The AAAI 2005 Mobile Robot Competition and Exhibition

Paul E. Rybski, Sheila Tejada, Douglas Blank, Ashley Stroupe, Magdalena Bugajska, and Lloyd Greenwald

■ The Fourteenth Annual AAAI Mobile Robot Competition and Exhibition was held at the National Conference on Artificial Intelligence in Pittsburgh, Pennsylvania, in July 2005. This year marked a change in the venue format from a conference hall to a hotel, which changed how the robot event was run. As a result, the robots were much more visible to the attendees of the AAAI conference than in previous years. This allowed teams that focused on human-robot interaction to have many more opportunities to interact with people. This article describes the events that were held at the conference, including the Scavenger Hunt, Open Interaction, Robot Challenge, and Robot Exhibition.

Yearly improvements of robotic and computational technology open vast opportunities for AI researchers to create embodied instances of their work. This was demonstrated at the Fourteenth Annual AAAI Mobile Robot Competition and Exhibition, an event hosted at the Twentieth National Conference on Artificial Intelligence (AAAI 2005). The robot event had a particularly strong showing this year, with 20 robot teams participating in both the competitions and exhibition.

This year, AAAI changed the venue format from a convention center to a hotel setting. This necessitated a change in how the robot event was organized, as well as the kinds of events that could be run. Due to the increase in visibility and the loss of open space, the robot program included events that focused on human interaction or that could operate in a smaller, cluttered environment. Events that focused on human interaction included the Open Interaction and the Robot Challenge, while the Scavenger Hunt event (appropriate in a cluttered environment) was selected over larger-scale events such as the Robot Rescue. As always, however, robot entries that ranged across the entire spectrum of AI research were welcomed.

Two overarching goals were promoted for the 2005 Mobile Robot Competition. The first was to give the competitions an exhibition-style format to make them as accessible to different areas of research as possible. The second goal was to try to encourage research into human-robot interaction. Since the venue change would place the competitions and exhibitions directly in line with the conference, teams would need to handle the challenges involved with noisy, cluttered, and unstructured human environments.

Briefly, each event is described as follows:

Scavenger Hunt: Autonomous robots were required to search a cluttered and crowded environment for a defined list of objects and were judged on task performance.

Open Interaction: Robots were required to autonomously interact directly with the general

Figure 1. Some of the Items Selected for the Predefined Scavenger Hunt Task.

conference population and were judged based on interaction complexity, success of interaction as defined by the team, and feedback from the participants.

Robot Challenge: Robots were required to attend the conference autonomously, including registering for the conference, navigating the conference hall, talking with attendees, and answering questions. Teams were judged based on successful performance of each task and audience feedback.

Robot Exhibition: Demonstrations of any relevant robotic or AI technology. Teams were judged, not for first, second, or third prize awards, but rather for recognition certificates that acknowledged innovative technologies.

The Mobile Robot Competition and Exhibition was organized by Paul E. Rybski from Carnegie Mellon University and Sheila Tejada from the University of New Orleans. The Scavenger Hunt event was organized by Douglas Blank from Bryn Mawr College, the Robot Challenge and the Open Interaction Task were organized by Ashley Stroupe from the Jet Propulsion Laboratory, the research component of the exhibition was organized by Magdalena Bugajska from the Naval Research Labs, and the educational component was organized by Lloyd Greenwald from Drexel University.

Scavenger Hunt

The change in venue from a convention center to a hotel drastically reduced the amount of open space available for running very large-scale events such as Robot Rescue. As a result,

the Scavenger Hunt competition was reintroduced. This event focused more on open-ended demonstrations of completely autonomous behavior and was first introduced at the Eighth AAAI Mobile Robot Competition in Orlando in the summer of 1999 (Meeden et al. 2000). The idea for a robotic scavenger hunt for AAAI was first proposed in "Innovation through Competition" at the 1998 AAAI Spring Symposium on Integrating Robotics Research (Blank et al. 2006). As the Urban Search and Rescue (USAR) competition was not held due to the space constraints, it was decided to reoffer the Scavenger Hunt in its place. The organizers felt that this would give the USAR teams an opportunity to compete, albeit in a more general competition setting.

In the Scavenger Hunt event, robots searched the conference hotel area for a checklist of given objects. This task required robots to navigate and map a dynamic area with moving objects and people in order to acquire objects to satisfy the checklist. The Scavenger Hunt competition is of particular interest to the AI community because it stresses spatial reasoning, object recognition, search, and planning. In order to make the Scavenger Hunt event as accessible as possible, two different types of entries were allowed: an exhibition-style entry, which was set up to allow for demonstrations of specific tightly focused areas of research, and a predetermined challenge that allowed entries to compete with a fully integrated system.

In the Scavenger Hunt exhibition, participants were allowed to demonstrate their robotic systems in such a way as to show off specific capabilities in a scavenger hunt environment. For example, participants could follow a trail of colored paper in the environment, receive a visual clue, and head to a mark where some sort of goal or treasure existed. In this category, participants largely set their own goals and exhibited their robots' capabilities. The hope behind this category was to allow a smooth transition from teams whose research (such as the search and rescue domain) could be modified to fit the scavenger hunt domain.

In the predetermined challenge, robots were required to search the conference hotel area for a checklist of given objects, shown in figure 1, such as people or information located at specific places and at a specific times. This task required robots to navigate and map a dynamic area with moving people in order to acquire items to satisfy the checklist.

A small set of objects (no more than 10) was selected in advance. Teams were warned that a few additional objects (no more than 5) would be added at the competition. The objects were located from floor level up to desk level (no higher than 3 feet). All objects were to be no further than 25–50 yards from the starting point. Unlike previous competitions, no specific area was roped off for the robots. Teams were notified that spectators would be asked to not crowd around the robots, but the robots would still need to be able to deal with the occasional person walking by. Furniture and other environment structures were not marked or altered for the sake of the robots. Robots were required to clearly report the location of the scavenger hunt items found. The format for this report was open ended and could be in the form of a natural language utterance or a map of the environment showing the location of items. The robots were allowed to pick the objects up if they were capable of doing so.

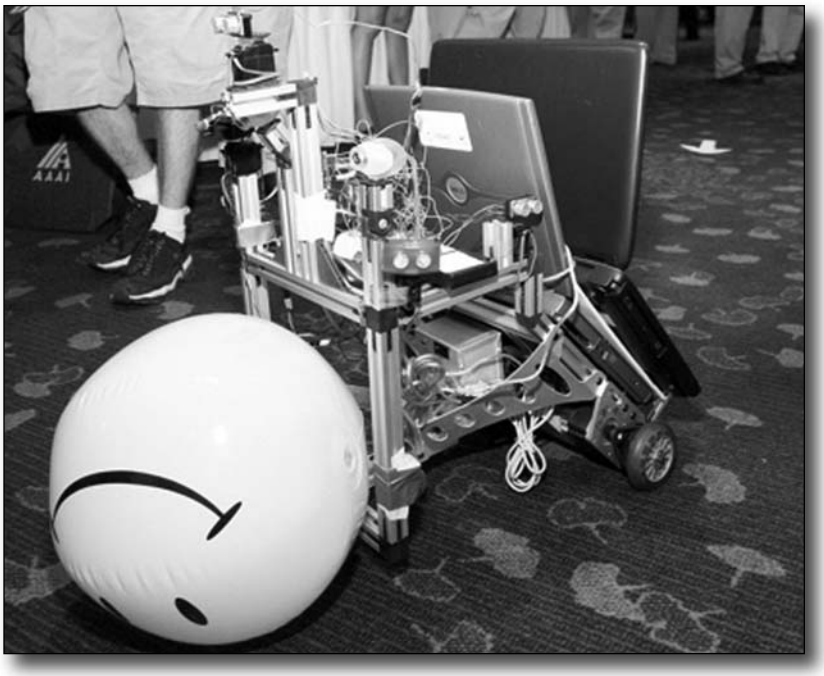

Figure 2. The Winning Scavenger Hunt Entry from Harvey Mudd College Based on an Evolution Robotics ER-1 Robot Platform.

Due to the open-ended nature of the competition, the judging criteria were necessarily high level and fairly subjective. The primary requirements were that the entrants must demonstrate AI techniques during the competition. One emphasis of this event was having the robots interact with people in the environment during timed missions run throughout the course of the conference. Multiple robots were also allowed with the understanding that they would be required to show some sort of cooperation. A panel of four to five judges was recruited from the conference, and a subjective score between 1 and 10 was assigned to

Figure 3. The Kansas State University Pioneer 3-AT Entry for the Scavenger Hunt. Here the Robot Searches the Area for the Objects of Interest.

Figure 4. The Custom-Built Scavenger Hunt Robot from the Stony Brook Robot Design Team.

each exhibit from each judge. These scores were averaged to produce a final score. The contestants were evaluated on overall success as well as on any particular capabilities they incorporated into their solutions. The winning entry for the Scavenger Hunt event was HMC Hammer from Harvey Mudd College (HMC), shown in figure 2, which used an Evolution Robotics ER-1 robot to successfully search an area to find the most objects. HMC Hammer's robot localized itself within a prebuilt map of the environment and used colored markers to navigate a path toward the target items. The all-undergraduate team demonstrated the ability to recognize the scavenger hunt objects by combinations of shape and color and also won a technical achievement award for overall excellence for its fully autonomous system.

The LABORIUS (Laboratoire de Robotique Mobile et de Systèmes Intelligents / Laboratory on Mobile Robotics and Intelligent Systems) team from the Université de Sherbrooke won a technical achievement award for its robot Spartacus for map building and human-robot interaction. Sherbrooke competed in the Open Interaction, Scavenger Hunt, and the Robot Challenge events and was the only team to participate in all three. Its team of graduate students displayed an impressive array of a variety of robotic skills.

The Kansas State University (KSU) team used an ActivMedia Pioneer 3-AT, shown in figure 3, for the Scavenger Hunt event. The team had developed a flexible infrastructure for efficient off-board processing of vision, localization, and control information. KSU received an honorable mention during the awards for adaptability and disaster recovery as the team did a masterful job at handling unexpected hardware problems that occurred before the competition. The team was able to compete even though it had to replace a vital component of its robot that failed during the event.

The Stony Brook Robot Design Team entered a completely scratch-built mobile robot platform that was custom designed to compete in the event. The robot, NavBot, shown in figure 4, included a color camera and a variable-height manipulator for seeing and grabbing objects of interest. The Stony Brook team consisted of undergraduates from many different engineering disciplines and thus received an honorable mention for interdisciplinary field integration. The team's enthusiasm for the Scavenger Hunt event was exhilarating for the judges and spectators alike.

The University of Massachusetts at Lowell entered an iRobot ATRV-Jr robot, shown in figure 5, that was originally used for research in

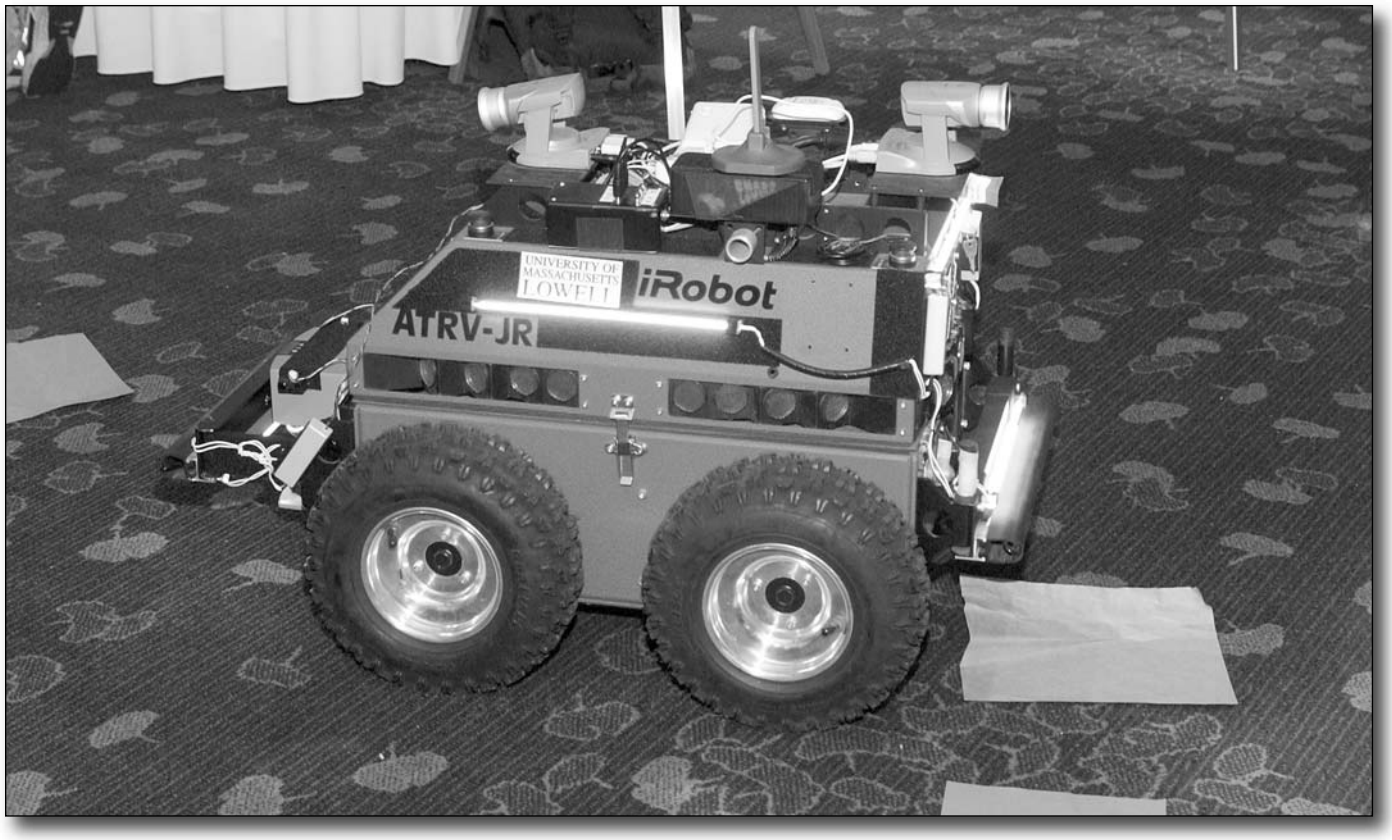

Figure 5. The University of Massachusetts at Lowell Scavenger Hunt Entry Based on an iRobot ATRV-Jr Platform.

the urban search and rescue domain. The team's research focused on methods to improve human and robot interaction as well as situation awareness in the USAR domain. The team received two technical innovation awards, one for robust path finding and object recognition and another for control interface usability, for its outstanding work on the robot's user interface. The team focused on visual processing, and the robot was able to follow a trail of colored slips of paper to a hidden object.

Open Interaction Task

The Open Interaction competition (Smart et al. 2005) was a returning competition from the 2004 AAAI robot event. The goal of this event was to entertain people using robots and to provide AI and robotics researchers a refreshing venue for demonstrating AI techniques for interactive, entertainment, and social robots. In this competition, robots were judged by how well they interacted with humans in a variety of tasks that were defined mainly by the teams. Some of the relevant research topics included navigation, cognitive modeling, perception, emotional state modeling, natural

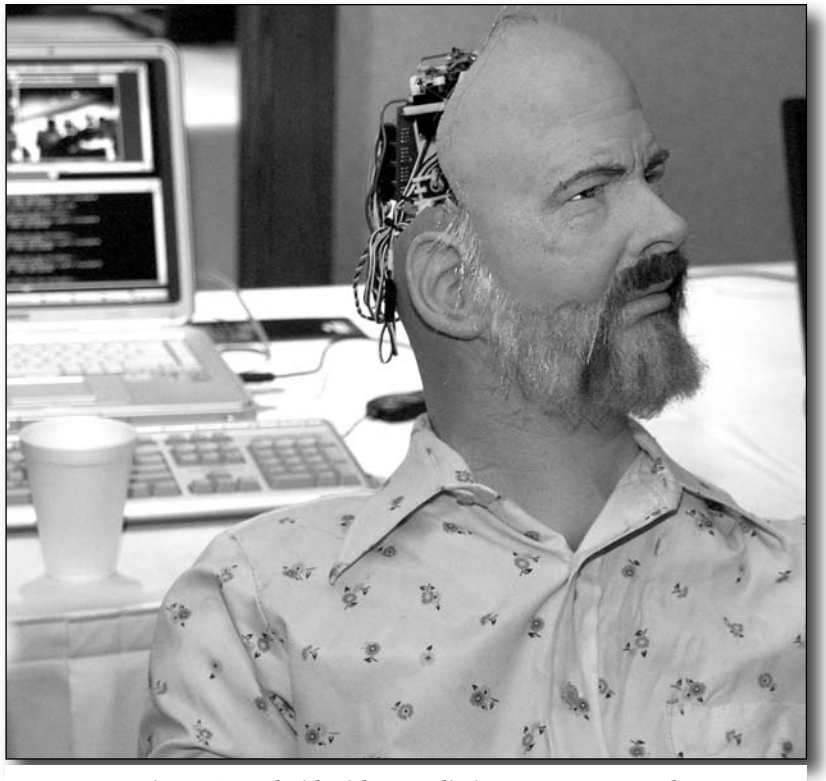

Figure 6. Android with a Realistic Human Face and Conversational Abilities from Hanson Robotics.

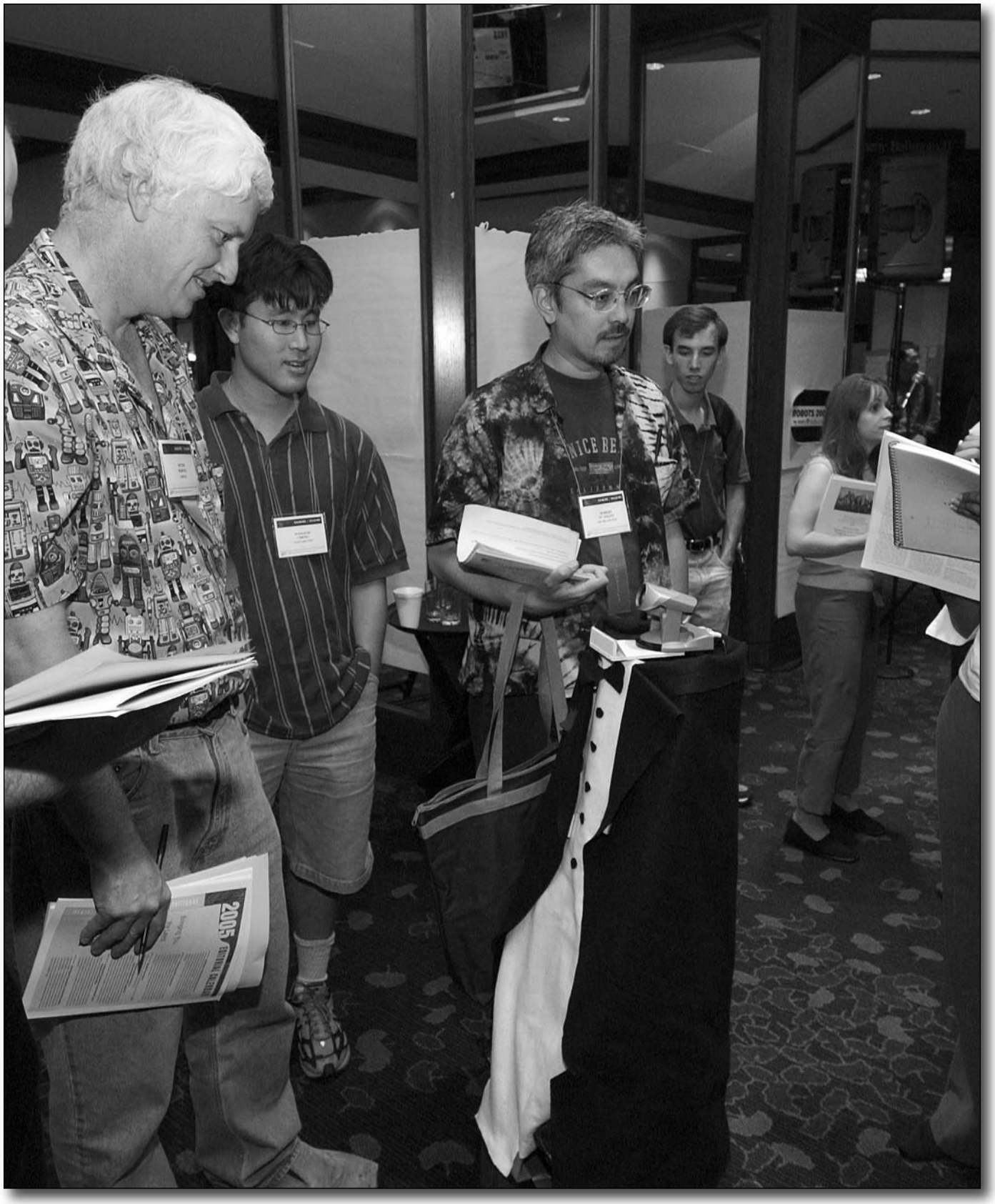

Figure 7. Swarthmore College's Open Interaction Event Robot Entertaining the Judges.

language processing, and human-robot interaction. Entrants were evaluated on their autonomous capabilities, entertainment value, and human-robot interaction.

The Open Interaction event evolved from the Hors d'Oeuvres and Robot Host event in years past. Because of these older events, regular audiences at AAAI have become increasingly habituated to robots wandering around, and this competition was intended to try to capitalize on this. As part of this event, the robots were expected to attract the attention of the conference attendees. This was intended to encourage people to come up to the robots and "kick the tires" a bit (it is to be hoped figuratively, but sometimes literally). The robots were expected to operate directly next to other conference attendees and with crowds gathering around them.

As the name suggests, the Open Interaction task did not have defined criteria by which entrants were judged. Teams were encouraged to come up with a creative entry of their own that involved some notion of creative human-robot interaction. Judging was done primarily by a formal panel, but votes from audience members were taken into account as well.

The winning entry this year was Human Emulation Robots by Hanson Robotics, FedEx Institute of Technology, the University of Texas at Arlington and Robotics Research Institute (ARRI), and the University of Texas at Dallas, which presented a lifelike robotic representation of the science fiction author Philip K. Dick, shown in figure 6. This robot was capable of carrying out simple conversations with passing attendees, tracking their movements with its eyes, and changing facial expressions based on an emotional model and the current content of the conversation.

The Academic Autonomy group from Swarthmore College demonstrated a social robot, based on an iRobot Magellan base, shown in figure 7, with an emotional model that controlled the characteristics of its physical actions. The team's robot autonomously wandered through the crowded area looking for people and identifying the color of their shirts. The color affected the emotional state of the robot and thus its physical behavior. The team received a technical achievement award for adaptive vision for lighting conditions.

The University of Notre Dame presented a robot based on an ActivMedia PeopleBot called Rudy, shown in figure 8, that demonstrated a cognitive system for human-robot interactions. Rudy used affective control mechanisms at various places in the architecture and could interact with people using natural language.

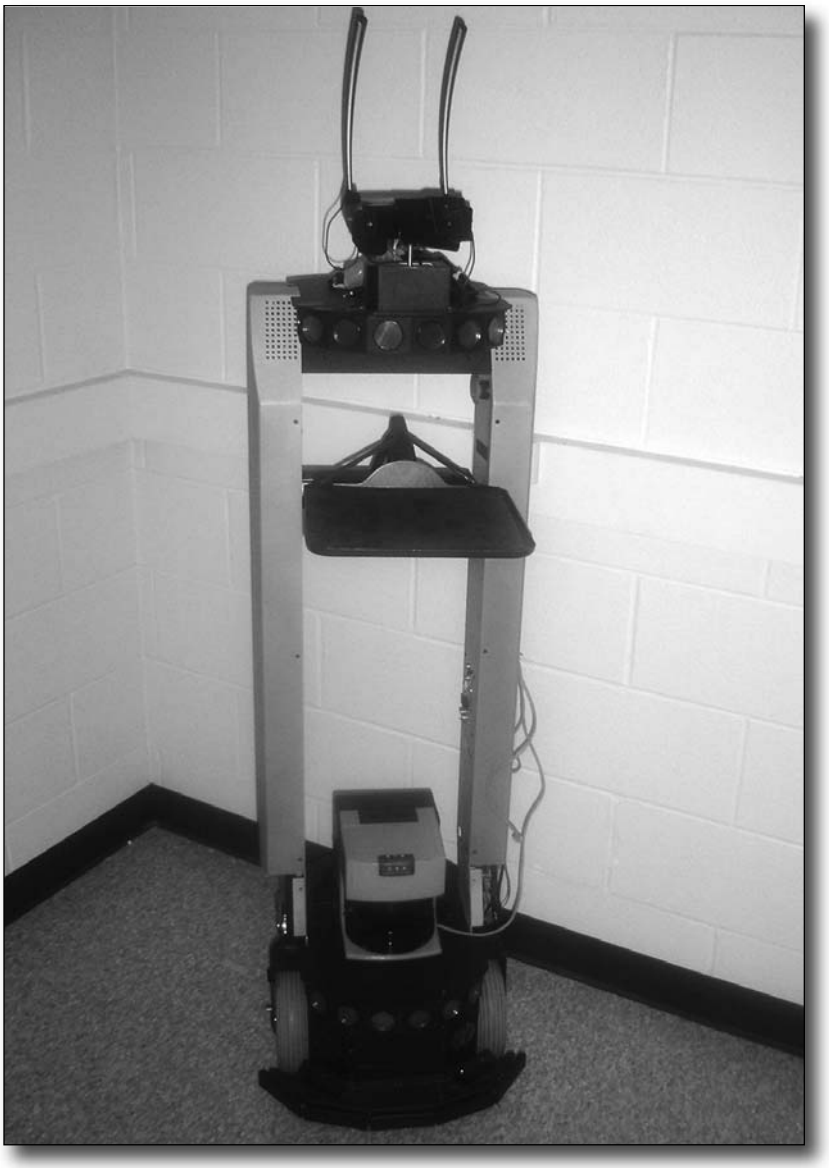

Figure 8. Open Interaction Entry from Notre Dame Based on an ActivMedia PeopleBot.

The Naval Research Laboratory and University of Missouri–Columbia presented research on a natural drawing / graphical interface (based on a sketch pad) for interacting with a team of robots, shown in figure 9. They received a technical achievement award for an innovative interface. The Naval Research Laboratory also presented a robot named George, shown in figure 10, that used a cognitive model generated from ACT-R (Anderson and Lebiere 1998) to play a game of hide and seek with conference attendees. The team received a technical achievement award for its engaging interaction using a cognitive model.

Figure 9. Three Robots as Part of the Naval Research Laboratory's and the University of Missouri–Columbia's Open Interaction Entry.

Figure 10. George, from the Naval Research Laboratory, Played Hide and Seek with Conference Attendees.

Robot Challenge

The goal of the AAAI Robot Challenge was to work toward the development of an interactive social robot. Toward that end, the challenge required a robot to participate in the AAAI conference. Aspects of conference participation goals included locating the conference registration desk, registering for the conference, performing volunteer duties, and presenting a talk (and answering questions) at a prescribed time and location. Additionally, the robot should have interacted socially with other conference participants. Navigational technical challenges included dynamic crowded environments, natural landmark detection, direction understanding and following, and map reading. Social interaction challenges included natural conversation regarding the robot and the conference and personalization of conversation with recognized individuals (by name, badge, or face).

Any robot team attempting the challenge did so in the natural environmental setting with little or no special environmental modifications. Just like the Open Interaction task, the robot should be able to handle dynamic, crowded environments filled with people.

The only team to enter the Robot Challenge competition this year was LABORIUS from the Université de Sherbrooke. Sherbrooke entered the robot Spartacus, shown in figure 11, which was capable of exploring and navigating through its environment as well as listening to and understanding human speech. Spartacus demonstrated that it could follow human instructions for getting from the hotel lobby to the registration desk as well as carry on a simple conversation with the person behind the desk. The Spartacus team also won a technical achievement award for map building and human-robot interaction.

Exhibition

The mission of the Robot Exhibition was to demonstrate state-of-the-art research in a less structured environment than the competition events. The exhibition gave researchers an opportunity to showcase current robotics and embodied AI research that did not fit directly into the competitions. This year, educational AI robotics teams were also given the opportunity to showcase their robots in the exhibition. The wide variety of exhibition-only robotics projects are described below.

Claytronics, shown in figure 12, a modular robotics project being developed at Carnegie Mellon University and Intel Pittsburgh Re-

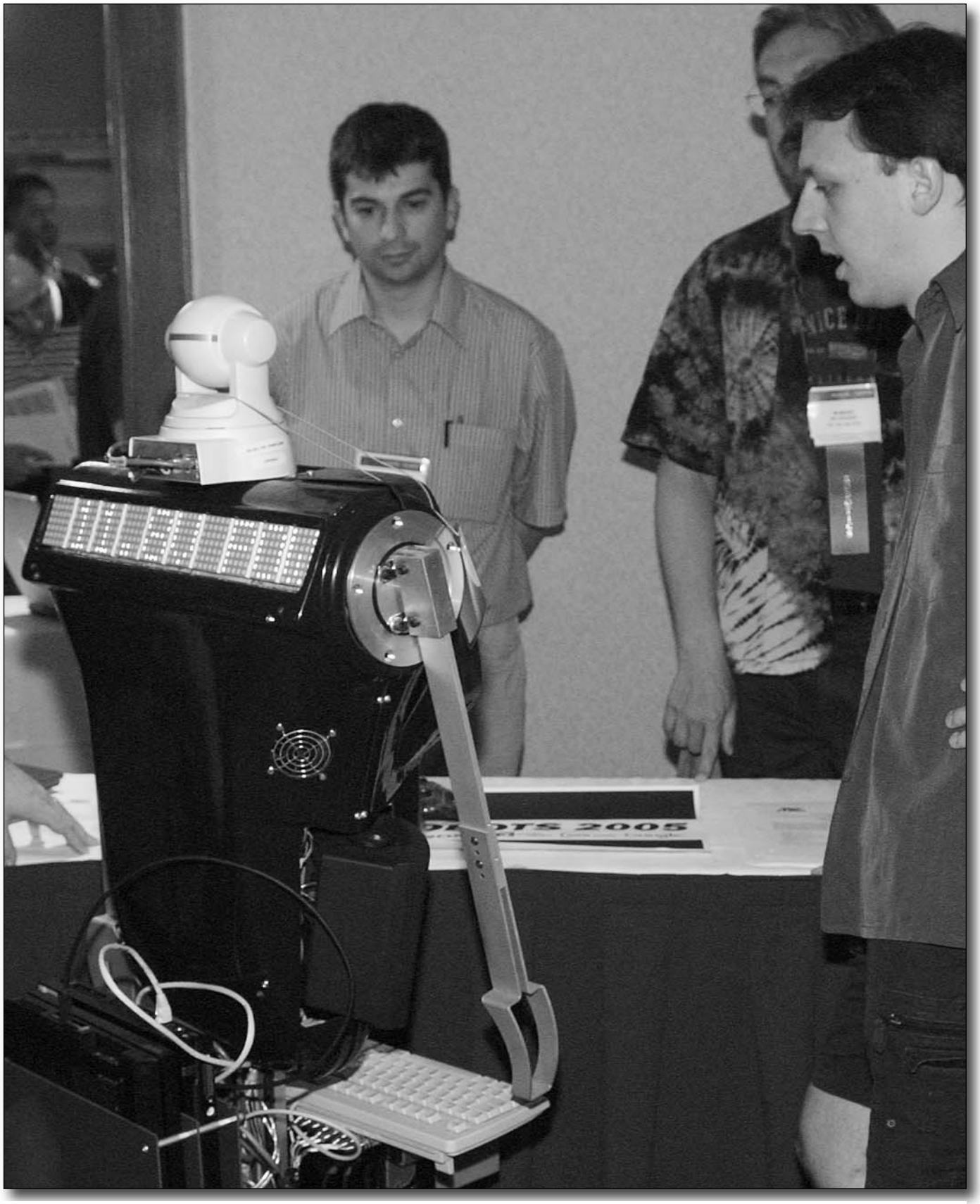

Figure 11. Spartacus, the Université de Sherbrooke's Entry for the AAAI Robot Challenge, Registering Itself for the Conference.

Figure 12. Two Nodes from the Claytronics Project.

Figure 13. The Carnegie Mellon University CMBalance'05 Team Demonstrated Human-Robot Soccer Playing with Robots Based on the Segway RMP.

search, demonstrated how the individual robotic units can reconfigure themselves relative to one another without the use of moving parts. Individual nodes are covered with tiny magnets that can be used to change their positions with respect to each other. The Claytronics project received a technical achievement award for a visionary hardware concept.

The CMBalance'05 team from Carnegie Mellon University, shown in figure 13, demonstrated its work with Segway RMP robots. The team has been using these robots to explore robot autonomy in human-robot teams engaged in dynamic adversarial tasks, in particular, with Segway Soccer, a new domain being developed that allows humans and robots to play on the same team.

The CMDash'05 team from Carnegie Mellon University, shown in figure 14, was the current U.S. Open champion in the RoboCup legged (Sony Aibo) league and presented sensing, be-

Figure 14. The Carnegie Mellon University CMDash'05 Aibo Soccer Team.

haviors, teamwork, localization, world modeling, and locomotion techniques. The demonstration included a Sony Aibo chasing a RoboCup competition plastic ball around the dynamic conference environment. The team also illustrated how the CMDash'05 codebase is used as part of the course "CMRoboBits: Creating an Intelligent Robot." CMRoboBits is taught in the Computer Science Department at CMU. The team received an honorable mention for its robust tracking and real-time adaptability.

The Drexel Autonomous Systems Lab (DASL) team demonstrated a 6-foot robotic blimp (figure 15). The team had recently participated in the 2005 Indoor Flying Robot Competition. This year's challenge involved autonomous line-following and teleoperated search-and-rescue components. A wireless camera, rescue tag release mechanism, and ground control image processing were featured. The team received an honorable mention for its promising application and domain. The Canisius College team displayed its efforts toward using robotics in computer science education. Starting with independent study projects, over the past semesters the team included a robotics unit in a newly developed course on

Figure 15. Figure 15. Robotic Blimp Demonstrated by Drexel University.

intelligent systems. Its demonstration included some of the robots developed by students as well as information about current efforts to introduce robots into a breadth-first introductory course and architecture course.

The LABORIUS team from the Université de Sherbrooke demonstrated four different robots during the exhibition, including Spartacus, its Robot Challenge event entry. The other three consisted of Azimut-2, a modular and omnidirectional platform, shown in figure 16; Tito, a teleoperated pedagogical robot for autistic children; and Roball-2, a spherical robot, the latter two shown in figure 17.

The Penn State Abington Robotics team demonstrated its low-cost autonomous mobile robot platform designed for the Mini Grand Challenge contest offered at Penn State. The robot platform, shown in figure 18, consisted of a commercial children's powered car platform modified for servo-controlled steering, given a vision system, GPS interface, sonar, and speech capabilities.

Carnegie Mellon's Pink Team Searching demonstrated how its robot GRACE (graduate robot attending a conference), shown in figure 19, played a game involving human-robot social interaction, navigation, and interface design. A member of the team wore a large pink hat, and the robot had to converse with other people attending the conference in order to determine the location of the person with the hat. The colored hat was used by the robot to identify the target person when found and also by the conference attendees to help GRACE find the person. The team received an honorable mention for audience participation.

The Pyro project, consisting of contributions from Bryn Mawr College, Swarthmore College, and the University of Massachusetts Lowell, demonstrated the project team's Python-based robotic programming environment (Blank and Meeden 1998) designed to provide a high-level general-purpose programming language that would enable students to very easily explore topics in robotics.

The Tekkotsu project developed at Carnegie Mellon University, shown in figure 20, demonstrated an opensource application development framework for the Sony Aibo, which uses an event-based architecture and provides a carefully designed level of abstraction that eases Aibo programming without sacrificing flexibility. Tekkotsu also includes a suite of remote monitoring and teleoperation GUI tools for which the team received a technical achievement award for visualization for educational robots.

The University of Pittsburgh has recently been involved with developing and evaluating "smart wheelchairs," which combine traditional manual and power wheelchairs with sensors and microprocessors to provide navigation assistance to individuals who find it difficult to operate "standard" wheelchairs. The University of Pittsburgh team demonstrated both wheelchairs that it developed, shown in figure 21, as well as wheelchairs that it evaluated in clinical trials (but did not develop).

Figure 16. The Azimut-2 Omnidirectional Modular Platform from the Universitè de Sherbrooke.

The team received an honorable mention for its potential for social impact.

The University of New Orleans (UNO) Robotics Team designed an interface for people to interact and collaborate with a group of heterogeneous robots such as Sony Aibos, wheeled robots, and blimps. The team demonstrated student AI class projects that combined AI planning techniques with a human-robot interface.

Conclusions

The AAAI Robot Competition and Exhibition serves as a mechanism for students and faculty to demonstrate their research in a standardized and relatively controlled environment. The challenge for the organizers each year is to field a set of events that are relevant and exciting to the research community. In general, the robotic events are important to the field of artificial

Figure 17. Roball-2 and Tito: Two Robots Designed for Children with Autism from the Universitè de Sherbrooke.

Figure 18. Penn State Demonstrating Its Mini Grand Challenge Robot in the Exhibition.

Figure 19. GRACE, the Entry for Carnegie Mellon University's Pink Team Searching Exhibit.

Figure 20. Sony Aibos Demonstrated by the Tekkotsu Project from Carnegie Mellon University.

intelligence because they provide researchers with a method of applying theory to practical problems. We saw a large number of exciting entries this year in which robotics provided a vehicle for AI to enter the real world in a safe and practical fashion. The public forum of the events provided researchers with the chance to receive "peer review" of their integrated robotic systems. Another useful purpose of the competitions is the creation of a difficult standardized problem that can be used as a method of focusing research and allowing it to be deployed in a useful and interesting fashion.

This year's change in venue for the mobile robot event (from a large open convention center to the tightly crowded hallways of a hotel) required a change in the formats for the competitions as well as in the expectations of the team's robotic capabilities. As a result, the contests focused more on tasks that would force the robots to demonstrate intelligent behavior in natural human environments. One of the significant issues that had to be addressed by all teams was the need to operate their robots in environments crowded with people and in suboptimal sensory conditions. The low "natural" light created many challenges for robots with vision sensors, but all of the teams stepped up to the challenge and were able to perform reasonably well given the circumstances. Perception and spatial reasoning in natural human environments are still very challenging problems and are made even more challenging when combined with the need to interact with humans directly. We

Figure 21. Robotic Wheelchairs from the University of Pittsburgh.

Robotics Champions Crowned as RoboCup 2005 Comes to an End

RoboCup crowned its champions as the competitions, held July 13–17, 2005 in Osaka Japan, came to a close. The successful event attracted more than 2,000 researchers and students, who came to see a host of events including robot soccer competitions (four-legged, humanoid, small, and mid-sized robot leagues), RoboCup junior, the rescue robot and rescue simulation leagues, the soccer simulation league, and a RoboCup symposium. The 2005 general chair was Hitoshi Matsubara of Future University, Japan.

Winning the small-sized league was Fu-Fighters from Freie Universität Berlin, who defeated Cornell Big Red from Cornell University to take top honors. The shoot challenge award was presented to Field Rangers from Singapore Polytechnic, while the pass challenge award was presented to Ngee Ann Poytechnic from Singapore. The open challenge award was given to Wingers from the University of Buffalo.

In the middle-sized league, EIGEN Keio University (Japan) took first place, defeating Fu-Fighters from Germany. Third place in this league went to Philips from the Netherlands. Taking home first-place technical challenge awards in this league were Eigen Keio University and the University of Minho.

In the four-legged league, the winner was GermanTeam, a consortium consisting of Humboldt-Universität zu Berlin, the Universität Bremen, and the Technische Universität Darmstadt. GermanTeam has participated in RoboCup since 2001, and recently made its 2005 source code available (see germanteam.org). They defeated NuBots from the University of Newcastle.

The award for best humanoid in the humanoid league was presented to Team Osaka, who also took top honors in the humanoid two-on-two competition, with their VisiON robots.

The soccer simulation league had winners in the 2D, 3D, coach, and 3D development competitions. Taking home first-place honors in the 2D competition was Brainstormers 2D from the University of Osnabrueck. In the 3D competition, first place was awarded to Aria from Amirkabir University of Technology. The coach competition winner was UT Austin Villa from the University of Texas at Austin. Finally, in the 3D development competition, Delta 3D (Shahid Bahonar College) and Kaveh (Sharif University of Technology) shared the development award.

In the rescue robot league, first place was awarded to Toin Pelican, Toin University of Yokohama, while the best design award was presented to Shinobi of Japan.

Other award winners, including winners in the RoboCup Junior League, are posted at robocup2005.org.

The Robocup proceedings appeared in Springer's *Lecture Notes in Computer Science,* volume 4020. Paper awards were presented to Jelle Kok, Nikos Vlassis, Gerald Steinbauer, Martin Mörth, and Franz Wotawa.

hope to continue the interest in these research problems in the 2006 competition and beyond.

Overall, we were very excited to see such a large turnout in the number of participating teams this year. We were encouraged by the great enthusiasm of all the teams and feel that the change in venue format will continue to serve two very important purposes. First, it helps researchers consider the challenges involved with having robots operate alongside humans in natural settings. This is an important problem to consider if we are to see more robots interacting with the public at large. Second, we feel that the close proximity of the robotics exhibits to the rest of the AI community at the conference helps to highlight the question of embodiment to those who may not be doing research along those lines. Through this effort, we hope to facilitate potential collaborations between more traditional areas of AI and robotics.

Acknowledgements

We would like to thank the Defense Advanced Research Projects Agency, the Naval Research Labs, Microsoft Research, Sony, Evolution Robotics, ActivMedia Robotics, and Google for their generous assistance in supporting the 2005 event. We would also like to thank the judges for each of the events, who very kindly donated their time and energies in order to evaluate each of the different entries. Last but not least, we would like to thank the AAAI staff for their expert help with organizing the event and assisting with its execution.

References

Anderson, J. R., and Lebiere, C. 1998. *The Atomic Components of Thought.* Hillsdale, NJ: Lawrence Erlbaum.

Blank, D., and Meeden, L. 1998. Innovation through Competition. In AAAI Spring Symposium: Integrating Robotics Research. AAAI Technical Report, Menlo Park, CA.

Blank, D. S.; Kumar, D.; Meeden, L.; and Yanko, H. 2006. The Pyro Toolkit for AI and Robotics. *AI Magazine* 27(1): 39–51.

Meeden, L. A.; Schultz, A. C.; Balch, T.; Bhargava, R.; Haigh, K. Z.; Böhlen, M.; Stein, C.; and Miller, D. 2000. The AAAI 1999 Mobile Robot Competitions and Exhibition. *AI Magazine* 21(3): 69–78.

Smart, W. D.; Tejada, S.; Maxwell, B.; Stroupe, A.; Casper, J.; Jacoff, A.; Yanco, H.; and Bugajska, M. 2005. The AAAI 2004 Mobile Robot Competition and Exhibition. *AI Magazine* 26(2): 25–35.

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Sixteenth Annual AAAI Mobile Robot Competition and Exhibition

July 22–26, 2007 Vancouver, British Columbia

Photo courtesy John Sinai, Tourism Vancouver

We invite you to participate in the Sixteenth Annual AAAI Mobile Robot Competition and Exhibition, sponsored by the American Association for Artificial Intelligence. The Competition brings together teams from universities, colleges, and research laboratories to compete and to demonstrate cutting edge, state of the art research in robotics and artificial intelligence.

The 2007 AAAI Mobile Robot Contest and Exhibition will be held in Vancouver, Canada, as part of AAAI-07, from July 22–26, 2007. The program will include the Scavenger Hunt, Human-Robot Interaction event, Integration Challenge, the Robot Exhibition, and the Mobile Robot Workshop. Registration and full details of the events will soon be available at the competition website. You will be required to complete the AAAI registration form as well and submit it with your payment.

Scavenger Hunt

In this competition, robots are given a listing of objects that they must locate and recognize. In order to determine what these objects look like, the robots are given an opportunity to search the web for images of the objects in their list before starting their search. This competition attempts to push the state of the art of semantic image understanding by requiring that robots make use of the wealth of unstructured image data that exist on the Internet today. We welcome a variety of teams to enter with one or more robots and/or human operators. More specific rules and guidelines will be posted shortly. We particularly encourage object recognition researchers and urban search and rescue teams to consider joining this event.

Human-Robot Interaction

This event will take the place of the Robot Host event from past years and will involve interacting with conference attendees to achieve a particular task in an unstructured environment. The goal is to entertain attendees using robots and to provide AI and robotics researchers a refreshing venue for demonstrating AI techniques for interactive, entertainment, and social robots. Some of the topics include navigation, cognitive modeling, perception, emotional state modeling, natural language processing, and human-robot interaction. Entrants may be any system that demonstrates some level of AI. In particular, we are looking for systems that include human-robot interaction as part of their entry.

Integration Challenge

The goal of the integration challenge is to integrate various existing algorithms and architectural components that have been developed independently within one architecture to produce a working system on a mobile robot that is (1) robust, (2) fault-tolerant, (3) flexible, and (4) easily adaptable to new tasks. All participating teams will be provided with a set of existing open-source components available for the research community (for example, speech recognizers, vision processing components, and so on).

The Robot Exhibition

The mission of the Robot Exhibition is to demonstrate state of the art research in a less structured environment than the competition events. The exhibition gives researchers an opportunity to showcase current robotics and embodied-AI research that does not fit into the competition tasks. In addition to research, exhibits that demonstrate how robotics can be used to enhance education in AI and other related courses are highly encouraged.

The Mobile Robot Workshop

A robotics workshop will be held on the last day of the conference. Teams who receive travel support must attend and present at the workshop. All other participants are strongly encouraged to attend and present. A research paper will be required within one month after the end of the workshop, and will be published in a workshop proceedings by AAAI.

Travel Funding

Limited travel funding will be available. If you wish to receive travel funding, the deadline for registering your intent to participate is May 15, 2007 (via the web registration).

Participation Fees

Each team will be required to pay a $250 participation fee that will help AAAI to defray the cost of the competition. This fee is in line with fees charged by other competitive robotic events, and helps AAAI to move towards a sustainable funding model for the annual robot competition.

General Cochairs

Jeffrey Forbes (forbes@cs.duke.edu)
Paul Oh (paul@cbis.ece.drexel.edu)

for sensor-impoverished robotic systems, and recognition of agent (human or robot) activities through observation. He served as cochair for the 2005 and 2006 AAAI Mobile Robot Competition and Exhibition. He can be reached at prybski@cs.cmu.edu.

Sheila Tejada is a visiting professor at the Electrical Engineering and Computer Science Department of Tulane University, New Orleans, where she teaches courses and performs research in AI, machine learning, and robotics. In 1993 she received her B.S. degree in computer science from the University of California, Los Angeles. She was awarded her M.A. and Ph.D. degrees in computer science from the University of Southern California in 1998 and 2002, respectively. Tejada has developed awarding-winning robots, such as the robot YODA, which took the silver medal at the 1996 AAAI office navigation robot competition, and the robot soccer team DreamTeam, the first world champions at the RoboCup International Robot Soccer Competion in Nagoya, Japan.

Douglas Blank is an associate professor at Bryn Mawr College. He received a B.A. in anthropology, a B.A. in computer science,

and a joint Ph.D. in computer science and cognitive science from Indiana University. His areas of research include developmental robotics, analogy-making connectionist models, pedagogical tools, and emergent intelligent systems. He can be reached at dblank@cs.brynmawr.edu.

Ashley W. Stroupe is a staff engineer at Jet Propulsion Laboratory in Pasadena, CA, working as a Rover driver with the Mars Exploration Rover Project, building sequences of commands to drive the Rover and deploy science instruments. In addition to her flight work, Stroupe does research focusing on multirobot teams in complex environments and behavior-based control, with applications to exploration and mapping, dynamic target observation, and cooperative manipulation. Stroupe received a B.S. in physics from Harvey Mudd College in 1990, an M.S. in electrical engineering from George Mason University in 1998, an M.S. in robotics from Carnegie Mellon University in 2001, and a Ph.D. in robotics from Carnegie Mellon University in 2003.

Magdalena Bugajska is a computer scientist at the Navy Center for Applied Research in Artificial Intelligence. She received a B.S. in computer science and mathematics with minor in AI and robotics from Colorado School of Mines and an M.S. in computer science from George Mason University. Her research interests include artificial cognitive systems, robotics, and machine learning. She can be contacted at magda@aic.nrl.navy.mil

Lloyd Greenwald (lgreenwald@alumni.upenn.edu) is a member of technical staff at Bell Labs in the Internet Research Department pursuing research on advanced algorithms for network security including anomaly detection, vulnerability analysis, penetration testing, wireless security, and mobile ad hoc networks. He received a Ph.D. and Sc.M. in computer science from Brown University and a B.S.E. in computer science and engineering from the University of Pennsylvania. He is the former director of the Intelligent Time-Critical Systems Lab at Drexel University.