Although the School of Engineering and Applied Science’s Rice Hall Information Technology Engineering Building has been open only since last August, faculty and students already are exploring new and creative uses for its 100,000 square-feet of teaching, research and study space. The six-story building was made possible by a lead gift from Paul (EE ’75) and Gina Rice through the Rice Family Foundation.

Electrical and Computer Engineering Professor Joanne Bechta Dugan directs the Computer Engineering Program, one of many programs located in the building. Dugan welcomes the increase in the number and size of lab spaces. While the increased space will enable the program to accommodate more students, she points to the revised curriculum as the most significant change the program has been able to make. Consolidating and ensuring the effective delivery of programs help prepare graduates for leadership, an important goal for the Engineering School.

“The program has been able to add a class in embedded systems, something we’ve wanted to do for years,” said Dugan. “Previously, we didn’t have the space or the resources.” Dugan is grateful to Dean James H. Aylor for providing the necessary funding for what will become a three-course sequence conducted in an innovative Rice Hall education laboratory. Associate Professor John Lach, one of the course instructors, describes the sequence as the “culminating experience for computer engineering students.”

Lach also noted the increased collaboration across research groups. “In the past there was no natural way to stumble across each other’s work and projects,” he said. “Rice encourages collaboration between electrical engineering and computer science, getting people together to solve the IT challenges of the future.”

Dugan said students seem genuinely excited about the new classes the program is able to offer. Students also are applying their engineering skills to the building’s study areas by putting sensors into each space to check availability before climbing “all those stairs.” Dugan also noted one other feature that is driving a great deal of student enthusiasm: “the basement bagel shop!”

READ MORE: www.seas.virginia.edu/admin/ricehall
After eight fulfilling years as chair of the Charles L. Brown Department of Electrical and Computer Engineering, I will be leaving the position this summer. Dean James H. Aylor created a search committee in January and plans to appoint my successor at the start of the next academic year.

Reflecting on the past eight years, I have been pleased to work with colleagues to grow our department. Among the six full-time faculty we’ve hired are two members of the National Academy of Engineering: Joe Campbell, who came to us from the University of Texas, and Toby Berger, who joined us from Cornell. Our growth has enabled us to attract top-quality graduate students. We now have close to 100 doctoral students in our program. It says a lot about our department that we continue to attract so many talented faculty and students.

I also want to acknowledge the growth in our endowment and thank our many supporters, in particular the estate of the late Charles L. Brown (EE ’43), and Paul Rice (EE ’75), a member of the department’s advisory board. Paul and Gina Rice’s generous donation enabled the recently opened Rice Hall Information Technology and Engineering Building. Its open and bright atmosphere and abundant lab space will no doubt foster many collaborations.

I believe a successful department depends on close ties between us all. To better integrate our undergraduate program into our research and education missions, we are encouraging the introduction of more open-ended project courses.

As we’ve increased the size and scope of the department, we’ve also increased the diversity of our student body. And last year the National Research Council ranked our electrical engineering graduate program among the top 10 in the nation.

As I move on, I want to thank my colleagues across the department for their collaboration, our alumni for their support and our students for their application, their inquisitiveness, and most of all for choosing to study electrical and computer engineering at the University of Virginia.

Lloyd Harriott
Professor and Chair
New instructor Harry Powell brings his many years of small-business experience to a course he and Professor Joanne Bechta Dugan launched this semester. The course focuses on embedded computer systems, and Powell hopes his “jack-of-all-trades” attitude that enabled his success in his family-owned machine design business will rub off on his students.

“Embedding computer systems is the art of putting computers in places you don’t think of, such as in a key fob for unlocking car doors or in a microwave oven,” said Powell. “As students design and program embedded computers, they will have to think about how their design will interact with external devices and their users.”

Powell saw the need for the course while teaching fourth-years. “It became apparent to me that we needed an embedded systems course that, together with our major design course, would tie together a lot of second- and third-year concepts,” he said.

What makes an embedded systems class different from other courses? Powell points out that a typical embedded computer has 400,000 times less memory and runs at 500 times lower speed than a desktop model. “The programmers have to think about how efficiently they write code and how they can best exploit the capabilities of the machines they are working with,” said Powell. “At the end of the course, students should have the ability to program basic applications and understand the relevance of their coursework to circuits, electronics and signals.”

Powell also wants the course to reflect his approach to engineering work. “A good engineer should be able to make a reasonable try at solving a challenge beyond their specialty,” said Powell. “I’ve structured this course to encourage students to step out of their comfort zone — to poke around, to experiment.” Providing undergraduates with a sustained, high-impact educational experience is an initiative of the School’s Strategic Plan.

Powell reports an excellent student response to his new course. Enrollment was capped at 30, and “we’re maxed out,” he said.

READ MORE: www.ee.virginia.edu/curriculum
Whether visiting a physician for a regular checkup or a specific medical problem, patients usually have routine readings taken, such as blood pressure and weight, but between visits patients are rarely monitored. For elderly patients in particular, the lack of consistent contact with a health care professional can add up to serious problems, as crucial early signs, such as the weakening of joints and muscles or the onset of tremors, may go undetected.

Associate Professor John Lach, together with Engineering School and U.Va. Health System colleagues, founded the U.Va. Center for Wireless Health to address gaps in the monitoring of patients. The center is designing body sensor networks that monitor a patient's condition and indicate potential problems. The center first designed wireless sensor nodes that track the patient's motion. “The sensor devices in the nodes are accelerometers and gyroscopes,” Lach explains. “From this motion data, we can extract medically relevant information.”

“For example, for fall-risk patients it is particularly important to monitor ankle strength and stability over time, so we wanted to collect data on a continuous basis, but in a non-invasive and inexpensive way. Fortunately, we’ve been able to achieve both goals — the technology we’ve deployed is about the size of a wristwatch, and a full monitoring system will likely cost less than $100 when mass produced,” said Lach.

What’s next? “The center validated these systems in a number of medical studies and is eager to start using them in clinical practice to improve patient care while lowering overall health care costs,” said Lach.

Lach’s Center is one of many examples within the School of Engineering and Applied Science of the impact of faculty research. Increasing these types of research programs is an important goal of the School’s Strategic Plan. “We’re big believers in doing this kind of design and research because of its applicability to real-world medical challenges,” said Lach.

READ MORE: www.ee.virginia.edu/faculty/lach.html
Professor Scott Acton is leading a federally funded project to develop a suite of software tools that will enable transportation engineers to mitigate the impact of sinkholes, structural defects in road bridges, and landslides on major roads. U.Va. is partnering with the Virginia Center for Transportation Innovation and Research and TRE Canada to develop the software that will soon be commercially available to state departments of transportation across the United States.

The project uses remote sensing technology that takes repeated satellite images of the earth’s elevation. The sensors can detect changes in elevation down to a quarter of an inch. The technology combines interferometric synthetic aperture radar supplied by TRE Canada and novel image analysis algorithms developed by Acton’s lab. Two ECE graduate students, Andrea Vaccari and Mike Stuecheli, are developing the software that will highlight the regions of potential risk. Their software will interface with popular display methods, such as typical geographical information systems (GISs) and Google Maps.

The project reflects several goals of the School of Engineering and Applied Science’s Strategic Plan, including increasing its research impact and preparing graduates for leadership.

The project initially will focus on a region of the Interstate-81 corridor plagued by sinkholes, while researchers develop the software for analyzing the images.

“This is the first time we’ve been able to predict sinkhole collapse,” said Acton. “If we determine that we can use remotely sensed data to detect and monitor the subsidence that precedes sinkholes, bridge settlement and landslides, we can potentially save millions in highway repairs, reduce highway closures and enhance the safety of travelers.”
Alumni

ZACH BUCKNER, FOUNDER OF RELAYFOODS.COM

Zach Buckner (EE ’02) is founder and president of Charlottesville-based Relay Foods. Buckner describes his company as “a replacement for the age-old trip to the grocery store.”

The company’s website Relayfoods.com features foods and other products from over 75 farms and stores,” said Buckner. “And, it’s also a way for local farmers to find another market for their produce.”

Consumers can have their virtual cart purchases delivered to one of 25 locations in the Charlottesville area or one of 35 locations in Richmond.

The company recently received an infusion of $3.1 million from a global venture firm and other investors. The capital investment will provide the company with money to expand the company’s operations base and customer services.

Buckner’s entrepreneurial spirit is now moving to the professional services arena. He recently launched Fanaticall, a company that aims to bring legal, accounting and other services into the Internet age.

“Right now, consumers still have to deal with a lot of paper and meetings if they want professional services,” he said. “The goal of Fanaticall is to move services to the Internet and reduce costs to the client.”

“The Engineering School provided an ideal education for me. I’ve noticed the solutions inevitably come from my engineering background. I rely heavily on the methods and techniques I learned at U.Va. I am grateful to the exceptional professors who taught them to me.”

CHRISS REHORN SUCCEEDS AT AGILENT

While pursuing his master’s degree, Chris Rehorn (EE ’04, ’06) credits his work with Associate Professor Scott Barker with leading him to his current position as a research and design engineer with Agilent Technologies.

“Working with Scott was very hands on,” said Rehorn. “We designed and built a miniature spectrum analyzer within defined size and cost constraints for our client, the U.S. Air Force. For Agilent, I’ve worked on similar projects — from designing high-speed customized application-specific integrated circuits to working on the chip set for the Agilent 90,000X oscilloscope.”

“Customers who are involved with the next generation of high-speed serial interfaces use the oscilloscope. Our products are behind a lot of the technical innovations in consumer electronics. What we’re doing is enabling our customers to design the next generation of electronics. It’s very gratifying,” said Rehorn.

Rehorn said that working at Agilent is similar to his experience at U.Va. “My thesis project with Barker was good preparation for real-world engineering, where you have deadlines and cost constraints. It gave me invaluable hands-on experience. Also there’s real intimacy with professors at SEAS, which rubbed off on me,” said Rehorn. “At Agilent I like to work with others and share ideas — I think it adds value to Agilent’s products.”

Rehorn’s work reflects an important goal of the School of Engineering and Applied Science’s Strategic Plan: preparing graduates for leadership.

Graduate Student

YOUSEF SHAKHSHEER

Fourth-year doctoral student Yousef Shakhsheer (CpE/EE ’08, EE ’14) spends much of his time developing energy-efficient sensors. He also gives back to the community serving as a volunteer firefighter. “My advisor, Associate Professor Benton Calhoun, has gotten me involved in interesting projects,” said Shakhsheer. “And, U.Va.’s ties to the community enabled me to reach beyond Grounds to contribute.”

Shakhsheer helped develop a wearable electrocardiogram (ECG) body sensor node that detects atrial fibrillation, sending the last eight heartbeats over wireless radio to a physician when the arrhythmia is detected. The chip runs without a battery, instead harvesting energy from the wearer’s body heat.

Shakhsheer also helped design a processor that implemented fine-grained dynamic voltage scaling to extend battery life.

Shakhsheer is now working on a power management scheme for energy-harvesting nodes to improve node lifetime. “This project is a great opportunity to improve the state of the art in both engineering and medicine,” said Shakhsheer. “The project can have a broad impact for physicians and patients.”

“It’s been rewarding to work on so many interesting projects while continuing to volunteer at Seminole Trail Volunteer Fire Department,” said Shakhsheer.
Corey Gough, Patrick Dougherty and Anisha Gorur designed and built a cognitive assessment device for treating athletes who have suffered concussions. The “Think Twice” device is a Capstone project under the guidance of instructor Harry Powell. Student teams are tasked with building a machine for a client. “My team is interested in sports medicine,” said Gough, “so we approached U.Va. physicians Jeffrey Barth, M.D., and Donna Broshek, M.D., about devising a machine that will help them test concussion patients.” The physicians asked for a device that would cause some strain in patients in order to create a baseline assessment that could be referred to during subsequent tests. They also asked that it not require an Internet connection.

In addition to testing memory and reaction, the Think Twice device features distraction light-emitting diodes (LEDs) of different colors, because the inability to filter distractions is a common symptom of concussions. The team believes theirs is the only concussion-testing device on the market with a distraction element. “We’ve now added a feature to measure responses while auditory distractions are taking place,” said Gorur.

Gough credits Powell’s ideas for much of the team’s success. “I don’t think any of us had ever worked on a project of this magnitude,” he said. “We really appreciate professor Powell’s ideas and guidance.”
YOUR GIFTS MATTER
SUPPORT YOUR DEPARTMENT

Make a gift online to the ECE department on our secure website: www.seas.virginia.edu/support. Please designate “Electrical and Computer Engineering” in the Special Instruction box on the form. If you have questions about giving to ECE, please contact Alice Baker at ab8s@virginia.edu or 434.924.1332.

Send your news, milestones and address changes (mail and email) to eceinfo@virginia.edu or P.O. Box 400743, Charlottesville, VA 22904-4743.

ALICE BAKER joined the U.Va. Engineering Foundation as a development officer in December 2010. She works with alumni and corporations to support the continued success of ECE research and education programs.

Alice brings more than 12 years of development, communications and education experience to her current role. Her experience includes working as associate director of development for the Georgetown University Law Center and as director of development for Trinity Episcopal School in Richmond, Va. She holds a bachelor’s degree in education from the University of North Carolina at Chapel Hill.

Alice lives in Goochland and enjoys horseback riding and gardening. She also volunteers with the Goochland Free Clinic and Family Services and served on the board of Richmond CASA.

Please contact Alice at ab8s@virginia.edu to learn how you can help support ECE.