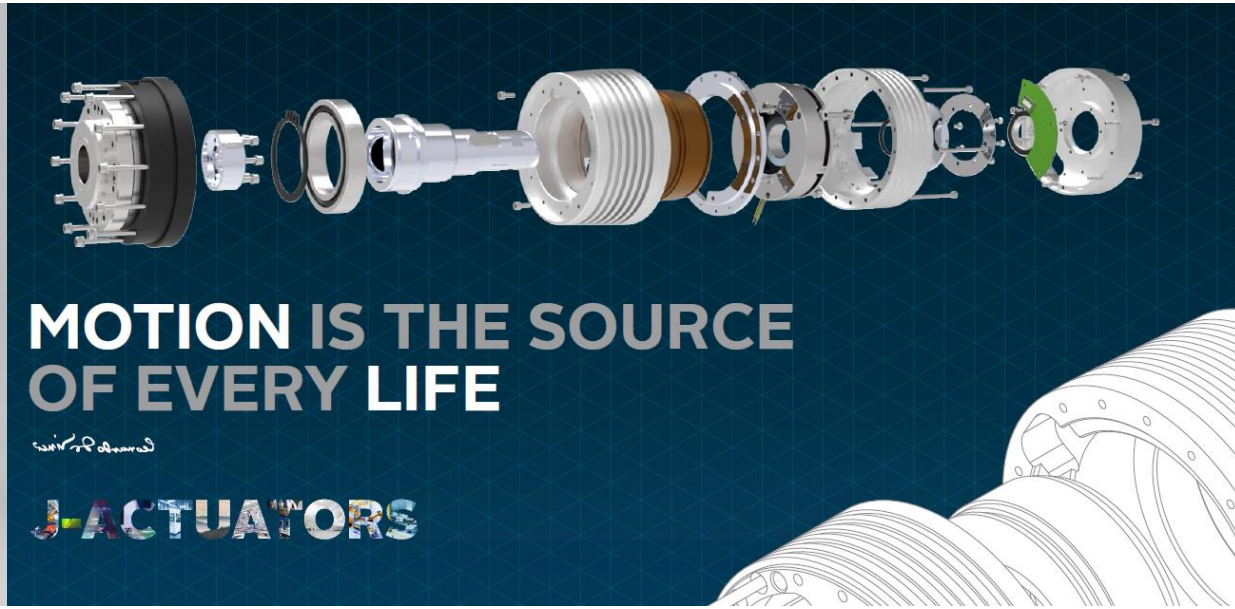
AutomationWare™

One step ahead on the future



AW- Robotics

Seminars July 2020

Dr. Fabio Rossi

Automationware Background

AW in a nutshell

- Private company **founded in 2002**
- Head-quartier in **Venice** Metro area
- Last 3 years orders **Growth over 123%**
- Leadership **in E-Actuators and robotics**
- **Cobot project 15 PhDs on Engineering** , high education , collaboration with **Fraunhofer** Institute and Universities.
- Partnership with Robotics developers of AVG, AMR . Fast robotics researcher .

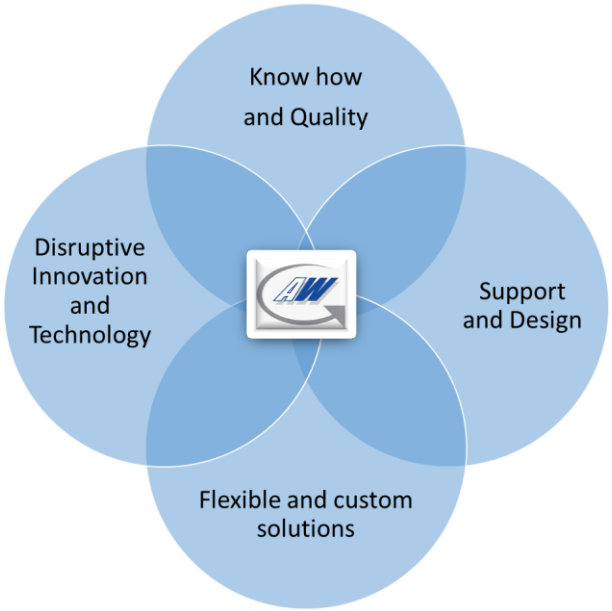
Product Strategy

Expanding on med-high end **E-actuators** and investing in Co-Robotics technology

Expanding the Co-robotics Modularity

Creating a full portfolio of **Robotics Actuators** for ARMs , AMRs , AVGs, Parallel fast robotics system

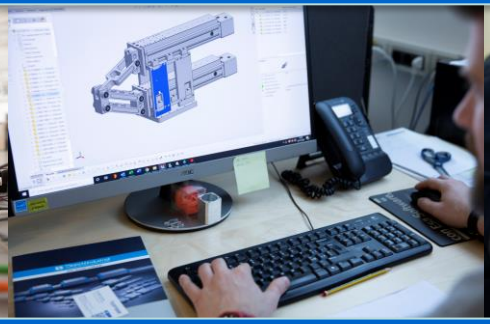
- Developing a full mechatronics and robotics system for specific applications

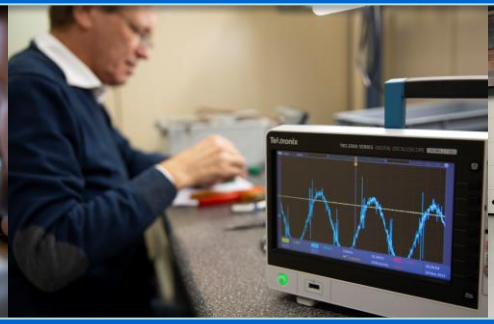


AW HeadQ. Campus for Innovation

AW- One stead ahead on the future

5000 M² Mechatronics and Robotics labs – Assembly and CNC labs (Venice Italy)

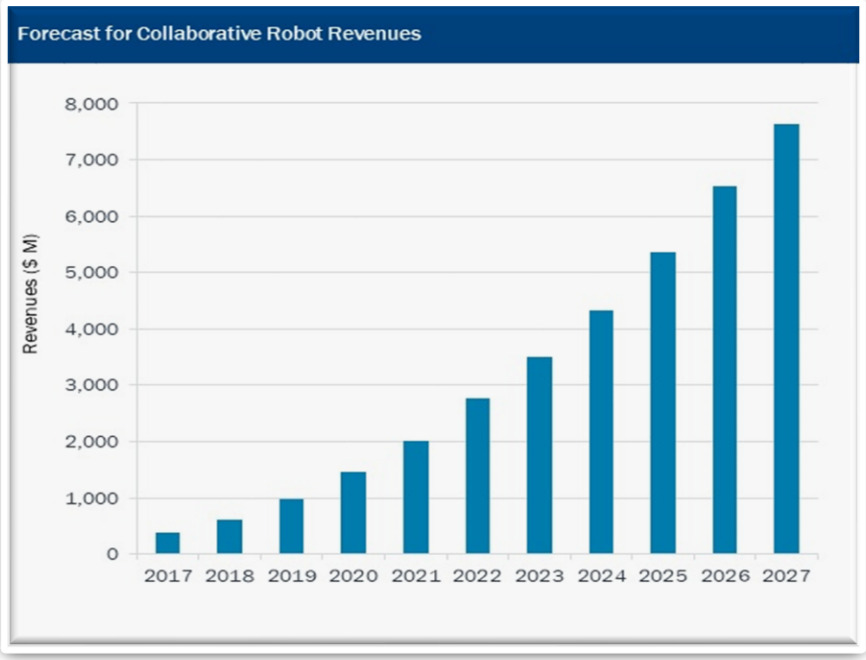




Robotic & Research lab Fraunhofer Bolzen (Italy)

Fraunhofer ITALIA

Why we are investing on Co-Robotics ?



The market for collaborative robots is set to skyrocket, going from $ 1 Billion in sales in 2019 to an estimated $5 billion by 2025, according to Barclays Equity Research. Europe is the leading region , APAC emerging

Our view on actual Cobot market

Today :

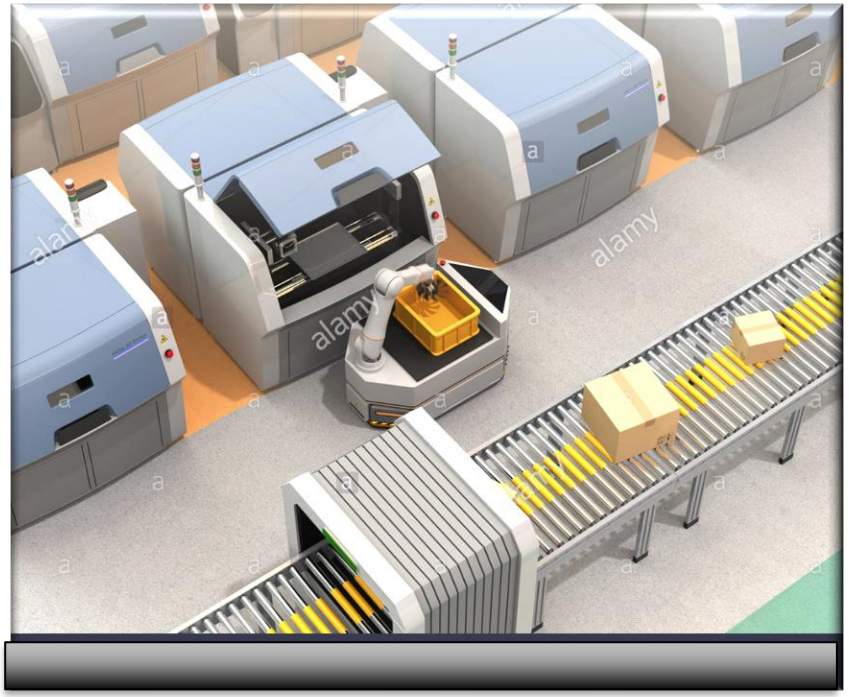
- Specs based on Payload only
- No modularity or Scalability
- Limited productivity
- Limited kinematics
- Limited machine learning
- Small Mobile applications
- Limited to Ethernet connection
- Small remote controls
- Limited mobility (With AGVs)
- Limited Safety

Aw-Tube

Next 5 years :

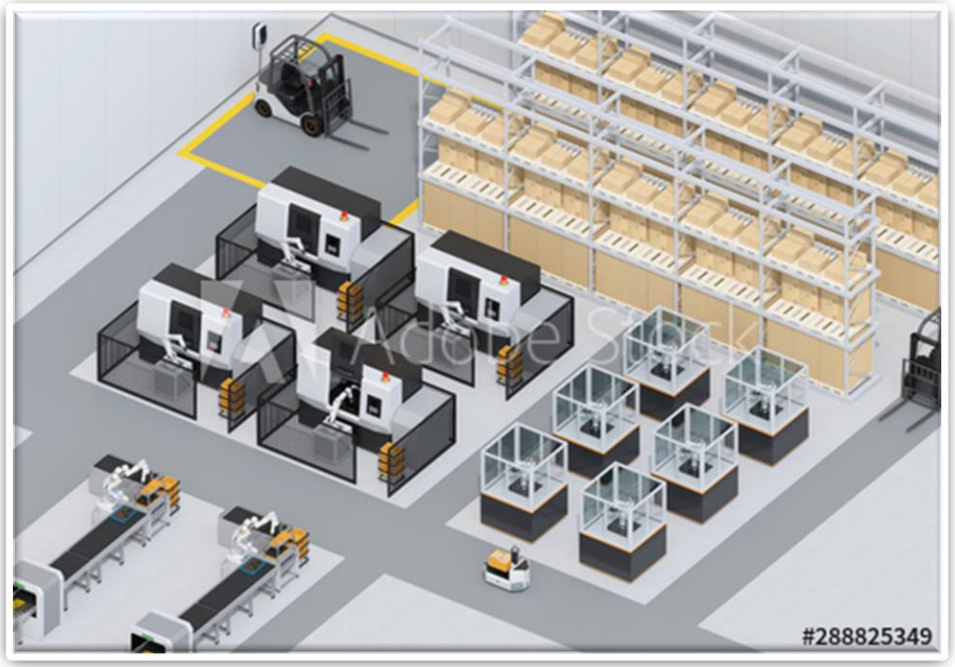
- Areas of work and Payload
- Modularity or Scalability
- Boosted productivity
- Open source kinematics
- ROS expansion
- Extensive Mobility applications
- EtherCat or industrial links
- Remote and Wi-fi controls
- Large Logistic applications
- Expanded Safety and improved Human interaction

Robotics circle



- E-Actuators and Robotics actuators are Part of same Ind. 4.0 platform
- Communication need to be well organised
- Machine learning should be elevate to coordinate the full system
- Safety to be boosted on the full system

Factories should be virtually simulated, actuators and robotics Joints to became part of full equation and been elevated to interconnected on a proper industrial standards



Let start from Robotics Joints …

- Modularity and Scalability
- Performance
- Open Source or Direct EtherCat
- Machine Learning
- Interoperability and connectivity
- Safety 2.0

Future Robotics start at the Actuator level

Introducing 5 Cobotics Joints

J-Actuators

- Reaching up to 450 Nm Peak
- 3+1 levels of Safety
- Current – Gravity – Stiffness
- Exploring Visual Zone (SafeVu)
- EtherCat Bus for direct control
- ROS driven (RoboVu)
- Safety Block

Options:

- Environment sensing (Atex and others)
- Gripping I/O
- Stand Alone version EtherCat Version

Safety 2.0

Interoperability and connectivity

Evolving Robotics Joints Electronics

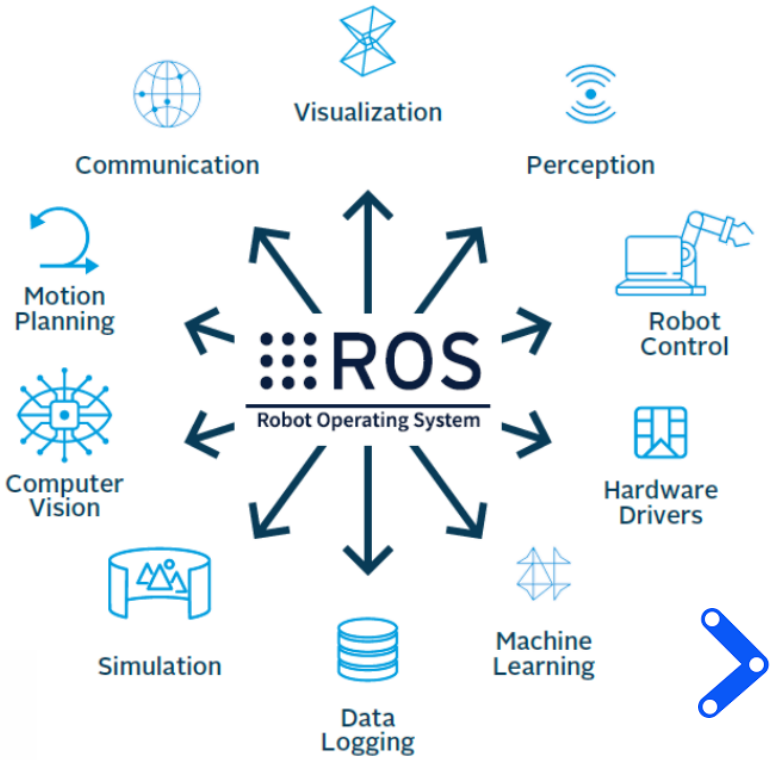
Key Features

- EtherCat Bus - FSoE
- Fast ADC 12 bits
- 3D Accelerometers
- Gyroscope included
- 2x20 bit Encoders
- Other Sensors (optional)
- I/O bus
- Double Safety Processor
- Double Kinematics Processor

Let prove J-Actuatros heavy payload …

Introducing Robot Operating System

- Invented by Stanford university (CA) in 2008
- Became the most used open source system to manage complex robotics kinematics in research
- Analyst predict 55% of Robots to be drive by ROS within 2024



ROS

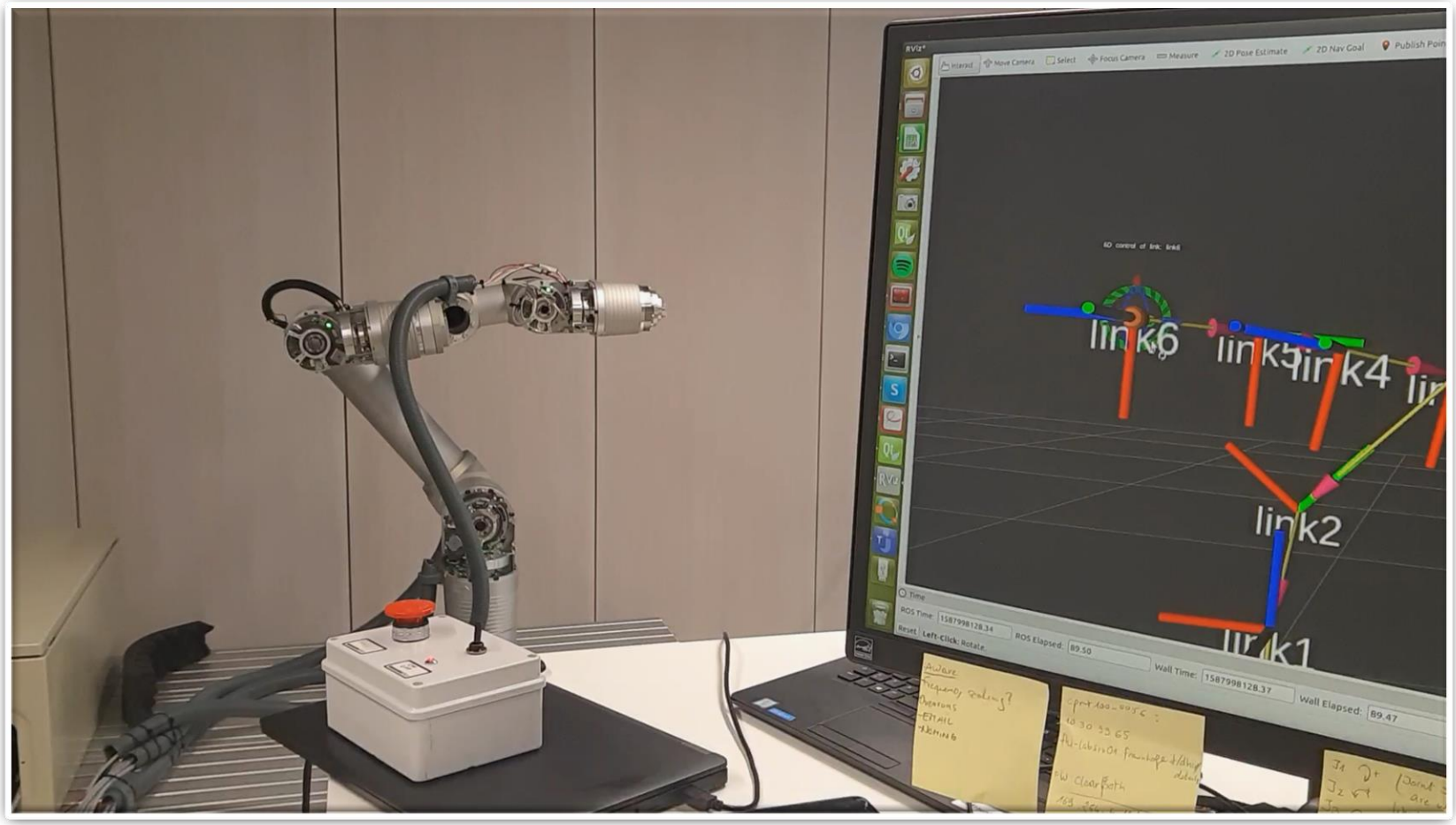
GAZEBO

EtherCAT

MoveIt 1

The **Robot** Operating System (**ROS**) is a set of software libraries and tools that help you build **robot** applications. From drivers to state-of-the-art algorithms, and with powerful developer tools, **ROS** has what you need for your next robotics project. And it's all open source. (Such Linux)

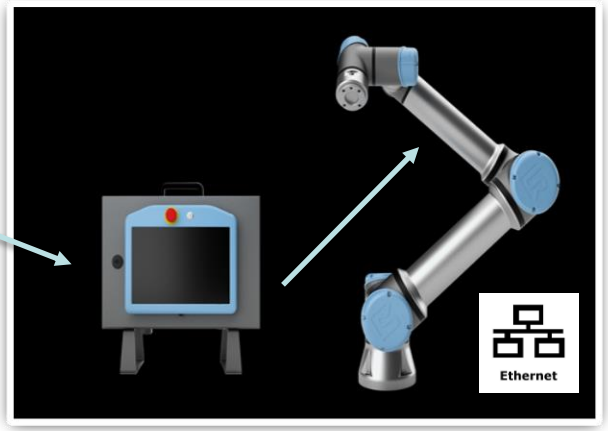
Driving J-Actuators on ROS



Aw-Tube Direct connection to EtherCat

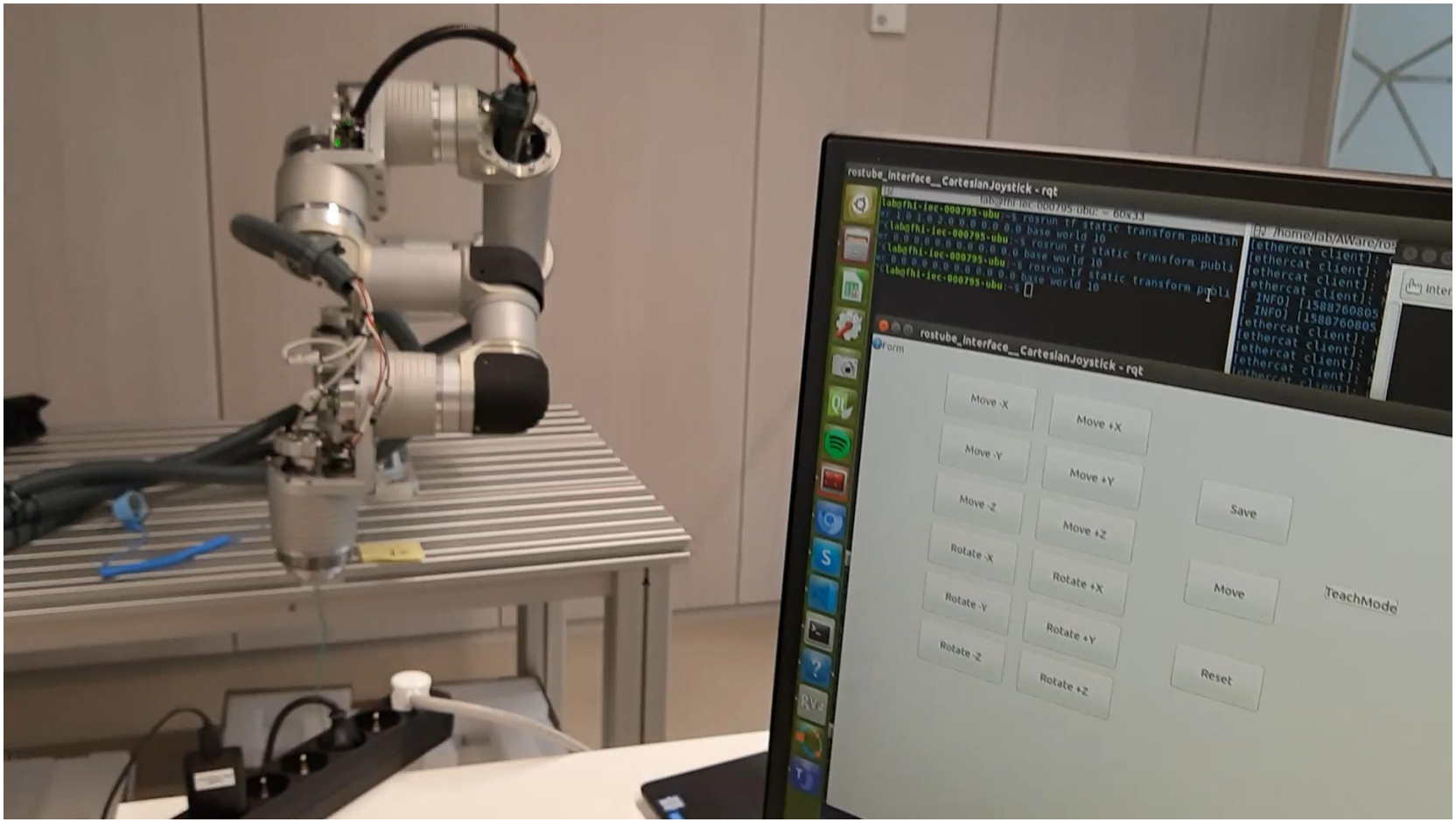
EtherCAT®

Vs.



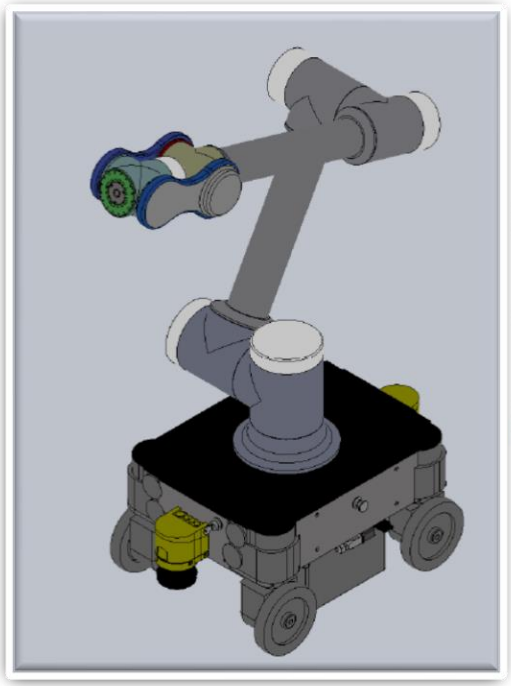
Traditional cobot needs ethernet links vs the application area

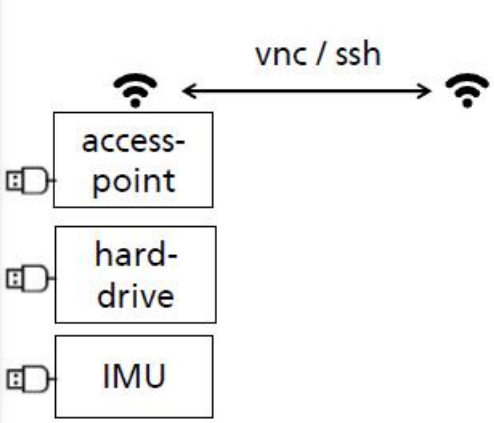
Easy Positioning even @ 100mt distance or wifi connected (Cabinet is not required)



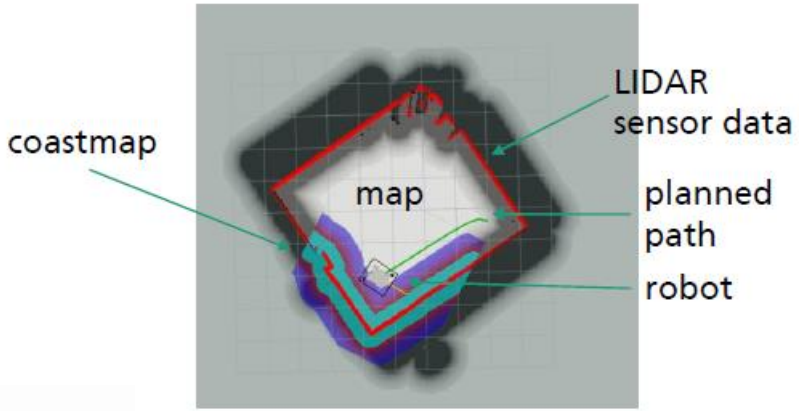
A new way to develop Safety and auto learning (in Gravity compensation)

Aw-Tube : Mobility without limitation





- access to mobile robots pc
- access to ROS on mobile robot
- visualizing sensor data & coastmap
- controlling robot



Aw-Tube : Architecture

Robot ROS Workspace

MoveIt!

Cinematica:
Iterative/Analytic
Kinematics Solver

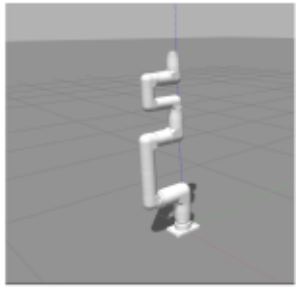
Motion Planner

GAZEBO

ROS Control

ROS RoboVu™

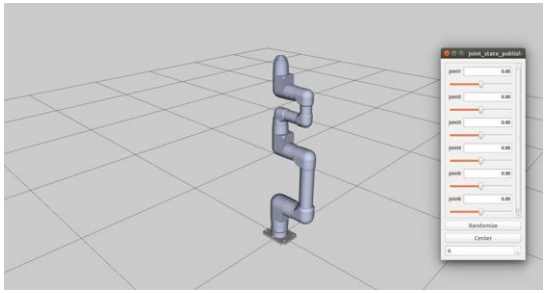
GAZEBO

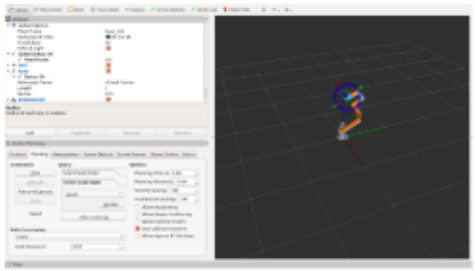


SIMULATION

REAL ROBOT

RViz

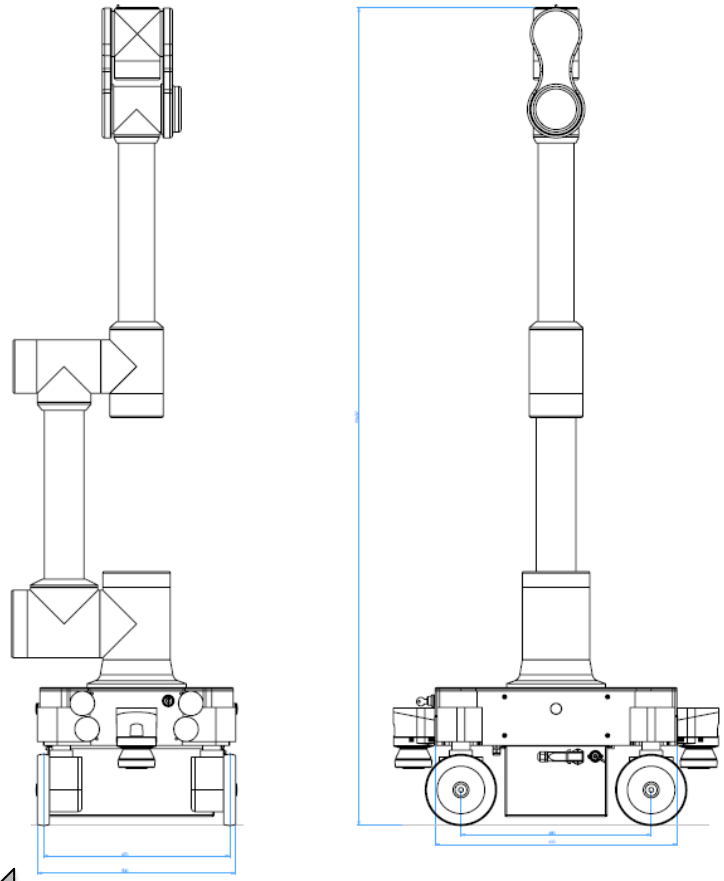




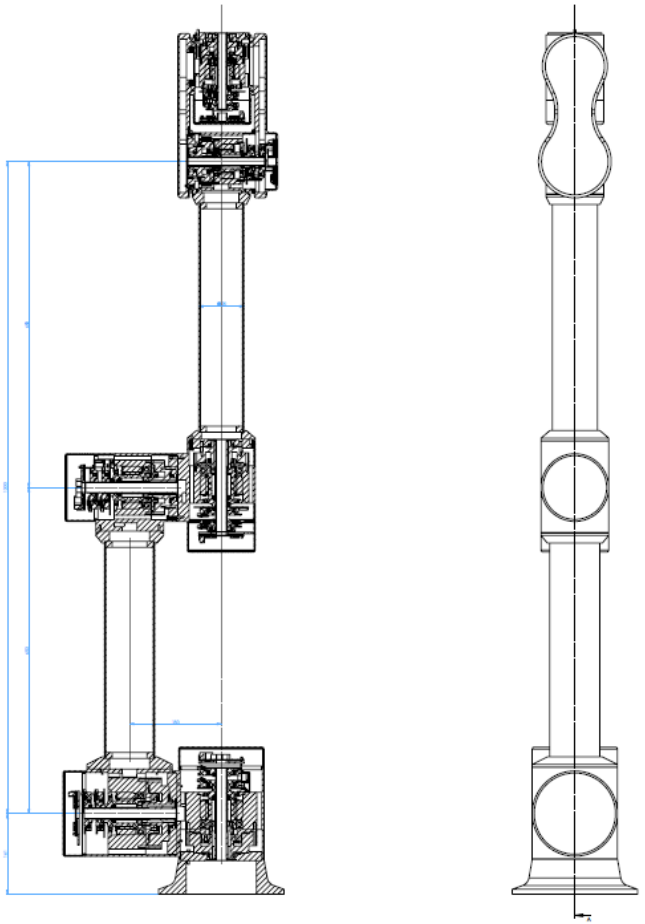
Kinematics and machine learning

Safety

Aw-Tube Robot Configuration



Mobile Version



Fixed Version

Automationware Robotics Modules

Robotics Modules	SM Sliders	J-Actuators	T-Actuatros	W-Actuators
Applications	Pick and place Mini Scara Parallel Robotics	Robotics Joints Ethercat AW-Tube Modular Cobot AW-Tube double Arms	Fast Parallel Robots ROS Mini Scara Base ROS Delta Robots ROS	AGVs wheels system AMR wheels System Advance AMR system (8 Axis)
Industrial Bus	Ethercat	Ethercat	Ethercat	Ethercat
Encoders	relative absolute	20 bit magnetic	20 bit magnetic	16 bit magnetic
Safety	Force	Force-Contact-Torque	Force	Force-Contact-Torque
ROS	compatible	compatible	compatible	compatible

Solution trajectory

- Aw well prepared to support specific application areas in critical segments
- Aw robotics modules to be adopted on major Robotics builders
- Enabling advance robotics solution on Key Pharma extreme applications (COVID)
- Collaboration with Fraunhofer and key European partners will re-scale our ability to deliver , tailored solution in mechatronics and future robotics vs Logistic and advance manipulation systems .

Thank you!
awaiting for your questions…

End of Presentation

J-Actuator

- Modularity
- Safety 2.0
- Performance
- Interoperability and connectivity

Modularity

Main J-Actuators Specs

Automationware	AW-J14	AW-J17	AW-J20	AW-J25	AW-J32
Total Power	119 W	280 W	280 W	572 W	570 W
Gearbox ratio	from 30-50-80-100	from 30-50-80-100-120	from 30-50-80-100-120-160	from 30-50-80-100-120-160	from 30-50-80-100-120-160
Rated Torque	11 Nm	39 Nm	49 Nm	108 Nm	220 Nm
Peak torque	28 Nm	54 Nm	87 Nm	167 Nm	353 Nm
Torque max Speed	4000 max 5000	3000-max 3400	3000-max 3400	2500-max 2800	1000 max 1400
Diameter	94 mm	94 mm	104 mm	128 mm	154 mm
Length	160 mm	170 mm	170 mm	186 mm	210 mm
Hollow shaft diameter	8 mm	14 mm	16 mm	20 mm	24 mm
Voltage	48 V	48 V	48 V	48 V	48 V
Work conditions	0 °C to +35 °C	0 °C to +35 °C	0 °C to +35 °C	0 °C to +35 °C	0 °C to +35 °C
Interface	EtherCat Safe	EtherCat Safe	EtherCat Safe	EtherCat Safe	EtherCat Safe
API	ROS Platform	ROS Platform	ROS Platform	ROS Platform	ROS Platform
Encoders	2x20 bit, magnetic ABS	2x20 bit, magnetic ABS	2x20 bit, magnetic ABS	2x20 bit, magnetic ABS	2x20 bit, magnetic ABS
Torque Sensor	Based on RS	Based on RS	Based on RS	Based on RS	Based on RS
Current sensor	14 Bit ADC	14 Bit ADC	14 Bit ADC	14 Bit ADC	14 Bit ADC
Impact Sensor	Less than 1 Nm (adjustable)	Less than 1 Nm (adjustable)	Less than 1 Nm (adjustable)	Less than 1 Nm (adjustable)	Less than 1 Nm (adjustable)
Weight	1700 gr	2400 gr	3000 gr	5000 g	8000 gr

- Preliminary Spec. : This may change during the development process
- Final end factors speed may change according with HD ratio selected
- Electronics could be embedded or external according with Applications needs

Evolution Vs. large Pharma Project

Open Source ROS

Safety 2.0

Machine Learning

Modularity

Flexibility

Interoperability and connectivity

Performance