Abstract

For an assistive system such as an intelligent wheelchair, it is particularly important that system should not only automatically adapt the level of assistance but also perform in a way so as the user is unable to realize that he is getting help! Such a notion of assistance is a vision still far from being fulfilled. The work presented in this dissertation attempts at bringing this vision a little closer to realization.

For an intelligent wheelchair, it is desirable that the system must take full advantage of user's potential abilities. This is often addressed by a *collaborative approach.* Most of the current collaborative approaches for wheelchairs control ignore the basic fact that human act independently (of the system) and are often satisfied with a good solution (which may not be optimal). This motivates us to focus on the fact that for effective human-machine collaboration, machine needs to be cognitively enhanced. To capture the intuition we propose the following thesis: a cognitively enhanced control framework for wheelchair navigation can improve collaboration between wheelchair user and the machine. This thesis put forward a framework for cognitively enhanced collaborative control of navigation. This is based on Alan C. Schultz's concrete illustration on using embodied cognition for effective human robot interaction.

To support the thesis, this work starts by presentation of an extended BDI architecture to facilitate collaboration with human. We present a generic architecture for a collaborative agent, cBDI, an extended BDI architecture.

As agent move towards being collaborative in navigation task, the basic ingredients for such a behavior is agent's knowledge of human strategies to getting from *here* to *there*. In this context, we explore wayfinding in a virtual maze. The

knowledge of human strategies from empirical investigation thus gained form part of the extended BDI agent.

In this thesis, we explore how the extended BDI agent and the facts of human wayfinding influence a controller design for collaborative navigation. The control architecture aims to establish cognitive enhanced collaborative control of navigation for an intelligent wheelchair. Finally controller is demonstrated and evaluated through human subject studies.

Keywords: Human-Robot Collaboration, Human Centric Behaviour in Collaboration, BDI architecture, Collaborative agent, Collaborative Control of Wheelchair, Collaborative Planning.