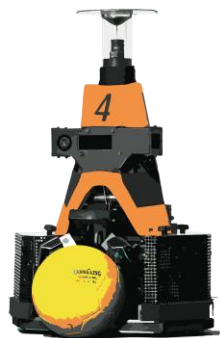
System Integration Robotics

- System of robots
- Orchestration and equipment status
- IT aspects: data management, cybersecurity, model-based...
- World models - System memory

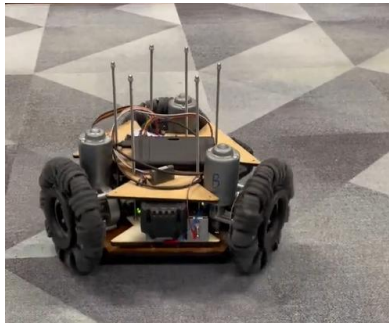
Application areas, e.g.,



Questions or remarks?



Soccer robot - autonomy



Self Driving Car –AI engineering



Social robots, care



Military UGV



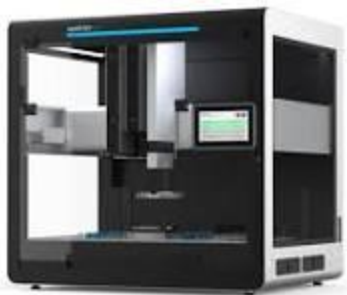
Delivery & Transport Robots



UGV/UAV



Manufacturing robots



Laboratory robots



2018

2022

2026

Research Group High Tech Embedded Software

Fontys ICT & Fontys Hogeschool

Centre of Expertise AI for Society & HTSM



> FOR SOCIETY

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Amy Latour - a.latour@fontys.nl (lectoraatsmanager)

<https://www.fontys.nl/Onderzoek/High-Tech-Embedded-Software.htm>

