

Students Create Wireless Sensor Network for Campus

The capstone course for 18 electrical and computer engineering majors has not only tested the knowledge that they have acquired through the past four years at Lafayette, it has given them experience on the level of what they will do as professional engineers.

Led by Jeff Gum, the group designed and deployed a wireless sensor network for the campus.

"After a while a peer relationship begins to develop with me, someone who's older than them, and I actually become less of an instructor and more of a colleague. And this gets them to start thinking about dealing with colleagues and being comfortable as engineers," Gum says.

"This course gets us as close to the real world as you can get without actually working there," says Tom Emanski. "Everything about it illustrates how close we are to it and gets us ready for the next 40 years."

The design project consists of linking mobile and stationary sensor nodes to a central network to monitor environmental conditions and campus buildings and track vehicles. The team had \$3,000 to complete the project, which began at the end of January and was demonstrated on May 15, 2005.

Nicholas Cali, who minored in mathematics, says separating into subgroups gave him the chance to use specific skills he learned in classes. "I was involved with the radio frequency group. I built antennas and tuned them to the frequency we needed," he says.

The project presented some challenges, notes Greg DeVito. As part of the system's integrity group, he encountered problems with interfacing the operating system and the central processor. It was a challenge to make the processor accept



Seniors demonstrated their projects in May.

the real-time information sent by the operating system.

"One of the biggest things is just learning to work in the group environment," Cali says. "Especially in the preliminary meetings, there was a lot of arguing back and forth. There are so many angles to choose and there's really not a wrong way, but we had to come up with compromises."

Other class members included Keith Barry, Fayola Bostic (also majored in international studies), Jonathan Dufresne, Melissa Farrand, Bradford Fritz, Peter Gray, Ekaterina Jager (also majored in mathematics-economics), Usman Khan (also majored in mathematics-economics), Kristian Kleinbach, Jason Mansilla, Colin McDonough, Merhawi Redda, Richard Roscioli, Mark Wells, and Kevin Young. ■

Glasser '06 Develops LED Display Controls

Under the direction of John Greco, David Glasser '06 created a system for controlling an LED display via the Internet. An electrical and computer engineering major and computer science minor, he created a system that enables a user to control a light-emitting diode (LED) display over the Internet.

Immovable, stationary boxes typically control LED displays, which are electronic signs that use lights to transmit messages, such as blinking highway signs or lighted signs at gas stations.

Glasser's research and design might be incorporated into some of Greco's courses.

Glasser used a microcontroller, which is equipped with an Ethernet connection, to act as a web server. People can connect to the microcontroller through a web browser. The user types a message on the computer and sends it to the microcontroller. The microcontroller translates the message and sends the appropriate digital signal to the LED display.

Glasser is treasurer of the student chapter of Institute of Electrical and Electronic Engineers and a resident adviser. He plays trombone in Jazz Band and Brass Ensemble and has played for Concert Band and Marquis Players. ■

Bowen '05 Named Pepper Prize Winner

An electrical and computer engineering major and computer science minor, Oliver Bowen '05 of Johannesburg, South Africa, received the George Wharton Pepper Prize, given each year to the senior who best represents the Lafayette ideal. The student, chosen for a sound academic record as well as participation in college activities and student life, addresses the graduating class at commencement.

Bowen, who was on the dean's list every semester, graduated with honors in his major for his thesis on high level control of an FPGA maze routing accelerator. He assisted John Nestor as an EXCEL Scholar on research for computer-aided design and Verilog visualization. A member of Tau Beta Pi engineering honor society and Eta Kappa Nu electrical engineering honor society, he was a peer tutor in mathematics and physics.

After noticing a division between international and American students, Bowen decided to get involved. He became a peer adviser in the International Students Association and later became president. "First as a peer adviser, then as a member of my fraternity's executive board, and then as ISA president and a resident adviser, I made a major effort to lessen the division between groups, and helped integrate Lafayette's diversity into the rest of the community."

Bowen was vice president of scholarship for Delta Upsilon fraternity and resident adviser for McKean Hall as a junior, Gates Hall as a senior. He completed an internship with Agere Systems during summer 2004. He is currently working at Lutron. ■



Oliver Bowen '05 (seated) worked with computer hardware description languages in EXCEL Scholars research with John Nestor.

Mission:

Our mission is to be one of the nation's premier undergraduate ECE departments. We are dedicated to providing students a thorough technical preparation, the continuous development of professional awareness, and a heightened sense of social responsibility.

This mission statement leads to three major goals:

(1) to bring together students of high ability and a faculty composed of teacher-scholars in the major fields of electrical and computer engineering for the purpose of learning through study, inquiry, discourse, and discovery—our people.

(2) to maintain a continuous evolution of curriculum, pedagogical practices, and resources to educate students in the guiding principles of the engineering profession and the best practices in both electrical and computer engineering—our program.

(3) to create an interactive environment between students and faculty which fosters a dedication to learning and an appreciation of both the history and future of the discipline—our learning environment.

OBJECTIVES

Graduates will have the ability to:

- educate themselves continually;
- adapt to changing job assignments/challenges;
- function in a team and provide leadership;
- apply their engineering education in solving a broad range of problems;
- be involved in professional/public/community service;
- excel in their chosen area of professional activity;
- communicate in a mature and effective manner, and
- appreciate business enterprise, technology management, and social and legal issues.

PROGRAM OUTCOMES

Upon graduation, students will:

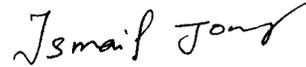
- value life-long learning and understand contemporary issues;
- function in a multidisciplinary team;
- analyze data and communicate results;
- solve broad-based engineering problems in a socially conscious and ethical manner;
- be able to design, simulate, build, and test both complex analog and digital circuits;
- use mathematical technique and science knowledge to model and analyze communication and control systems;
- use modern engineering hardware and software tools;
- be able to formulate an engineering problem and solve it by creating, debugging, and testing a team-based solution;
- understand microscopic material properties and how they are used to develop modern electronic devices.

From the Department Head

Welcome to the third edition of ECE: Electrical and Computer Engineering. We are thankful for the opportunity to report to you about our students' activities, projects, and accomplishments, and we are pleased to update alumni about faculty activities and departmental news.

This year, the first-year students designed a white LED-based lighting system equipped with activation sensors. The sophomores designed and built an analog-to-digital converter, and a digital-to-analog converter. They also controlled miniature robots using an HC11 microcontroller. The juniors designed an infrared target acquisition system which activates a laser response system. For added fun, the project platform was shaped as a tank turret.

The seniors built an Ethernet-based computer network using an FPGA in fall semester. In spring, they built a solar-powered and completely integrated unit for transmitting and receiving sensor data over a wireless network. Such a project has many environmental applications. The students, who built three independent units, called it the Lafayette Wireless Network (LaWN). Faculty and visitors enjoyed various demonstrations of these projects. Alumni, as always, are encouraged to contact the department or stop by for a visit with faculty and students.



Ismail I. Jouny
Charles A. Dana Professor of
Electrical and Computer Engineering



Jonathan Dufresne '05 (left) researched the application of support vector machine technology in both mammography and land mine detection as an EXCEL Scholar working with Ismail Jouny.

Lodato '06 Receives Homeland Security Scholarship

An interest in developing security-related products helped Mark Lodato '06 earn a Department of Homeland Security Undergraduate Scholarship for rising juniors.

The scholarship provides Lodato, an electrical and computer engineering major and varsity fencer, with tuition and fees for his junior and senior year and a \$1,000/month stipend for nine months. He will also serve an internship at a DHS-designated facility next summer.

Students selected to receive this award have expressed interest in pursuing basic science and technology innovations that can be applied to the DHS mission. Lodato plans to pursue a career in one of two fields related to homeland security—information security devices such as firewalls or software that detects holes in a network, or biometric devices such as fingerprint scanners.

Last summer, Lodato assisted William Jemison with simulations for the design of high-speed lasers as part of a National Science Foundation project.

A Trustee Scholarship recipient, Lodato is a member of a student chapter of Institute of Electrical and Electronics Engineers, serves as a peer tutor, and participates in intramural sports. ■



Mark Lodato '06 (left) works on electronic circuits with Jeff Mentzer '06.



is produced annually by the Office of Public Information for the Electrical and Computer Engineering Department and distributed to Lafayette engineering alumni and students. The department welcomes your comments and letters. Send to: Ismail I. Jouny, ECE Department, Acopian Engineering Center, Lafayette College, Easton, PA 18042; (610) 330-5414, jounyi@lafayette.edu, www.lafayette.edu.

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Associated Staff: Nicolette Stavrovsky Photography: David W. Coulter, Lisa Massey Buffer

Juniors Design Model Tanks to Fire Laser Beams

Junior electrical and computer engineering majors designed and built circuit boards to control turrets of small tanks, enabling them to fire laser beams with the speed and accuracy needed to hit targets.

The systems are autonomous in that no remote controls or computer programming is involved. The tanks, 8-12 inches long by 6-8 inches wide, lock onto targets that emit infrared signals and fire lasers at them. Students were given the tank platform and the motor. They created the electronics and the process to make the sensors work.



Simon Mushi '06 puts final touches on circuits for the turrets of a small tank.

"It's a culmination of their analog experience at Lafayette," says Todd Wey, who teaches the design class. "We have a mandatory three-course sequence and this is the final required course." Unlike earlier courses, where problem solutions are given, this one required the students to come up with the solution.

Simon Mushi '06 says designing a circuit, which enabled the tank's guns to lock in on the target and fire, was the toughest. "The biggest challenge was mastering the target acquisition algorithm and getting it to work," he says.

The students also had to get parts and coordinate with technicians in the machine shop to have some made. "We got a chance to apply what we've learned in class to actually making something work and do what we wanted it to do, so it was a lot of fun," says Jeff Mentzer '06. "Having something come together and work, getting the hang of using a soldering iron, and soldering parts to the board—it's really interesting to watch and think, 'Hey, I designed that!'"

Mentzer says the skills he's learned will help him when he gets a job. "Working with a partner and practicing project management skills are some things I can take from this class and apply to any other design projects I'm given," he says.

Other students in the course were Scott Curry, Amanda Driscoll, Laura Fredley, David Glasser, Sherrise Hatcher, Tricia Indoe, Edward Kimotho, Hugh King, John Kolba, Mark Lodato, Marc London, Zach Silverman, Joanna Vetreno, Danielle Wyckoff, and Yang Feng Zheng. ▀

Faculty News

Small Jouny was on sabbatical in fall. In spring, he taught electromagnetics, communications, and digital signal processing. His research focused on detection of malignant tumors in mammograms, and blind source separation. He was appointed Charles A. Dana Professor of ECE.

John Greco taught a new special topics course in robotics, and he also taught the digital circuits sequence. He served on several Lafayette committees and will be on sabbatical in fall 2005.

William Jemison taught ES101, the introductory engineering course in which students designed and built an emergency white LED-powered lighting system. He is engaged in research on wireless/fiber communications and has several students working with him as EXCEL Scholars.

Todd Wey finished his first year at Lafayette. He taught the junior design course and is active in lab development and research. He has submitted research articles and is working on an invited article.

John Nestor taught Senior Design I in which students designed a computer network using FPGA where the code is written in Verilog. He will present this design at a microelectronics education conference. He also taught VLSI in which students completed the design of analog-to-digital converters.

William Hornfeck was acting department head in fall 2004 and led a group of engineering students on the Lafayette Semester Abroad program in Brussels, Belgium in spring 2005. He taught engineering ethics and a First-Year Seminar on energy sources.

Kim Bennett, who has been on leave in Shanghai, China for the past two years has decided to leave Lafayette and continue his work there. A member of the faculty for 15 years, he established the fiber optics lab and involved numerous students in his research. ▀

Web Site Update

The web site for the electrical and computer engineering department is being redesigned. The new look will go live by August. Alumni and friends are encouraged to visit the site and contribute to the alumni survey. Visit www.lafayette.edu/~ee

Class of 2005 Job Success

All electrical and computer engineering graduates in the Class of 2005 who were seeking employment had jobs confirmed prior to graduation. Some of the employers include Microsoft, Lockheed Martin, Lutron, Picatinny Arsenal, Merrill Lynch, and Proctor and Gamble.

Lafayette to Host Bioengineering Conference

The 32nd annual Northeast Bioengineering Conference will be hosted April 1-2, 2006 by Lafayette. Papers by electrical, mechanical, chemical, biomedical, or bioengineering specialists from industry representatives, faculty, or students will be presented. Research proposals are being accepted now. Visit the conference web site for updates and details. Sponsored by International Society of Electrical and Electronics Engineers and Engineering in Medicine and Biology (EMBS).

To access the conference web site, go to <http://www.lafayette.edu> and click on "academics," then "engineering," then "NEBC2006."

2005 Honor Graduates

The following students, listed with the title of their theses and their faculty advisers, graduated with honors in electrical and computer engineering.

Farhan Ahmed, "Kernel Extensions to μ C/OS-II Real-Time Operating System on the Motorola 68HC11," Jeff Gum and John Nestor

Oliver Bowen, "Improving Routing Performance using an FPGA Maze Routing Accelerator," John Nestor

Kavon Nasabzadeh, "Extensions to Direct Grid Maze Routing Accelerators," John Nestor
Ben Ellwood, "The Laser Bounce Listening Device," Jeff Gum

"Lafayette is classified as one of the nation's most academically competitive colleges and is committed to providing the best possible undergraduate education in the liberal arts, sciences, and engineering for men and women who can benefit from the Lafayette experience." —Peterson's Four-Year Colleges, 2004



Designing Robots

A new special topics course was developed and taught by John Greco. Nine seniors in the course designed, built, and tested their own individual robots. These robots walked on black strips and reported their position to a computer program running on a PC.

They built five small robots, each with different specifications and objectives. The purpose was to enable them to explore a predetermined path. ⁿ



Kris Kleinbach '05 (left) and Tom Emanski '05 make adjustments to a microcontroller for a robotics course.

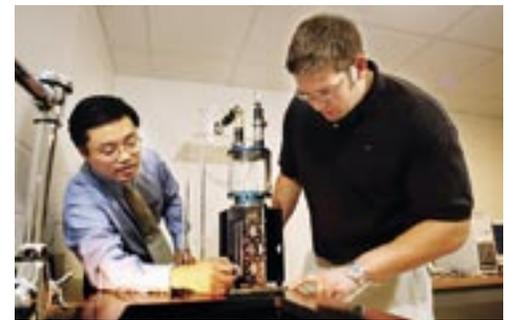
- Student-focused teaching and mentoring by an exceptionally qualified faculty, committed to each student's success.
- A challenging, broad-based academic curriculum that offers strong programs in the liberal arts, sciences, and engineering.
- A small college environment with large college resources.
- A friendly residential community offering an exciting social life with a broad spectrum of extracurricular activities.

Yu Receives NSF Grant for Biomedical Engineering

The National Science Foundation has awarded a \$138,000 grant to Yih-Choung Yu that will enhance research and learning opportunities in the biomedical laboratory he has established in Acopian Engineering Center. It will further his research in biomedicine and enable students to receive technical training rarely available for undergraduates. It will also provide access to high-end equipment to conduct research and for training in signal processing, control, and bioengineering.

Previously, Yu received a grant from the Lindback Foundation, which he and three students used to develop a mock circulatory system for research to improve testing procedures for ventricular-assist devices and enhance cardiovascular physiology instruction. The loop simulates key blood pressures and flows in the human cardiovascular system. The grant will enable continued work on the mock circulatory loop as well as development of a controller for ventricular-assist devices.

"Bioengineering is an emerging field in which hands-on experience is important," says Yu. Students pursuing a bioengineering minor will



Christopher Royle '03 did research on ventricular-assist devices as an EXCEL Scholar with Yih-Choung Yu, assistant professor of electrical and computer engineering.

have more opportunities for work involving fluid mechanics, cardiovascular physiology, electro-mechanical devices, instrumentation, signal processing, automatic control, and computer programming.

Students who have worked with Yu include Christopher Royle '03, Pujitha Weerakoon '04, Matthew Loh '04, Farhan Ahmed '05, Joshua Porter '06, and Simon Mushi '06. ⁿ

Student Research Receives Awards

Oliver Bowen '05 won third place at the IEEE Region II paper competition for his paper "Improving Routing Performance using an FPGA Maze Routing Accelerator."

Farhan Ahmed '05 won first place at the IEEE Walter B. Morton Student Contest in the Lehigh Valley for his work "Kernel Extensions to μ C/OS-II Real-Time Operating System on the Motorola 68HC11." ⁿ

Farhan Ahmed '05 (far right) is conducting honors research guided by Chun Wai Liew (left), associate professor of computer science, and John Nestor."

