

Robotanic: an externalist outlook of a robot architecture

Antonio Chella

*Dipartimento di Ingegneria Informatica, Università di Palermo
Viale delle Scienze, building 6
90128 Palermo, Italy*

Abstract

The current generation of systems for man-machine interaction shows impressive performances with respect to the external shapes, the mechanics and the control of movements; see for example the android robots developed by Ishiguro and colleagues (Ishiguro & Nishio 2007). However, these robots, currently at the state of the art, present only limited capabilities of perception, reasoning and action in novel and unstructured environments. Moreover, the capabilities of user-robot interaction are standardized and very well defined.

A new generation of robotic agents, able to perceive and act in new and unstructured environments should be able to pay attention to the relevant entities in the environment, to choose its own goals and motivations, and to decide how to reach them. To reach this result, a robotic agent must be able to simulate different functions of the human brain that allow humans to be aware of the environment that surrounds them. In a word, new robotic agents must show some form of machine consciousness (see, e.g., Aleksander & Morton 2008).

The current work takes into account the externalist (Rockwell 2005, Manzotti 2006) point of view by hypothesizing that the perception process is based on a generalized loop between the brain, body and environment. The perception loop is in part internal and in part external to the robot, and it comprises the interactions among the proprioceptive and perceptive sensor data, the anticipations about the perceived scene, and the scene itself, through a focus of attention mechanism. The perception loop is strictly related with the Haikonen cognitive architecture (Haikonen 2003, 2007) and with the architecture at the basis of the CRONOS/SIMNOS anthropomorphic robot described in (Holland 2007).

The perception model has been tested on an effective robot architecture implemented on Robotanic, the outdoor successor of Cicerobot (Macaluso & Chella 2007). Robotanic is an operating outdoor autonomous robot MobileRobots Pioneer 3-AT using differential drive and equipped with a laser scan range finder, a sonar array, a stereo camera and a GPS.

The robot offers guided tours in the Botanical Garden of Palermo, a semi-structured outdoor environment, nearly 20000 sq m. large, characterized by several pathways sometimes bounded by short walls or plants. The environment is highly dynamic as visitors are all day walking inside the botanical garden, gardeners work alongside the plants and even workers trucks happen to pass by. The live test-bed for the proposed system was during an international conference held in the Botanical Garden. The robot successfully performed several tours, covering more than 3 km in a day.

References

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