Team Description for RMIT-on-Fire: Robocup Rescue Simulation Team 2001

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Abstract. This team description paper outlines the reasons that RMIT Compter Science considers RoboCupRescue a valuable domain for ongoing research, and describes the preliminary architecture which has been developed as an infrastructure for ongoing work in the area of building BDI (Belief Desire Intention) intelligent agents and multi-agent cooperating teams.

1 Introduction

RMIT Computer Science has been involved with various aspects of RoboCup each year since its inception in 1996. The main reasons for this involvement is because RoboCup provides an international forum for discussing, comparing and evaluating implemented approaches for achieving multi-agent co-operation in a complex and changing world, an area we have been actively working in [CP98].

Of course it also provides many more challenges than just this one which was originally, and remains our central area of interest. One must manage uncertain information, develop high quality low -level behaviours, do localisation, and many other tasks.

With the start of RoboCupRescue we decided that this domain was better suited to our long term research interests than the soccer domain and we made a decision to focus this year on starting to set up the infrastructure for an ongoing participation in RoboCupRescue. Prior to the competition we had been unable to run on more than a single pentium PC, which somewhat hampered the infrastructure development. We are now in the process of setting up more adequate resources, in the form of 4-5 networked high end PC's.

2 Research Directions

RoboCupRescue offers an extremely broad research opportunity spanning social systems research, research in physical systems, both rescue robots and a variety of information gathering devices, disaster management research and research in multi-agent software systems. Our particular interest is in the latter area, although we welcome the opportunity to interact with people from the other

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areas, particularly in order to better focus our research on addressing problems that lie within our area of expertise and are of importance to real and important applications.

The research questions which we are currently most interested in within this project, are those surrounding the issue of obtaining timely and effective co-operative behaviour, with sufficient flexibility for autonomous individual behaviour towards the agreed system goals of maximising rescue and minimising damage.

The fact that agents are inherently heterogenous, with different abilities requires at least implicit co-operation if the system as a whole is to be effective. There are however many questions as to how this co-operation can best be achieved. It is important that methods chosen are robust so that if some part of the system is rendered inactive, the rest of the system continues to operate in a reasonable if not optimal manner. Exploration of effective and robust means of co-operation is one of our foremost goals.

We are also interested in the process of software development and are consequently working on ways to reliably specify and program complex agent behaviour, including team behaviour. To this end we are using and evaluating JACK^{TM} Intelligent Agents development environment [HRHL01], which uses the wellestablished Belief, Desire, Intention, (BDI) agent paradigm [RG95]. We plan to explore the JACK^{TM} software support for building and programming agent teams [HRB00], which uses a different paradigm for buidling cooperative software teams than much other work in the area (e.g. [SGK00, Tam97]).

Another area of research interest for us is that of co-operation of software agents in open systems. How can we write our software so that it can sensibly interact with and co-operate with software written by others in the same domain, but without any planning for co-operation. We see this as an area which is a potential future focus for RoboCupRescue as a natural way to explore this would be to have agents written by different groups, come together at the competition where we could evaluate how well each managed to co-operate with previously unknown agents.

3 Implemented System

Our implemented system this year was quite minimal as most effort was towards setting up the infrastructure for future work. Two undergraduate students worked in their spare time on developing the framework for our java code to interact with the simulator. We used and modified the sample code supplied by ?? for processing of visual data and for obtaining routes to move.

We built an architecture where significant events are extracted from the visual data by each agent and are then passed to the agent reasoning mechanism for decisions as to how to react. Reactions are in terms of predefined plans which contain multiple steps, some of which may be further plans, or plan sets, where the appropriate plan is chosen from the set at run time, depending on circumstances.

At each time step the agent does the next action as determined by the plan which it has decided is the most appropriate to follow. Plans can be aborted if the situation changes, and if a plan fails to achieve its intended goal, a new plan can be tried.

The agent reasoning mecahnism uses the Belief Desire Intention (BDI) style of agent reasoning [RG95] which is implemented using the JACK^{TM} system.

This year we implemented only the fire engine agents and had only a skeletal reasoning structure with a minimal set of very primtive plans. One of the advantages of the BDI architecture is that once a system is in place it is reasonably straightforward to add more specialised plans which are effective in particular situations. We are hopeful that in the future we will have a much richer set of plans (as well as more reliable primitive behaviours) that will asllow our agents to react flexibly and effectively in the simulated disaster situation.

References

[CP98] Simon Ch'ng and Lin Padgham. From roles to teamwork: a framework and architecture. *Applied Artificial Intelligence*, 12:211–231, March 1998.

[HRB00] Andrew Hodgson, Ralph Rönnquist, and Paolo Busetta. Specification of coordinated agent behaviour (the simple team approach). Technical Report 5, www.agent-software.com.au, 2000.

[HRHL01] Nick Howden, Ralph Rönnquist, Andrew Hodgson, and Andrew Lucas. Jack intelligent agents – summary of an agent infrastructure. In *5th International Conference on Autonomous Agents*, 2001.

[RG95] Anand S. Rao and Michael P. Georgeff. Bdi agents: From theory to practice. In *Proceedings of the First International Conference on Multiagent Systems*, 1995.

[SGK00] D.J. Sullivan, B.J. Grosz, and S. Kraus. *Intention Teconciliation by Collaborative Agents.* IEEE Computer Society Press, 2000.

[Tam97] Milind Tambe. Towards flexible teamwork. *Journal of Artificial Intelligence research*, 7:83–124, 1997.