



engineering news

School of Engineering

WINTER 14

SANTA CLARA UNIVERSITY

DEAN'S MESSAGE

Each February we honor our presidents, valentines, and...our nation's engineers. Since 1951, National Engineers Week has been dedicated to spurring interest in engineering and technology careers and to raising awareness of the positive contributions made by engineers. This year's *eWeek* (February 16–22) at Santa Clara University is chock-full of fun and informative activities and events for our students, alumni, and friends. We hope you will join us on campus and help us celebrate this illustrious profession.

Engineering, as a field of study and practice, has evolved and grown markedly over the years in its pursuit of advancing technology, quality of life, and social justice. At SCU, we offer undergraduate and graduate engineering degree programs in five disciplines: bioengineering, civil, computer, electrical, and mechanical, as well as master's programs in engineering management and leadership and applied mathematics. Coupled with our interdisciplinary studies in the areas of entrepreneurship, frugal innovation, nanotechnology, and robotics, these programs ensure the next generation of Bronco engineers is ready to make us proud.

In these pages, we celebrate a few of the accomplishments and experiences of our Santa Clara engineering family. Enjoy!

Godfrey Mungal
Dean
School of Engineering

Photo: courtesy of The Horvath Group



Assistant Professor Hisham Said (center) with Brad Fannin, project manager, and Michael Blach, CEO, Blach Construction

FACULTY INTERNSHIP PAYS BIG DIVIDENDS

Once you've earned your Ph.D., worked in industry, and then landed a faculty position with a prestigious university, you may think your internship days are over. But that was not the case for civil engineering's Assistant Professor Hisham Said, who spent three months interning with Blach Construction Company (BCC) last summer as part of a program designed by AGC's (Association of General Contractors) Education and Research Foundation to get professors out of the classroom and into the field.

Said's internship encompassed specific experiences that would augment the construction management courses he teaches at Santa Clara: two months on a worksite as project engineer intern and one month spent in BCC's main office as a junior estimator. "At SCU, we enhance our students' education by incorporating real-life engineering experiences," he said. "Just as an internship enriches student learning, it can do the same for professors," Said noted. His work for Blach included managing and administering project communications, budgets, and schedules;

regularly walking the site with the superintendent to observe and participate in discussions with foremen, laborers, and subcontractors; becoming facile with the latest methods for converting drawings to quantities of materials needed; and more. "My time with Blach provided me with lots of ideas for case studies to implement in my courses. Also, the construction industry is adopting new software and evolving and adding capabilities at a very fast pace; learning new programs and techniques helps me mentor and guide my students to acquire the necessary skills they will need for construction operations management, planning, and estimation."

According to Said, having such current field knowledge pays other dividends as well. "It gave me ideas on how to make my research more relevant, how I can involve undergraduates in research or guide them toward meaningful senior design projects." But Said and his students are not the only ones to benefit from his internship with Blach.

—Continued inside

UNDERGRADS GO TO EXTREMES

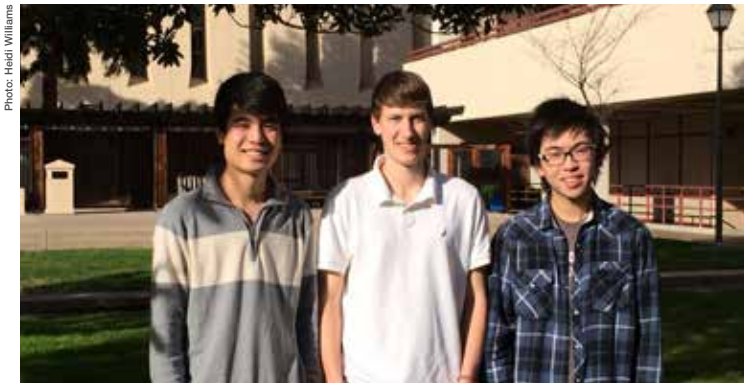


Photo: Heidi Williams

Left to Right: Brandon Young, Kirby Linvill, Aaron Chung

Imagine holing yourself up in a conference room with two of your buddies for 24 hours. Now, imagine you're doing this as part of a global challenge to test the skills of student teams in solving programming problems. You probably can't even imagine what it would take to keep you going, but electrical engineering's Brandon Young and computer engineering's Kirby Linvill and Aaron Chung (all class of 2015) found out when they participated in the IEEEExtreme 7.0 Global Programming Competition last fall. What it took to keep them

coding away was teamwork, sunny dispositions, and lots of iced tea and k-pop (Korean pop music).

"We went in not knowing what to expect," said Chung, "but it sounded fun and a little ambitious." The trio enlisted the help of professors Shoba Krishnan and Samiha Mourad (electrical engineering) and Ahmed Amer, Silvia Figueira, and Maria Pantoja (computer engineering) to take shifts proctoring their effort. The profs kept the team fed and

encouraged, and Amer, who had coached the team in advance by providing health tips for surviving the marathon, even pulled an all-nighter.

The competition began with the release of about 20 questions that teams could tackle in any order. Every three hours, more questions were unlocked. "It was a test of your intuition, seeing what your mind can think of in a clever, efficient way," said Chung. But it was also a lesson in teamwork. They quickly identified individual strengths and maximized their time by assigning tasks appropriately. "It was surprising how easy it was to stay focused when you were always engaged in solving the problem," said Linvill, who likened the experience to "an interview, but a step above."

While teams were allowed up to two graduate students, SCU's all-undergraduate team performed extremely well. "In spite of this being their first attempt to enter such a competition, the team had

a great finish," said Amer. "They ranked 387th in the world, out of 1,838 teams, 62nd in the U.S., and 16th in Region 6 of IEEE. We are very proud of their achievements and look forward to more teams competing next year." The team agrees. "We're telling freshmen they should get a team together next year," said Brandon. "Even if it's hard, it's a good experience using what you're learning in class and challenging yourself."



Bagels and lots of iced tea kept the team fueled up.

BIOENGINEERING STUDENT PUBLISHES IN PRESTIGIOUS JOURNAL



Photo: Charles Barry, University Photographer

Dr. Asuri and Jeffrey Kunkel discuss their research.

Providing opportunities for undergraduate student research is a hallmark of Santa Clara's engineering program, and recently the success of these efforts was illustrated when bioengineering senior Jeffrey Kunkel and Assistant Professor Prashanth Asuri had their

paper, "Function, structure, and stability of enzymes confined in agarose gels," accepted for publication in *PLoS One*—one of the top five multidisciplinary journals in the United States. "When I presented the paper at a national conference, one of the audience members remarked that we must have outstanding students to generate this level of work," said Asuri, who agrees wholeheartedly with his colleague's observation.

Since the end of his sophomore year, Kunkel has been working in Asuri's Biomaterials Engineering Laboratory. During his first summer with the lab, Kunkel worked 30 to 40 hours per week on data collection and analysis, and he assisted with the development of an *in vitro* system to better understand

in vivo protein behaviors. "Inside the body, proteins exist in a crowded environment, but experiments on the bench are performed in dilute buffer solutions, which don't capture the complexity of the human environment," said Asuri. The pair's work more closely simulates the true environment by confining proteins into pores of a nanoporous hydrogel and observing their functions with the goal of advancing the use of proteins for drug delivery or as biosensors. "While the work we did is not the first of its kind, the methodology and information we can tease out of our system is novel," said Asuri. "And Jeff has already presented a conference paper on his findings at the AIChE Annual Meeting (American Institute of Chemical Engineers)."

"I really enjoy being in the lab and running experiments, being independent," said Kunkel, who is enrolled in the five-year, combined B.S./M.S. bioengineering degree program. "The lab environment is friendly, and we all get along well. Although we're working on separate projects, we learn a lot from each other." Each summer the lab holds a research seminar where students present their work to their peers, updating them all on their progress. "Last summer, Jeff trained a rising junior to come on to the project," said Asuri, "thus ensuring the longevity of the project."

FOR ALUM, COMMUNICATION MAKES IT HAPPEN

“I probably wouldn’t be where I am today without networking,” says Disney Interactive Producer Chris Menezes ’10, who has worked—and talked—his way to career success. As a computer engineering student, Menezes knew he wanted to be in the game industry. But he soon learned that while he enjoyed programming, it wasn’t his passion. Adjunct Professor Jared Finder helped Menezes discover how his particular talents could best be put to use. “Jared pointed out that as one of the most communicative and social students in class, I was well suited to the role of game producer,” said Menezes. “A producer helps an entire team run well—building skills, managing time and morale. Jared built up my confidence and helped me see my potential.”

Talking with his professor was just the first step toward success. Speaking up during a field trip to Electronic Arts during his senior year led to an entry-level position in QA with the prestigious studio. There, Menezes jumped at the chance to learn as much as he could by mingling with everyone on the team. After a year with EA, he was hired by Crowdstar to build their QA department, but he knew he wanted more. “I was confused about whether I wanted to be a producer or a designer,” he said. “So, I talked with members of the team; built connections; went to industry parties, panels and trade shows; and talked shop with lots of people to learn how people operate in the industry.” After a year of working on multiple projects for Crowdstar, Menezes was hired by Disney as associate product manager taking charge of the content pipeline for one of their social games. Last September, he was promoted to producer on a new game (currently under wraps), managing the art and audio, in addition to serving as a liaison between Disney and LucasArts.

Menezes credits his meteoric career trajectory, in part, to all the talking he’s done over the years. “Wherever I am, I always talk about video games. You never know where connections will lead you.”



Chris Menezes '10 puts his talents to work at Disney.

GLOBAL INTERNSHIP = REAL-WORLD ENGINEERING EXPERIENCE

In preparation for work on her capstone project, Rachel Wilmoth, a senior mechanical engineering student, spent a month in Uganda last summer interning with Village Energy—learning about engineering in a developing country, teaching locals about the merits of solar power, and gaining the experience and confidence necessary to take on her year-long work.



Rachel Wilmoth '14 with her completed design.

Wilmoth’s senior design team is designing and constructing a device to turn discarded Ugandan plastic water bottles into 3D printing filament. “In Uganda, they use imported plastic filament for 3D printing,” she said. “The mail service is unreliable and expensive, so having a locally sourced material would be ideal.” With little organized recycling in existence in the city of Kampala, there is a huge surplus of raw material available to use for the students’ process. “This was a pre-research trip,” Wilmoth explained. “I learned what things to take into account, how their ideas compare to ours, and what supplies can be purchased there.”

Her host company, Village Energy, is dedicated to bringing locally produced and distributed solar energy systems to rural areas in Uganda. But with their wood or sheet metal packaging, they were finding it difficult to compete with the sleek appearance of imported products. The solution: create an enclosure for the solar panel, battery, and control electronics using 3D printing. Wilmoth’s task was to draft the enclosure, figure out the 3D printer settings, determine which filament to use, and test the printing process.

“I was in Kampala for three weeks working on the design. While I was there, the night guard for Village Energy took an interest in what I was doing, so I taught him how to use the 3D modeling software and the printers. By the time I left, he could print boxes and get things moving.”

Her final week in Uganda was spent traveling through rural villages, showing what solar products can do. “I would stand up in front of 50 people with a translator and explain the technology behind the products and the philosophy behind Village Energy’s goal of empowering local people and supporting their economy.”

When Wilmoth returned to California, she brought with her a suitcase full of discarded Ugandan water bottles. She and her teammates are researching the thermal properties of the PET plastic, which differ from the ABS plastic used for 3D printing here at home. With the design stage coming to a close, they are ready to start building their machine.

“In my sophomore year I took a class, Technology for Social Justice, and we looked at a lot of case studies of reverse engineering for the developing world. Before that, I didn’t know about social entrepreneurship. Now, having been to Uganda and working with Village Energy, I have a better understanding of how a for-profit company can have a social mission. It was a really great experience and I learned a lot. Engineering in the real world—problem-solving, working with people, helping to make a difference in people’s lives—it’s pretty gratifying.”

A DREAM FOR GRADUATE ENERGY EDUCATION BECOMES REALITY

Professor Samiha Mourad's vision of an interdisciplinary graduate degree program in sustainable energy at Santa Clara University has become a reality. But the dream doesn't stop there, according to Mourad, the William and Janice Terry Professor of Electrical Engineering. The IEEE Fellow is now looking forward to creating an interdisciplinary Ph.D. in sustainable energy.

Mourad conceived the idea of an interdisciplinary graduate degree program in sustainable energy in 2009, during the semiconductor industry downturn. The program grew out of a desire to help electrical engineers gain the necessary tools to enter the emerging field of solar energy and also to serve the growing solar industry in Silicon Valley by educating today's energy experts.

Starting with a certificate in renewable energy, the program has grown to include a master's degree in sustainable energy. From the beginning, Mourad has been insistent that the program be interdisciplinary in scope.

"This is not your mother's energy anymore," she explained. "In the 1970s, the School of Engineering had energy courses in electrical and mechanical engineering, but today engineers must understand energy holistically—what it is; how it is generated, used and conserved; and how it can be managed through a smart grid. This entails combining elements of civil, computer, electrical, and mechanical engineering into the curriculum along with courses in economics, ethics, and energy policy. With this thorough knowledge of the comprehensive nature of energy, students then further their technical knowledge within their own particular discipline through a growing list of courses such as biofuel, storage devices, etc."

This field of study draws a passionate group of students, so Mourad's next idea was to harness that energy through the formation of the SCU Energy Club. Club president and cofounder Claudia Chen came to SCU with a bachelor's degree in civil and environmental engineering from the University of California, Davis. "I wanted

Photo: Courtesy of Claudia Chen



Claudia Chen (far left) and members of SCU's Energy Club on a Campus Sustainability Tour.

to work in sustainability and energy and found a great program here," said Chen, who, in addition to her graduate study, works part time with a local environmental consulting group. "Since the club's inception last spring, we've held a film screening, visited a power station, hosted guest lectures, and taken a tour of the SCU campus, led by the University's sustainability director." Last quarter, the club invited a renewable energy consultant and the deputy director of Lawrence Livermore National Laboratory's nuclear

fission research team to speak at SCU. "That's the great thing about the University," Chen said. "You have the chance to explore so many different things."

"I really like what we're doing with this program. We are generating the workforce that really makes things work. And we are doing it the right way, with a program that is not the offshoot of any one engineering discipline," said Mourad, adding, "I would love to see us offer an interdisciplinary Ph.D. in sustainable energy!" The dream continues.

FACULTY INTERNSHIP PAYS... —Continued from front page

David Kramer, director of BCC Preconstruction Services reports that Said was a quick study and a great help "at a time when our backlog was getting severe. In addition, we were able to tap Hisham's expertise and have him teach other staff members our methods and software tools. Most important, we identified future opportunities for academic research that will support our prefabrication initiative and, possibly, some time/motion studies on our fieldwork. I'm looking forward to many years of innovating with Professor Said and his associates."

Reflecting on his summer internship, Said relayed, "It was a good experience to be in the shoes of our students, to see first-hand the types of situations and expectations they will encounter when they graduate. My goal is to encourage my students to pursue careers in the construction industry; this internship will greatly help me in my mission at SCU."

THE LANGUAGE OF LEARNING



Photo: Charles Barry, University Photographer

Lecturers Marie Bertola (left) and Maria Pantoja

When Maria Pantoja, lecturer in the Department of Computer Engineering, was the featured speaker last year at a weekly spring quarter faculty forum on teaching innovation, a fruitful collaboration and a new teaching tool were born. Pantoja's presentation focused on her use of a video game application to overcome students' fears about learning computer programming. In the audience that day was Marie Bertola, lecturer of Italian in the Department of Modern Languages and Literatures, who recalls, "I had this vague idea for using a computer app to help students acquire and practice speaking skills in a way that is convenient and user-friendly, so

I was looking for someone with the technological know-how to help implement it." She found a perfect partner in Pantoja.

As neither are native English speakers (Bertola was born in Italy, while Pantoja hails from Spain), both professors have first-hand experience with the challenges of learning a new language and perfecting its pronunciation. "Technology is impacting the teaching of language at different levels today," said Bertola. "We use e-workbooks so students of language can get effective feedback on written exercises, but so far the computer has not been able to give immediate and reliable feedback when students speak."

Supported by an internal research grant from SCU, Bertola enlisted volunteer students' help to video a wide range of speakers. While the recordings displayed completely different movements, some consistencies were found that informed Pantoja's work to refine the program. "It took all summer to determine which facial movements were the best indicators of proper pronunciation. Mustaches can hide the lips, not everyone has the same crease along the side of the mouth, and forget about noses," quipped Pantoja. "In the end, we decided to concentrate on four points of the mouth that are statistically very consistent and can provide a precise tool for improving pronunciation."

The end product will be an interface that is visual, auditory, and tactile. The program will analyze the speaker's voice and facial movement, compare them with those of a standard speaker, and then provide recommendations for improvement. "In 'olden times,' I would ask students to get a pocket mirror to help internalize the connection between how the mouth looks and how the words

sound—much like the way a ballerina uses a mirror to properly position and control every muscle. This app will give feedback that guides those speaking and lets them know if they've got it right or if they should try again using specific modifications—all in a nonthreatening, nonjudgmental manner," said Bertola.

Pantoja is excited about the pedagogical potential for the app—not just from the students' perspective but for professors, as well. "The algorithm will keep learning, and the databank we are creating will provide us with feedback on our own work of teaching, giving us information on what students struggle with and how best to use our time in class," she said. With an audio version ready to demo now, she and Bertola will continue to develop the app. "We will never finish; I can see a new upgrade every year," said Pantoja, who continues, "Collaboration with the modern language department is not one that has traditionally been done. Hopefully, this is just the tip of the iceberg of what we can accomplish together."

JAYSHREE ULLAL '86 NAMED DISTINGUISHED ENGINEERING ALUMNA



Jayshree Ullal '86, 2013 Distinguished Engineering Alumni Award recipient

Last November, Jayshree Ullal, '86, M.S. engineering management and leadership, received the School of Engineering's Distinguished Engineering Alumni Award.

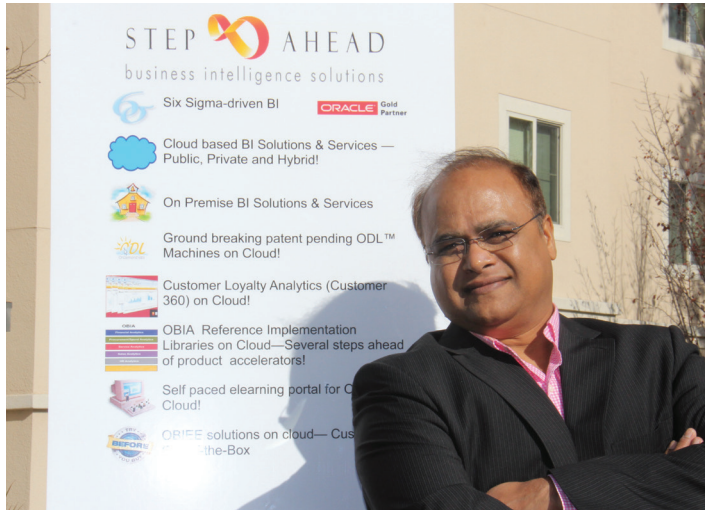
For more than 25 years, Ullal, president and chief executive officer of Arista Networks, has had an exemplary career in Silicon Valley. As former senior vice president at Cisco Systems, she oversaw some 20 mergers and acquisitions in the enterprise sector and was responsible for roughly \$15 billion in annual revenue. Over the past 10 years she has been recognized on numerous fronts as one of the most powerful people in technology. At Arista Networks, she is currently responsible for building the company's business in cloud networking.

In addition to her many industry accomplishments, Ullal has also found time to establish (with her husband) a foundation to support cancer research, social services projects, and hunger relief programs in India, and she is a former trustee of the Anita Borg Institute for Women and Technology, a nonprofit organization created to increase the impact of women in technology. She has been quoted in *Forbes* magazine as saying: "the model at Arista is engineering first—you have to be 10 times better to beat the competition." This is a model that Ullal has implemented in her own life. In recognition of her many outstanding accomplishments in engineering, leadership, and entrepreneurship, Ullal joins an elite group of Bronco engineers who have received the highest honor conferred by the School of Engineering to recognize those alumni whose accomplishments in their professions, communities, and University service have set them apart.

Do you know a Santa Clara University alumnus/a who deserves this honor? Submit nominations at scu.edu/engineering/dea.

ENGINEERING MANAGEMENT AND LEADERSHIP ALUM HAS HIS HEAD IN THE CLOUDS

Photo: Krishna Matcha



Robert Kenny Joseph '02 has put his engineering management and leadership education to good use.

SCU alumnus Robert Kenny Joseph '02, founder and CEO of Step Ahead Solutions, Inc., is working hard to revolutionize cloud computing. “We are taking a radical new approach to leveraging the best of the clouds,” said Joseph, who earned his master’s degree in engineering management and leadership from the School of Engineering.

A former Oracle employee with a background in mathematics and computer science, Joseph saw the cloud as “the next big thing,” but recognized there were major stumbling blocks to adoption—the array and complexity of services available and the difficulty of navigating the cloud, to name just two. So in 2010 he transformed Step Ahead Solutions to mitigate these problems for customers. According to Joseph, “Dealing with enterprise

software requires highly skilled resources and systems; it’s expensive and time consuming. Step Ahead occupies a unique space between cloud providers and end customers. We deliver engineered systems using cloud computing for enterprise computing—provisioning the infrastructure on demand for individual customers by bundling the best in class servers from cloud providers and enterprise software programs to suit their particular requirements. Consumers don’t want to be tied to any one vendor; they want to be agnostic—have some AWS, some IBM; we provide that abstraction at quite a reduction in cost and we offer a single point of support to resolve all issues related to the products and cloud services from any provider we partner with.”

After assembling a team to do all the engineering work and creating a high bandwidth network that is extremely fast, Step Ahead took their solution to a Boeing subsidiary. “They loved it the moment they saw it. They were in a cost-cutting spree and recognized our system was a sure way to cut costs,” Joseph said. “Soon, Oracle Corporation followed the path and is now evaluating the company’s ODL™ (On Demand Laptop) for their Oracle University programs. “Our service has the ability to change the way people use computers and the way IT operates. We can deploy a new system for customers within 15 minutes that has elastic memory, compute power, and storage capabilities to meet their individual software needs. All this is insulated from wireless attack and delivered inside the customer’s secure cloud.”

Having applied for a patent on their cloud application provisioning system, Joseph reports, “Our company is the only one of its kind to provide total solutions and customizations for enterprise computing, and it’s a win-win situation: the customer saves money, and the providers make money as more entities make use of their products.”

More information: www.stepaheadsolution.com

CELEBRATE eWEEK WITH US



Check out our full lineup of activities and events in celebration of National Engineers Week, February 16–22, 2014:
scu.edu/engineering/eweek



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