Founded in 2002, Carnegie Mellon Silicon Valley is in the heart of the Valley. HQ is a two-story building at Moffett Field, on the grounds of the NASA Ames Research Center, just minutes from top-tier firms and downtown Mountain View. The reasons for having a campus here are obvious; buzzwords like “on-the-ground presence,” “synergy,” and “leverage” come to mind. But the new push in mobile technology is changing how the presence creates synergies and leverage.

The campus started, logically, with a focus on software. The faculty grew by drawing notable software gurus (including the founding dean, Jim Morris), and the student body took on a distinct profile. Since the Silicon Valley campus has only graduate programs, it quickly became a go-to place for young professionals — many working full-time at firms in the Valley while studying part-time for master's degrees in software engineering or software management.

The software programs remain a core strength; in fact they're continually being fine-tuned and added to. However, rapid new growth is now happening around the core, in mobile IT.

A new Ph.D. program, in ECE with a focus in Mobility, took its first students in 2008-09. And the “MOB” (Master of Science in Information Technology-Mobility) is now offered in conjunction with INI (the Information Networking Institute) at the Pittsburgh campus. These are all full-time, bi-coastal programs: some courses are teleconferenced from Pittsburgh to Silicon Valley or vice versa, and the many Faces of Mobility

continued on pg. 2
Aveek Purohit, ECE Grad Student

phone. You could punch up custom views on your own screen, from the angles of your choice, via wireless feeds from cameras at key points around the arena. The system has a Pittsburgh high-tech name: Yinz Cam. Conceived by Priya Narasimhan and deployed by her graduate and undergraduate students, the YinzCam system has been such a hit that it will be built into the Penguins’ upcoming new arena.

Narasimhan has a simple credo. “I don’t like to build toy lab projects. I want to build real-world systems,” she says. “They’re limiting. Nobody knows what the future will be. This campus is a haven where we can do what we want. Let’s do it and see where it takes us.”

How things translate
A good application leads to others. Narasimhan notes, for instance that the lessons learned from YinzCam could lead to new smart-mob applications. It’s now common for large groups of people to coordinate their actions by cell phone, and an ad hoc system broadcasting live video feeds would extend the possibilities: all we could see what none can see directly.

One project that has already led to branching possibilities is Trinetra. This is an assistive technology for the blind. The project was conceived by Narasimhan when watching a Pittsburgh blind man catch a bus, and gained traction when she teamed up with an expert on the subject—Dan Rossi, a database administrator here at the university, who is blind.

Sight-impaired people like to be independent, which is hard when shopping, especially for items like canned foods. What’s in the can, peas or corn? Well, packaged goods have bar codes. So Trinetra combines a portable scanner with text-to-speech software on a smart phone; scan the item, hear the contents. Thus far, this works in controlled settings. But to take it into the world, Narasimhan says, “the next stage is RFID-tagging the aisles and shelves to guide the person to the right part of the store.”

And here, wider uses beckon, even for those with good eyesight. When you’re in a supermarket different from your home store, wouldn’t you like a “product locator” that tells you where the soy sauce and the hand soap are hidden? Better yet, if the system were set up to log and learn your buying patterns, it could generate your shopping list. That item you always forget? You haven’t bought it for a month, time to restock. Corporate partners are very interested.

One intriguing assistive project within Narasimhan’s research group is HandTalk. Deaf people are quite fluent at using their hands to talk, but they have to deal with people who don’t know sign language. HandTalk “translates” by providing a pair of accelerometer-bearing smart gloves, again linked to text-to-speech and a mobile phone: sign the words, speak the words. Some tough work lies ahead, such as growing the system’s vocabulary, and adapting to user differences — smaller people, including children, sign with smaller gestures — but stay tuned.

Your friendly mobile companion(s)
Martin Griss, at the Silicon Valley campus, likes to say that “truly mobile applications help you in being mobile.” In other words, they help you get around and get along in the world. One embodiment of this, says Griss, would be the “mobile companion” — a single, very smart device loaded with apps to help you in more ways than you’d imagine. A logical platform is the mobile phone, since it’s already headed in that direction, and “in many countries it’s your primary or only device.”

Griss is interested in expanding the powers of the mobile companion through context-awareness. If the device can know more about where you are, who you’re with and what you’ve been up to, not only do the possibilities multiply, but tasks can be run more efficiently. Real-time translation of spoken language is one example. If you’ve sat down to order in a restaurant, “you must be talking about food,” and the companion’s algorithms can home in on food talk.

But the whole smarter-companion approach is, itself, only one possible approach to mobile IT. Another school of thought goes as follows: While a single very smart device can have many uses, some things are better done by swarms of cheaper, dumber devices that deliver swarm intelligence.

Pei Zhang is an advocate of that approach. Zhang is a bicoastal professor, that sense it’s real engineering. Not necessarily a matter of developing new research (which YinzCam does) alone, but also of putting stuff together in new ways (and Narasimhan notes that scaling up to handle massive numbers of ad-hoc users is “not trivial” and hasn’t been demonstrated in the real world at such scale by either academia or industry until YinzCam), until it does, in fact, work.

BICOASTAL MOBILITY CONT.

students physically split time between the two locations, by various arrangements.

(The idea in each case is to leverage the “best of both” campuses. For instance, you might come to Pittsburgh for a full range of multidisciplinary academics, and home base at Silicon Valley for work that involves research or internships with industries there.)

Mobility work is also broadening industry linkages. In the past year, the Valley campus has hosted a Mobility Research Summit — where a dozen major IT firms explored views on R&D agendas for the future — plus a Mobile Health Workshop, which drew high-level delegates from Kaiser Permanente, as well as IT firms delving into mobile apps for health care.

The list of actual partners and sponsors for mobility research is growing. As of early 2009, Motorola, Nokia, Panasonic, SAP, the U.S. Army Research Office, and others were on board with various projects; proposals and talks for new work were proliferating.

And mobility research, in turn, is drawing new kinds of faculty to both campuses. Research professor Pei Zhang is a mobile hardware guy who won notice, in his own recent student days, as part of a project called ZebraNet: tracking the movement of wild zebra herds in Kenya by fitting animals with special GPS collars that enabled peer-to-peer sharing of stored data. (Benefit: capture data from one collared zebra, and you get data on all the others that’ve been in its signal range.)

Zhang chose Carnegie Mellon over other institutions for the chance to help build a new and growing presence in Silicon Valley. As he tells prospective students, “It’s like joining Google in the early days.”

Does he have a grand vision of what the Silicon Valley campus might become? “I’m allergic to grand visions,” Zhang says. “They’re limiting. Nobody knows what the future will be. This campus is a haven where we can do what we want. Let’s do it and see where it takes us.”

Martin Griss, New Dean of the Silicon Valley Campus

that sense it’s real engineering. Not necessarily a matter of developing new research (which YinzCam does) alone, but also of putting stuff together in new ways (and Narasimhan notes that scaling up to handle massive numbers of ad-hoc users is “not trivial” and hasn’t been demonstrated in the real world at such scale by either academia or industry until YinzCam), until it does, in fact, work.
with offices on both campuses, and his Valley office comes with a traveler’s advisory. If you scroll down the hallway to visit, watch out for the tiny helicopters. They’ve got blade spans of about 3 inches and are neither remote-controlled nor smartly autonomous. “They navigate by touch sensors,” Zhang explains. “If they bump the walls, they’ll bounce off; they may fall but they will get back up. It’s good-enough technology. It will prevent you from crashing often.” Each helicopter’s payload is a tiny camera, not for steering but for looking. One use would be in rescue situations — say, a fire or earthquake, with buildings damaged and treacherous. Are people inside? “Throw in a bunch of helicopters,” Zhang says. “If you have a hundred and you lose ten, who cares?”

Also, you’d like systems to be minimally intrusive and demanding for the people who use them. In health care, for instance, there is a growing need for systems to monitor the elderly when they’re home alone. One approach, being explored by Griss and others, centers on the mobile companion. Sensors in a smart phone could tell if the person has fallen, or isn’t moving. As Griss notes, the phone could even prompt movement: time to exercise!

Zhang, in general, is fascinated by what can be done with “minimal sensing and minimal control.” In a bicoastal Valley/Pittsburgh course that he teaches, students are given Sun SPOTs — Sun’s “Small Programmable Objects” that have bare-bones memory and onboard gear (e.g., a light sensor but no camera) — and are urged to “discover the limitations and use them as features.” This is partly because one of the grand challenges of mobile IT is resource consumption: every task should use minimal power, add minimal bulk.

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But some researchers worry, like Zhang, that “Grandma doesn’t like to carry a phone in her pocket” or may forget. BabyCam-style video monitoring isn’t good-enough technology. It will prevent you from crashing often.” — Siewiorek raises his hand, swiping it down vertically, then across — “as if you were giving the patient the Last Rites.”

Moral of the story: “When you go out mobile, there are a lot more issues from the personal and social point of view.”

Yet the opportunities far outweigh the issues. Moreover, when Dan Siewiorek steps back to consider all the various engineering challenges of mobile IT, he likes what he sees. He’s seeing a set of reasons why mobility is the perfect Next Big Thing for Carnegie Mellon to emphasize.

“Carnegie Mellon has almost a unique advantage, with the skill set we have — multidisciplinary, system-oriented, studying the user as a part of the system. Mobility fits our strengths without requiring a lot of capital. We’re on a very good track.”

**How to Keep Mobile Security from Becoming an Oxymoron**

As mobile technology moves forward it raises new security and privacy issues. One worst-case scenario has to do with implanted medical devices. If a device is networked — and is set up to deliver medications or stimulate inside the patient’s body — a hacker who gains control might conceivably ‘hold somebody hostage,” as Priya Narasimhan says.

A more common concern is simply that most mobile uses will require “sharing information,” says Martin Griss of the Silicon Valley campus. He notes that “in order to do anything involving location, you have to share with other applications,” and peer-to-peer data sharing is growing generally. You don’t want just anyone freely interrogating a smart device that knows a lot about you, so your own apps “have to decide selectively what information to share,” says Griss. “Maybe they give different levels of answers depending on who’s asking.”

It helps immensely that Carnegie Mellon’s Mobility Research Center is officially part of CyLab, one of the world’s largest academic R&D centers for cybersecurity. (In fact, the importance of mobile security is what prompted this institutional tie-in in the first place.)

Also, Martin Griss points out, we shouldn’t assume that going mobile will only add to our security problems. “The other side of the coin is, smart mobile applications can use context to make your information more secure,” he says. For instance, user authentication at login could be aided by locational and peer-to-peer data: “If I’m in one of my typical places, and surrounded by people who know me, it’s probably me.”
“Smart Grid” Conference Warms Up Discussion

From its beginning in December 2004, the Annual Carnegie Mellon Conference on the Electricity Industry has been covering important ground. Organized by ECE/EPP Professor Marija Ilic and Tepper School of Business University Professor and J. Higgins Chair Lester Lave, the conference is now in its fifth year.

This year’s theme was timely—Future Energy Systems: Efficiency, Security, Control—and the conference brought together approximately seventy-five leaders, consultants, managers, and researchers from industry, government, and academia.


For more information and access to conference presentations, see www.ece.cmu.edu/~electricityconference.

ELECTRIC ENERGY SYSTEMS GROUP: SMART RESEARCH

Led by ECE and EPP Professor Marija Ilic, a team of Carnegie Mellon researchers are dedicated to powering up a new smart energy grid project for the future.

Ilic is director of the university’s new Electric Energy Systems Group (EESG) focused on developing research programs, curriculum and outreach initiatives to improve the nation’s $26 billion electric energy system.

EESG comprises faculty from four colleges at Carnegie Mellon, numerous graduate students, plus visiting faculty and students from universities outside the U.S., all working on the huge problems that face the world’s future electric energy systems. In addition, new faculty in this research area will be starting soon in ECE, funded in part by a Pennsylvania state grant from the Keystone Innovation Starter Kit program.

“I am proud to be working in this growing field of energy and electricity research. I see it as a tremendous opportunity to reach across traditional disciplines and organizational boundaries and work toward shaping a new generation of leaders,” said Ilic.

Ilic is developing intricate software-based tools to make the electric power grid more economical to operate and safer to use.

While Ilic has been working in the area for a number of years, her efforts are in line with the Obama administration’s latest announcement that the new economic stimulus plan contains $11 billion for development of what has become known in science and engineering circles as the “smart grid.”

“The smart grid will do for the delivery of electric power what the Internet did for the movement of vast amounts of information,” said Ilic. She argues that a smart grid would use computer, sensor, and communications technology on a house-by-house and business-to-business basis to stem the flow of electricity to devices when not in use.

“A smart grid also could eliminate some of the widespread problems like blackouts that have plagued many of the nation’s aging systems and caused economic hardship for users,” Ilic said. “For a clean energy future, we need a smart grid and increased use of renewable energy. At Carnegie Mellon, we are looking beyond what we have today and we are creating a curriculum to train future energy managers.”

Ed Schlossinger, ECE Department Head, praised Ilic for reaching across traditional disciplines and organizational boundaries to shape a new generation of leaders.

“Our department currently offers unique courses essential for future concepts in electric energy systems by identifying clear links across physical systems and embedded intelligence necessary to make these systems secure, reliable, and efficient. Professor Ilic has been instrumental in developing these new courses,” Schlossinger said.

Last fall, Ilic received an honorary academic chair from the TU Delft University in The Netherlands. Named the Control of Future Electricity Network Operations chair in the Department of Technology, Policy and Management at TU Delft, it is the first chair of its kind dedicated directly to future electricity infrastructure.

For more than a decade, Carnegie Mellon’s Department of Engineering and Public Policy (EPP) has done extensive collaborative research involving critical infrastructures with Delft researchers.

“We feel that this dual appointment at both universities is a wonderful opportunity to establish increased research synergies and boost our exchange of outstanding Ph.D. students,” said EPP’s department head, Granger Morgan.

Also this past year, Ilic signed a research agreement with Swiss-based ABB Group to support its efforts in modern energy systems. ABB is a leading manufacturer of technologies known as Flexible AC Transmission Systems (FACTS) and High Voltage Direct Current (HVDC) light technologies which form the core of future smart electric power grids.

The Carnegie Mellon-ABB effort is aimed at designing advanced control embedded within these technologies for better utilization of the overall energy resources, even when conditions deviate significantly from nominal. Carnegie Mellon is one of very few U.S. universities selected by ABB for targeted collaboration.

For more information about the Electric Energy Systems Group, please visit www.eesg.ece.cmu.edu
The Smart Grid: Power from the People

Called “the most significant engineering achievement of the 20th century” by the National Academy of Engineering, the energy infrastructure that has served us so well for more than a century is rapidly running up against its limitations in every way.

How can the Smart Grid alleviate the many hazards associated with continuing with the status quo in the 21st century?

**Demand:** Since 1982, growth in peak demand for electricity has exceeded transmission growth by almost 25 percent every year. The ultimate goal of the Smart Grid is to meet increased consumer demand without adding infrastructure.

**Reliability:** There have been five massive blackouts over the past 40 years; three in the past nine years. A Smart Grid will anticipate, detect, and rapidly respond to problems, reducing wide-area blackouts to near zero.

**National Economy:** The Northeast blackout of 2003 resulted in a $6 billion economic loss to the region. In a world gone digital, the load from chip technologies and automated manufacturing has risen to 40 percent, and is expected to climb to 60 percent in just six years from now. Opening the grid to innovation will enable markets to grow unfettered and innovation to flourish. Consider the market-making effect of the deregulation of the telecommunications industry in the 1980s.

**Affordability:** Consumer costs are rising as rate caps come off and utility companies’ long-term coal contracts expire. With a Smart Grid, though energy costs will rise, it is anticipated that the trajectory of the future cost increases will be far more gradual. Smart Grid technologies will provide customers with new options for managing their own electricity consumption.

**Security:** The grid’s centralized structure leaves us open to terrorist attack. Cascading failures could bring our nation’s banking, communications, traffic, and security systems to a complete standstill. The Smart Grid will be more resistant to attack and natural disasters and will move us toward energy independence from foreign energy sources. For example, after a storm, communities will be able to take advantage of a distributed generation concept called “islanding.” Combining resources of every description—roof-top solar, fuel cells, electric vehicles—the community can generate sufficient power to keep critical infrastructure such as communications and grocery stores up and running.

**Environment:** The U.S. accounts for 4 percent of the world’s population and produces 25 percent of its greenhouse gases. Half of our electricity is produced by burning coal. Clean, renewable sources of energy like solar, wind, and geothermal can easily be integrated into the Smart Grid. Polluting “peaker plants,” which go online when demand is high, will be phased out.

**Global Competitiveness:** Germany, Japan, and the European Union all have aggressive agendas or are already implementing alternate sources of power generation or distribution. Regaining our lead in solar and wind will create a healthy green-collar economy.


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**Jon Peha Named FCC Chief Technologist**

EPP and ECE Professor Jon Peha has been named chief technologist for the Federal Communications Commission (FCC), where he will apply his extensive telecommunications expertise to a variety of issues.

Peha will function as a senior advisor to the FCC chairman and commissioners on technology related matters and perform specific assignments, such as conducting research addressing policy issues regarding IP and telecommunications networks, according to the FCC.

For more than two decades, Peha’s research has spanned technical and policy issues of computer and telecommunications networks. He also frequently consults for industry and government agencies around the world.

M. Granger Morgan, head of Carnegie Mellon’s Department of Engineering and Public Policy, said, “Jon combines deep technical knowledge of telecommunications with superb policy skills. The FCC will benefit greatly from his presence, and we will also benefit when he returns to Carnegie Mellon to inform his teaching and research with a wide range of new experiences.”

In his previous government roles, Peha has addressed telecommunications and e-commerce issues with legislative staff in the U.S. Senate and House of Representatives, and helped launch a U.S. government interagency program to assist developing countries with information infrastructure. In 1998 he served as a diplomacy fellow of the American Association for the Advancement of Science (AAAS) and in 1999 he served as a Congressional Fellow of the IEEE.

In industry, Peha has served as chief technical officer of three high-tech startups, and as a member of the technical staff at SRI International, AT&T Bell Labs, and Microsoft.
Music and Technology Play a Duet

It was a long time coming—14 years to be exact—but Carnegie Mellon is now offering two new degrees in Music and Technology, a Bachelor of Science and a Master of Science. Three academic units are collaborating to train the next generation of composers, engineers and programmers in music signal processing, sound production, composition, and the cognition of music.

Associate teaching professor Tom Sullivan, and Richard Stern, professor of ECE and Language Technologies, were the ECE faculty instrumental in bringing the program to fruition.

“Riccardo Schulz [associate teaching professor in the School of Music] and I first proposed a joint ECE/Music program in 1995,” said Sullivan. “We’ve been working to make a program like this happen for some time.”

Based in the School of Music, the programs bring together faculty from the Carnegie Institute of Technology, the School of Computer Science, and the School of Music to explore new ways of performing, creating, presenting, and archiving music. The first classes will enter in the fall of 2009.

“Many different people have been involved along the way,” said Sullivan. “With the inclusion of Computer Science [most notably Roger Dannenberg], ECE’s Richard Stern, and the hiring of Noad Zahr of School of Music department head in the summer of 2007, things finally came together over the 07-08 academic year with yet another reworking of our initial curriculum proposal.”

Zahr, who has incorporated technology into his own compositions, says that Carnegie Mellon has the unique opportunity to transform the training of musicians “in the 21st century.

“This convergence of disciplines creates exciting opportunities for forward-thinking artists, scientists, and engineers who are interested in combining their talents,” said Zahr. “The program combines the innovation of the Carnegie Mellon experience with the world-class music making of this school to produce new and compelling musical experiences.”

As this field of study crosses several curricula, a team of advisors will assist students in planning courses to help them reach their professional goals. Students will develop an understanding of music, computer science, and electrical engineering, with an emphasis on one of these concentrations. Courses such as sound production, music signal processing, and recording will be interspersed with core music courses, including music history, software, and harmony. Both degree programs will culminate in a research-based capstone project.

Undergraduate students will take Introduction to ECE, Mathematical Foundations of Electrical Engineering, and Signal and Information Processing. In addition, if students choose a concentration in ECE, they will need to complete the ECE curriculum core. All undergraduate students in the program will be required to complete 24 units of a capstone project combining music and technology.

Sullivan teaches the three courses mentioned above and Electroacoustics, which is an elective for the Music and Technology degree and a required course for the new college minor in Audio Engineering. In 2011, Sullivan will be the regular instructor for a capstone signal processing course which will be of interest to the Music and Technology majors. Development of a course on signal processing for audio technology is on Sullivan’s future agenda.

The required Signal and Information Processing course, and program electives Digital Signal Processing and Electroacoustics are on Stern’s teaching rotation. Stern says he is interested in developing a signal processing course for “sheer musicians” which will bring together aspects of music, signal processing, and auditory perception.

Stern is delighted that the music and technology program is finally materializing after so many years. An undergraduate music major at MIT, Stern studied music performance in Europe after earning his engineering doctorate.

“When I arrived at CMU in 1977,” said Stern, “I was startled to find out how little interaction there was between Music and the engineering and science colleges. The present climate at CMU in which cross-disciplinary activities between the arts and sciences are encouraged and actively supported is a very welcome change in the fundamental nature of the campus that has evolved over many years.”

“We are all much the better for it,” said Stern.
Rob Rutenbar Elected ACM Fellow

Rob A. Rutenbar, Jatras Professor of ECE and CS, was elected a Fellow of the Association for Computing Machinery (ACM) for contributions to computer-aided design tools for mixed-signal integrated circuits.

Rutenbar is widely known for his contributions to computer-aided design (CAD) algorithms and software for mixed-signal integrated circuits and for the contributions that his company, Neolinear, has made to the industry.

Rutenbar's seminal work over the last two decades pioneered today's first generation of commercial synthesis software for design challenges presented by the non-digital side of "mixed-signal" system-on-chip designs that integrate digital and analog function.

Randy Bryant, University Professor and Dean of the School of Computer Science, notes the importance of Rob's contributions in the area of analog circuit design.

"Before his work (in collaboration with Rick Carley), analog design was the domain of a small set of highly skilled individuals," said Bryant. "Only they could take into account the dozens of constraints in the circuit and layout design of an analog integrated circuit. Rob used his expertise in physical design automation, combined with different optimization techniques, to encode all of these different constraints in a common framework to let the computer generate high quality designs."

A 1987 paper describing his work was the first analog synthesis paper ever to win Best Paper at the ACM Design Automation Conference.

Over the next dozen years, Rutenbar's research group pioneered a sequence of increasingly sophisticated synthesis formulations for these difficult circuits, eventually inventing a set of optimization strategies tailored to these unique problems. Rutenbar also pioneered the first algorithms for geometric layout of these designs.

In 1998 Rutenbar cofounded Neolinear, Inc. to commercialize this research. In 2004, the company was acquired by Cadence Design Systems, the world’s largest EDA company. Today, Neolinear tools are integrated components in the Cadence flagship Virtuoso platform.

Rutenbar is a Fellow of the IEEE and received the 2004 Semiconductor Research Corporation Technical Excellence Award for contributions to circuit synthesis. In 2007, he received the IEEE Circuits and Systems Industrial Pioneer Award for his efforts in making analog synthesis a commercially successful CAD technology.

Rutenbar is the founding director of the multi-university FCRP Focus Center for Circuit & System Solutions, C2S2, one of five national focus centers supported jointly by the U.S. semiconductor industry and DARPA, chartered to solve long-range problems in IC design.

His contributions to education have been recognized by the College of Engineering Team Teaching Award and the 2001 Aristotle Award for the impact of his graduate students on the U.S. semiconductor industry.

Rutenbar joined our faculty in 1984 after receiving his Ph.D. from the University of Michigan at Ann Arbor. In January 2010 he will become the head of the Department of Computer Science at the University of Illinois at Urbana-Champaign. We wish him the very best of luck in his new endeavor.
Ganger Wins HP Innovation Award for Second Consecutive Year

Greg Ganger has received a prestigious HP Innovation award for the second year in a row. Ganger, professor of ECE and computer science, was among 60 recipients worldwide to receive an award as part of HP’s 2009 Innovation Research Program. The program is designed to create opportunities for colleges, universities, and research institutes around the world to conduct breakthrough research themes at HP Labs.

Ganger, director of the Parallel Data Lab (PDL) at Carnegie Mellon, wrote a winning proposal titled “Toward Scalable Self-Storage.” He said the award will serve to strengthen and deepen the longstanding relationship between HP Labs scalable storage researchers and the PDL.

“We will be collaborating on our common interests in scalable, self-managing storage to tackle key challenges, including performance isolation between tenants sharing a common infrastructure and tenants with different requirements,” Ganger said.

He added “As enterprise storage demands continue to grow and diversify, we need scalable storage that supports the new industry demands with lower administrative costs.”

Prith Banerjee, senior vice president of research at HP and director of HP Labs says their goal with the Innovation program is to collaborate with the brightest minds from around the world to tackle industry’s most complex problems and push the frontiers of fundamental science.

“Carnegie Mellon has demonstrated outstanding achievement and a vision that will help inspire technological innovation and address the most complex challenges and opportunities facing the industry in the next decade,” Banerjee said.

HP reviewed nearly 300 proposals from more than 140 universities in 29 countries on a range of topics within the eight high-impact research themes at HP Labs.

Leaving a Legacy

Engineering Scholar Alfred A. Thiele Leaves Legacy of Innovative Research

Alfred A. Thiele, a distinguished scholar in Engineering, is the recipient of the 2009 Philip L. Dowd Fellowship for his leadership and guidance of the Information and Communication Technologies Institute (ICTI), a joint Carnegie Mellon University and Portuguese Educational and Research Program.

“Thiele came to Carnegie Mellon in 1981. Mark H. Kryder, the founding director of the DSSC and the person who hired Thiele at Carnegie Mellon, worked on magnetic bubble memory devices at the IBM T.J. Watson Research Center when Thiele was doing much of his most well-known work on the physics of magnetic bubble domains at Bell Labs. He was a wonderful researcher and a real problem solver,” said Kryder. “The work that Al Thiele did explaining the stability of magnetic bubble domains was seminal at the time, and is still being used in the design of perpendicular recording materials that are in every disk drive manufactured today.”

Jimmy Zhu, the ABB Professor of Engineering and current director of the Data Storage Systems Center, praised Thiele for his attention to detail and great capacity for thinking outside of the box.

An avid sportsman, Thiele enjoyed ice skating at Schenley Park and riding his bicycle through Oakland and Shadyside. A lifelong patron of the Metropolitan Opera, friends said he would take in an opera and then go ice skating at Rockefeller Center in New York City.

“He was a great friend, and a wonderful inspiration to graduate students who enjoyed mentally sparring with him about a broad range of research challenges,” said friend and colleague Chris Bowman, director of the university’s National Fabrication Center who drove to Kentucky to attend the April 1 funeral.

Carnegie Mellon News

José M.F. Moura, professor of ECE and Biomedical Engineering, is the recipient of the 2009 Philip L. Dowd Fellowship for his leadership and guidance of the Information and Communication Technologies Institute (ICTI), a joint Carnegie Mellon University and Portuguese Educational and Research Program.

“The breadth of the program and the rapidity of its establishment is unprecedented in the history of Carnegie Mellon,” said ECE Department Head Ed Schlesinger. “José Moura was central to creating and executing this vast program.”

Moura is Director of the Carnegie Mellon portion of ICTI, an academic and research partnership between the university and several top-ranked and government agencies in Portugal. It is a major initiative undertaken by the Portuguese government to strengthen the country’s knowledge base at an international level. Master’s and Ph.D. students are admitted to a dual-degree program, splitting time between the Portuguese university and the affiliated Carnegie Mellon department to fulfill the degree requirements.

Upon completion, the students receive degrees from Carnegie Mellon as well as the affiliated Portuguese university. In addition, there is a substantial industrial-funded research program also conducted jointly between Carnegie Mellon departments and Portuguese universities.

The scope of ICTI is unprecedented at Carnegie Mellon, involving professors, researchers, and students from six colleges, nine departments, and six research centers and institutes at the university, and a large consortium of Portuguese research and educational institutions including twelve higher education institutions, four associated laboratories, two governmental agencies, and an applied research institute.

There are currently four Master’s programs involved. In addition, there is a robust industrial affiliates program including Portugal Telecom, the main telecommunications operator in Portugal, Nokia Siemens Networks, Navabase, and Critical Software, a leading Portuguese software company, committed to help define the program strategy and direction.

The first class of students entered in the fall of 2007 and the first master’s classes have already been awarded degrees and hired by Portuguese companies.

Moura joined our faculty in 1986. He is a Fellow of the IEEE, a Fellow of AAAS, and a corresponding member of the Academia das Céências de Lisboa (Portugal). He received the College of Engineering Outstanding Research Award in 2007, the IBM Faculty Award, the IEEE Third Millennium Medal, and the 2003 IEEE Signal Processing Society Meritorious Service Award. He is currently the president of the IEEE Signal Processing Society.
Ricketts Receives Ladd Research Award

ECE assistant professor David Ricketts is the recipient of the 2009 George Tallman Ladd Research Award from the College of Engineering. Ricketts’ research focuses on the investigation of the fundamental performance limitations of nanoscale circuits. His research crosses the fields of device physics, materials science, and circuit design, investigating the ultimate capabilities of nanoelectronic devices and how these can be exploited in novel circuits to produce the highest performing systems. The research covers a wide range of areas, including silicon and polymer nanowire FETs, RF graphene circuits, spinwave devices as well as nonlinear circuits, high-speed converters, neural networks and energy conversion.

Since the semiconductor industry is approaching fundamental physical limits on the shrinking of transistors, the “next set of grand challenges” focuses on the building blocks for circuits and new applications that will continue to drive the enormous world market, said Rob A. Rutenbar, Jabies Professor of ECE, who nominated Ricketts. “David works precisely at the intersection of nanotechnology and electronics. He has already made significant contributions in both areas.”

One area of Rickett’s research focuses on design of novel nonlinear circuits that exploit new post-silicon and non-silicon devices. He is one of a group of faculty who were awarded a large DARPA contract for research that seeks to understand if scanning tunneling microscope (STM) technologies for atomic scale analysis can now be pushed toward atom-by-atom nanoscale manufacturing.

Ricketts was recently honored with a DARPA Young Investigator Award to pursue work in spintronic technologies. He is working with faculty in the Data Storage Systems Center on the application of spin torque oscillators (STOs) in spectrum-agile RF circuits.

“David is also a remarkably effective and popular teacher,” said Rutenbar. He co-created a new ECE undergraduate class design class featuring the first real hands-on radio design experience for ECE students, and he created a “semi-conductor bootcamp” class for entering grad students intended to give them a deep view into the fundamental problems of modern semiconductor devices.

Before joining our faculty in 2006, Ricketts earned his Ph.D. at Harvard after working in industry for a number of years.

Kumar and Savvides Win College Outstanding Research Award

Vijayakumar Bhagavatula (Kumar), professor of ECE, and Marios Savvides, assistant research professor of ECE, are winners of the 2009 Outstanding Research Award from the College of Engineering. Two were nominated for pioneering the use of correlation filters for the recognition of humans from their biometric signatures such as face and iris images.

Biometric recognition is crucial to the development of reliable, secure access to both physical and virtual spaces. Unlike passwords or badges, biometric signatures are an integral part of a person that cannot be lost or stolen. Most importantly, they provide non-repudiation, a critical aspect of security.

Many university and industrial research groups have been working on methods for accurate face recognition, but most of these methods are based on computer vision approaches, comparing a current image with that of a stored image. Real-world performance of these methods is poor because of natural differences between the original enrolled image and verification imagery, e.g., changes in expression, lighting, pose, and iris occlusion by eyelids, etc.

Kumar and Savvides have developed a robust biometric recognition capability using a signal processing-driven approach to match biometric images collected during enrollment and verification. Based heavily on Fourier transforms of the face and iris images, this correlation filter-based biometric recognition method offers two key elements for success—shift-invariance and graceful degradation.

In two recent grand challenges sponsored by the National Institute of Standards and Technology, the Kumar and Savvides method for outperformed expectations. In the Face Recognition Grand Challenge, they won first place for the most difficult task in the competition, the uncontrolled image-based face recognition. And in the Iris Challenge Evaluation, their method placed second only to a well-established company with a slightly better genuine accept rate. In addition, Kumar and Savvides was the only team to submit algorithms for both grand challenges.

“Kumar and Savvides are creating a paradigm shift in the image-based biometric field,” said Tobias Kanade, the Whitaker University Professor of Robotics and Computer Science and world-renowned expert in the field of computer vision. “The reputation of CIT in this field has soared internationally and nationally.”

The Kumar-Savvides research has spawned a company, BiometricCore, to commercialize the technology. Carnegie Mellon is the first entity outside of government research labs to be cleared to host a state-of-the-art iris recognition system.

Computer Generation of Commercial Libraries Becomes a Reality

Intel’s high performance library IPP, used by thousands of companies worldwide, features a new domain for functions generated by Spiral, a tool developed by an ECE research group under the lead of Professors Markus Püschel and José Moura.

Spiral can replace the human programmer in the very difficult task of writing highest performance code for important mathematical functions and often achieves even better performance than human programmers. The technology underlying Spiral’s success with IPP was developed by ECE Assistant Research Professor Franz Franchetti and Püschel’s 2008 Ph.D. graduate Yevgen Voronenko, who won the ECE best dissertation award.

Spiral’s core domain is linear transforms, which are crucial building blocks for many high performance applications such as physics modeling or audio/image/video processing. In other words, if the transforms are fast, then the application will run fast. Current practice in high performance library development is to carefully hand-tune and hand-optimize code whenever a new platform is released (which happens on an annual or bi-annual basis), a costly effort that requires several man-months to complete. With Spiral it becomes possible to reduce this effort to a few hours of computer time. Besides being cheaper, this makes it possible to take advantage of new platforms faster.

One important example is the discrete Fourier transform which is used in most signal processing applications. Spiral-generated code will typically run 10 to 30 times faster than a straightforward implementation by a skilled programmer without training in performance optimization. Compared to the best existing human-written code (typically highly tuned assembly code), Spiral-generated code may be anywhere between competitive or five times faster.

Spiral generates libraries using an innovative formal framework that enables the automation of various optimizations typically performed by a human programmer including vectorization and parallelization for recent multicore platforms and tuning to a given computer’s memory hierarchy. Further, Spiral can autonomously generate and evaluate thousands of algorithmic alternatives to find the fastest solution for a given computing platform.

Spiral has been funded by several grants from NSF, DARPA, and various companies. For more information and other research threads in the Spiral project please visit www.spiral.net.
Students

In Pursuit of Excellence

HKN Sigma Chapter Hosts National Leadership Conference

Last fall, 150 ECE honor society students from 27 U.S. universities arrived on campus to attend the 2008 Eta Kappa Nu National Leadership Conference hosted by Carnegie Mellon’s Sigma Chapter.

“We are all proud of Sigma Chapter’s growth and development over the past few years,” said Susan Farrington, ECE’s Director of Alumni and Student Affairs and Eta Kappa Nu (HKN) co-advisor along with ECE Professor Dave Casasent.

Glen Meakem, cofounder and managing director of Meakem Becker Venture Capital, cofounder and former CEO of Free Markets, and a Carnegie Mellon University Board of Trustee’s member, delivered the opening keynote. ECE Professor Raj Rajkumar, a member of the Carnegie Mellon team that won the 2007 DARPA Urban Grand Challenge, prepared the students to win a mock DARPA challenge.

Attendees had an opportunity to see Boss, the Urban Challenge winning vehicle and to hear a keynote address by legendary Red Whittaker, director of the Robotics Institute’s Field Robotics Center and team leader for the Urban Challenge.

Mark Kryder, university professor of ECE, founding director of the Data Storage Systems Center and retired CTO and VP of Research at Seagate Technologies, provided the dinner keynote on leading and innovating in academe and industry.

Christina Johns, Vice President of Sigma Chapter and Conference Chair appreciated the learning experience of managing the conference. “At the end we were very happy and extremely proud of what had been accomplished,” said Johns.

Brad Miller, President of Sigma Chapter and Sponsor Chair said, “It was an awesome professional development opportunity and a chance to make the ECE honor society shine.”

Sarah Hsieh, Sigma Treasurer and Speaker Chair for the conference, noted the excellent personal and professional insights and useful career advice provided by the speakers and panelists, and the various sources of support for the conference. “Our advisors stood by us every step of the way and Eta Kappa Nu national was quite helpful. We showed that we have quite a community and many valuable resources to draw on,” Hsieh said.

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Panel participants:
Jane Rudolph (E ’79)
Senior Vice President, Lockheed Martin
Joseph Havrilla (E ’77)
Senior Vice President and CTO, Medrad
Ron Hodge
Partner and Officer
Global Information Technology
Booz Allen Hamilton
Greg Lester
V.P. Air and Missile Defense, Dynetics

The Sigma Chapter officers were congratulated at the conference by the president of Eta Kappa Nu, Bruce A. Eisenstein, Arthur J. Rowland Professor of ECE at Drexel University (right). The students are, from left to right: Christina Johns, Vice President and Conference Chair; Sarah Hsieh, Treasurer and Speaker Chair; and Brad Miller, President and Sponsor Chair; Other students involved in conference planning were Hemant Sikaria, Sudeep Yegnashankaran, Steven Ellis, Andres Rodriguez and Sidarth Singh.

David Casasent, Westinghouse Professor of ECE, who will retire at the end of this academic year, was honored by Sigma Chapter for more than 25 years of service as their faculty advisor. Casasent was an officer in HKN as an undergraduate at the University of Illinois, Urbana-Champaign.

in Pursuit of excellence
ECE Team Takes First Place in Smart Radio Challenge ‘08

ECE Team Plaid, comprising ECE graduate students Reginald Cooper, Kevin Borries, and Xiaohui Wang, came away the winner of the Second Annual Smart Radio Challenge sponsored by the Software Defined Radio Forum, a nonprofit international industry association dedicated to promoting the success of next-generation radio technologies. The team took home three awards: Best Design, First Prize in their category, and the Grand Prize.

The Smart Radio challenge is a worldwide competition in which student engineering teams design, develop, and test software-defined and cognitive radio technologies that address specific problems relevant to the advanced wireless community.

“...I am really excited for the students,” said ECE Professor Dan Stancil who advised the group. “This is the result of a lot of hard work and creativity by each of the team members. Regional especially deserves credit for enthusiastically organizing and leading the effort.”

Because of the rapidly evolving capabilities of digital electronics, Software Defined Radios (SDRs) are expected to become the dominant technology in radio communications in the future with significant utility for the military and cell phone services.

Teams were to develop a secondary-user cognitive transceiver system that can detect primary-user signals operating in the 2.4 GHz ISM band and determine the occupied spectrum, transmission times, and geographical locations to sufficient resolution to avoid interference with legacy systems while operating within that band.

Team Plaid designed a wireless radio network that can avoid crowded wireless environments and use the 2.4 GHz ISM band as secondary-users.

“Most cellular phone users have had the displeasure of experiencing dropped phone calls,” said Cooper. “Sometimes, this is caused by too many subscribers being on a given cellular provider’s network at the same time. This makes the wireless environment very crowded and congested, and this eventually leads to dropped calls. Dynamically reconfigurable secondary user schemes are promising approaches to addressing such channel shortages.”

Team Plaid’s network of wireless radios is able to locate wireless environments that are not being used by other radios, and deploy applications such as text, voice, and picture messaging through a method called spectrum mapping.

Using this method, some of the radios in the wireless network constantly sense and gather information about the wireless environment. This information is then processed by another radio to determine what part of the spectrum is not being used at a given time or spatial location, allowing the network to use it.

Wii Want to Write

DRS Sponsors Best Class Project Award

ECE students Jeffrey Lai, David Leong, and Jeffrey Panza are winners of this year’s 18-551 design competition with their project “Wii Want to Write.”

As it has done for the past several years, DRS Technologies, Inc. sponsored a Best Project Award competition for 18-551, Digital Communication and Signal Processing Systems Design, a fall, capstone design course taught by David Cassasent, George Westinghouse Professor of ECE. The awards were presented at a joint HKN/IEEE meeting.

A new area of research involving gesture recognition has grown out of the emergence of entertain-

ment and mobile communication devices that include accelerometers. The winning group chose to investigate these new technologies, utilizing a 3-axis accelerometer as the interface device for symbol and alphanumeric gesture recognition input to any computer device.

The project was called Wiimote gesture recognition. A Wiimote is the controller for the Nintendo Wii, a current genera-
tion video game system that uses an imaginative new interface.

The controller itself contains a speaker, infrared laser, and a 3-axis accelerometer. The project used only the accelerometer for gesture recognition. The user forms symbols, uppercase letters, or numbers by drawing in the air with the Wiimote in hand. The accelerometer data is then detected by the DSP system hardware in the lab and the gesture input is automatically determined.

DRS employee Michael Kessler from the company’s Washington operations traveled to campus to help judge the oral and laboratory presentations.

“I was impressed by the difficulty of the projects selected and the various problems the students faced as they worked toward completion of the lab,” said Kessler, a software engineer at DRS. The course helped prepare the students for real life problems encountered in industry.”

ECE’s Ogras and Singhee win European Best Thesis Awards

ECE graduates Umit Y. Ogras and Amith Singhee won 2009 Outstanding Dissertation Awards from the European Design Automation Association (EDAA). Each year, EDAA gives Outstanding Thesis awards across four areas related to design automation for integrated circuits and systems.

“Having Carnegie Mellon win half of these awards in one year is unprecedented,” noted Rob A. Rutenbar, Singhee’s thesis adviser. “Both of these contributions have already had major impact on the research community,” adds Radu Marculescu, Ogras’ thesis adviser. Ogras’ thesis, “Modelling, Analysis and Optimization of Network-on-Chip Communication Architectures,” was in the category of New Directions in Embedded System Design and Embedded Software.


The prizes were awarded April 2009 at the Design Automation and Test in Europe (DATE) Conference in Nice, France.

ECE Junior Authors First Place Paper at STEM Conference

ECE junior Somarth Bhargava won first place for his paper at the 2009 Innovative STED (Science, Technology, Engineering and Mathem-
atics) Symposium hosted by Morgan State University in April.

Bhargava’s paper, which resulted from his undergraduate project, is titled “An Ultrasonic Motor Utilizing Axial-torsional Vibration Actuated by Orthogonally Paded Single-layer Piezoelastic Actuators.”

Piezoelectric motors are used for precision positioning (for example, in cameras) and have also been studied for potential application in microarrays.

Bhargava investigated a variation of a piezoelectric motor design recently reported in the technical literature. Under the direction of Professor David Greve, he fabricated several motors and characterized these motors mechanically and electrically.

The work is expected to form part of a paper that will be submitted to the 2009 IEEE International Ultrasonics Symposium to be held in Rome in September.

Garg and Marculescu Win Best Paper at Electronic Design Conference

ECE graduate student Siddarth Garg and his thesis adviser, Professor Diana Marculescu, won a Best Paper Award at the International Symposium on Quality Electronic Design in March.

The paper is titled “3D-CGP: An Analytical Model for the Impact of Process Variations on the Critical Path Delay Distribution of 3D ICs.”

Due to variations in the manufacturing process parameters, nano-scale CMOS inte-
grated circuits (ICs) are subject to increasing uncertainty in their performance characteristics. This paper makes the first attempt to theoretically characterize the impact of process varia-
tions on the maximum operational frequency of three dimensional (3D) ICs—an emerging IC packaging technique in which multiple dies are stacked vertically on top of each other and inter-connected using through-silicon vias (TSVs).

The analysis reveals that process variations can impact 3D-ICs more than their equivalent 2D implementations; a prediction that motivates the need for further research into novel variability mitigation techniques for 3D technology.
O’Donoughue Wins Best Student Paper Award at Acoustical Conference

ECE graduate student Nicholas O’Donoughue won the Best Student Paper award for the Structural Acoustics and Vibration track of the 157th Meeting of the Acoustical Society of America, held in Portland, Oregon, May 2009. The paper is titled “Single-Antenna Time Reversal of Guided Waves in Pipes,” and was co-authored with his advisor Prof. José M.F. Moura and Yanwei Jin, an assistant professor at the University of Maryland Eastern Shore and former Project Scientist in our department, along with several other members of the ECE and CEE Departments at CMU.

O’Donoughue’s research develops time reversal signal processing techniques that are particularly effective in highly dispersive media. He is applying his work to monitoring the structural health of natural gas pipelines, a project supported under a cooperative agreement with National Energy Technology Laboratory (NETL) through Concurrent Technologies Corporation (CTC). For more information see www.cm.edu/homepage/health/2009/spring/gas-line-safety.shtml.

ECE Students Place Third in IC Design Challenge

After an effort that began in November 2007 with the initial submission of a design description, a team of three ECE graduate students received their prize for Third Place in the 2007-08 SRC/3/IA IC Design Challenge in February 2009. The $10,000 prize was awarded to Abhishek Jajo, John Rainke, and Leon Wong at the International Solid State Circuits Conference with Jajo representing the team.

Their contest entry integrates the students’ Ph.D. research in RF MEMS devices and circuits into an implementable design for “A Tunable Multiband Conductor Research Corporation, the theme of the challenge was “Performance at the Limits.”

Justin Beaver, class of 2010, says he has two passions: “I love technology and I love sports.” In high school in Chambersburg, Pa., he played varsity soccer and sports informally. When he came to Carnegie Mellon he thought athletics would have to take a back seat. Instead, through student research projects, he has found a way to combine his interests and perhaps build a career on them.

Making Football Smarter

In the Fall of 2007 Professor Priya Narasimhan spoke to the students in the sophomore Emerging Trends seminar. A dishkes Steelers fan, her new project was called “football engineering.” Frustrated by the video reviews of officials’ calls in the NFL, Narasimhan called “football engineering.” Frustrated by the video reviews of officials’ calls in the NFL, Narasimhan wanted to devise wireless mobile systems for making objective calls. She was looking for student researchers.

Justin Beaver joined the team. Soon he and others were out on the turf at Gesling Stadium, tossing a prototype of a “smart football.” The ball had an embedded GPS chip and accelerometer, for indicating forward progress in situations such as goal line plays. And Beaver led the development of the first prototype of a pair of “smart gloves.”

The gloves can detect if and when a player has control of the ball, for instance while making a tricky catch. “We took standard wide-receiver gloves and put resistive force sensors in the fingertips and palms,” Beaver explains. “The first prototype was bulky, but we threw a ball around just to see if the gloves would do what we wanted them to, and they did.” Wrist-mounted transmitters sent signals to a computer graphics display. The display showed the pattern of gripping forces applied to the ball in real time, and it wasn’t hard to tell a clean catch from a bobble.

The research group is now refining the football technology, which isn’t yet game-ready but may have uses in performance analysis, training, and coaching as well. The work has drawn media attention, including an article in Wired and the front-page article on the Discovery Channel website on the day of the 2009 Superbowl.

Did Yinz See That?

Meanwhile, Beaver joined another of Narasimhan’s sports technology projects—YinzCam (see cover article). The YinzCam concept moved directly from the lab into the real world after the Pittsburgh Penguins hockey team solicited proposals for technology to improve the fans’ experience. The winning idea after Narasimhan met with the Penguins was for them to pitch her YinzCam concept: outfit the Penguins’ arena so that spectators can get live-action unique video feeds and instant replays on their wireless phones.

Mellon Arena in Pittsburgh has a jumbotron screen “but it only shows what the operator chooses,” Beaver says. “There are four in-house cameras at the Arena, and we figured that a wireless system would give you control over what you see. From your wi-fi phone you could choose the camera angles you want; you could rewind and watch again as often as you want”—hence, the name YinzCam. The service was provided on fans’ own phones, about 25 different mobile phone platforms.

Better yet, says Beaver, the project offered real research value: “As far as we could determine, no one was doing live video on mobile phones in a high-density venue for lots of users. So this was uncharted waters. ‘We’d have something that not a lot of people have.’”

This also meant that the YinzCam team—Narasimhan, Dr. Rajeek Gandhi, plus about a dozen students, from undergraduate to Ph.D. level—would face a good bit of tinkering. The Penguins management collaborated with the YinzCam team significantly, supporting the installation of wireless routers at the Arena housing the YinzCam system servers and offering the premium camera feeds to make YinzCam compelling for the fans.

Testing and tuning ran from October 2008 through January 2009. “We tested live at about fifteen home games,” Beaver recalls. “We’d have a few of our research team in the server room while a few of us strode the stands. We tried different types of wi-fi phones in different locations. It was quite a lengthy process to get the signal strength and the video quality good enough.”

YinzCam officially debuted for the public on February 6, 2009. The Penguins beat Columbus 4-1 and the system was a hit. Before long 50 percent of the target pilot audience was using the system, with actual usage rates being higher. “Friends and family shared a single phone. Typical user feedback, on a Facebook page set up for comments: “the ability to create my own instant replays was awesome.” Indeed the YinzCam team soon faced a delightful problem. There were few complaints but a multitude of requests for added features: live chat, slo-mo replay, statistics updates, and more.

Planning Ahead

In short, YinzCam is a student research project that has grown real legs. For the Penguins, it’s a keeper. And so for the students: Justin Beaver is an integral part of a core group committed to staying with the project, through 2009 and perhaps beyond.

“This is in the startup mode,” he says. “We’re scoping out the idea of building a company. One question is, how would we distinguish ourselves as a company?” And one answer would be, through original applied research.

Ensuring scalability will be one of their major research contributions. As Beaver explains, “you don’t want to just add users by adding hardware, because that gets expensive. What if you’re going into Penn State’s football stadium? It holds 107,000 people, and what if most of them have wi-fi devices? Priya wants us to develop software that alleviates the need to add hardware.” Needless to say, solving this problem alone creates significant breakthroughs and intellectual property.

Beaver says he’s astounded at the possibilities that have opened up by the end of his junior year in ECE. “If somebody had told me I could come to college and work on projects like this, I’d have said, ‘you’re crazy!’ But Carnegie Mellon really encourages this type of innovation. It’s amazing, unbelievable.”

"Students"
James Kong’s Research Path: From Mobile Robots to ‘Mobile Eagle’

As an undergraduate in ECE, James Kong (B.S. ’09) did more than earn a degree. He immersed himself in the department’s fast-growing world of student research — one in which a project may begin as part of a course, but then takes on a life beyond the curriculum, acquiring real-world sponsors and even generating spinoffs.

“A degree program is what you make of it,” says Kong, “and to me, going out and doing these kinds of projects is the way to go. You see how your knowledge applies. You get so much more insight into how things work.”

Kong’s first foray into student-led research came with the Carnegie Mellon Robotics Club, one of the premier student groups of its type. There he was part of the Colony team, building “colonies” of small, autonomous wheeled robots.

Then, at the start of his senior year, Kong found a project which so intrigued him that he’s now continuing with it as a graduate student in ECE. The project, called Mobile Eagle, is led by Professor Priya Narasimhan and is aimed at creating a new smartphone-based shopping system for customers of retail chains such as Giant Eagle.

Kong is currently leading the effort to spin off Mobile Eagle from another student research venture called Trinetra (see cover story on “The Many Faces of Mobility”). The Trinetra team had been working on assistive technologies for the blind. They combined a barcode scanner with text-to-speech over a mobile phone, enabling a blind person to “read” the contents of food packages. The setup worked well in field tests at the campus convenience store, and the team had ideas for adding other features to make shopping easier for blind people.

But many of the new features would be useful to sighted people as well, and besides, Trinetra’s prospects as a stand-alone niche product for the blind were limited. It would require store-owned systems and interfaces, which weren’t likely to ever be deployed across large numbers of stores unless they could serve a broad customer base. Hence Mobile Eagle. “Hopefully the assistive technologies will be plugged into this once it succeeds,” Kong explains. “But first we have to build something that’s commercially viable and of practical value for sighted people.”

Kong and others created a pilot system for a demo at Giant Eagle’s headquarters near Pittsburgh. At the core of the system is a website with a database of products on the shelves at various stores. In the demo this spring, the students showed how the system could add value and convenience for shoppers in some novel ways on the shoppers’ own iPhones, Android G1, and BlackBerry smartphones.

From your smartphone (or any device with a web browser) you could access the website to check on product availability and pricing. You could look up recipes, and if you wanted to make, say, lasagna for your dinner guests, the site would display the products required so you’d be sure to come home with everything you need: the pasta, the right sauce, the several cheeses. With a user account, you could review your past purchases and create shopping lists. The Mobile Eagle project is one of Narasimhan’s showcase research projects, with some of the underlying research being sponsored by Motorola Labs under the aegis of the CyLab Mobility Research Center.

Kong is now eager to add more functions, such as tie-ins to store promotions, and “predictive shopping.” Members of the Trinetra team have written software that will give you a list of items you probably need at home, based on how often you’ve been buying them in the past, “and we’d like to integrate that,” says Kong. A key next step for Mobile Eagle is user testing and a potential pilot inside a Giant Eagle store, as soon as a more complete system is ready.

James Kong is from Piscataway, N.J. He chose Carnegie Mellon because “here, you have access to faculty who do research at the tops of their fields.” As for his own future, Kong sees two paths. One is to earn a Ph.D. and be a research professor himself, “but that could change,” he says, “if I come up with something that has startup potential.”

Kong is currently enrolled as a Master’s student in the ECE Department’s Integrated Master’s/Bachelor’s (IMB) Program.

IMB Master’s student James Kong worked to spin off Mobile Eagle from another student research effort, Trinetra, which provides assistive technologies for the blind. Since Mobile Eagle is useful to a broader customer base and therefore more commercially viable, it is hoped that with its success, Trinetra’s features will be incorporated.

Want to make an interesting salad for your dinner guests but find yourself wandering obscurely around the grocery store? Mobile Eagle may just have a solution for you.
Greetings ECE Alumni,

No matter when you received your diploma from EE or ECE at Carnegie Mellon, I think you will find the student initiatives that emerged during AY 2008-09 highly interesting, as well as indicative of things to come.

The ECE student organizations of IEEE, Eta Kappa Nu, WinECE, EGO and SAC have continued to develop as strong professional and service organizations for our undergraduates and graduates. These organizations, some with national affiliations, not only provide valuable leadership and volunteer opportunities for our students, but are a visible way for the students to make important contributions to their peers and to the ECE community as a whole. In tangible ways, their actions, as well as their input, help to supplement and improve the student experience.

As professional advisor to these organizations, I have frequently observed specific ideas leap from casual conversations and seed thoughts to full-blown pilot projects and then become a new feature of the ECE landscape (e.g., ECE Day). The remarkable thing is that these idea developments often span several years and are picked up by successive classes and carried to the next level.

Another great example is Eta Kappa Nu/Sigma Chapter planning and hosting the 2008 National Leadership and Innovation Conference at Carnegie Mellon. The details of the conference are elsewhere in Currents, but it should be noted that the idea originated in 2007 with one student who had a vision, then senior and HKN officer, Sidharth Singh. Sidharth inspired the Chapter to go after this opportunity. Consequently, the next year’s officers inherited the huge task of further defining and delivering the entire conference, which they managed flawlessly.

With similar trajectories, two new initiatives emerged this year out of ECE Student Advisory Council: 1) the plans to develop a comprehensive student course wiki in concert with faculty; and 2) an activity known as build_18. Since build_18 had a successful trial run at the end of spring semester, we’ll give it some focus in this issue.

Build_18 proposes to add a new dimension to the educational environment through an optional activity that SAC members like to describe as the “sandbox” for ECE majors. This activity allows students to work together on technical projects that are not directly associated with a class or grades. It would dedicate space and time (most likely the week before the end of spring semester) when students would “tinker” or “gadget” from an ECE perspective for the sake of fostering creativity, innovation, entrepreneurship, and lifelong love of discipline.

A major tenet of build_18, as articulated by Boris Lipchin, a SAC leader who recently graduated, is that engineering is important work, and it is also a creative activity that benefits from enthusiasm and passion. They think that this less structured activity will be an energizing outlet for creative ideas and another opportunity to consider and work on technical challenges with their peers. Project ideas may come from anywhere—something the student wants to explore, a faculty suggestion, even a corporate request, but the mainstay will be self-proposed projects. Funding efforts are underway by my office. Faculty have agreed to be available as advisors, competition judges, or just to make sure lab space and equipment are available. The students hope faculty and alumni will stop by and join in the fun.

Future Issues of Currents: It is our hope to bring you two issues of Currents each year, one in the summer focused on the previous academic year, and the other early in the New Year with more alumni focused information. To that end, please inform us of your newsworthy activities, career promotions, company launches, awards, travel adventures, special projects etc. We will also plan to recap Department alumni events in that issue and try to give a better sense of the terrific professional network that exists and is developing across the U.S. and around the world.

Build_18 projects, like the ones pictured above, used non-off the shelf parts while others were driven by the availability of components. Time was the enemy this year and some great ideas were left partly finished; others to be resurrected another day.

One group of students with their LARBAT project wanted to provide a forum-like communication service, similar to Twitter, which would be hosted and displayed on a TV in the ECE cluster. The project would allow people to post anything from TA office hours to the all-important location of the nearest free food.

In the end, mainly because of the limitations of the Ardino board they were using, the students could only make 4-5 short posts displayed on laptops. But, armed with what they learned, the students are determined to revisit the project and make it a success next year, said John Sexton, an ECE junior who worked on the project.

The orange threatening looking weapon in the photo was intended to be a laser-guided cannon that would detect targets with a camera and automatically aim using servos. Unfortunately, we only get the servo controlled part working,” said senior Manuel Gonzalez-Rivero, a member of the team.

WebCompass (above, right) orients itself based on where the owner is currently located. “Think Weasley family clock from the Harry Potter series,” says junior Max Buevich, who designed the project. WebCompass is remotely accessible from any web-enabled device, so if the owner moves from place to place without returning to the office, his location can be changed and visitors can still find him. No more missed appointment excuses!
The innovators of tomorrow met the innovators of yesterday at the Senior Banquet this year held at the Heinz History Center. The venue served to emphasize the inventiveness and entrepreneurial spirit that has characterized Pittsburgh since its beginning.

One of the purposes of the banquet was to recognize class leaders and volunteers, among them an ECE Spirit Award given this year to Boris Lipchin, aka “SAC Man.” Always there to facilitate discussions and generate ideas to improve the student experience in the department, Boris is credited with creating the build_18 initiative, which allows students to have designated “technical play” outside the classroom in order to foster creativity and deeper interest in the discipline. (More about build_18 on p. 14). Boris has gone off to his dream job at Space Exploration Technologies in Los Angeles, California.

Others recognized for their ECE spirit included Sarah Hsieh, president of Women in ECE and Treasurer of Eta Kappa Nu, and Brad Miller, president of Eta Kappa Nu.

Alumnus John Muza (B.S. 1994, M.S. 1996), Director of IC Design at Pittsburgh-based Akustika, Inc. was the guest speaker.
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