Politecnico di Torino
Dipartimento di Automatica e Informatica

PhD in Computer and Control Engineering
XXXIV cycle

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Virtual, Augmented, and Mixed Reality for Education and Training

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1. Context

The incredible technological advancements over the last decade and the availability of cost-effective hardware is promoting the diffusion of eXtended Reality (XR) at a mass scale. Undoubtedly, education and training were considered as two of the most promising "killer applications". In fact, XR training systems (XRTSs) are regarded as being capable, e.g., to make the learning processes significantly more effective, improving engagement and fostering active participation. Moreover, they enable the development of learning experiences that would not be otherwise possible or would be incredibly costly or risky. However, there are still issues and challenges to be addressed.

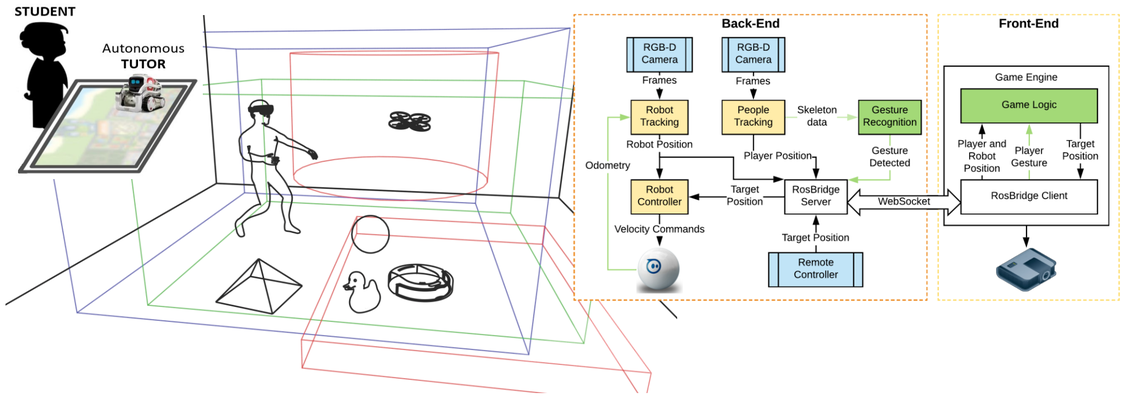
2. Goal

The objective of this research is to study and cope with issues related to XRTSs and exploit novel pedagogical opportunities offered by this new technology, focusing on aspects pertaining the **effectiveness** and the so-called **ecology** of the experiences

3. Methods

3.1 Robot as Pedagogical Agents

It was explored the use of commercial robots as pedagogical agents in Mixed-Reality (MR) educational applications. The intrinsic **phygital** nature of robots make them a perfect match to bridge the gap between the learning material delivered through MR and the real world. A set of **guidelines** to effectively design such intera-



-ctive experiences were proposed and validated [1], together with ways to integrate novel pedagogical paradigms into them.

3.2 Workforce Development with XRTSs

Many investigations were conduced regarding how to teach and assess hands-on tasks and operating procedures with XRTSs [2,3]. A number of tools were proposed to benefit both **trainees** [2] and **training provisioners** [3] with different degrees of scaffolding: from shared simulation environments in which both trainees and trainers can simultaneously interact, to self-learning experiences intended to be used without the supervision of a human instructor.

4. Results

Experiments carried out involving both domain experts and users in the training scope, performed both in controlled, laboratory settings and in **real use-cases** scenarios, aided in validating the proposed **approaches** and **tools**. Results highlighted that XRTS experiences could be **as effective** as real-world training, but the knowledge transfer quality is sensitive to design and implementation choices [1,2].

References

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