The iCub humanoid robot: an open platform for research in embodied cognition

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Abstract — We report about the iCub, a humanoid robot for research in embodied cognition. At 104 cm tall, the iCub has the size of a three and half year old child. It can crawl on all fours and sit up to manipulate objects. Its hands have been designed to support sophisticate manipulation skills. The iCub is distributed as Open Source following the GPL/FDL licenses.

The iCub has been developed by the RobotCub project, a collaborative effort funded by the European Commission under the sixth framework programme (FP6) by Unit E5: Cognitive Systems, Interaction and Robotics. It has the two-fold goal of: i) creating an open hardware/software humanoid robotic platform for research in embodied cognition, and ii) advancing our understanding of natural and artificial cognitive systems by exploiting this platform in the study of the development of cognitive capabilities.

The RobotCub stance on cognition posits that manipulation plays a fundamental role in the development of cognitive capabilities. As many of these basic skills are not ready-made at birth, but developed during ontogenesis, RobotCub aims at testing and developing this paradigm through the creation of a child-like humanoid robot: the iCub. This "baby" robot will act in cognitive scenarios, performing tasks useful for learning while interacting with the environment and humans. The small (104cm tall), compact size (approximately 22kg and fitting within the volume of a child) and high number (53) of degrees of freedom combined with the Open Source approach distinguish RobotCub from other humanoid robotics projects developed worldwide.

We focus here on the description of the iCub, both in terms of hardware and software. In particular, we will briefly discuss the rationale of the hardware design, the modularity and reuse of software components, and the consequences of the Open Source distribution policy.

The hardware of iCub has been specifically optimized and designed somewhat holistically: modularity in this case had to be traded for functionality and overall size. Software, on the other hand, has been designed with modularity and component reuse in mind. Both the hardware and software of the iCub have been released under the GPL and FDL licenses.

Additional initiatives are aiming at promoting the iCub as the platform of choice for research in embodied cognition. Nineteen robots are expected to be delivered by spring 2010 as part of RobotCub and of other EU funded projects.