The Software Architecture for the Humanoid Robot COMAN

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October 2014

Abstract

In this talk, the development of a novel software infrastructure for the humanoid robot COMAN will be presented. COMAN is a humanoid robot equipped with series elastic actuators, capable to perform complex tasks in a semi-autonomous and tele-operated way. To achieve this level of performance, the software that runs on COMAN has been designed in order to facilitate the developing cycle and to be easy to use.

The software architecture of COMAN is divided in 3 levels: the low level firmware for joint control, the whole body motion control and the perception level. The *Firmware* layer is decentralized to each joint providing local position, impedance and torque control. The *Whole body Control* layer is implemented using the YARP framework and a new library named *OpenSoT* which is oriented to prioritized inverse kinematic control. The main principle of *OpenSoT* is that provides decoupling of the concepts of task description, type of control and solver. The *Perception* level is implemented using both YARP and ROS. In particular, high frequency sensors (such as force/torque sensors, IMU, ...) uses YARP interfaces while low frequency sensors (such as cameras, Kinect, ...) uses ROS drivers.

Two additional levels include the software tools that permits to tele-operate COMAN and to further develop and extend its software. Tele-operation of COMAN is realized through a UI called PI (Pilot Interface). PI permits to control COMAN in joint, Cartesian and task level. Furthermore it permits to monitor COMAN status and visualize on-board sensors data. The latter level consists of the whole infrastructure that manage all the developed software and dependencies, called *SuperBuild* and a set of plugins for the Gazebo simulation environment to simulate our modules.

The talk will focus on all these topics stressing lessons learned, best practices and fundamental decisions taken in order to develop the whole system.

The research leading to these results has received funding from the European Union Seventh Framework Programme [FP7-ICT-2013-10] under grant agreements n.611832 WALK-MAN and ERC Advanced Grant no. 291166 SoftHands.