2003 AAAI Robot Competition and Exhibition

I. Overview

The Twelfth Annual AAAI Robot Competition and Exhibition was held in Acapulco, Mexico in conjunction with the 2003 Int'l Joint Conf. on Artificial Intelligence. The events included the Robot Host and Urban Search and Rescue competitions, the AAAI Robot Challenge, and the Robot Exhibition. Three-days of events were capped by the two robots participating in the Challenge giving talks and answering questions from the audience.

The purpose of the Robot Competition and Exhibition is to bring together teams from colleges, universities, and research laboratories to share experiences, compete, and demonstrate state-of-the-art robot capabilities. Of interest this year is that some of the prizes for the competition events were iRobot Roomba robot vacuum cleaners. Six years ago, at the 6th AAAI Robot Competition, one of the events challenged teams to develop a vacuum cleaning robot [1]. This year, that event came back full circle, and people can now buy robot vacuum cleaners for their homes at a price similar to that of a non-robotic vacuum. Thus, progress continues, and the highlights of this year's competition could be a window into consumer robots of the next decade.

II. Robot Host: Robots Helping People

This year the two competition events–Robot Host and Urban Search and Rescue [USR]–focused on helping people, albeit in very different situations.

For the Robot Host event, the teams had two tasks: mobile information server, and robot guide. The primary task was to interact with people and provide information to them about the conference–talks and exhibit locations, for example. The secondary task was to act as a guide for conference attendees, guiding them either to specific talk rooms or exhibition booths. Other than outlining the mission, and requiring a

safety qualifying round, the task contained no specific restrictions or constraints on the environment or the robots. The robots performed their duties in the middle of the main lobby of the conference center, navigating around people and natural obstacles.

Fig. 1. University of Rochester's robot Mabel in the 2003 Robot Host Competition.

This year two teams participated: the University of Rochester and Stony Brook University. Both incorporated speech recognition, a visual interface, vision capability, and synthetic speech on a mobile platform. Figure 1 shows one of the robots interacting with conference attendees.

First place this year went to the University of Rochester, and second place went to the State University of New York, Stony Brook. Both the first and second place teams won an iRobot Roomba and a $1000 certificate towards the purchase of an ActivMedia robot.

III. Urban Search and Rescue

The goal of the IJCAI/AAAI Rescue Robot Competition is to increase awareness of the challenges involved in search and rescue applications, provide objective evaluation of robotic implementations in representative environments, and promote collaboration between researchers. It requires robots to

demonstrate their capabilities in mobility, sensory perception, planning, mapping, and practical operator interfaces, while searching for simulated victims in a maze of increasingly difficult obstacles.

The competition encourages participants to contribute to the field of urban search and rescue (USAR) robotics and provides the competitors with a sense of what a real USAR situation involves. Six teams competed this year: Idaho National Engineering and Environmental Laboratory [INEEL] (USA), Swarthmore College (USA), University of Manitoba (Canada), University of New Orleans (USA), University of Rochester (USA), and Utah State University (USA).

Two place awards and a technical award were presented at this year's competition. The place awards are based solely on the teams' performances during the competition missions. The technical award is given to the team exhibiting novel artificial intelligence applications and technical innovations.

INEEL won the first place award and Swarthmore College won the second place award. These two teams had the highest cumulative scores from four (of five total) missions. Both teams performed well, but INEEL was able to find victims in both the yellow arena and the orange arena, which contains more significant obstacles, even negotiating the ramp at one point to find a number of victims on the elevated floor. They also showed 100% reliability by scoring points in every mission. Swarthmore attempted the more advanced arenas but their robots were not able to move over the uneven flooring and score points, which hurt their overall reliability (60%). By staying mainly in the yellow arena with its reduced arena weighting, and avoiding costly penalties, Swarthmore's high score was 12.5, with an average score of 6.1.

The University of New Orleans earned a technical award for their innovative

attempt at collaborative mapping. However, their reliance on multiple operators to control several robots generally lowered their overall scores. The University of Rochester also performed well during particular missions. Meanwhile, the University of Manitoba and the Utah State University demonstrated fully autonomous custom-made robots with varying degrees of success in negotiating the simplest arena, but didn't attempt to produce maps of the arenas with victim identified–a key element in scoring.

IV. THE ROBOT CHALLENGE

The Robot Challenge, first dreamed up at the 1998 AAAI Robot Competition, entered its fifth year. The Challenge is for a robot to successfully attend the National Conference, which includes finding the registration desk, registering for the conference, navigating to a talk venue, giving a talk, and answering questions. Other possible tasks include acting as a conference volunteer, and talking with conference attendees during coffee breaks.

This year, for the first time, two teams–the GRACE team and Lewis, from Washington University, St. Louis–completed the main Challenge tasks. The GRACE team consisted of Carnegie Mellon University, the Naval Research Laboratory, Metrica Labs, Northwestern University, and Swarthmore College. Both teams were successful at getting their robots to a faux registration booth, registering, going to the

talk venue and giving a talk. Each of the aspects of the challenge were addressed with varying levels of success. None of the robots could attempt the trek to the real registration booth as it was on the second floor, and, more importantly, the convention center had no elevators. The GRACE team actually brought two robots, GRACE and George, both of which independently undertook the challenge, demonstrating slightly different capabilities. Figure 2 shows both GRACE and George giving their talk at the end of the Challenge event.

Fig. 2. GRACE and George giving their talk as part of the 2003 Robot Challenge.

Washington University received the title of Challenge Champion for 2003, and an iRobot Roomba, and the GRACE team received the "Grace Under Fire" award for success in spite of tremendous challenges and hardware difficulties. The GRACE team also received a technical award for integration, integration, integration.

This year the Ben Wegbreit Award for Integration of AI Technologies,

which includes a $1000 prize, went to the Washington University for Lewis' smooth run in the Challenge Event.

V. SUMMARY

The Twelfth AAAI Robot Competition and Exhibition continued the tradition of demonstrating state-of-the-art research in robotics. Many of the improvements this year were largely invisible to those watching the robots, but improvements in integrating systems and vision capabilities will eventually make the robots more robust, more adaptable, and better able to succeed in their challenging tasks. Without progress in these invisible areas, progress in the more visible robot capabilities will be slow.

The challenge of making robots that can navigate and successfully complete tasks in the real world was the focus of all the events this year, and that is a great advance over the events of a decade ago that required special arenas and brightly colored objects. Where are we going next?

In 2004, it will be the AAAI National Conference in San Jose. Bill Smart and Shiela Tejada will be co-chairing the event. We invite everyone in robotics to participate and demonstrate their current research. For more information, see http://palantir.swarthmore.edu/aaai04.

REFERENCES

[1] R. Arkin. The 1997 aaai mobile robot competition and exhibition. *AI Magazine*, 19(3):13–17, 1998.