DEAN'S MESSAGE

While attending a presentation by Tim Bucher, a software engineer who has worked with some of the brightest engineering luminaries of our time, I heard something that has been percolating in my mind ever since. Bucher said one word could be assigned to each of three powerful people he had worked for: Bill Gates—software; Steve Jobs—design; Michael Dell—cost. This made me wonder about words that could be assigned to some of the people I know and places I have worked.

Without a doubt, "mission" is the word that best encapsulates SCU engineering. Each day, through our unique mix of theoretical and hands-on education, personal attention, and Jesuit values, we fulfill our mission to provide the next generation of engineers with the tools and commitment to go out into the world and improve the human condition.

In this edition of *EngineeringNews*, you will read stories of how our seniors have spent their year designing tools to improve surgical procedures in the United States, water filtration in Honduras, and motorcycle safety for riders everywhere; how our professors are teaching and inspiring our students to design a conceptual rebuilding campaign for Haiti and to think outside the box (or the vending machine, in this case); and the way our programs encourage women in engineering. At SCU, we are *Engineering with a Mission*. Read on, and see just what that word means to us.

Godfrey Mungal
Dean
School of Engineering

Photo: Charles Barry

From left: Colby Moore, Nick Greos, Alex Granieri, Alex Fischer, and Harmanjit Sekhon with their "smart" vending machines.

THINKING OUTSIDE THE...VENDING MACHINE?

The assignment for Associate Professor Christopher Kitts's new class, Smart Product Design (MECH/ENGR 144) was intended to get students to think outside the box—or the vending machine, in this case. Working in interdisciplinary teams, students last quarter designed smart vending machines that were technically innovative, cost effective, sustainable, and impacted the customer and society in a positive way.

The Eco Dispenser was the brainchild of juniors Michael Calcagno and Nick Greos , and senior Colby Moore . Their machine was designed to both dispense reusable water bottles and the reusable, sustainable Eco-Trays (a take-out box alternative) currently being used by SCU, as well as receive dirty trays and bottles for cleaning, saving the University thousands of dollars each year in disposable plates and take-out boxes, and shrinking the University's carbon footprint by reducing the number of plastic bottles that are thrown away each day, according to Greos.

Another team designed a machine with multiple payment options where the consumer could purchase a snack, beverage, and hot entrée in one step. "This class taught me a lot about myself as an engineer," said junior Alex Fischer. "I learned so much about machine design and project management, and I got to sharpen my presentation skills. There is a stereotype about engineers," he continued, "that we can crunch numbers but can't interact with human beings; this class helped me develop my comfort level presenting our idea to the industry professionals Professor Kitts brought in." Junior Harmanjit Sekhon appreciated learning about the business side of engineering a smart product. "Thinking about how the product should be marketed and considering shareholders' input was a new experience," he said.

While the students all agreed they learned a lot and had some serious fun along the way interacting with their grad school "shareholders," senior Alex Granieri commented on the number of hours they spent on their design, saying the course should come with a disclaimer: "Sleep will not be had." "True," said Sekhon, "but the time paid off!"

For more on innovation at SCU:
http://innovate.engr.scu.edu/

MECH SENIORS BUILD A BETTER HEADLIGHT

From left: Samantha Frampton, Giovanni Magaña, Nicole Papetti, Sergio Rodriguez, Alex Granieri, Colby Moore.

Last spring, five mechanical engineering juniors, each armed with their own "bug list" of things that bothered them and needed fixing in their own lives or society, locked themselves in a room and determined no one would leave until they had decided what they would work on for their capstone senior project. The team was drafted by Alex Granieri, who hand-picked individuals he knew to be smart, personable, hard-working, low stress, and "good documentation-ists."

Fast forward nearly a year and the team of Granieri, Giovanni Magaña, Colby Moore, Nicole Papetti, and Sergio Rodriguez have designed Night Rider, an adaptive headlight equipped with sensors, a microprocessor, and a control system that moves the lamp to optimize a motorcyclist's visibility according to road conditions, speed, roll, and pitch of the vehicle.

Based on their strengths, the team broke into subgroups focusing on mechanical design and dynamics, logical systems, and kinetics. Recently, senior Samantha Frampton from the business school joined the team to help package and promote their design (BMW has expressed interest).

"It's amazing how much work this project takes," they said, "with five or six people working nonstop, it still feels like we're just crawling along sometimes." Early on, the team learned they had to be realistic about how much they could accomplish and they admit to biting off more than they could chew at first, but they realized adjusting their goal to be more realistic and less idealized was part of their growth process.

Another lesson: frugality. Paying for most of the materials themselves (with some help from the Dean's fund and donations from kindly grandmothers) has led to some dumpster diving, closet raiding, and a sustainable mindset. "We don't buy unnecessarily and we are very conscious of how efficiently we use our materials," said Granieri

All in all, they agree the experience has been "awesome!" "I've waited my whole educational career for this moment to apply what I've learned to a year-long, hands-on project like this," said Moore, "Having our group work so well putting our specialties together… It's pretty shocking to see it all work!"

For more information: **www.scu.edu/ engineering/solardecathlon/reports**

STUDENTS DESIGN FROM A SOCIAL PERSPECTIVE
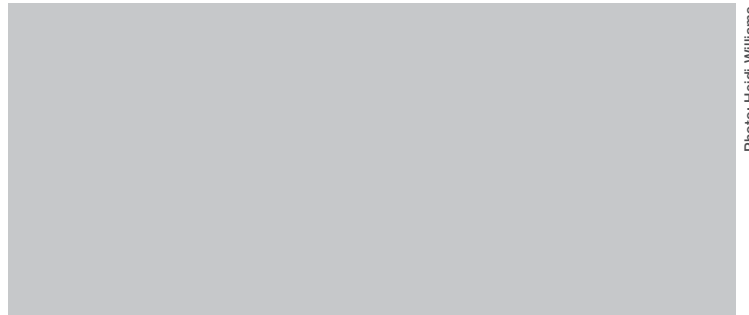
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With the disaster in Haiti fresh in their minds, students in Professor Reynaud Serrette's Structural Systems class (CENG 148) were given a challenge last quarter: Develop a design concept for a two-room house in Haiti that would be culturally acceptable, use local materials, and stimulate the country's economy.

"Students had only ten weeks to work on the project, so the goal was to design conceptually," said Serrette. "They were tasked with defining the requirements for the concept. They found it frustrating not to have a defined project, particularly because they were designing for an environment that does not have the building codes we adhere to in the United States, but it is good for students to experience frustration," he said. "As engineers, we deal with a certain amount of uncertainty, but we are responsible for doing the right thing even when we are not legally obligated to do so. The occupants of our structures deserve to be safe and feel comfortable—we are their insurance."

In developing their concepts, students researched India's use of raw bamboo, considered local weather and soil conditions, and even contacted the World Bank and United Nations for input. Jai Master said his team took Haiti's deforestation problems into account while designing their home built on bamboo stilts set in bamboo-reinforced concrete. "We did a lot of brainstorming," he said. "As engineers, we like calculations and we're used to the comfort of knowing how to build for the U.S.; designing for a developing area was a new thing for us and made us think about everything."

Serrette added, "This project forced the students to look at design from a social perspective and be cognizant of all that designing encompasses. The hope is that they take this same awareness to all their classes and out into the world as working professionals."

WEB DESIGN PROGRAM ATTRACTS WOMEN STUDENTS

An early look at the statistics emerging from SCU's enrollment management office revealed an interesting finding this spring: 77 percent of the students admitted into the new Bachelor of Science Web Design and Engineering (BSWDE) program are women. Read the rest of the story to find out why women are drawn to this program: **scu.edu/engineering/enews/2010spring**

Swades board members.

"THE FUN GANG" HELPS STUDENTS ASSIMILATE

There is a fun new club on campus for graduate engineers—Swades, the Indian Students Organization. Formed to help Indian students at SCU feel at home, the self-proclaimed "fun gang" lives up to their moniker by planning entertaining activities, sharing the joy of the culture and heritage of India, and bringing awareness to others. Keep reading: **scu.edu/engineering/ enews/2010springm**

PROFESSOR WINS PRESTIGIOUS BELLMAN AWARD

Recognizing his "fundamental contributions to the theory of large-scale systems, decentralized control, and parametric approach to robust stability," the American Automatic Control Council recently awarded the prestigious Richard E. Bellman Control Heritage Award to Dragoslav D. Siljak, professor of electrical engineering. Honoring distinguished career contributions to the theory or application of automatic control, this award is the highest recognition of professional achievement for US control systems engineers and scientists.

"To be singled out by this eminent organization is a tremendous honor and indicates a level of career accomplishment few achieve. We are fortunate, indeed, to have someone of Drago's caliber on our faculty," said Godfrey Mungal, Dean of the School of Engineering.

Further evidence of Siljak's influence: his 1991 book, *Decentralized Control of Complex Systems*, was recently ranked #1 in sales on Amazon.com in two categories, Systems and Control Systems.

PROFESSORS COLLABORATE ON SPEECH CODING TEXTBOOK

Professors Madihally Narasimha and Tokunbo Ogunfunmi

Spend a few minutes talking with Associate Professor of Electrical Engineering Tokunbo Ogunfunmi and adjunct Lecturer Madihally (Sim) Narasimha (who is also Senior Director of Technology at Qualcomm, Inc. and Consulting Professor of Electrical Engineering at Stanford University) and you learn two things right off the bat—these two are passionate about speech coding and they talk really FAST! Maybe that is why they focus their research on improving methods of transmitting speech via today's technologies such as VoIP and cellular phones. Recently, they collaborated on writing a textbook, Principles of Speech Coding (available on Amazon.com), for their graduate level courses Speech Coding I, II (ELEN 421, 422), and Voice-over-IP (ELEN 432).

The two met at Stanford University. "I asked him to come to SCU and teach," said Ogunfunmi. "We had both been teaching speech coding

for years, but there was no textbook available. It had been on my mind for some time to write a book, so when Sim came to Santa Clara, it was a good time to move forward."

The book covers the different standards and philosophies of speech coding for various communication devices. "The appropriate coding algorithm for each telephone conversation must be negotiated at call setup time as sound quality differs with the available bandwidth," said Narashima; "and students need to understand the nuances of all these algorithms."

Both agree that this field continues to evolve and grow as newer technologies are constantly emerging. "Skype is a good example of how technology is driving this research," said Ogunfunmi. "Skype allows users to talk over the Internet, but the Internet channel is not reliable, it is not amenable to real-time communication as it uses packet switching to send information and the components do not necessarily arrive in the proper order, or at all. But the Internet is quickly becoming the ubiquitous network," he continued, "and our challenge is to teach students to adapt other communication tools to the Web, to improve the quality of speech transmission in different communication environments."

"Speech coding is a technology that is taken for granted, but this business is not going to disappear," adds Narasimha. "Speech is the fundamental basis of communication for humans; it will always be important."

THE WOMEN OF SCU ENGINEERING

One of the distinctions of Santa Clara University's School of Engineering is that 30 percent of our full-time faculty members are female. In fact, according to the latest figures from the American Society for Engineering Education (ASEE), we are second in the nation for percentage of women tenured or tenure-track (www.asee. org/publications/profiles/ upload/2008ProfileEng.pdf).

Some of the women professors of SCU engineering. From left (front row) Ashley Kim, Katie Wilson, Sally Wood, Silvia Figueira, Rani Mikkilineni; (back row) Yuling Yan, Samiha Mourad, Rachel He, Ruth Davis, Weijia Shang.

Sarah Kate Wilson, assistant professor of electrical engineering, believes having a substantial number of women faculty members is important to both female and male students. "Working with and experiencing women engineers in highly responsible positions makes it easier for female students to see that moving up the corporate ladder or earning a Ph.D. is not such a stretch," she said. Silvia Figueira, associate professor of computer engineering agrees, "It provides women with role models, and gives male students the right picture: Women can be engineers, and there will be women in the workforce in leadership positions." Commenting on a mechanical engineering class she took from Assistant Professor Wendelin Wright, a female student backs this belief, saying, "I appreciate that the male students in my class are able to see that females can be great engineers as well."

With women making up only 10 percent of the total of engineers worldwide, SCU's female undergraduate engineering student population, at 25 percent, is well above average. And while a number of female SCU engineering students reported that their male colleagues have always been supportive and respectful, some challenges remain.

One is the perceived need to prove themselves worthy as peers in the classroom. "Sometimes in group projects the guys would give me easier parts or not listen to my input," said one civil engineering student, "but a couple examples of expertise and success got them to change their minds." Another obstacle: "Men usually take a firmer stance on their ideas, so it's sometimes difficult to get an idea out in the open," according to a bioengineering major. Another student agrees, "If you're shy, it's very hard because boys can be louder and more aggressive. So, as a female engineer, I've learned how to get along with my male classmates and I've developed other important social skills that will serve me well in the mostly male dominated field of engineering."

A lack of previous engineering experience can also be a stumbling block. "Male peers often have experience building things, which helps them visualize processes that are posed in problems," said one student. Because of this, SCU women faculty and students expose younger girls to engineering through outreach with Girl Scouts and programs such as One Step Ahead and GAINS (Girls Achieving in Nontraditional Subjects). "I love to encourage younger girls to discover that engineering is actually something that doesn't have to be just for boys," said one of our seniors, "I am elated when I hear that a girl in high school is looking into engineering for college and I try my best to convince them it is the best way to go."

"The large percentage of women faculty makes this a unique place for our female students," said Professor Wilson, and the women students agree. "There is a camaraderie among all the females in SCU engineering, professors and students alike," said one. "I feel a sense of 'girl power' with my senior design team members and advisor who are all women. I think it is very empowering to know that some of the best classes, where I have learned the most, have been taught by some highly regarded women."

GLOBAL WATER BRIGADES

SCU seniors (back row from left) Molly Dunphy, Mindy Yoneshige, and Ryan Clark with members of Pajarillos Sanitation Committee holding their water filters.

Joining other university students, SCU engineering seniors Ryan Clark, Molly Dunphy, and Mindy Yoneshige traveled to Pajarillos, Honduras, during spring break to dig trenches and lay pipe as part of the nonprofit group, Global Water Brigades. But these Broncos took their outreach one step further, bringing with them water filters they had created for their senior design project.

"During the past year," said Clark, "we have been working on designing a filter the community would use. It had to be sustainable, and something they could stitch themselves that would be understandable to them from a cultural point of view."

The team devised a filter for use in the home, settling on a design using 8 layers of fabric (97 percent cotton, 3 percent spandex). They tested their filter by replicating the condition of the village's water in SCU's civil engineering environmental laboratory.

In Honduras, the trio arranged with local water officials to demonstrate their filter in six homes. "The sanitation committee and water counsel helped the villagers understand the importance of using our filter," said Yoneshige. "Having this source of power within the community backing us was exciting," added Dunphy. "They made it clear that if the people wanted their kids to live longer, they need to make some changes." The students left 20 filters with the villagers and say their next step is to get the $14 filters into the remaining 100 homes.

"This was an amazing experience; the people were so appreciative that we would think their community was important enough to do this for them," said Yoneshige, "but it made us feel really good that a very simple design could make such a difference."

To learn more: **globalbrigades.org**

SENIORS SHARPEN THEIR SKILLS ENGINEERING A NEW SCALPEL

Photo: Charles Barry

Margaret Howe, Mehana Ho'opi'i, and Shereen Elserougi show off their electrosurgical prototypes.

After taking Engineering in the Community (ENGR 110) and a medical device production class (BIOE 107) taught by Paul Davison, vice president of research and development for PEAK Surgical, electrical engineering students Shereen Elserougi and Margaret Howe and bioengineering major Mehana Ho'opi'i took on the challenge of adapting PEAK's revolutionary PlasmaBlade (an electro- surgical device that uses radiofre- quency to cut at a low temperature) for their senior design project.

The students have been working since summer to engineer a transducer element on the PlasmaBlade that will recognize the proximity of blood vessels, and, in response, notify the surgeon. Their design incorporates a number of sensors to detect the movement of blood within the vessel. "If the surgeon can avoid cutting a blood vessel, there is no need to stop and clean up, so surgery can be completed more quickly with reduced blood loss," said Elserougi. After testing and discarding a number of prototypes, the team is now performing tests with their device using water and gelatin with a plastic- pet store tubing "vein."

"It's definitely been a journey," said Ho'opi'i. "We've tried so many different prototypes and variations of the placement of the sensors. We all had internships in the area last summer, so we were able to get a jump on our project working together during our free time."

"Senior design has been so different from any other project," added Howe, who admits she is, surprisingly, queasy about blood and surgery. "Working in a for such a long time and maintaining a professional relationship with each other and with a third party—our advisor— has shown us we have to get along in order to succeed."

"This team works well together and with their advisors," said Davison, "Each team member has different strengths that have crystallized to form a project that has interesting implications for surgery and medical devices."

The three intend to write an ethics paper about their project and the testing of medical devices. "We all have different viewpoints on that subject," they said, "but that should make for a good paper!"

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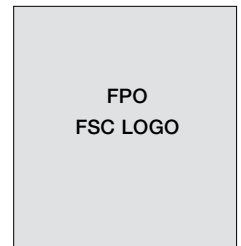
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