ROBO-PARTNER

Human robot interactive cooperation in hybrid assembly systems
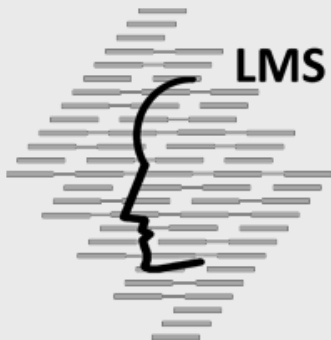
Dr. George Michalos

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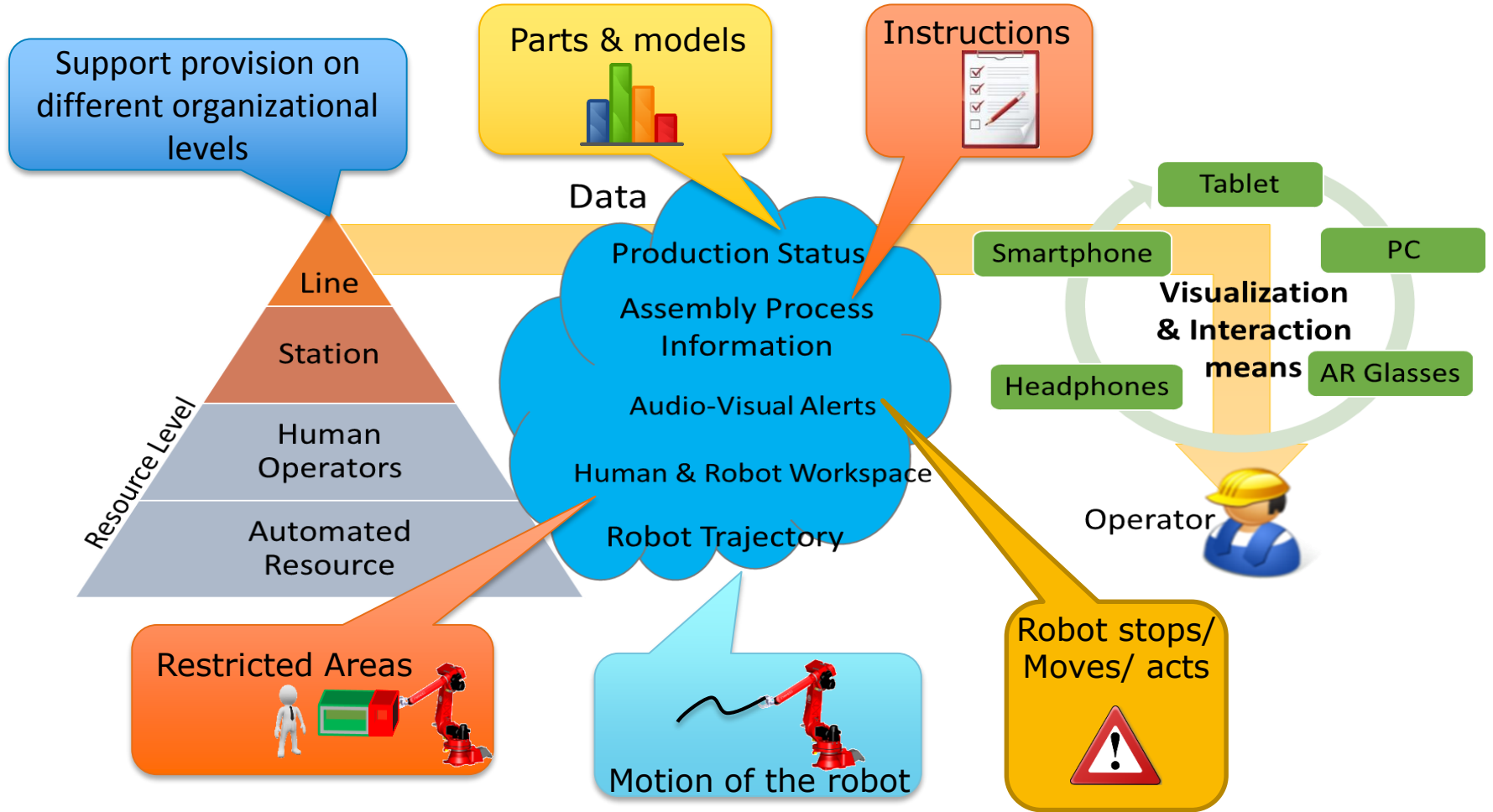
Challenge

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Human Based Assembly

Robots Based Assembly

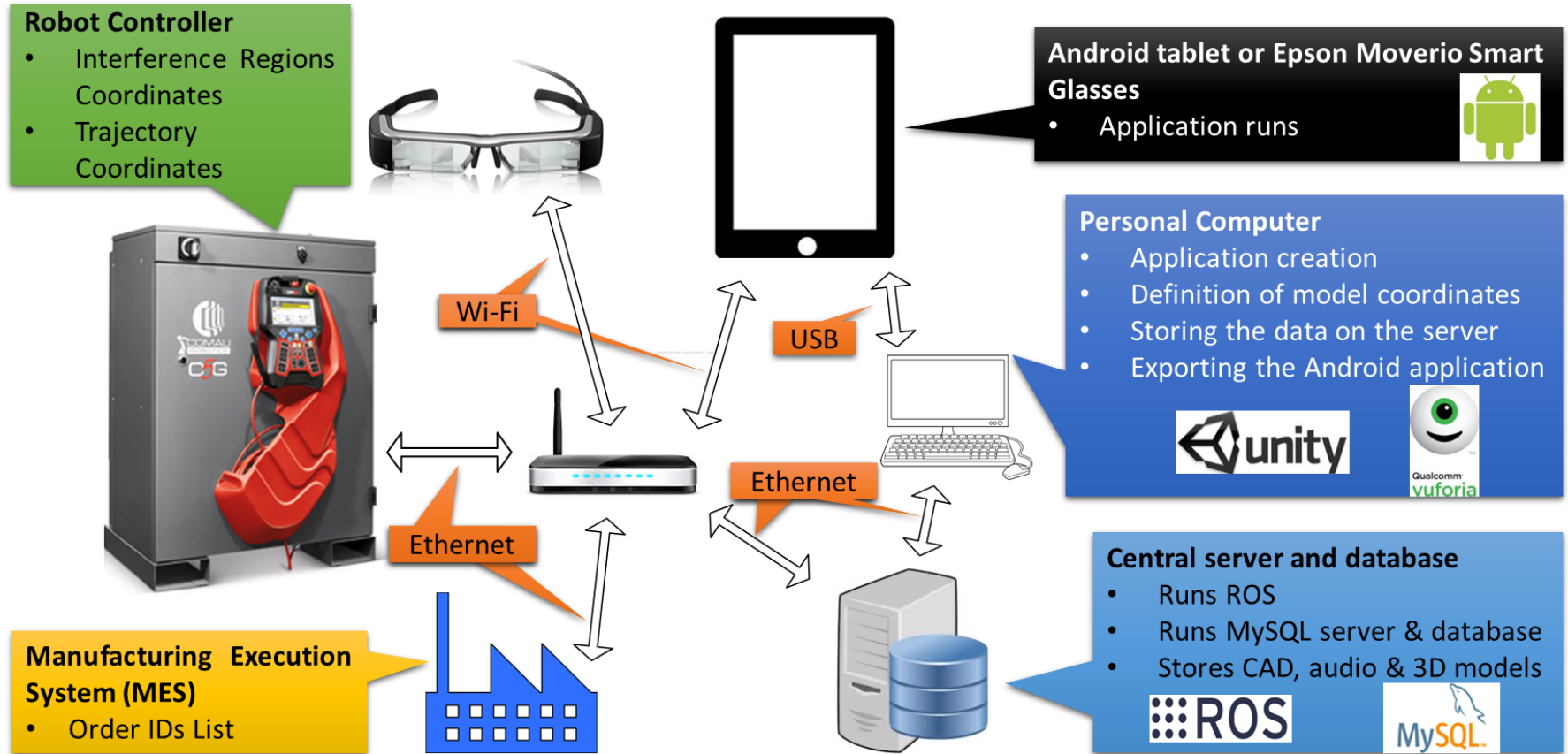×Fatigue Accumulation

×Repetitiveness leads to quality defects

×Requires training for different products

✓Cognition capabilities and troubleshooting

✓Highly dexterous tasks

✓Repetitive operations with consistent performance over time

✓Ability to manipulate heavy parts

✓Higher accuracy during task execution

×Can't handle unexpected occurrences

×Can't handle delicate tasks

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Approach

Augmented Reality Interface Architecture

Robot Controller
- Interference Regions Coordinates
- Trajectory Coordinates

Android tablet or Epson Moverio Smart Glasses
- Application runs

Personal Computer
- Application creation
- Definition of model coordinates
- Storing the data on the server
- Exporting the Android application

Wi-Fi

USB

Ethernet

Ethernet

Manufacturing Execution System (MES)
- Order IDs List

Central server and database
- Runs ROS
- Runs MySQL server & database
- Stores CAD, audio & 3D models
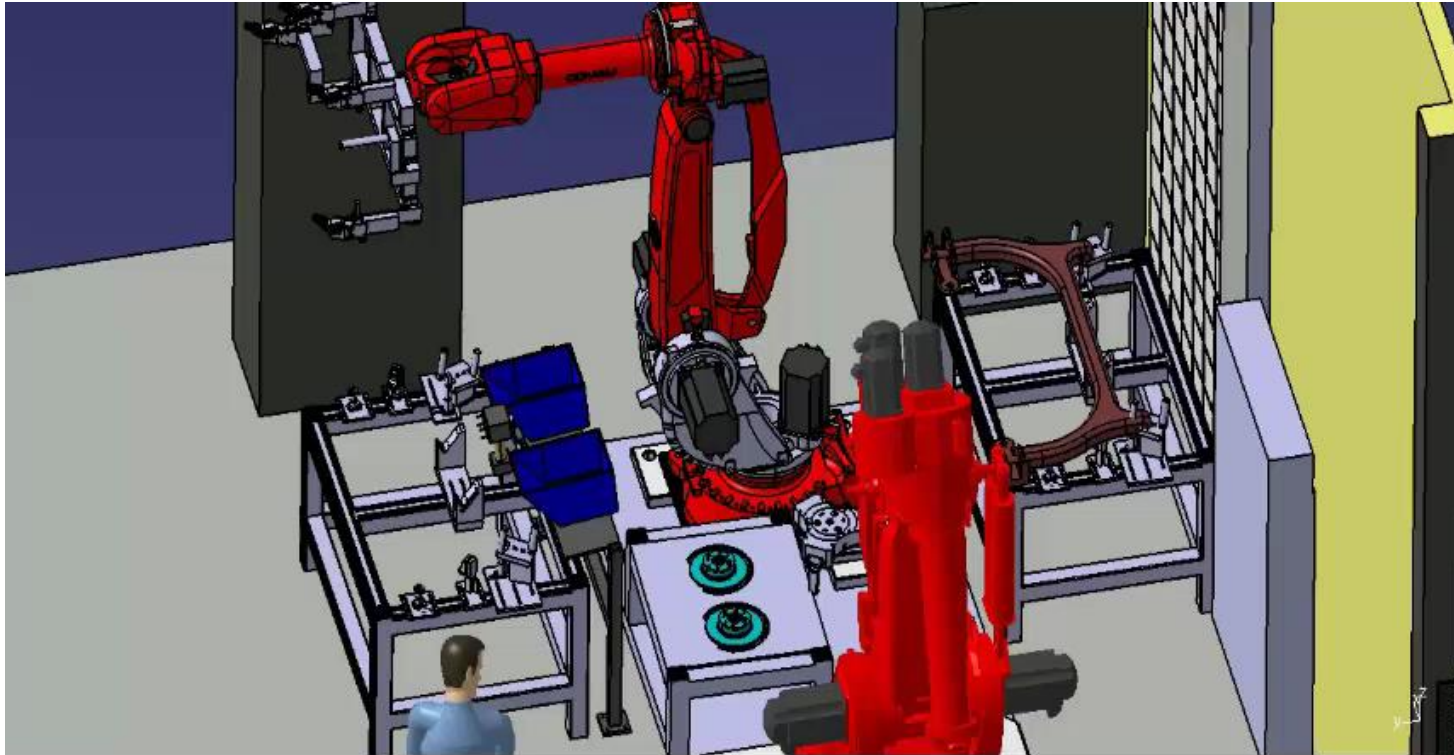
Assembly of a car's rear wheel axle

✓ 1 Real axle (25 kg) ✓ 2 Rear wheel group (12 kg) ✓ 4 Clips for fixing cables ✓ 8 screws

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AR System implementation

Implemented System Functionalities

General Settings | Operation To Operation Control

Execute Next Step.

Operations Status Table

TASK NAME	OPERATION NAME	RESOURCE NAME	STATUS
Screwing	Screwing	Operator 1	
Guiding Robot for position correction	Guiding Robot	Operator 1	
Reset Position	Exit Human Guide Mode	Racer Robot 1	
Reset Position	Reset Position	Racer Robot 1	
Pick & Place the Left Wheel Group	Pick up Left Wheel Group	Racer Robot 1	COMPLETED_OK
Pick & Place the Left Wheel Group	Place Left Wheel Group	Racer Robot 1	PENDING
Pick & Place the Left Wheel Group	Enter Human Guiding Mode	Racer Robot 1	
Pick & Place the Axle	Pick up Axle	Racer Robot 1	COMPLETED_OK
Pick & Place the Axle	Place Axle	Racer Robot 1	COMPLETED_OK

Password

AR Menu

Production Information

LMS
Laboratory for Manufacturing
Systems & Automation
University of Patras

TOFAŞ TÜRK OTOMOBİL FABRİKASI A.Ş.

Conclusions & Outlook

An AR based application, to **support human-robot interactive cooperation** in assembly.

Two main goals:

- **Support the operator** in co-existing and cooperating with robots

- Supplement operator's safety by **increasing human awareness.**

Next steps:

- Integration of **lightweight AR glasses and wearable devices -** operator's comfort

- More **ergonomic design** of the provided support (colors, transparency levels etc.)

- **Investigate challenges of** other industrial environments where the human-robot interaction is necessary

- Test application's capabilities to support **markerless visualization**

Contact Information

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Thank you for your Attention!

Questions?

For more information visit us at www.robo-partner.eu