Master's Program in Bioengineering

Thesis Project Form

Title (tentative): Design and development of an innovative robot for physical human – human wrist interaction

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### Description

**Motivation and application domain**

In commercial rehabilitation systems the haptic interaction between the robot and the patient is usually uni-directional. Rehab systems should be based on bi-directional interaction, including on-line evaluation of important sensorimotor indicators. To achieve such integration it is necessary to expand the ‘cognitive’ architecture of future intelligent rehab robots to implement a structure where the robot mediates the haptic cues of the human therapist with the haptic features of the patient.

**General objectives and main activities**

The goal of the thesis is to implement a first robot prototype where two humans have the possibility to jointly interact with, and exchange haptic information between them. The robot will be based on two separated robots for wrist rehabilitation developed at the Istituto Italiano di Tecnologia. The work will consist in the design and implementation of the software architecture that permit to link the two robots in terms of communication of kinematic and dynamic data and of control signals. The implemented prototype will be then tested with human participants in a real experiment of physical human – human interaction.

**Training Objectives (technical/analytical tools, experimental methodologies)**

The student will learn:
1. Design criteria for a robot prototype (Hardware and Software)
2. Mixed software skills (C/C++, Matlab, Python)
3. Testing and validation techniques with human subjects
4. Behavioral experiments methodologies

**Place(s) where the thesis work will be carried out:**

- Robotics, Brain and Cognitive Sciences Unit, Center for Human Technologies, Istituto Italiano di Tecnologia (Erzelli) & DIBRIS

**Additional information**

Maximum number of students: 2