Robotics

Tartan Racing Wins 2008 DARPA Urban Challenge

A self-driving SUV called Boss made history by driving swiftly and safely while sharing the road with human drivers and other robots. The feat earned Carnegie Mellon University's Tartan Racing first place in the DARPA Urban Challenge. The event pitted 11 autonomous vehicles against each other on a course of suburban/urban roadways. The first-place prize includes a $2 million cash award. After reviewing judges' scorecards overnight, DARPA officials concluded that Boss, a robotized 2007 Chevy Tahoe, followed California driving laws as it navigated the course and that it operated in a safe and stable manner. Many of the robots made good decisions, which meant speed became the determining factor, and Boss was the fastest of the competitors by a large margin. Boss averaged about 14 miles an hour over approximately 55 miles, finishing the course about 20 minutes ahead of the second-place finisher, Stanford University.

Carnegie Mellon's Robotics Institute has been a world leader in basic and applied research in the field of robotics since 1979. The institute takes a broad view of robotics: it builds robots for planetary exploration, robots that crawl through pipes and over rough terrain robot arms, minifactories, grippers, sensors and controllers. But it also works on speech understanding, process scheduling, data mining, traffic safety and many more things that don't exactly look like robots. At the institute's National Robotics Engineering Center, scientists are building robot forklifts, ship-cleaning robots and other devices for prompt commercial application. Other work is more conceptual, and may take longer to find practical use, but will undoubtedly have major impact on life in the future.

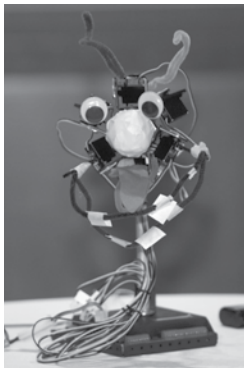
Field Robotics Center: The area of field robotics involves mobile robots operating in natural terrain. These robots must learn about their surroundings and safeguard themselves while performing tasks and objective sensing as well as self-navigation in random or dynamic environments. Projects at the Field Robotics Center include robots that can map mines and explore harsh planetary environs. *www.frc.ri.cmu.edu*

MERITS of Pittsburgh: This center performs basic and applied research in computer-assisted surgery, smart medical and diagnostic tools, 2D and 3D medical image analysis and informatics, rehabilitative and prosthetic devices, assisted living and preventive healthcare equipment and continuous healthcare process improvement. Much of its research involves partnerships with a variety of regional medical centers and biotechnology corporations. *www.ri.cmu.edu/centers/mrcas*

Center for Integrated Manufacturing and Decision Systems: CIMDS is an eclectic collection of people, projects and labs involved in research in the fields of manufacturing; visualization and interfaces; intelligent coordination and logistics; intelligent sensors, measurement, and control; and artificial intelligence. *www.ri.cmu.edu/centers/cimds*

National Robotics Engineering Consortium: Founded in 1994, with a $2.5 million grant from NASA, NREC's mission is to commercialize the mobile robotics technologies that NASA has developed by working with American industry. Currently, NREC has nearly

Internet-Controlled Robots That Anyone Can Build



Researchers have developed a new series of robots that are simple enough for almost anyone to build with off-the-shelf parts, but are sophisticated machines that wirelessly connect to the Internet. The robots can take many forms, from a three-wheeled model with a mounted camera to a flower loaded with infrared sensors. They can be easily customized and their ability to wirelessly link to the Internet allows users to control and monitor their robots' actions from any Internet-connected computer in the world. The new tools that make this possible are a single piece of hardware and a set of "recipes" that people follow to build their 'bots. Both are part of the Telepresence Robot Kit (TeRK) developed by Associate Professor of Robotics Illah Nourbakhsh and members of his Community Robotics, Education and Technology Empowerment (CREATE) Lab. Their goal is to make highly capable robots accessible and affordable for college and pre-college students, as well as anyone interested in robots. Unlike other educational robot kits on the market, TeRK is not sold as a complete set of parts. The CREATE Lab's recipes allow for a variety of robots to be built with parts commonly available through hardware and hobbyist outlets. At the heart of each TeRK robot is a unique controller called Qwerk that combines a computer with the software and electronics necessary to control the robot's motors, cameras and other devices.

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Scarab Tests Drilling Technology for NASA

Researchers in the Robotics Institute of Carnegie Mellon University's School of Computer Science have built a robotic prospector for NASA that can creep over rocky slopes and then anchor itself as a stable platform for drilling deep into extraterrestrial soils. Called "Scarab," this four-wheeled robot will never leave the Earth, but it will demonstrate technologies that a lunar rover will need to find concentrations of hydrogen, possibly water and other volatile chemicals on the moon that could be mined to produce fuel, water and air that are essential for supporting lunar outposts. Scarab is equipped with a Canadian-made drill for obtaining meter-long geological core samples and features a novel rocker-arm suspension that enables the robot to plant its belly on the ground for drilling operations.

20 projects ranging from autonomous farming equipment to robots that inspect and repair gas lines without disturbing gas flow. *www.rec.ri.cmu.edu*

Vision and Autonomous Center: Computer vision, autonomous navigation, virtual reality and space robotics are the areas explored by the 100 faculty, staff and students here. A vision-guided autonomous helicopter that can help law enforcement officials in mapping, surveillance and search-and-rescue operations is one of the premier projects developed at this center. *http://vasc.ri.cmu.edu*

Space Robotics Initiative: The SRI is developing robots and their support technologies (communication, manipulators and multiple robot coordination) for interplanetary exploration, space solar power station construction and MRO and solar-powered space flight. Some projects include Autonomous Rover Technologies; pursuing insights in fundamental aspects of robot perception; navigation; position estimation; integrated exploratory science from a robot; and the "Icebreaker" Lunar Ice Discovery Initiative, a proposed mission to explore the south pole of the Moon. *http://www.ri.cmu.edu/centers/sri/*

Advanced Mechatronic Laboratory: Research within the AML focuses on the idea of Rapidly Deployable Intelligent Systems. The main threads of this research are composition, collaboration, task management and adaptation; current research focus includes adaptable software, distributed information systems, distributed robotics systems, intelligent instruments and interactive robot programming. *www.ri.cmu.edu/labs/ lab_1.html*

Tele-Supervised Autonomous Robotics: In January 2004, NASA established a long-term program to extend human presence across the solar system, a primary goal of which will be to establish a human presence on the moon no later than 2020, as a precursor to human exploration of Mars. A central concept of this vision is that future space exploration activities must rely on human and robotic capabilities combined in order to achieve a long-term, well-orchestrated campaign of space exploration. In order to meet these technological challenges, systems which support safe human supervision of fleets of task-oriented robots will be a necessity for future space exploration. T-SAR's research focuses on providing end-to-end tools for human tele-supervision of autonomous robots in support of sustained, affordable and safe space exploration. *www.ri.cmu.edu/labs/lab_72.html*

Intelligent Software Agents Laboratory: The ISAL envisions a world in which autonomous, intelligent software programs, known as software agents, undertake many of the operations performed by human users of the World Wide Web, as well as a multitude of other tasks. The Software Agents Lab has developed the RETSINA multi-agent system infrastructure and has applied that infrastructure and its agents to many domains, including financial portfolio management; personalized Web information management; book-buying auctions; logistics planning in military operations; and wireless, mobile communications, to name a few. *www.cs.cmu.edu/~softagents*

Manipulation Laboratory: The goal of the Manipulation Lab is autonomous robotic manipulation in the presence of uncertainty, that is, the production of robots that can perform a variety of tasks in the physical world, ranging from industrial assembly to everyday chores. Examples include pre-positioning parts for camcorder assembly to sorting papers on a desktop. Practical issues addressed by the lab's research include: What are the fundamental mechanics of manipulation? How can a robot construct a plan to achieve specified goals? How can minimal sensor information be used to achieve tasks? *www.ri.cmu.edu/labs/lab_9.html*

Microdynamic Systems Laboratory: The MSL is exploring the limits of robotics in terms of speed, precision, dexterity and miniaturization. This endeavor requires development of new sensing, actuation and control technologies for agile robotic systems that can be applied to a variety of real-world situations. Major themes of the work include moving toward robotics operating at or below the micrometer scale, simplifying robotic mechanisms while providing greater functionality through software and providing new ways for humans to interact with the world through robotics. Examples include sensor-moderated coarse-fine manipulation, miniature factories for precision assembly, magnetic levitation haptic interfaces that allow humans to interact with remote or simulated environments through the sense of touch, dynamically-stable mobile robots for human environments and high-speed walking machines. *www.msl.ri.cmu.edu*

NREC Receives Contract To Develop Next-Generation Autonomous Ground Vehicle

Carnegie Mellon University's National Robotics Engineering Center (NREC), part of the Robotics Institute in the School of Computer Science, has won a $14.4 million contract to develop an advanced, autonomous, unmanned ground vehicle (UGV) for the US Army Tank-Automotive Research, Development and Engineering Center (TARDEC). The TARDEC contract funds NREC to build an updated version of the center's successful "Crusher" UGV as part of the Autonomous Platform Demonstrator program. Additionally, TARDEC plans to add to the contract, on a work directive basis, additional effort for NREC engineers to develop an Unmanned Ground Vehicle (UGV) end-to-end control architecture and demonstrate the viability of autonomous UGV operations in a relevant environment as part of the Robotic Vehicle Control Architecture program.