CANOPIES

A Collaborative Paradigm for Human Workers and Multi-Robot Teams in Precision Agriculture Systems

Call: H2020-ICT-2018-20
(Information and Communication Technologies)
Topic: ICT-46-2020
Type of action: RIA

University of Cassino and Southern Lazio, Italy

Project Consortium

Participant	Participant organisation name	Country
1 (Coordinator)	Università degli Studi Roma Tre	IT
2	KTH Royal Institute of Technology	SE
3	Sapienza Università di Roma	IT
4	Universitat Politècnica de Catalunya	ES
5	Università degli Studi di Cassino e del Lazio Meridionale	IT
6	Danish Technological Institute	DK
7	PaleBlue AS	NO
8	Pal Robotics SL	ES
9	Agrimessina Srl	IT
10	RSA Srl	IT

Total Budget: about 7M€ **Starting:** January 2021 **Duration:** 4 years

Project Outline

Human-robot paradigm in unstructured highly dynamic outdoor environments of crop farming

Collaboration of multiple heterogeneous robots for harvesting and pruning operations

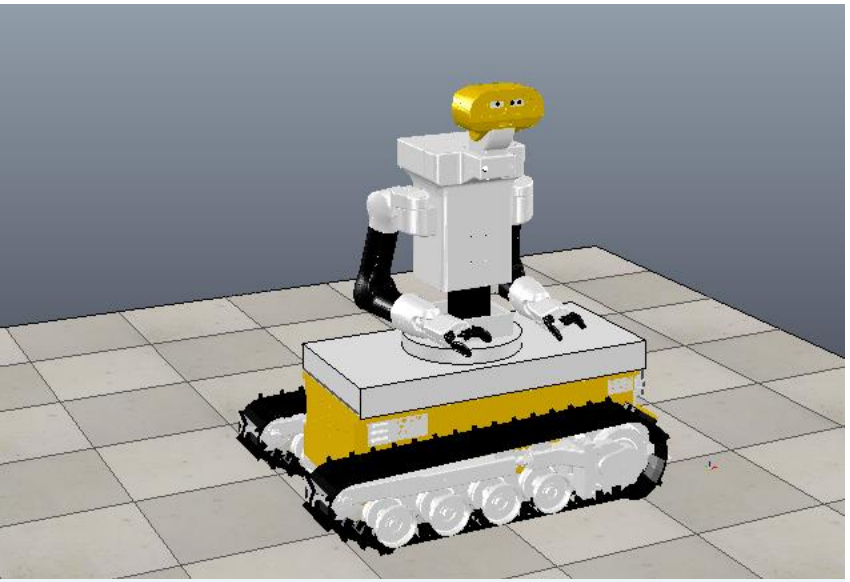
Specific Goals:

- complex processes of perception, human prediction, human-robot communication and shared planning
- novel human-robot interaction methodologies for enhanced safety and coexistence, system adaptability and intuitive usability
- novel multi-robot coordination methodologies for improved scalability

Main Objectives

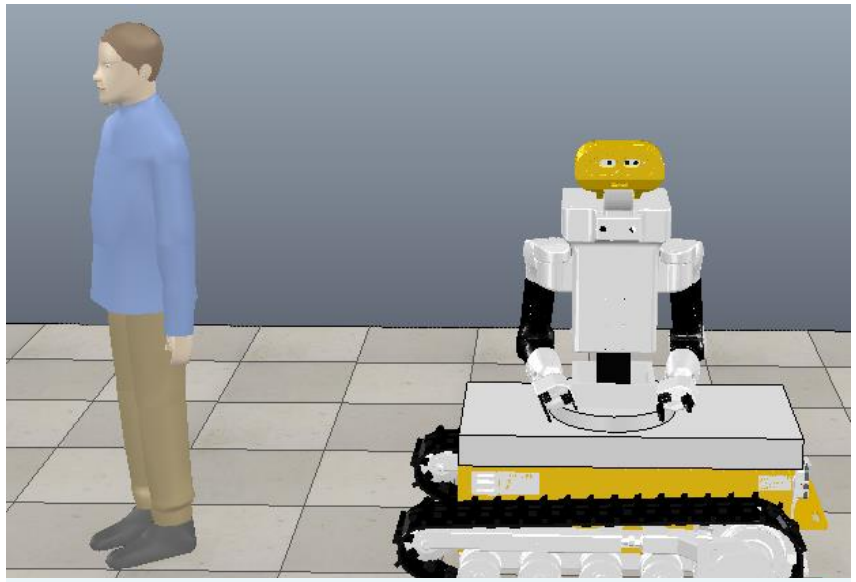
- ✓Safe human-robot interaction in shared outdoor workspaces both with and without physical interaction
- ✓Efficient communication between robots and humans and intention awareness
- ✓Human-like bimanual robot manipulation for intuitive HRC
- ✓Successful robot programming using learning by demonstration
- ✓Multi-robot coordination for collaborative tasks
- ✓Simulated farming environments for algorithm prototyping (Virtual Reality)
- ✓Table-Grape vineyard case-study implementation

Activities at University of Cassino 1/2



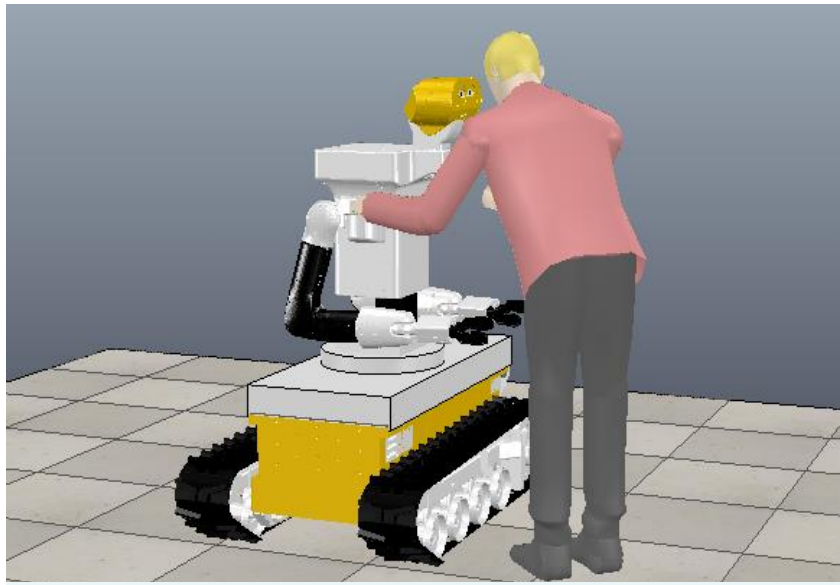
Two-Arms Coordination Functionalities

- Design of strategies for controlling the arms in an uncoordinated and coordinated way
- Use of human-like motion capabilities and the sensory information for online adapting the task reference and constraints



Robot Safety Functionalities

- Design of active safety mechanisms for workspace sharing using ad-hoc sensors, e.g. LIDAR and RGBD



Robot Physical Interaction Functionalities

- Design and implementation of variable admittance control strategies to track desired forces, ensure stability, and adapt to different environments
- Exploitation of human motion prediction

Activities at University of Cassino 2/2

Experimental activity

- Experiments in single arm and dual arm coordination, base-arms coordination, human-robot safety
- Preliminary trial at LAI Robotics laboratory, Cassino on mock-ups
- Field experiments in a vineyard located in Aprilia, Rome, Italy
- Programming: ROS/GAZEBO, Matlab/Simulink, C/C++

LAI Robotics Group

Stefano Chiaverini
Full Professor

Gianluca Antonelli
Full Professor

Alessandro Marino
Associate Professor

Filippo Arrichiello
Associate Professor

Giuseppe Fusco
Associate Professor

Paolo Di Lillo
Post Doc

Daniele Di Vito
Post Doc

Giuseppe Gillini
PhD Student

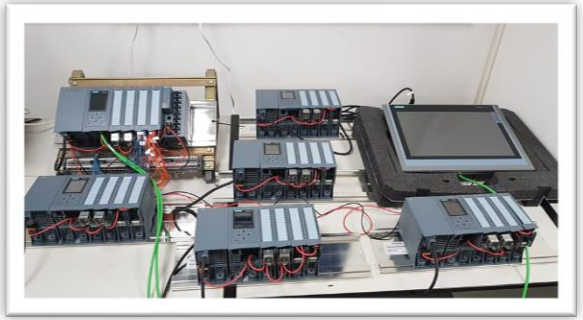
Giacomo Golluccio
PhD Student

http://webuser.unicas.it/lai/robotica/

LAI Robotics Equipment

- Robotic manipulators
- Mobile robots (ground&aerial)
- Brain-Computer-Interface (BCI)
- Programmable Logic Controllers (PLC)
- Industrial Automation simulator
- Human-Machine-Interface

LAI ROBOTICS



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