Intelligent Agents and Their Applications

Conference Paper *in* Lecture Notes in Computer Science · October 2006

DOI: 10.1007/11893004_63 · Source: DBLP

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Intelligent Agents and their Applications

WIC Australia Centre Report 2002-2004

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Abstract

*This paper attempts to encapsulate the activities for the year 2002-2004 of the **Web Intelligence Consortium** (WIC) **Australia Centre,** an affiliated Centre of the WIC international organization.*

1. Introduction

WIC Australia Centre started with a vision to perform world class research by collaborating with industry and contributing to the development of industry by producing intellectual property through research effort. In this initial establishment period of the WIC Australia Center within the Knowledge based intelligent Engineering System (KES) Center at the University Of South Australia (UniSA), it has established strong research collaboration primarily with the Australian Defence Science and Technology Organization (DSTO), and active involvement with industry, namely Agent Oriented Software Pty. Ltd (AOS), the manufacturer of Intelligent Agent Software called JACK. This joint collaboration has resulted in the formation of an umbrella project named Intelligent Agent and Multi- Agent Studies: Ia-MAS. Researchers involved in intelligent agent projects and web based intelligent systems have been brought together under the umbrella of KES. The following sections briefly describe the research undertaken by the WIC Australia Centre.

2. Intelligent Agent And Multi-Agent Studies: Ia-MAS

The initial phase of this project was to understand the area of intelligent agents and form a solid base for research.

2.1. Intelligent Agents for Airborne mission system [1]

The aim of this project is to form a collaborative human-agent team in order to increase human situation awareness in hostile environments. This aim was inspired from previous work/studies on automation in the field of Airborne mission systems, where humans are not in control of automated machines such as aircraft, which have several controls, thus resulting in reduced human situation awareness during critical missions. Intelligent agents were an attractive alternative solution for this problem due to certain characteristics that they possess, eg. autonomous behavior toward complex problems [2]. In particular, the Belief Desire Intention (BDI) agent which has intentions and desire and thus achieves its goals, seemed ideal for this project. Collaborative human-agent communication is also being a main focus of the proposed research. Aspects of communication will include control and management, coordination, self-learning, performance monitoring, warning, and assertive behaviour.

In the following projects we aim to implement appropriate methodologies in order to achieve the above stated characteristics.

2.2. Learning in Multi-Agent systems [3]

This research aims to introduce some aspects of learning to the existing BDI philosophy. Most of the functionality of agents can be implemented using the existing BDI-syntax of JACK [3], but a problem arises from the fact that BDI agents exhibit open-loop decision-making. That is, a BDI agent requires an *event* from the environment to generate a *goal* (either directly or by changing its *beliefs*) so that it can search through its *plans* to form an *intention* on how to act. When the plan has finished executing (by succeeding or failing), the decision process finishes. In addition, BDI-agents are optimised for a specific scenario, which means that an agent written for a particular environment will not easily translate to another environment. It is aimed to remove these shortcomings by introducing a learning component into the agent.

2.3. Test bed to demonstrate agent learning and teaming [5]

This research aims to implement a test bed to demonstrate agent learning and teaming. We have chosen a first person shooting video game called Unreal Tournament (UT) as a project concept demonstrator. This

Proceedings of the IEEE/WIC/ACM International Conference on Web Intelligence (WI'04)
0-7695-2100-2/04 $ 20.00 IEEE

was chosen due to its maturity in producing a fast paced dynamic environment as well as its flexibility for development and customisation using a C++ language based script called "Unreal script".

This project has successfully developed an in-house BDI intelligent agent Interface called *UtJackInterface* (UtJI) to interface BDI agents developed using JACK [3] to unreal tournament. Our future plans are to enhance the functionality of this interface further to accommodate previously specified agent capabilities such as learning and human-agent teaming.

2.4. An agent-based framework for holonic execution in manufacturing enterprises [6]

There is now a growing consensus within the manufacturing community that a holistic approach to manufacturing enterprise design is required if we are to achieve the flexibility and responsiveness that today's customers demand. A holonic enterprise can be viewed as a distributed system consisting of intelligent manufacturing agents. These agents (or holons) are capable of either operating autonomously or cooperatively to achieve manufacturing outcomes. The belief is that by providing a wide range of standardised holons, the design, construction and modification of manufacturing systems will become much easier. It is also intended that holons will be able to adapt to changes in their local environment, so that robust and reliable operation can be guaranteed.
This projects aims to address shortcoming of current industry trend of holonic manufacturing by utilising existing control technology in a novel way rather than awaiting the development of mature holonic control technology.

2.5. An Intelligent Aircraft Landing Support System [7]

This research is related to the problem of continuing accidents in contemporary aircraft landings and proposes three autonomous agents whose task is to jointly monitor the aircraft and its flight crew. These three agents act together to improve safety in the specific process of landing the aircraft.

2.6. Autonomous Flying platform

This project takes its inspiration from difficult search and rescue missions such as the World Trade Centre in New York, where victims that were stuck on high levels had no way of escaping. This triggers researchers to think about how to rescue these people. One way to do this is to deploy flying platforms that fly towards the building and bring the victims safety to the ground. Apart from this immediate aim the platform can be useful in several other search and rescue scenarios. We are in the process of designing intelligent control systems to stabilise and control the platform.

The future scope of this project is to enhance this platform to be controlled autonomously by BDI Jack agents.

3. Conclusion

We have initiated industry based research on intelligent agents and their practical applications. Some of our successful research directions are reported in this paper. WIC Australia Centre is continuing to pursue its research goals as described above. Our strength lies in efficient collaborations and continued support from WIC Australia researchers and WIC international organization.

4. Acknowledgements

Financial support by Australian Defence Science and Technology Organisation is acknowledged (Contract Number: 4500122767).

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