POLITECNICO DI TORINO

Dipartimento di Automatica e Informatica

PhD in Computer and Control Engineering

31th cycle

Supervisor

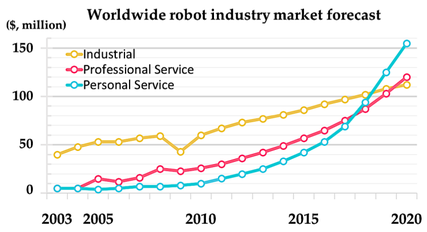
Prof. Fabrizio Lamberti

Human-Machine Interfaces for Service Robotics

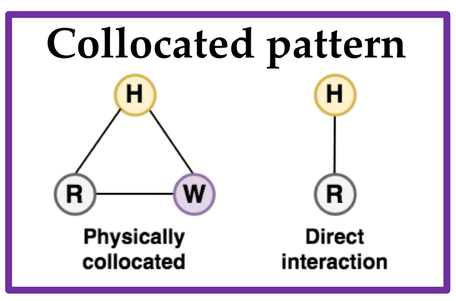
PhD Candidate: *Federica Bazzano*

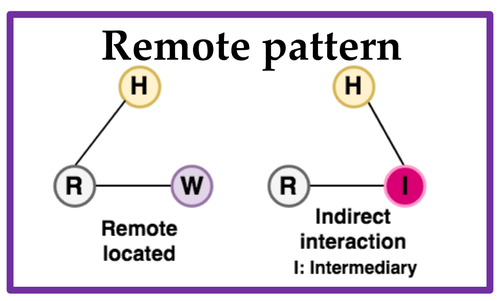
1. Introduction / Context

Service robots are playing an increasingly relevant role in the society. Consequently, identifying the most appropriate and effective paradigms for letting end-users interact with them is becoming of paramount importance.



Human-Robot Interaction (HRI) may take several forms, but these forms are largely influenced by spatial proximity. Thus, interaction and, therefore, interfaces can be classified into two categories.





Different open problems arise from this categorization based on spatial proximity.

Issues in Collocated Pattern

- robot's understanding of humans' presence and stimuli;
- robot's ability to interact naturally with humans;
- how are these robots perceived by humans? Are they accepted?

Issues in Remote Pattern

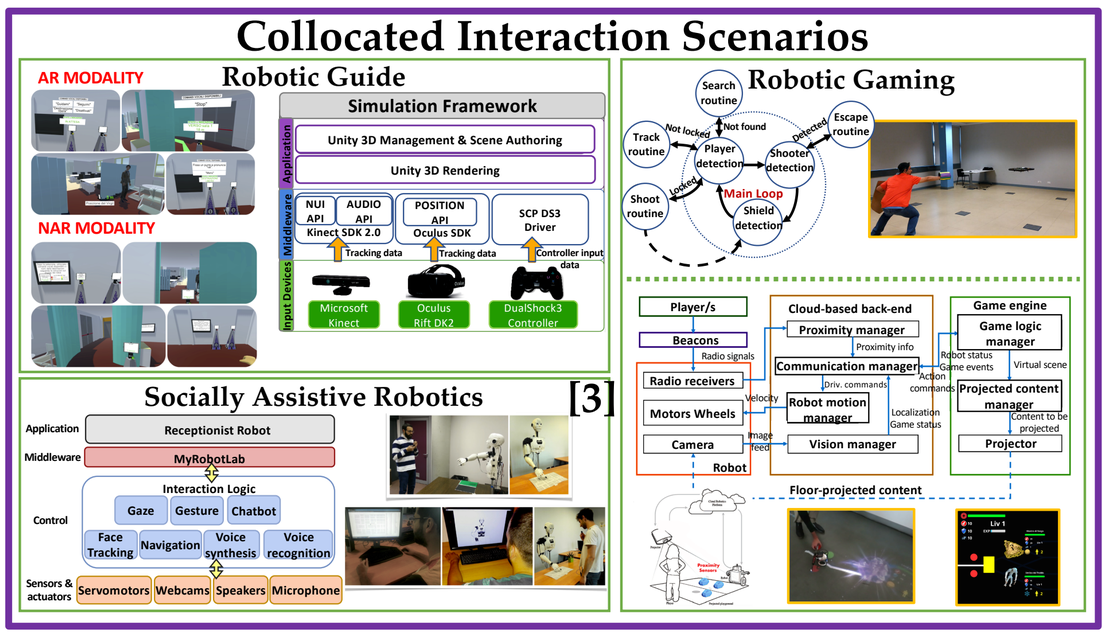
- poor human's **Situation Awareness** (SA) of the location, activities, status, and surroundings of the robot;
- high human's **Cognitive Demand** (CD) for operating robot from distance.

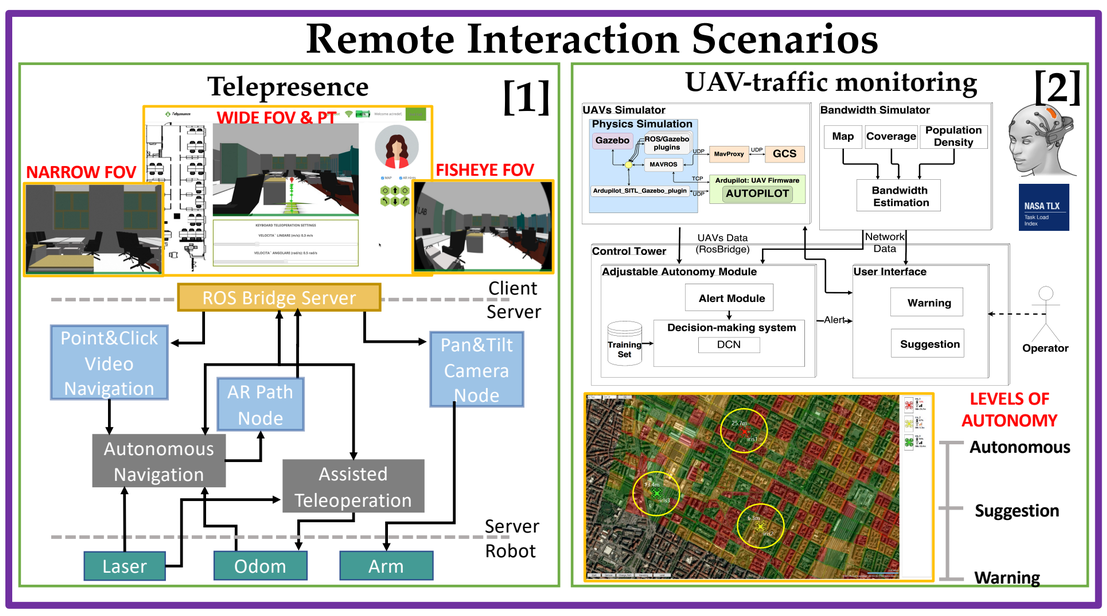
2. Goal

The goal of this research is to propose solutions to the identified problems by designing and developing frameworks dealing with concrete use cases and assessing them in real/simulated conditions.

3. Method

Service robotics domain includes various types of applications. Hence, in this thesis, some scenarios were selected and explored as representative examples.





4. Results and Conclusions

In conclusion, in remote HRI, interfaces with augmented Field of Views (FOVs) and different Levels of Autonomy (LOAs) improve users' SA and lower their CD, whereas, in collocated HRI, robots exhibiting human-like behaviors and human-like appearance are more acceptable, engaging and leading to better task performance.

References

1. Bazzano, Federica, et al. "Comparing usability of user interfaces for robotic telepresence." In *12th International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications* - Volume 2: HUCAPP, pp. 46-54 (2017).
2. Bazzano, Federica, et al. "Adjustable autonomy for UAV supervision applications through mental workload assessment techniques." In *9th International Conference on Intelligent Human Computer Interaction*. Springer, pp. 32-44 (2017).
3. Bazzano, Federica, and Fabrizio Lamberti. "Human-robot interfaces for interactive receptionist systems and wayfinding applications." In *Robotics* 7:3 (2018).