DEAN’S MESSAGE

Here in Silicon Valley, we are situated among world leaders in industries such as information products and services, energy and green technologies, and biotech and medical device development, and we are steeped in this community’s culture of diversity and collaboration that pays huge dividends in far-reaching innovations. So it follows that innovation, teamwork, and global engagement are intrinsic to an engineering education at Santa Clara University.

From creating No. 1 best-selling mobile applications to determining the standard for the next generation of video coding, our students, faculty, and alumni are innovating for today’s and tomorrow’s consumers. They are also visiting new places, meeting new people, and working with NGOs, corporate research teams, and other academic institutions in an effort to build a more just, humane, and sustainable world for all.

And, oh, the places they go! Alaska, China, India, Singapore, Austria, and Haiti to mention just a few of the locations you will read about in this edition of Engineering News. Of course, Bronco engineers don’t need to travel far to have universal influence as evidenced by our participation in the Solar Decathlon that was held right here in California earlier this month. But whether their work keeps them near or sends them to far-off locales, Santa Clara’s Bronco engineers are grounded in the Jesuit, Catholic tradition of ethical decision making and practice.

Happy reading!

Godfrey Mungal
Dean
School of Engineering

THE EXPERIENCE OF A LIFETIME

At the close of the 2013 Solar Decathlon in mid-October, the solar-powered homes that had been designed, built, and operated for two weeks at the international competition sponsored by the U.S. Department of Energy were dismantled and readied for the trip home. Solar Village, a once-bustling enclave of energy and engineering innovation brought to life by an elite group of university teams was now a memory for the thousands of visitors who were delighted and inspired by the teams’ creativity and ingenuity.

The ultimate in project-based, hands-on learning, the Solar Decathlon tested the engineering prowess, business acumen, and interpersonal skills of our Santa Clara undergraduate team. They designed Radiant House with the needs of a retired couple in mind, incorporating innovative bamboo construction techniques, low-maintenance building materials, and a user-friendly control system. Of the 10 contests held within the competition, half are objective measurements of how efficiently the systems of the home handle tasks such as producing hot water and maintaining comfortable temperature and humidity levels. Among these measured contests, Santa Clara was first in the scoring. Unfortunately, in the subjective contests such as Affordability and Architecture, Radiant House did not fare as well, and the team suffered a fall from 1st place to 11th by the end of the event.

Still, this was never just about the contest scores. “The experience the students have garnered over the past two years—the sense of pride and strength—is one they will carry for a lifetime, and we are so proud of them,” said School of Engineering Dean Godfrey Mungal. Nicole Pal ’14, assistant project leader, summed up the team’s unflagging optimism for a brighter energy future when she said, “It’s not about the project; it’s about changing the world—we got this!”

SCU’s Radiant House drew more than 20,000 visitors during the 2013 Solar Decathlon.
Each fall, 15 or so engineering students enroll in ENGR 110, Engineering Projects for the Community, and spend the next 10 weeks focused on creating a solution for a neighboring school, science camp, or local organization’s challenge. Because of the short timeframe, projects are generally limited in scope, but every now and again an opportunity arises, an unlikely crew comes together, and some magic happens. Following is an example of just that kind of synergy and an explanation of how a medical and dental clinic in rural Haiti has benefited from the dogged determination of a disparate cast of characters brought together through Santa Clara engineering.

THE PLAYERS

Bob Downey ’92: SCU economics alumnus, medical diagnostics and laboratory services specialist, resident of San Diego, secretary of the nonprofit organization Seattle-King County Disaster Team (SKCDT) that runs a medical and dental clinic in Haiti, and recipient of Santa Clara’s 2012 Ignatian Award recognizing alumni for outstanding achievement in service to humanity.

Shoba Krishnan: associate professor of electrical engineering, proponent of community-based projects and community building, tireless student mentor.

Luanda Rotondano Marinho: visiting student from Brazil who spent a year studying engineering at SCU, tenacious problem solver.

Mike Strykowski: co-founder of The Solar Way Forward, extensive background in solar design for schools in Africa, consultant to solar energy practitioners, mentor and consultant on numerous SCU energy projects.

THE PROBLEM

The medical/dental clinic in the small village of Leon, Haiti, run by volunteers from Seattle-King County Disaster Team had no electricity. Power was generated by a large diesel generator at the nearby Catholic parish, which was problematic because of the cost and limited availability of diesel. The lack of consistent electricity caused problems for the dentist who has not been able to run the compressor to power dental tools such as drills. Additionally, treatment of nighttime emergencies such as difficult labor/deliveries or traumatic injuries was inhibited because of the lack of proper lighting.

THE SOLUTION

Design a solar photovoltaic system with the following criteria:

• Parts must be either available locally in Haiti or sized appropriately for transport from the U.S. with SKCDT volunteers
• System must be easily installed, rugged, and designed to deter theft
• Instructions for installation and maintenance must be detailed

THE STORY

When Bob Downey approached Shoba Krishnan about having a student take on this project, he could sense that she was leery. “It’s best if the students have face-to-face contact with the customer,” she said. “Bob was in San Diego, the installation was in Haiti. There was no way to go and assess the situation. It’s important that students get that experience of meeting the community they are trying to serve and seeing firsthand the probleM

Students don’t get it if it’s not in front of them physically.” But Bob was determined. “I was familiar with the work the School of Engineering has done in other parts of the world and thought this would be a good opportunity,” he said. Even though he was based in Southern California and his colleagues who would help with the installation were in the state of Washington, he had confidence in SCU’s ability to come through. “I wouldn’t have chosen another school because I know the reputation SCU has for quality education and sustainable, practical projects,” he said. That explains his eagerness to collaborate, but what made Shoba overcome her reluctance? “He was a Santa Clara grad so I just believed in him; they’ve never let me down,” she said.

Enter Luanda. With a Brazilian education in controls and automation engineering that fell somewhere between SCU’s electrical and mechanical engineering programs, Luanda was eager to take on a renewable energy project. “I’ve been doing volunteer work for a few years now,” she said, “but being able to participate in this project and see the impact of the work we did was one of the most amazing experiences I had at Santa Clara University.” Twice a week she and Bob met by phone to formulate a plan that made the most sense for Haiti; soon Luanda got to work designing the system. A project of this scope cannot be completed in 10 weeks, so she continued working on it after the quarter finished, through the Christmas break, and past the New Year holiday.

Along the way, Shoba introduced Mike Strykowski into the mix. Mike’s enthusiasm for spreading the gospel of renewable energy is infectious. “I enjoy the mental gymnastics of putting systems in the middle of nowhere,” Mike said. “This is not a cookie-cutter operation, and the idea of doing solar panels in Haiti and working with divergent groups was exciting. Also, SCU’s policy of encouraging service-oriented projects was a guiding factor in my involvement. Many universities don’t push that—with others it’s all about the money. SCU prepares students to make money, but that’s not the only focus. That appeals to me.” With his boots-on-the-ground knowledge of what was
appropriate and was (or was not) available in Haiti, his input was important in determining the components that included PV panels, battery inverters, cabling mounting, and more—half of which were to be procured in Haiti and half to be purchased in the U.S.

After Bob confirmed the pieces that could be sourced in Haiti, Luanda, Mike, Shoba, and electrical engineering student Russell Weatherby addressed the challenge of training. Mike provided a sample mount solar panel and controller, and over the course of a weekend the team videotaped the process of building the system step-by-step. Next, Luanda wrote a project report, shipped some equipment to Seattle for the SKCDT volunteers to take with them in February for the installation, and the team waited to hear news from Bob about how the installation went.

THE RESULT

A few weeks later, a happy email: “Everything is installed and working great. Thanks for your help!” Reflecting on the collaboration, Bob recently reported, “The videos and other documentation were invaluable to a successful project. Additionally, how Shoba, Mike, and Luanda arranged to have the system assembled and tested on campus prior to shipment was very helpful. We were under a very short time window to get everything in country, up and running. All those things together helped to make it happen successfully in this very remote area.”

And what has the effect been on the clinic? “Having electricity at the clinic has been so very helpful,” Bob relayed. “A man with a compound open leg fracture was brought in one evening this past June. Our physicians and paramedics were able to stabilize him working under regular light.”

Oh, and that dentist? While we don’t have a report on how many more teeth he’s been able to drill, Bob did report: “The dentist is doing well and is able to run the air compressor for the drill off of the power generated from the solar.” A happy ending, indeed, and as Shoba says, “… that’s just one project!”

WEST MEETS EAST

In a classic case of “East meets West,” Shanghai Jiao Tong University (SJTU) and Santa Clara University have joined forces as creators and co-leaders of an annual summer program in which students can experience a new culture and educational system while visiting diverse industrial settings and expanding their vision of the global workplace.

Last summer, 11 SCU bioengineering students visited China, studying traditional Chinese medicine (TCM) with peers from the pharmacy program at SJTU and touring facilities in Shanghai and Nanjing. “The students experienced outstanding lectures from leaders in the field of pharmaceutical research,” said SCU bioengineering associate professor Zhiwen (Jonathan) Zhang, who helped create the program and accompanied the students on the trip. “At Santa Clara, we teach bioengineering with a clear goal toward its use in therapy or medical treatment. This direct exposure to a pharmacological point of research and therapy was invaluable to our students.”

Following their time at SJTU, the students were invited by Nanjing University to sit in on research seminars, hang out, and do some sightseeing. When the program wrapped up, six Bronco engineers stayed behind to perform research at the university. “The culture and protocols in the lab were a lot different than in the United States,” said Cade Ito ’14. “They did everything very precisely and quickly, but having to adapt to a different lab and a new language was a good experience.”

Jennifer Batara ’13 shared a different perspective: “Engineers in America are not expected to get a lot of outside cultural experience,” she said. “We are expected to cultivate our technical skills. A program like this goes along with the Jesuit mission of trying to develop the whole person. Men and women are more than just engineers or businesspeople.”

Having had such a great experience in China, the Bronco engineers are eager to return the favor next summer when they host the program in Santa Clara for the International Summer Academy of Bioengineering (ISAB). “Developing these ties so early in our careers is a great way to forge worldwide networks and enhances the reputation of both universities,” said Josergio Zaragoza ’13.

Read an expanded version of this story on our website: scu.edu/engineering/scu-sjtu.
For several years, bioengineering assistant professor Unyoung (Ashley) Kim has put students to work advancing research on a device to detect contaminants such as bacterial pathogens and arsenic in water samples collected in rural areas. A collaborative effort among students, SCU’s Frugal Innovation Lab, and St. Xavier’s College in Kolkata, India, the device—an electrochemical sensor, CheapStat analyzer, and laptop graphical user interface—was recently taken out into the field to test the validity of its results.

Jessica VanderGiessen ’14 and St. Xavier’s environmental studies professor Xavier Savarimuthu, S.J., gathered and tested 38 samples from the North 24 Parganas district in West Bengal, India. “We had a few objectives going in,” said VanderGiessen. “We wanted to see if the current testing protocol was appropriate in a real-world setting, we needed to determine the most efficient method for water source application, and we wanted to learn how the design of the device could be improved.”

Samples were collected and tested from shallow, midrange, and deep wells measuring from 30 to more than 120 feet. To validate the instrument, Fr. Xavier selected wells that were known to have the highest peak of arsenic contamination. Later, VanderGiessen analyzed the data and wrote a report.

In a Skype call with Kim, Fr. Xavier, and Radha Basu, director of the Frugal Innovation Lab, VanderGiessen reported her findings, and the group discussed how to improve the sensitivity of their electrochemical sensor, considered adding testing for a secondary contaminant to their platform, weighed options for safe and rugged packaging, and offered suggestions for simplifying experiments by modifying their sensors to include dried reagents, eliminating the need to mix the chemicals on site. “The project will continue over the next year with improvements being made to the sensor, signal conditioning, and integration with Android to create a ‘lab-on-a-chip,’” said Basu.

Reflecting on their time together, Fr. Xavier said, “I have followed up with some of the villagers about the quantity of arsenic that they are exposed to. This interaction helps us build a good rapport with the community that will help pave the way for future research.” VanderGiessen adds, “I’m so grateful to have had this experience. This field test provided invaluable data and feedback on our current design that will be used to guide our work through the coming year.”

Radical advancements in video technologies such as “Free viewpoint video” (capturing an image of objects from all directions) and ultra-high definition (UHD) television that will one day afford 16 times the spatial resolution of current HDTV require computer engineers to innovate techniques to drastically save space and time in video coding.

Recently, one video compression method developed by SCU in conjunction with global information and communications technology leader Huawei Technologies, Inc./Hisilicon, was adopted as a normative (or required) method for 3D video coding, targeted to be released in January 2015. In addition, another video compression method developed by the team was adopted as informative (or optional).

When the International Standardization Organization (ISO) and International Telecommunication Union (ITU) put out a call for proposals a year ago to improve the efficiency of encoding 3D video data, SCU was well positioned to accept the challenge in competition against industry titans such as Samsung, Qualcomm, Intel, and leading research giants like Germany’s Fraunhofer Heinrich Hertz Institute (HHI). Since 2005, Nam Ling, chair and professor of computer engineering at SCU, has led a team of Ph.D. students and research assistants working with Huawei/Hisilicon to advance industry standards for video coding. Zhouye Gu from Nanyang Technological University in Singapore had recently been recruited by Ling to join SCU’s team as a research scholar; his first assignment: work with the SCU-Huawei team to devise a proposed solution for this 3D competition.

Working with the team, Gu devised a simplified process in depth coding that produces a 30 percent encoding time savings without performance loss, providing the same visual quality while using the same bit rate as current methods. His solution supports multiple views for free viewpoint coding and can accommodate even greater gains in coding depth and texture data as the field advances. Though SCU’s proposal was not initially accepted, Gu was able to gain the support of a world-leading telecommunication research institution. “Our process improves upon techniques originated by them and, since they are a big player, their support holds a lot of weight,” he said. After months of work, it was announced that SCU-Huawei’s proposal had been adopted as a normative method for 3D-High-Efficiency Video Coding (HEVC). Between now and January 2015, SCU will continue to work with Huawei’s researchers to further refine the coding process and to propose new methods for adoption.

“The impact of the digital area is tremendous, and there is a lot more to be seen. As a university, it is important that SCU has a role in this,” said Ling.

Read more: scu.edu/engineering/3Dvideo
MOBILE APP ACQUISITION HAS ALUMNUS SHOUTING YAHOO!

That’s Jerry Shen ’10 (M.S. engineering management and leadership), founder of Bignoggins Productions, writing about the success of his wildly popular “Fantasy Monster,” which reached the heights of No. 1 paid sports app on iPhone, iPad, and WP7, and No. 2 paid sports app on Android. In addition, Shen’s “Draft Monster” climbed to No. 2 paid sports app on iPhone and iPad. Using these apps, fantasy sports league enthusiasts could easily edit lineups, make trades, take on free agents, and monitor scores on their mobile devices.

And it all started at Santa Clara University when Shen walked into adjunct professor Joshua Conner’s Mobile Apps Development class. Conner, an original member of the team that developed Apple’s iPhone, also created the course that would change Shen’s life. “It was the first time we offered the class,” said Conner, “and the first assignment was to come up with a list of ideas that students would like to explore. By the end of the quarter, they were writing their own apps. Jerry took his application and built his company on that class project.”

As Bignoggins began to take off, Shen quit his day job as a software engineer and “pushed the limits of how few hours I could work per week and still support my family.” Three years later, Yahoo! acquired his company and hired him as director of engineering for mobile and emerging products, incorporating his code and adding features to enhance the new Yahoo! Fantasy app.

While not every idea pays off so well, Conner (who currently works at NVIDIA as a compiler developer) says a number of students who have taken this course have started their own companies based on their classwork. “There is definitely a synergy here,” he said. “Jerry comes to talk to our students each year and it’s exciting to see their ambition grow as they take their ideas to the next level. It’s great to be around that.”

THE ETHICS OF BIOENGINEERING

At Santa Clara, we strive to educate the “whole person” to be of service in the world. Achieving this goal entails training students to think and act mindfully and ethically. This is particularly imperative in the field of bioengineering.

From the very beginning of the bioengineering program at SCU, department chair Yuling Yan has stressed the importance of an ethical perspective within its study. Each year, Margaret McLean, director of bioethics for SCU’s Markkula Center for Applied Ethics, senior lecturer in the religious studies department, and affiliate faculty member in bioengineering, teaches one class within the Introduction to Bioengineering (BIOE 10) course. And each spring, she co-teaches Social and Ethical Dimensions of Biotechnology (BIOL 171) with Leilani Miller, associate professor of biology. McLean reports that “while examining technologies, including those related to genetic testing, gene therapy, and global health, students explore the basic ethics questions concerning efficacy, safety, and impact on the end user. From there, we build a much more nuanced ethical infrastructure for them to draw upon as they approach their final project.”

Last spring, bioengineering students Nick Wolfe ’14, Tess Cauvel ’14, and biochemistry major Emily Robinson ’14 were intrigued by an article they read in Nature about a new gene therapy for reducing or eliminating mitochondrial disease in humans. They presented a consideration of the underlying science—addressing the medical problem, potential benefits, and ethical concerns—as fellow teams covered other cutting-edge issues at a Biotechnology Ethics Poster Session.

Prashanth Asuri, bioengineering assistant professor, brought his freshman students to a private viewing of the poster session for some peer-to-peer teaching. In small groups, the juniors and seniors shared their research with the younger students, most of whom hadn’t taken an ethics course yet.

“Bioengineering is evolving at an incredibly rapid pace,” said Asuri. “As the young engineers are preparing to contribute to the advancement of the field, they should also understand the ethical complexities involved. We want to develop technically competent and ethically responsible bioengineers.” To keep pace with the changing landscape, department chair Yan is expanding SCU’s bioengineering course offerings. “We are planning to offer BIOE 180, Clinical Trials—Design, Analysis, and Ethical Issues, next spring,” she said. “This course fulfills both the bioethics requirement and counts as a technical elective, giving students more choice while also weaving ethics more tightly into the engineering curriculum.”

Students share the ethics of bioengineering with their peers at a forum held each year.

For his part, Nick Wolfe said the ethics course will help him as he begins his career. “The future relies on technologies, and engineers need to thoroughly understand the concerns, consequences, and implications involved,” he said. Classmate William Truong ’13 added, “As engineers, we tend to think that any new technology must be good. This class made me think more deeply about the development of products and treatments and how they could help or hurt humanity.”
MOBILE APP ACQUISITION HAS ALUMNUS SHOUTING YAHOO!

The Ethics of Bioengineering

When Joshua Conner, the owner of Bignoggins Mobile Apps, declares in his blog, “I took the mobile app development class with my master’s degree, which includes technical competence and an ethical perspective within its study. Each one of us was stressed the importance of an ethical code of conduct while developing mobile and emerging products, incorporating ethical practices while developing features to enhance the user experience and app interface.”

While we may consider apps to be just a software or code that we obviously can code, but by the end of this article, we might find that the apps are very personal to our company and how they are understood and how they are branded.

Joshua Conner’s Mobile Apps

Bignoggins Mobile Apps, based in Santa Clara, California, owns and operates several mobile applications that help users to solve common problems or perform common tasks.

The company focuses on providing high-quality and user-friendly mobile applications that help people to get things done more efficiently and effectively.

Last summer, five Santa Clara University students worked to develop mobile engineering apps that could help users while they were at war in Iraq. They were working on a mobile app to help soldiers in the Middle East to find their way around.

Developments from last year’s mobile app development class at Santa Clara University propelled the students to create a mobile app that could help soldiers to navigate through the Middle East.

The app was called “Draft Monster” and it was developed to work on iPhone and Android devices.

The mobile app ranked No. 2 in the Apple App Store and No. 1 on the Google Play Store.

“Draft Monster” was developed in partnership with the U.S. Army and the U.S. Air Force.

“Draft Monster” was designed to help soldiers to navigate through the Middle East while they were on duty.

This mobile app is designed to help soldiers to navigate through the Middle East while they are on duty.

“The app was designed to help soldiers to navigate through the Middle East while they are on duty,” Conner said.

GitHub

The open-source platform GitHub was used to create the mobile app development class’s first mobile app.

The app was created using the React Native framework, which is a popular choice for mobile app development.

“GitHub is a place where we can collaborate and share our work,” Conner said.

Later, Yahoo! acquired his mobile app development company.

Later, in response to the company’s acquisition, Conner wrote on his blog, “I was not too surprised when Yahoo! acquired my mobile app development company, but I was a bit surprised when I found out that my mobile app had just been declared a federal disaster site following a devastating flood.”

Conner added, “I was glad that my mobile app could help people during the flood, but at the same time, I was disappointed that I could not do more to help.”

DRAMA’S NEWS

While in Silicon Valley, we are all about working among brilliant individuals in innovation-related positions. We are always looking for new and interesting experiences.

In this issue, we feature a story about the Santa Clara University’s Radiant House team, which was a part of the Solar Decathlon.

The team worked on the design and construction of a sustainable house that was powered by solar energy and featured advanced energy-saving technologies.

As the team was working on the house, they had to consider various factors, such as energy efficiency, sustainability, and durability.

The team’s goal was to create a house that would be able to generate its own electricity from solar panels and would be able to consume water in an efficient manner.

The Radiant House team was one of the top performers in the Solar Decathlon, and their house was highly praised by the judges.

“The Radiant House team did an excellent job in designing a sustainable house,” said one of the judges.

The team’s success was due to the hard work and dedication of the students, as well as the support of the faculty and the university.

“The Radiant House team was a true testament to the power of collaboration and teamwork,” said the dean of the School of Engineering.

The team’s success was also due to the collaboration with the university’s architecture and engineering departments.

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