GRASP Newsletter – Fall 2006
Volume 1 – Issue 2

The GRASP Newsletter is a bi-annual electronic newsletter for GRASP members, alumni, friends, and family. For more up-to-date information, we invite you to regularly visit the GRASP website at http://www.grasp.upenn.edu

RESEARCH NEWS

GRASP welcomes two new faculty members: **Ben Taskar** (January 2007) and **Katherine Kuchenbecker** (September 2007). Ben Taskar joins us as Assistant Professor in Computer and Information Science, following a postdoctoral position with Michael Jordan at the Electrical Engineering and Computer Sciences Department at UC Berkeley. Ben received his Ph.D. from the Department of Computer Science at Stanford University, working with Daphne Koller. His primary research interests are machine learning and applications to computational linguistics, computer vision, and computational biology. Katherine Kuchenbecker joins us as Assistant Professor in Mechanical Engineering, following a postdoctoral position with Allison Okamura at the Johns Hopkins University. Katherine finished her Ph.D. in Mechanical Engineering at Stanford, where she did her doctoral research with Günter Niemeyer in the Telerobotics Lab, developing methods for improving the realism of haptic feedback for virtual reality and teleoperation.

The GRASP Lab has been awarded a new DARPA research project on Sensor Topologies and Minimal Planning (SToMP). The principal investigator of the approximately $1 million, four-year grant is **George Pappas**, who will be working along with colleagues **Ali Jadbabaie**, **Dan Koditschek**, and **Vijay Kumar** on the project, whose goal it is to apply advanced topological and geometric techniques in sensor networks and distributed control.

Together with the Lockheed Martin Advanced Technology Lab (ATL) and others, **Mark Yim** and **Vijay Kumar** obtained a DARPA contract to design a remote-controlled nano air vehicle (NAV). The device will look similar in size and shape to a maple tree seed. A chemical rocket enclosed in its one-bladed wing will power a sensor payload module more than 1,100 yards. Delivered from a hover and weighing up to 0.07 ounces, the NAV will be about 1.5 inches long and have a maximum takeoff weight of about 0.35 ounces. The current contract is $1.7 million for 10 months to do trade studies and risk reduction component prototypes, with an 18-month extension to design and test a flying prototype.

Mark Yim and his Ph.D. student Paul White recently performed a demo at the Intel Research Pittsburgh Open House 2006. They demonstrated a proof of concept modular robot self-reconfiguration with external actuation, showing that by using energy from the

environment, modules can be made more simply and cheaply.

Kostas Daniilidis' paper "Realizing any central projection with a mirror pair" (co-authors: Andy Hicks and their former undergraduate student Marc Millstone) made the cover of a recent issue of *Applied Optics* (volume 45, issue 28, pp. 7205-7210). The article can be viewed at http://ao.osa.org/issue.cfm?volume=45&issue=28

Dan Lee's RoboCup team, the UPennalizers, returned home from Germany this June after another eventful RoboCup competition. After getting through the first two rounds, the UPennalizers were unfortunately eliminated in the quarterfinals by an excellent UNSW team (8-0). Two Australian teams (UNSW & Newcastle) dominated the competition and ended up taking first and second places overall, routinely beating their opponents 10-0 during the matches. Nevertheless, the UPennalizers finished as the only American team to make it to the round of 8. They also tied for first place in the New Goal Challenge competition (whose aim it was to see how many goals a robot could score on a more realistic soccer goal) with a last -minute entry. Additionally, they teamed with RHex to create a crowd-pleasing demo where an Aibo rode on top of RHex and told it where to go to follow and kick a RoboCup soccer ball. This may be the first time a legged robot actually rode on another legged robot! This year's UPennalizers team featured a completely new set of teammates, whose members include David Cohen, Paul Vernaza, Gilad Buchman, Wei Jiao, and Kitae Kim.

FACULTY AWARDS

Dan Lee received a 2006 Lindback Award, an honor presented to Penn faculty in recognition of distinguished teaching, based on the recommendations of colleagues and students. Many students mentioned Dan's accessibility and willingness to be helpful. One student said, "He is one of our outstanding professors, very passionate about his work and caring about his students."

EVENTS

GRASP hosted the **2006 Robotics Science and Systems (RSS) Conference** at the University of Pennsylvania, for which **Mark Yim** and former GRASPee **Jim Ostrowski** were the workshop chairs, and **Vijay Kumar**, **George Pappas**, and **Mark Yim** were local arrangement co-chairs. Over 300 registrants convened to attend talks and workshops at the conference, held at the Hilton Inn at Penn. A highlight of the event was the GRASP Lab Demo Program at which a variety of research projects were demonstrated by student researchers. The demos were followed by a banquet at the Kimmel Center, and conference events wrapped up with a workshop on Saturday evening. Conference details and photos can be viewed at http://roboticsconference.org/index.shtml.

Kostas Daniilidis was conference co-chair with Marc Pollefeys of the Third International Symposium on 3D Data Processing, Visualization and Transmission

(3DPVT 2006) that took place in Chapel Hill, NC from June 14-16, 2006. The conference website is located at http://www.cs.unc.edu/Events/Conferences/3DPVT06/

The **Spring 2006 GRASP seminar series** featured a stellar cast of speakers:

January 13	Naomi Leonard (Princeton University)
January 20	Illah Nourbahksh (Carnegie Mellon University)
January 27	D. A. Forsyth (University of Illinois at Urbana-Champaign)
February 3	Yoky Matsuoka (Carnegie Mellon University)
February 10	Claire Tomlin (Stanford University)
February 24	Karl Hedrick (University of California at Berkeley)
March 3	Andrew Zisserman (Oxford University)
March 17	Richard Szeliski (Microsoft Corporation)
March 24	Karl Johansson (KTH, Sweden)
March 31	Peter Stone (University of Texas)
April 7	Julia Parrish (University of Washington)
April 14	H. Harry Asada (MIT)
April 21	Jim Marsh (Lockheed Martin Corporation)
April 28	Henrik Christensen (KTH, Sweden)

The **Fall 2006 GRASP seminar series** is proving to be equally stimulating:

September 22	Frank Dellaert (Georgia Tech)
September 29	Daniela Rus (MIT)
October 6	Magnus Egerstedt (Georgia Tech)
October 13	Dinesh Manocha (UNC-Chapel Hill)
October 20	Alyosha Efros (CMU)
October 27	Geir Dullerud (UIUC)
November 3	Bruce Francis (University of Toronto)
November 10	Chad Jenkins (Brown University)
November 17	Ken Goldberg (UC, Berkeley)
December 1	Eric Feron (Georgia Tech)

Further information on the series can be obtained at the GRASP website: http://www.grasp.upenn.edu/seminar/index.html

IN THE PRESS

The **GRASP team-working bots project** was featured in the June 13 issue of *New ScientistTech*, http://www.newscientisttech.com/article/dn9328.

Engadget.com also featured coverage of Penn researchers testing their system of team-working bots at a realistic urban warfare training ground at the Army's Fort Benning base http://www.engadget.com/search/?q=Pennsylvania. The GRASP system could help in search and rescue efforts and military operations – and even has the potential to include humans in the team.

The **2006 Robotics Science and Systems (RSS) Conference**, hosted by the GRASP Lab, was covered by *Philadelphia Inquirer* reporter Tom Avril. His article, which focused

on networked robotic firefighter-helpers, contained quotes from **Vijay Kumar** and **George Pappas** on recent advances in the world of automation. Avril's article, which was published in the August 23rd edition of the newspaper, can be viewed at: http://www.philly.com/mld/inquirer/living/health/15336463.htm

Vijay Kumar and students were featured in a Fall 2005 *Penn Engineering News* article which discussed their SWARMS project. The article is available at http://www.seas.upenn.edu/alumni/PennEngNews_F05.pdf

Mark Yim discusses the art and science of mechatronics in the Spring 2006 *Penn Engineering News.* The article is available at *http://www.seas.upenn.edu/alumni/PennEngNews_S06.pdf*

The RHex and RiSE robots developed in **Dan Koditschek's** lab were mentioned in a piece published in *The Almanac* on February 14. The article discussed a DC technology exhibition co-hosted by Penn's Office of Government and Community Affairs for members of Congress and their staff, at which Penn was joined by CMU, Penn State, and the University of Pittsburgh in demonstrating the substantial impact that federally funded research has on the Commonwealth of Pennsylvania.

Dan Lee's RoboCup team made the front page of the *Wall Street Journal*. The article covered the 2006 RoboCup Competition, held in Bremen, Germany, and discussed the history of the event, its long-term goal (creating a humanoid robotic soccer team that can defeat the winner of soccer's real World Cup by the year 2050), and the status of various U.S. teams. The article can be viewed at http://www.cs.utexas.edu/~AustinVilla/wsj-article-060523.pdf

The DARPA Grand Challenge project was highlighted in a PBS special which aired on March 28. "The Great Robot Race" demonstrated how driverless vehicles compete in a 130-mile race across the Mojave Desert, and introduced the various teams involved. The program can be viewed online at http://www.pbs.org/wgbh/nova/darpa/. **Vijay Kumar** and colleagues are currently working on a project which will be entered in a future Grand Challenge competition.

EDUCATION/OUTREACH

GRASP will offer a **Master's of Science and Engineering in Robotics,** beginning in the Fall of 2007. This multi-departmental, multi-disciplinary program will provide an ideal foundation for industrial jobs in robotics, defense, aerospace, and automotive industries and various government agencies. Further information on the program can be obtained at the GRASP website: http://www.grasp.upenn.edu/education/mse.htm

Vijay Kumar and Mark Yim helped design a new **Product Design Studies program** that incorporates courses from the Design School, SEAS (Mechanical Engineering), and Wharton. These courses are intended for graduate and upper-level undergraduate

students with an interest in interdisciplinary studies in the design of advanced technological products.

A **GRASP Lab tour and demo** were provided to a group of 4th- and 5th-graders from Lower Merion School District's gifted program during their visit to SEAS, where the students also visited the NBIC and HMS labs. This is one of numerous GRASP Lab tours/demos offered to elementary and secondary students throughout the year. For information on scheduling a visit, please contact the Lab assistant at (215) 898-0374.

STUDENT NEWS

Michael Zavlanos is one of four finalists for the 45th IEEE Conference on Decision and Control's Best Student Paper Award for his paper entitled "A Dynamical Systems Approach to Weighted Graph Matching." This award recognizes excellence in a conference paper contribution whose primary author is a student member of the IEEE. The winner will be selected during the conference in December 2006.

Kevin Galloway won third place in the 2006 ASME Student Mechanism Design Competition, Graduate Division, for his design of the RoboTrikke, a robotic platform that is derived from the principles of the Trikke, a three-wheeled, human-powered scooter that can be propelled by a combination of cyclic motion of its handlebar and swaying motion of the rider.

Additional congratulations to **Kevin Galloway** and members of the Wharton Business Plan Competition grand prize winning team SmartMotion Technologies (MuscleMorph), who rang the closing bell at the NASDAQ Stock Market in its MarketSite broadcast studio on Tuesday, August 8, 2006. The team's product, MuscleMorph, is a supplier of next-generation motion actuators for the life sciences, robotics, and defense industries. The company's proprietary actuators match the performance of biological muscles and are more power-efficient, lightweight, scalable, and cost-effective than any other present form of actuation. For product manufacturers, MuscleMorph's revolutionary technology provides greater design flexibility and enables them to build lighter, quieter, and more durable products at a fraction of the cost of traditional actuators.

Nader Motee was a finalist for the Best Student Paper Award at the 2006 American Control Conference, held June 14-16, 2006 in Minneapolis, MN. His paper was entitled, *Distributing Receding Horizon Control of Spatially Invariant Systems.*

GRASP postdoctoral scholar **Abubakr Muhammad** received a Sigma Xi Best Dissertation Award from his previous institution, Georgia Tech. The electronic version of his thesis, entitled "Graphs, Simplicial Complexes and Beyond: Topological Tools for Multi-agent Coordination," can be found at http://www.ece.gatech.edu/media/awards.html.

Ameesh Makadia ranked in top place in the first 3D shape retrieval contest:

http://give-lab.cs.uu.nl/shrec/shrec2006/allRunfiles.html Ameesh conceptualized the algorithms and prepared the submitted binaries all by himself in one month, beating groups with multiple years of experience like the Princeton group. The contest attracted groups from computer graphics as well as soli modeling from mechanical engineering departments.

Congratulations to GRASPees **Jongwoo Kim** and **Meghann Lomas** (Mechanical Engineering) on the recent completion of their Ph.D.s. Jongwoo's dissertation was entitled, "Adaptive Randomized Algorithms for Validation and Analysis of Complex Systems." He is returning to his native Korea to join family and begin a job there. Meghann's dissertation was entitled "Reinforcement Learning for Mobile Robot Controllers: Theory and Experiments." She is going to stay in the area and expand a working relationship with Lockheed Martin.

ALUMNI NEWS

Tom Sugar's (Ph.D., Mechanical Engineering, 1999) baseball fielding robot was featured in the *New York Times* sports section on June 10, 2006. Sugar and his colleague Michael McBeath received an NSF grant for this project, which is attempting to create machines that perform simple human tasks, such as helping a stroke victim fetch a glass of water.

Paulo Tabuada has moved to his new position as an Assistant Professor of Electrical Engineering at the University of California at Los Angeles (U.C.L.A.).

Alumni: *To contribute updates, please e-mail Janet White at jawhite@seas.upenn.edu*