Brain Infrastructure for Coco

Charlie Kemp

The Problem: We wish to use Coco, a small ape-like robot shown below, to explore humanoid intelligence. Sophisticated humanoid robots such as Coco require large amounts of parallel computation in order to support rich real-time multi-modal sensory input and complex behavioral output. Creating a computational system of this nature is difficult.

Motivation: A well-designed computational infrastructure will help us to organize the requisite computation and allow us to more easily add functionality to Coco. For example, along with other code we would like Coco's brain to simultaneously run a variety of real-time vision algorithms, audio processing algorithms, tactile information processing algorithms and motor control algorithms. Without a framework for making these algorithms work together the effort spent maintaining the system, let alone producing new research at the creature level, would be infeasible.

Previous Work: As has been demonstrated with other robots in the humanoid robotics group, such as Kismet and Cog, incorporating a diverse set of real-time algorithms into the brain of a properly designed robotic body can lead to rewarding investigations of humanoid intelligence. Kismet uses many networked machines and several operating systems glued together with an assortment of communications mechanisms. [1] Cog primarily relies on networked computers running the QNX 4.25 real-time operating system. [2]

Approach: We are attempting to use MPI, a message passing standard, to create a flexible C++ code base that meets the needs described above. MPI is widely used by the high-performance computing community to write parallel applications for large clusters of computers. [3]

Difficulty: Robotic systems controlled by software of the proposed level of complexity are very new. Currently these systems are not well understood, so the true requirements for the code we are attempting to create are unknown.

Impact: A successful library would help us focus on the big picture of intelligent creatures.

Future Work: Our code will need to evolve significantly as we use it to produce intelligent behaviors in Coco.

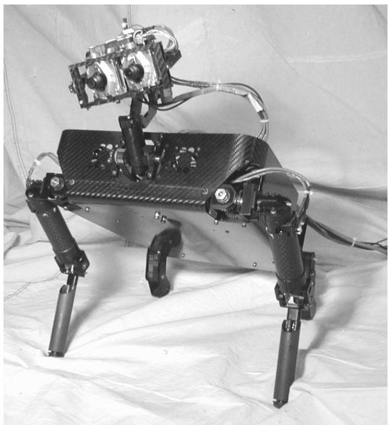

Figure 1: Coco a 15 dof ape-like robot.

References:

[1] C. Breazeal Sociable Machines: Expressive Social Exchange Between Humans and Robots Sc.D. dissertation.

[2] Rodney A. Brooks, Cynthia Breazeal, Matthew Marjanovic, Brian Scassellati, Matthew Williamson The Cog Project: Building a Humanoid Robot Springer-Verlag Lecture Notes in Computer Science.

[3] official MPI (Message Passing Interface) standards documents, errata, and archives of the MPI Forum http://www.mpi-forum.org