

Moving Towards Gesture Recognition and Self Programming

Deutsche Messe Technology Academy

11. Robotics Congress 2022

Reaching The Goal Faster With Smart Cobots

26 April 2022

TABLE OF CONTENTS

- ROBODER Introduction
- What is a "Robot"?
- Robot Programming History
- Robot Programming Solutions – Yesterday
- Robot Programming Solutions – Today
- Robot Programming Solutions – Today to Future
 - Innovative Programming & Learning Methods
 - What is Self Programming?
 - Sensor Fusion
 - Internet of Robotic Things

About ROBODER

- Founded in 2018
- 44 members
 - Robotic equipment manufacturers
 - System integrators
- Increasing the effectiveness of the member companies in Turkey and in the World
- Member of MAKFED – member of Turkish Machinery Federation
- Headquarters in Bursa



About ROBODER

- Leads a great number of young students from dozens of universities to the sector (manufacturing technologies and digital transformation) via Roboder Youth Council (Younglab).
- Organizes academic collaborations and events with universities.



About ROBODER

Equipment, software and technologies such as

- Industrial robots
- Peripheral equipment that can be integrated to industrial robots such as workpiece positioners gantry robots and sliders
- Robotic cell / station / production line / system
- EOAT and various robotic equipment
- Sensors and IoT Mobile softwares, based on AR and VR for enabling remote support and education
- Industrial machine and robot safety technologies



About ROBODER


- Mechanized or to be integrated to the robot - centred, MIG, MAG, TIG welding equipment, process equipment technologies such as plasma and laser resonator,
- CAD CAM software technologies, digital twin technologies,
- Electrical, electronic, hydraulic/pneumatic actuator and drive systems
- Clamping, assembly, mold, equipment and fixture systems
- Mobile robots, AGV, AMR, ASR/S robots, mobile systems
- Conveyors and transportation systems
- Autonomous systems, UAV (unmanned aerial vehicle), UGV (unmanned ground vehicle), UMV (unmanned maritime



What is an "Industrial Robot"?

Industrial robot, based on ISO 8373;

automatically controlled, reprogrammable multipurpose manipulator, programmable in three or more axes, which can be either fixed in place or fixed to a mobile platform for use in automation applications in an industrial environment.



Industrial
Robots

Cobots

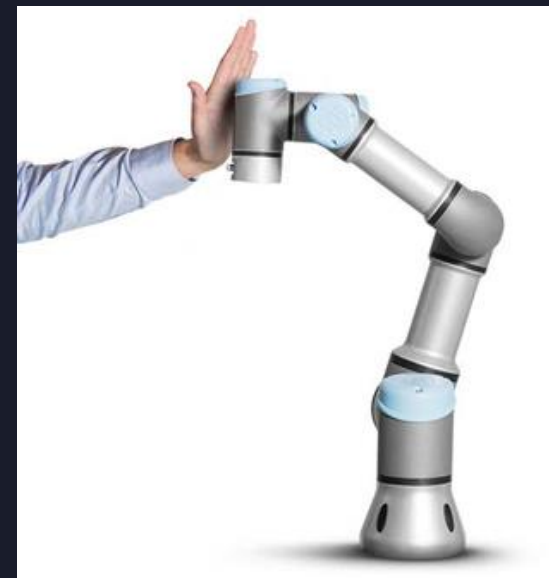
Mobile
Robots

Types of Industrial Robots



Industrial Robots (Conventional)

An industrial robot, which has three or more programmable axes, used in industrial processes is an automated controlled, re-programmable, multi-purpose, fixated or mobile manipulator.



Cobots

Collaborative robots are robots that are able to work safely by interacting with people in a common workspace.



Mobile Robots (AGV)

"Mobile robot" is the common word used for robots that have mobility. Not only can they be operated remotely but they can also self-operate by AI.

Photos and illustrations courtesy of Fanuc Robotics, Universal Robots and Kuka Robotics

Robot Programming History

- T3 and Funky
- VAL, RCL, AML and RPL
- Joint interpolated motions
- Cartesian motions
- Simple arithmetic operations

- Artificial intelligence
- Image processing
- Sensors
- IoRT

1954-1982

- Recording desired joint
- Operator would increase each joint in small stages towards the intended goal position
- Magnetic drum memory
- There was no way to edit the software later on, nor were there any debugging facilities

1982-2000

2000-2022

- Teach pendants
- Lead-through teaching
- Offline programming

2022-FUTURE



Robot Programming Solutions Yesterday

Robot Programming Solutions - Yesterday

AML (A Manufacturing Language)

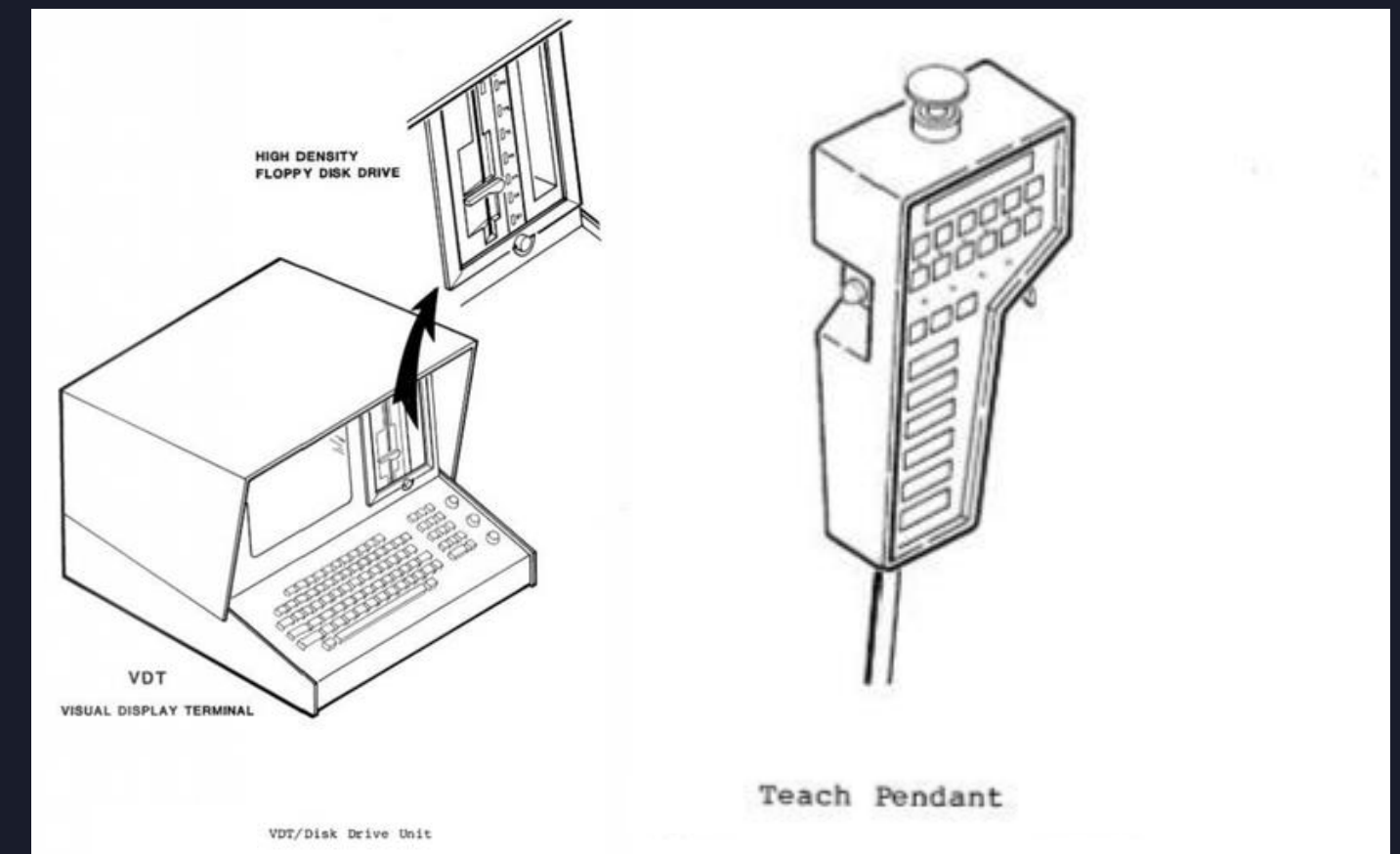
- AML programs can call subroutines written in AML, C, or FORTRAN
- Coded offline
- Can be tested via an offline simulator
- Prior to execution on the robot, they are uploaded to RAM residing in the robot's control unit

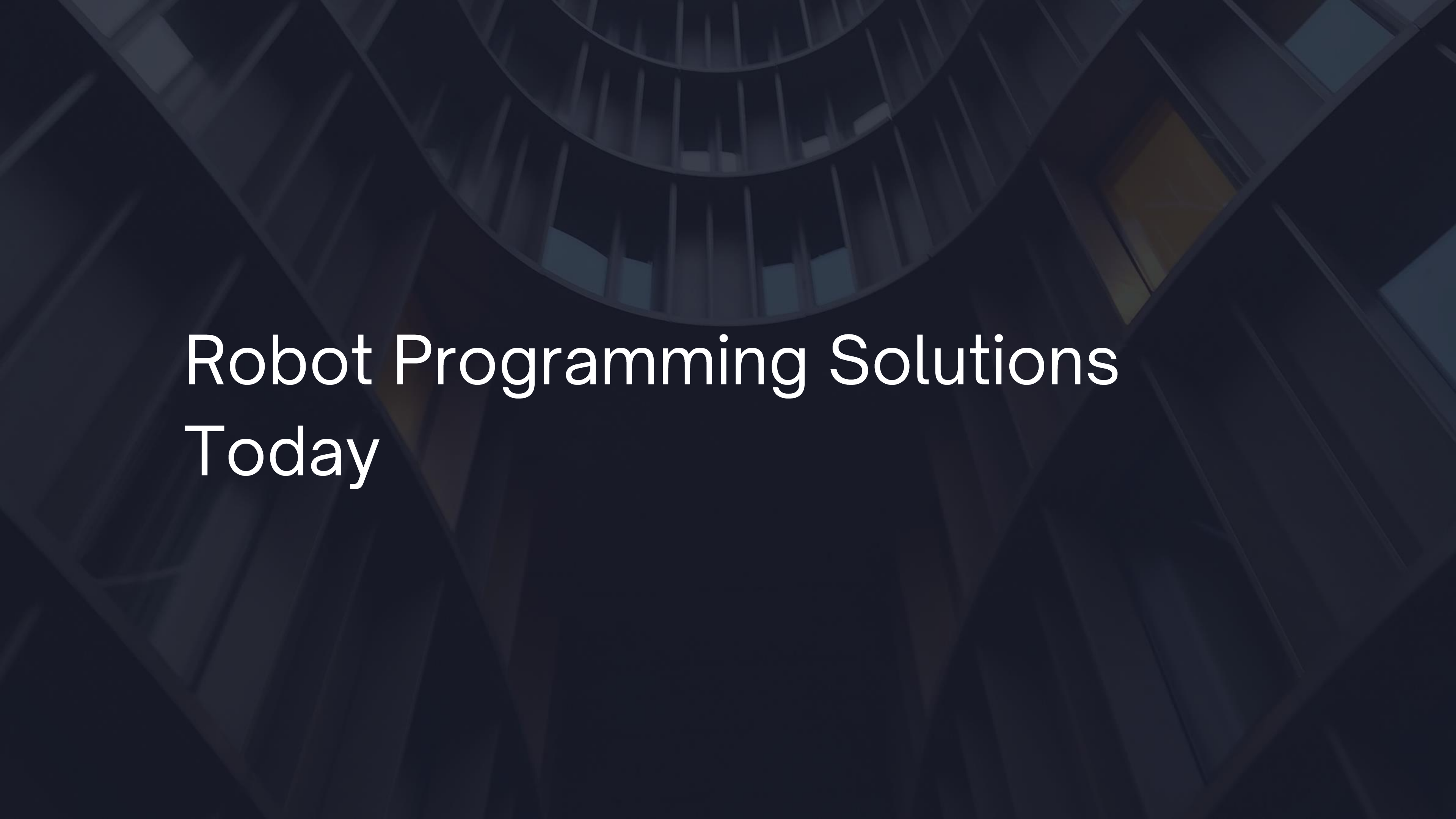


Robot Programming Solutions - Yesterday

VAL (Variable Assembly Language)

- VDT (Visual Display Terminal)
- Teach Pendant
- Joint, Free, World and Tool Moods





Robot Programming Solutions Today

Robot Programming Solutions - Today

Advancement in technology has provided the developers with new tools.

Robot manufacturers have made the programming process easier and more practical for users.

- Point-to-point teaching
- Kinesthetic teaching
- Offline programming

Robot Programming Solutions - Today

PTP teaching

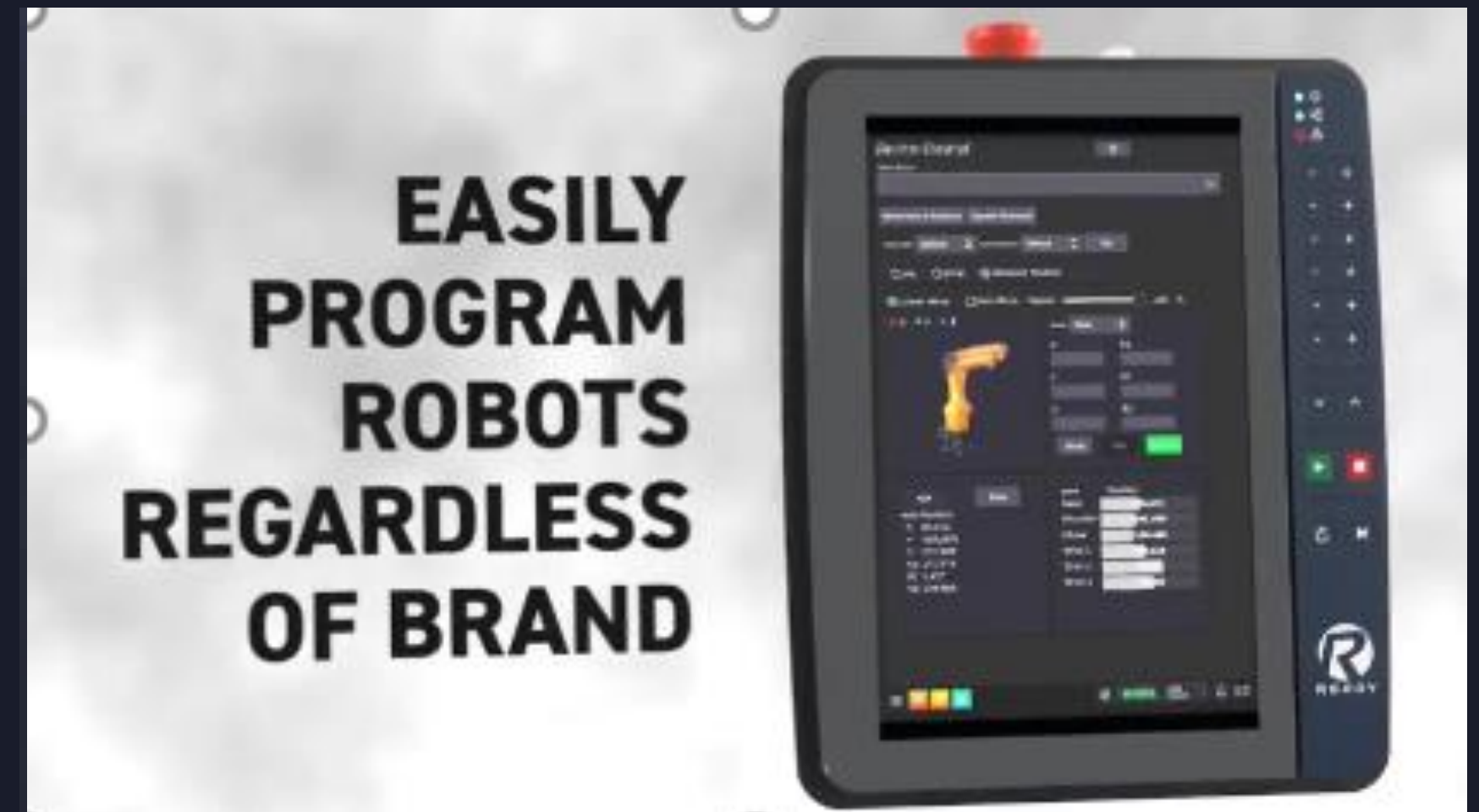
- Manual programming of trajectory
- Point to point
- Linear
- Spline
- Circle



Robot Programming Solutions - Today

Universal programming methods

- Universal operation system
- Single programming language
- Single programming method
- Single HMI / Teach pendant
- Using block diagrams



Robot Programming Solutions - Today

Kinesthetic teaching

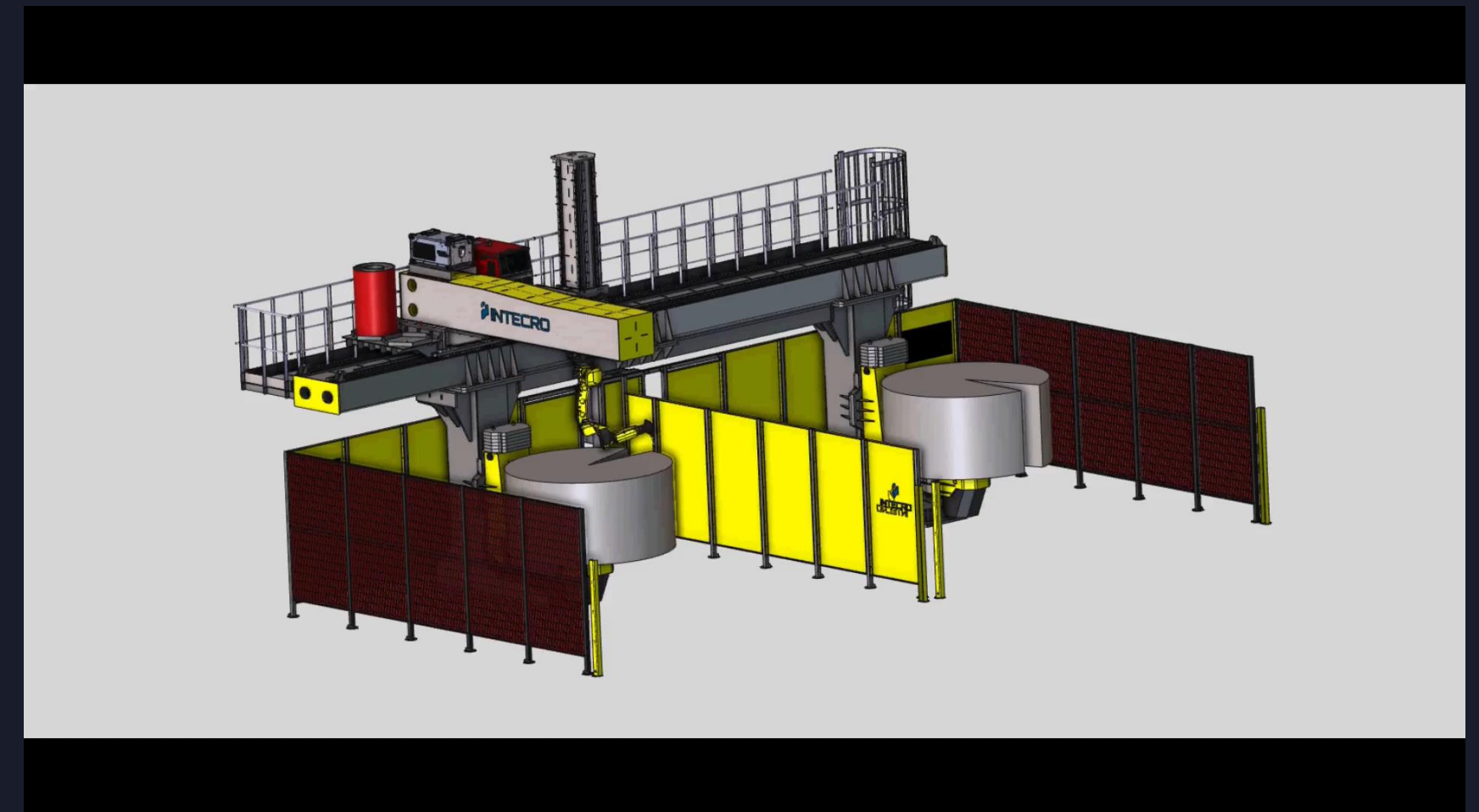
- Force control
- Drag teach point




Robot Programming Solutions - Today

Offline programming

- Digital Twin
- Programming in PC environment
- Utilisation and programming of sensor functions
- Dual way (PC to robot & robot to PC)
- Automatic trajectory generation
- Reachability control
- Collision detection
- Simulation



Cenit- Fastsuite OLP Software
Intecro Robotics - Gantry Robot - 2022



Innovative Programming & Learning Methods Today to Future

Innovative Programming & Learning Methods Today to Future

Proximity & tactile sensor

- Tactile perception
- Proximity perception
- Obstacle avoidance
- Safety



Innovative Programming & Learning Methods Today to Future

Environment Recognition

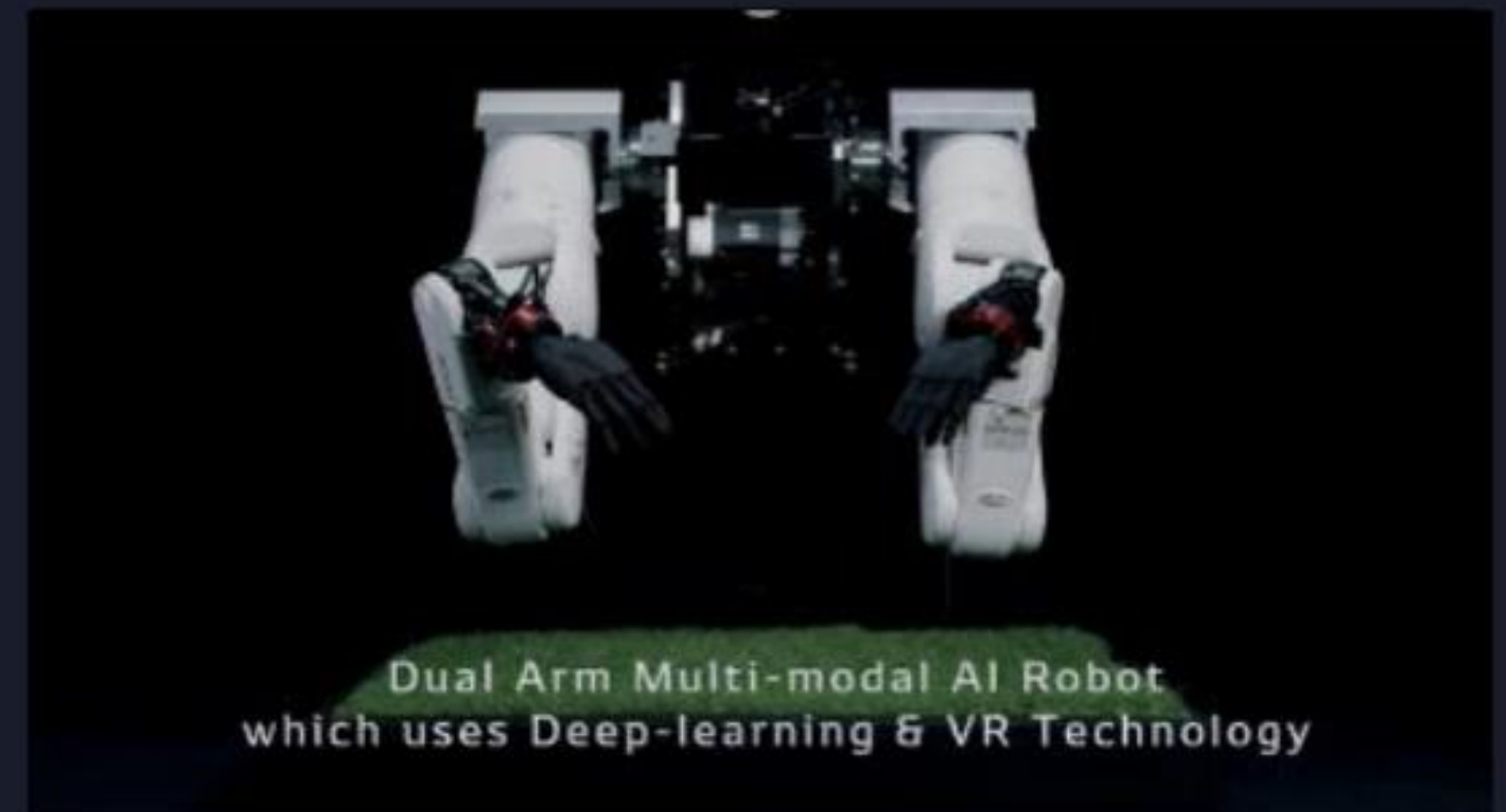
- IMU
- Safe area
- Digital human geometric model



Innovative Programming & Learning Methods Today to Future

Robot Control With VR

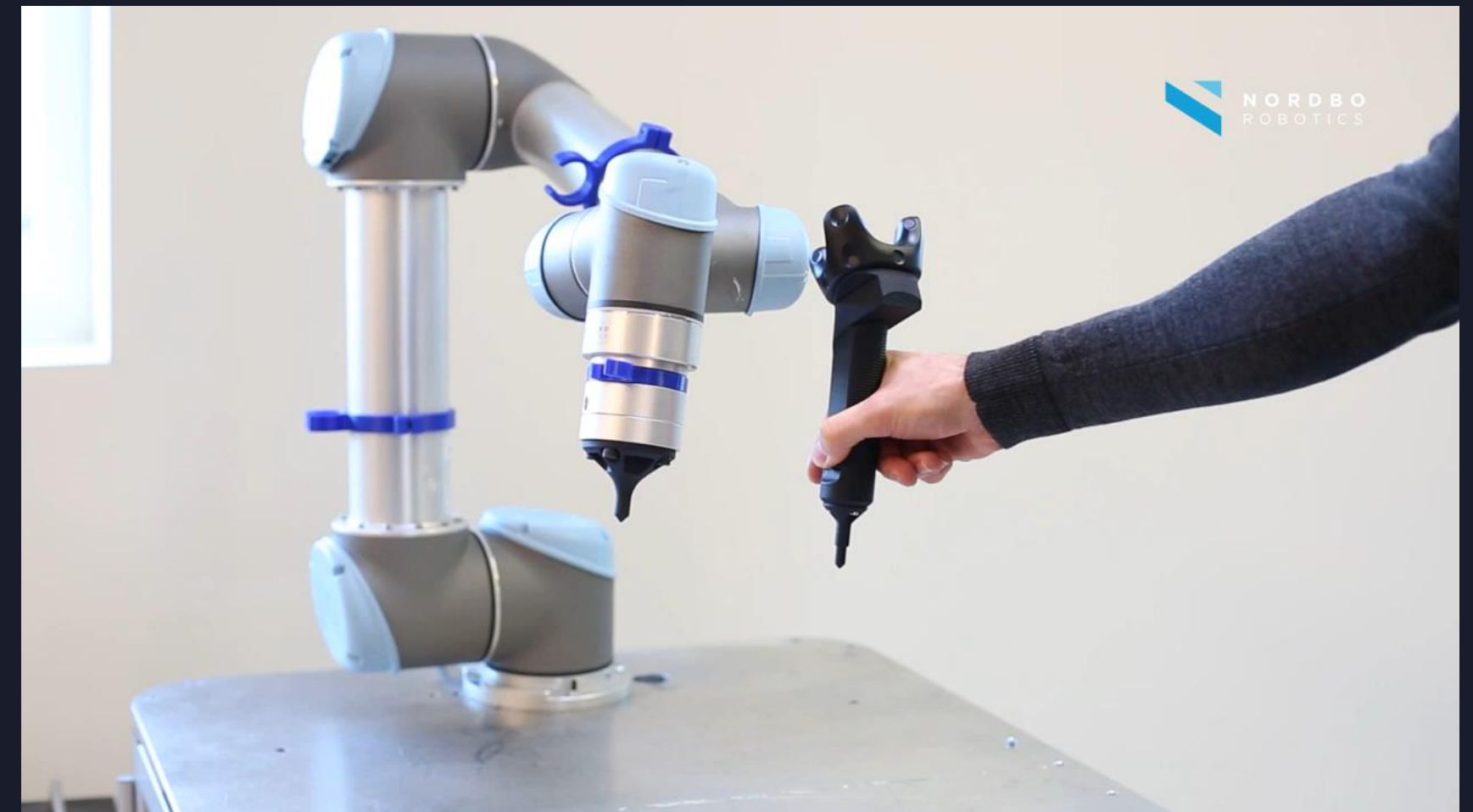
- VR
- Remote Control
- Computer Vision



Innovative Programming & Learning Methods Today to Future

Mimic Pencil With IR Tracker

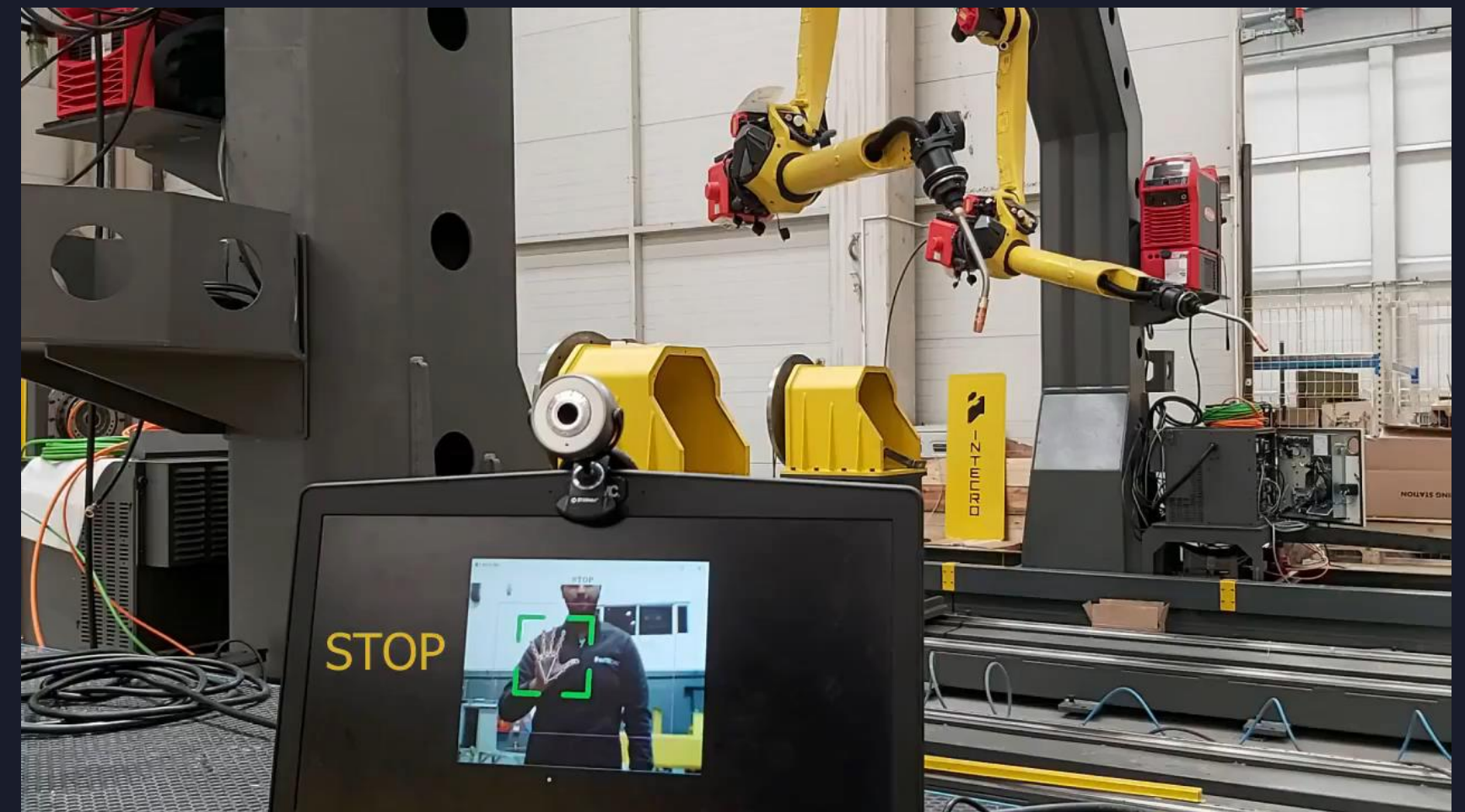
- Point Determination
- Movement Learning



Innovative Programming & Learning Methods Today to Future

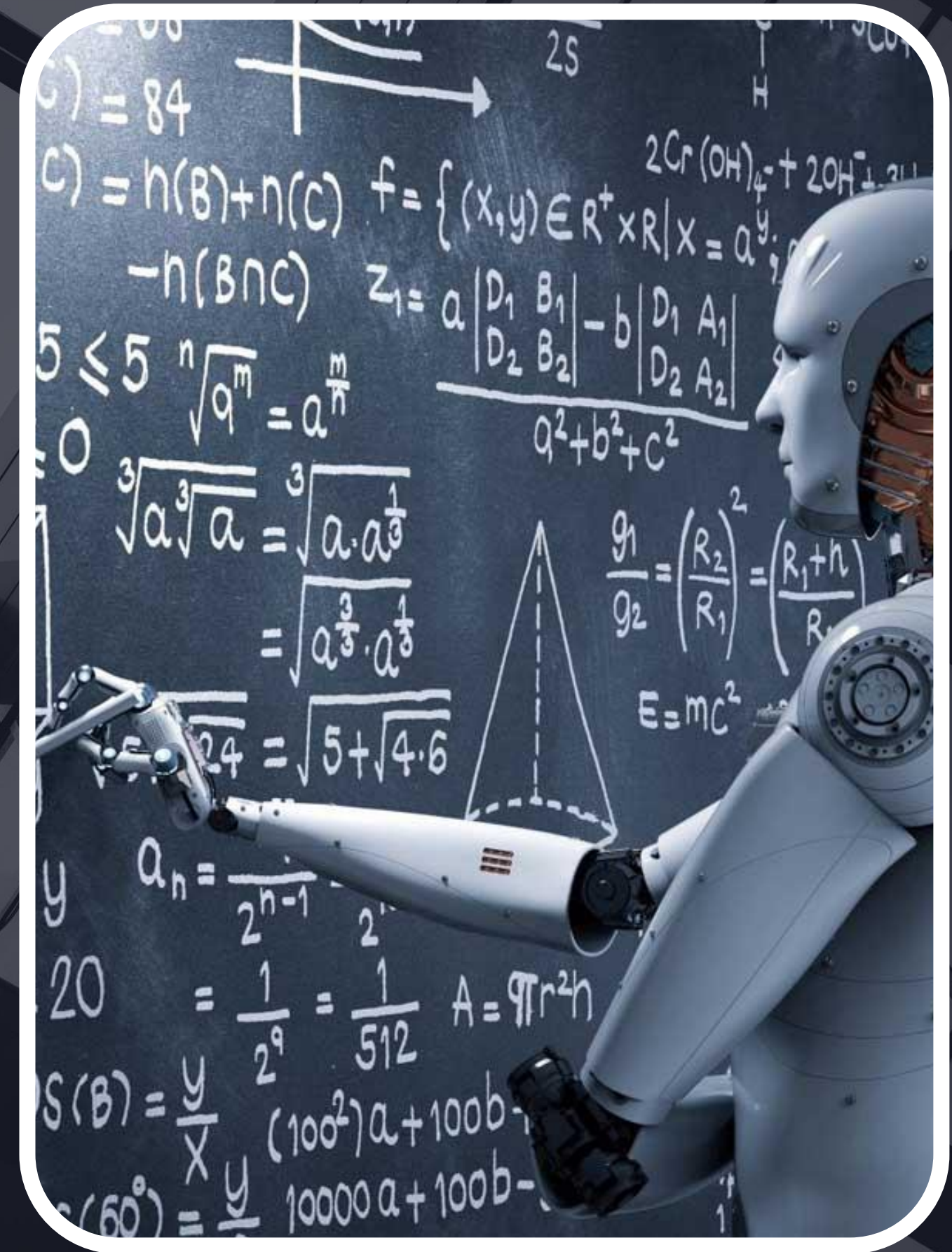
Computer Vision

- Image Processing
- Robot Control By Hand Signal Commands



What is Self Programming of Robots?

The future is coming...



What is Self Programming of Robots?

Self Programming

- Robots learn by themselves
- Map the surroundings by using sensors
- Make decisions and taking actions by themselves
- Artificial Intelligence



Self Programming by Robots

Self Programming

- Digital Twin
- 3D Space
- Sensor technology
- Definition of the object
- Artificial Intelligence
- Tool Path Generation



Self Programming Methods

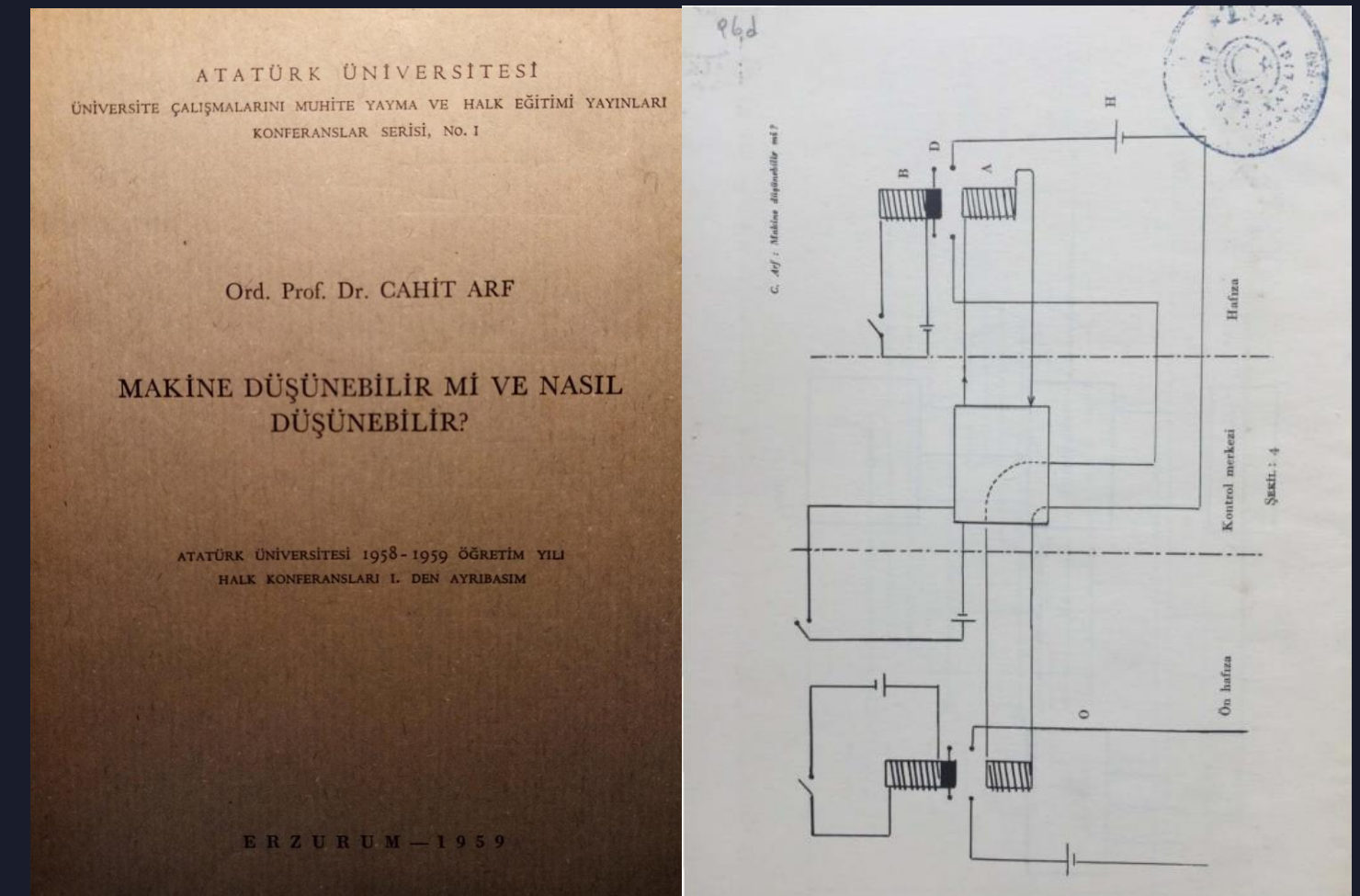
Can machines think and how can they think?

Turkish Scientist

Professor Emeritus Cahit Arf

Ways of thinking; being able to

- use language
- calculate
- make an analogy
- Eliminate



Self Programming Methods

Self Programming

- Perceiving of Speaking
- Mimicking
- Discovering
- Sharing Experience
- AI

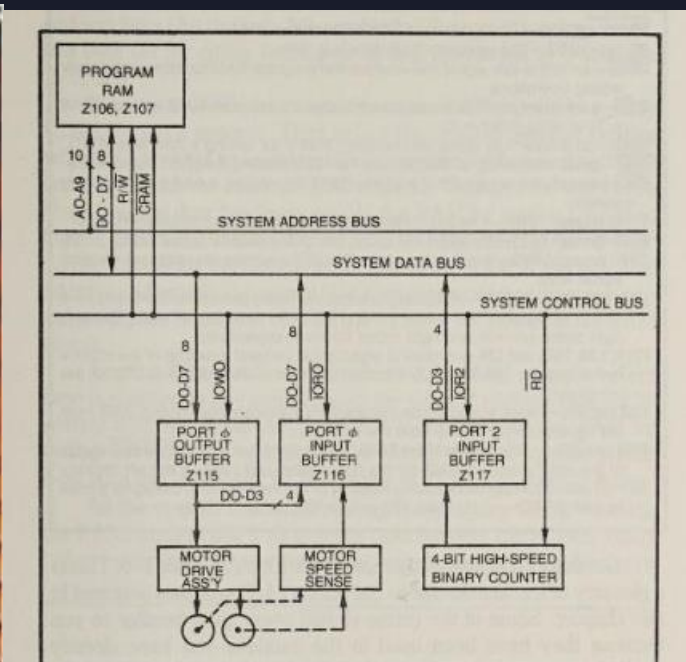
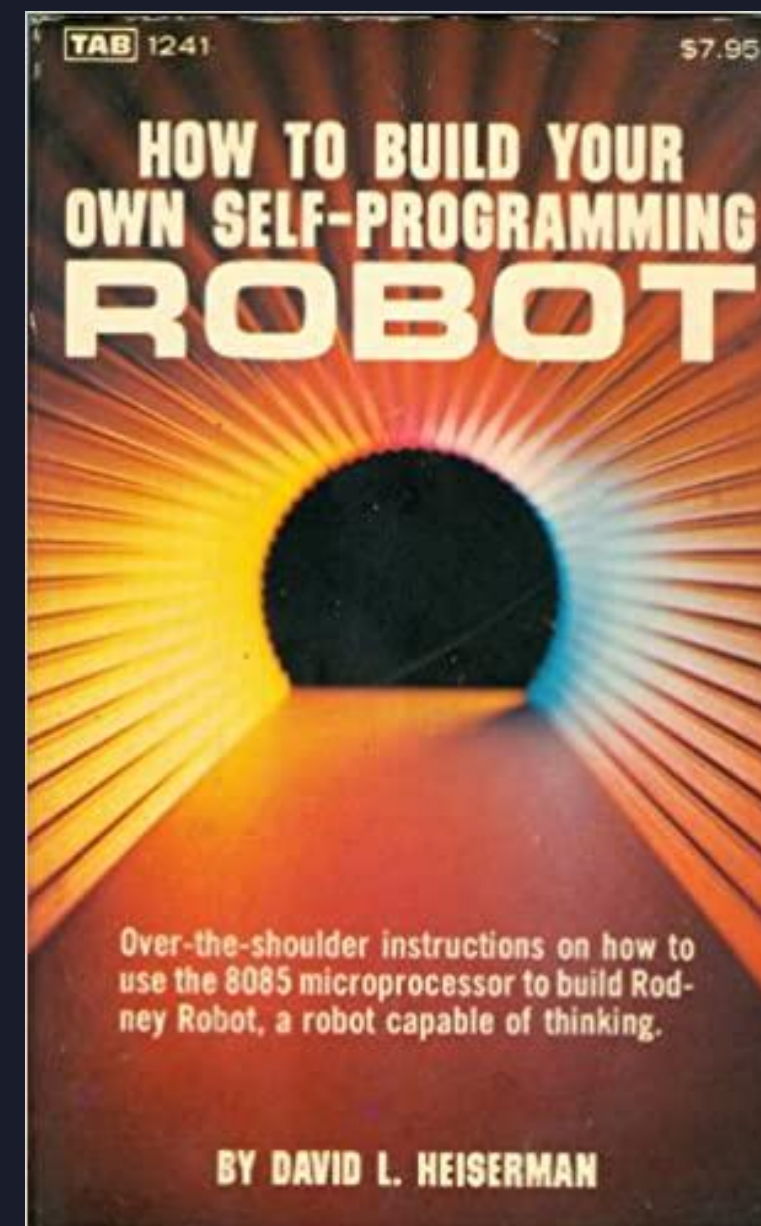


Fig. 7-1. Block diagram of Ports 0 and 2 and the program RAM.

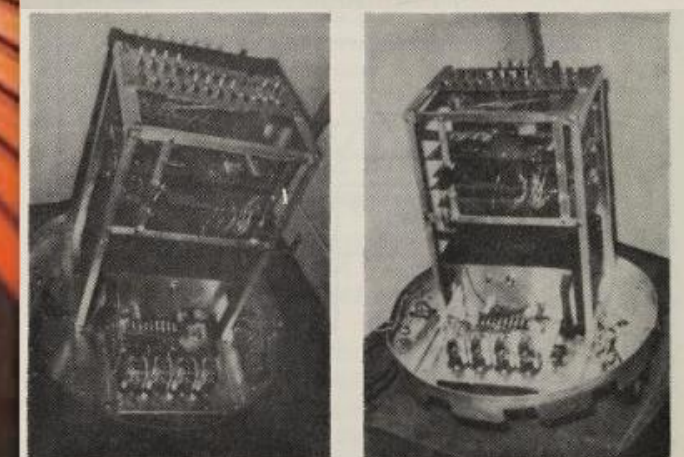
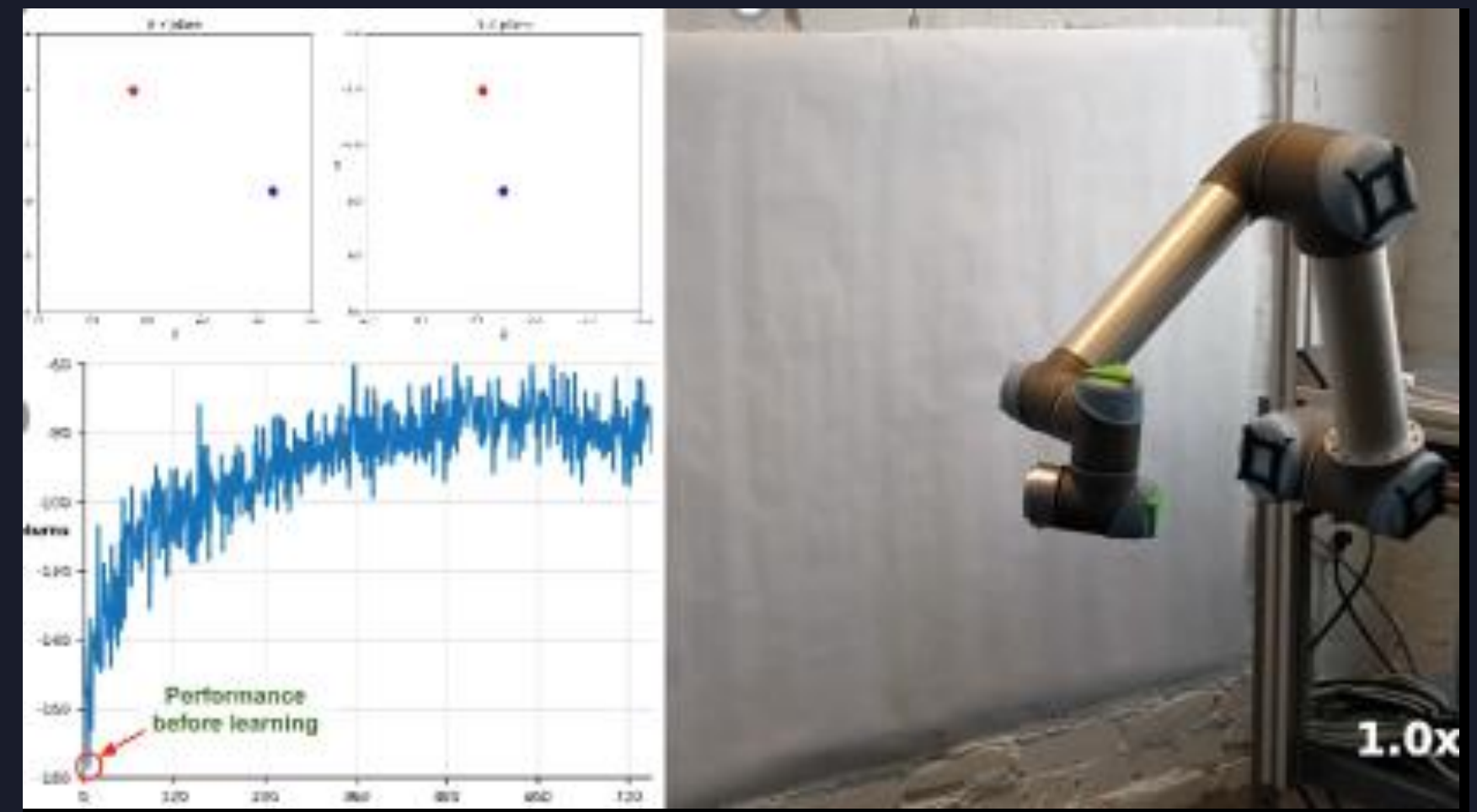


Fig. 14-5. Two views of Rodney.

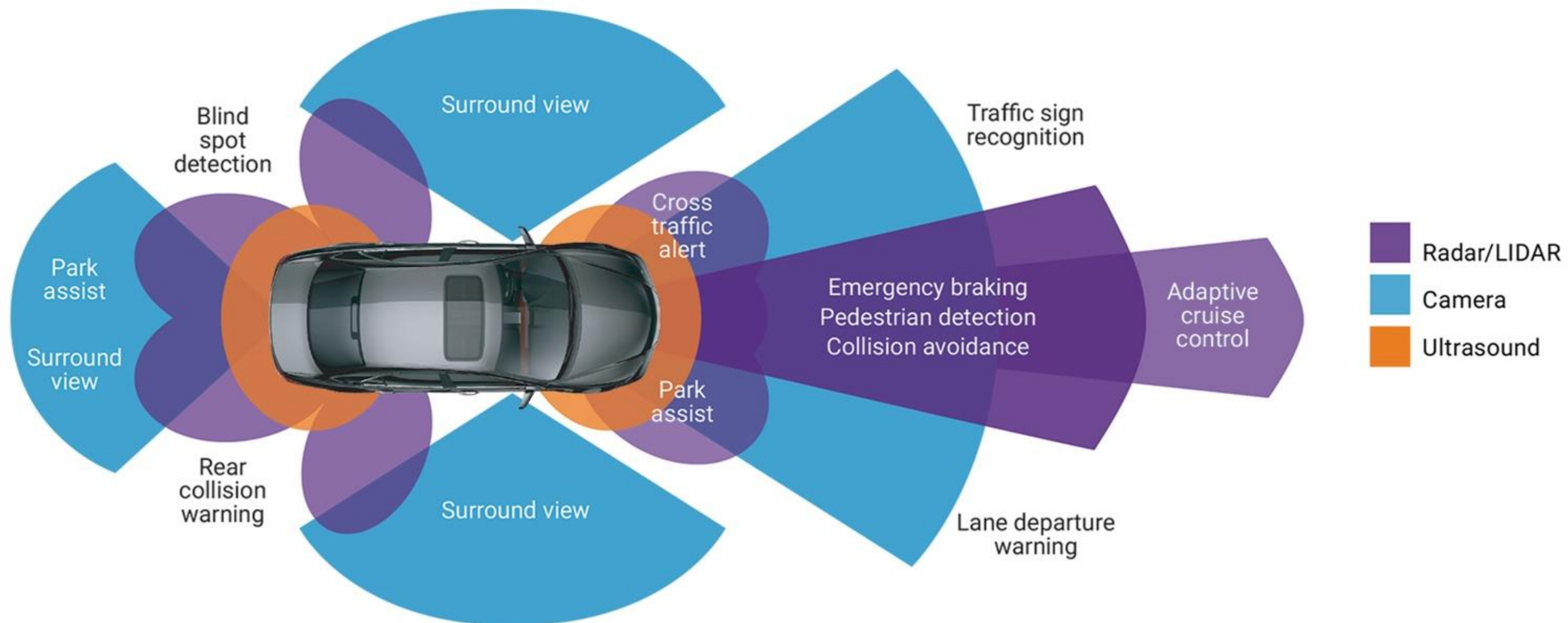
How Do Robots Self Learning?

Reinforcement Learning

- Deep Reinforcement Learning
- Discovery



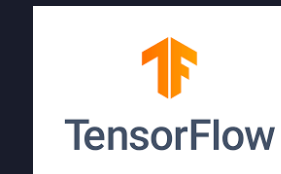
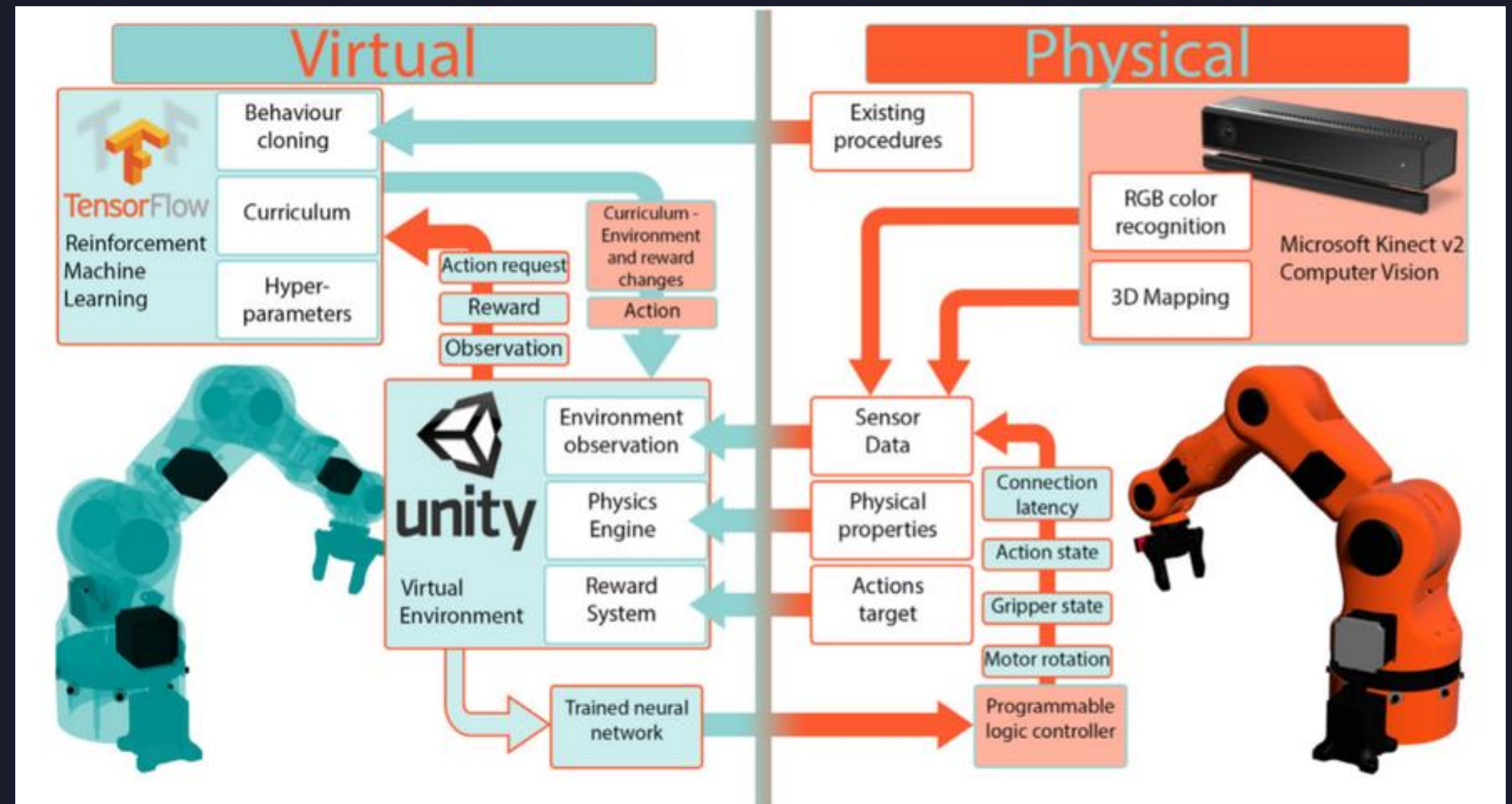
Sensor Fusion



Sensor Fusion

Virtual and Physical Systems

- Simulation
- Sensor Data
- Camera
- IMU
- Torque Sensor
- Tactile Sensor
- Proximity Sensor
- etc.



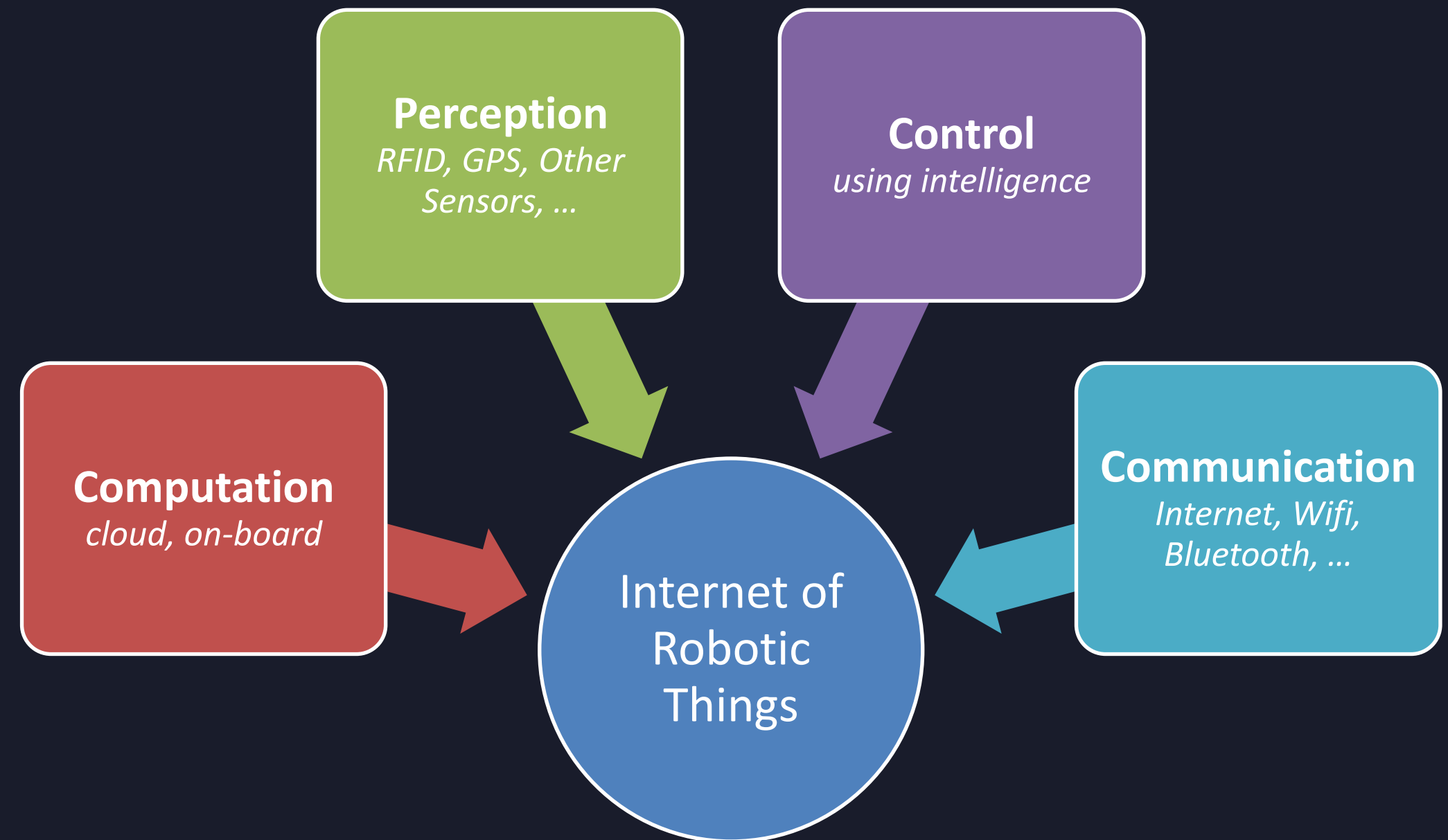
Internet of Robotic Things



Internet of Robotic Things

IoRT

- Computation
- Perception
- Communication
- Control



SOME IoT USES IN MANUFACTURING



Thank you for your attention

For further information please contact

Mr. Cem Deşen

cem.desen@intecro.com.tr