2017-00205 - Immersive whole-body teleoperation of the humanoid robot iCub

Level of qualifications required: Graduate degree or equivalent
Fonction: Temporary scientific engineer
Level of experience: From 3 to 5 years

About Inria

Inria, the French National Institute for computer science and applied mathematics, promotes “scientific excellence for technology transfer and society”. Graduates from the world’s top universities, Inria’s 2,700 employees rise to the challenges of digital sciences. With its open, agile model, Inria is able to explore original approaches with its partners in industry and academia and provide an efficient response to the multidisciplinary and application challenges of the digital transformation. Inria is the source of many innovations that add value and create jobs.

Context

The engineer will join the team working in the European Project AnDy (http://andy-project.eu/), a H2020 funded project with several international partners in Germany (DLR), Slovenia (JSI) and Italy (IIT).

One of the objectives of the project is to realize collaborative scenarios between the humanoid robot iCub [1] and a human partner, equipped with several wearable sensors. Collaboration is intended as anticipatory physical interaction that assists the human partner in realizing a task while optimizing some criteria (equilibrium, effort, ergonomy). For example, we need to realize a collaborative assembly or pick & place task, where the iCub and the human partner pick an object together, transport it (eventually) to a desired location, and then place it, to make some assembly.

In this context, we would like to implement an immersive whole-body tele-operation of the iCub, so that a human operator can control in real-time the humanoid iCub, to provide demonstrations of the desired robot behavior for these tasks. The human operator will be equipped with a XSens MVN suit [2], a wearable system for motion capture, a virtual-reality system with joysticks (e.g., HTC vive), sensorized gloves [3] and shoes. A preliminary theoretical model for offline synthesis of the robot's movement from XSens data was proposed in [4], whereas a preliminary implementation of a human-aware controller of physical interaction for iCub was described in [5]. The goal of this project is to retarget the movement and actions of the human operator into the robot iCub, in real-time.

Project meetings and travel expenses of the candidate engineer will be covered by the project AnDy.

Lab equipment: the iCub robot, two XSens suits, sensorized gloves and shoes. Force plates and external motion capture Qualisys/Optitrack are also available.

About the team: the engineer will work in cooperation with the other engineers, researchers and phd students of the team LARSEN, and more specifically with the AnDy team lead by Serena Ivaldi (https://members.inria.fr/Sivaldi/). The team consists of 5 full-time researchers and several postdocs, phd and engineers, french and international. The team LARSEN is doing research in both robotics & AI, particularly in robot learning, human-robot interaction and probabilistic models. More in: https://team.inria.fr/larsen/

About Inria: established in 1967, Inria is the only public research body fully dedicated to computational sciences. The team LARSEN's laboratory is located in the research center of Inria Nancy-Grand Est [6], in the heart of a major cross-border region that facilitates industrial and academic partnerships between France and Germany. Nancy is a student city, conveniently located at 1h20 from Paris and 1h from Luxembourg.

References:
Assignment

The engineer will be in charge of designing and developing the software suite to perform the immersive tele-operation of the robot. There are available software modules for interfacing the sensors (Xsens, glove, etc) on YARP/ROS, but no interfaces yet for the virtual reality set. The candidate can rely on existing modules for whole-body control, with kinematics/dynamics controllers.

The candidate is expected to test and validate the software on the real robot iCub in one collaborative scenario.

The recruited engineer will closely work with the AnDy team, with both researchers and engineers.

Main activities

- Propose software architecture for orchestrating modules, drivers, etc
- Develop the software modules for the tele-operation
- Write documentation
- Validate software on iCub
- Test and validate the tele-operation application with human operators equipped with one or multiple wearable sensors, among the Xsens, e-gloves, virtual reality set (e.g., HTC Vive), force shoes, etc.

Skills

Technical skills and level required:

- Strong programming skills, particularly in C++
- Good knowledge of C++, python/matlab, and programming tools (CMake, git)
- Working knowledge of Linux/Ubuntu and Windows

Languages:

- Very good technical English required, as documentation will be in English and the candidate will interact with other international engineers/researchers
- French is a plus, but not mandatory

Relational skills:

- Excellent communication and collaboration skills, as the candidate will have to work in close collaboration with engineers, postdocs, phds and researchers

Other valued appreciated:

- Passion for technology, virtual/augmented reality and robotics

Benefits package

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Flexible working hours
- Sports facilities

Remuneration

From 2734,00€ brut per month