IOWA STATE UNIVERSITY
Department of Electrical and Computer Engineering

alumni newsletter
spring 2011
volume 27
issue 2

ecpe connections

student iPhone apps generate thousands of downloads

more inside ...

- phd program receives high marks
- professor increases solar cell efficiency
- alum discusses contributions to fax technology

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letter from the chair

As we put this newsletter together, our department is working diligently on several efforts to further improve our already excellent research and education programs.

First, our faculty are in the process of developing a new strategic plan for the department. The new plan will seek to enhance our efforts in the five strategic research areas set forth in our last strategic plan, which was developed in 2004. The five research areas we are focusing on are bioengineering, cyber infrastructure, distributed sensing and decision making, energy infrastructure, and small-scale technologies. Focusing research efforts on these particular areas will help position the department, our faculty, and our graduate students to conduct cutting-edge research at the interface of electrical engineering, computer engineering, and other engineering and scientific disciplines where exciting advances can be made and where our research can make the most significant impact on statewide, national, and international engineering challenges.

Second, we have reorganized the department's central administrative committee. The most notable change is the addition of a Director of Research. The new Director of Research will oversee a new research committee that will help the department to identify research opportunities and sources of research funding. Professor **Vikram Dalal** has been appointed the Director of Research. In addition, Professor **Manimaran Govindarasu** has been appointed the department's new Associate Chair and Associate Professor **Zhengdao Wang** has been appointed the Director of Graduate Education.

Another step we are taking to continue to move the department forward is setting up an external review of the department. We are in the process of inviting four leading experts in the field to look objectively at our department's research, education, and outreach programs and provide us with advice on areas in which we can improve so we can advance our position among the best electrical and computer engineering programs in the country.

Additionally, I am pleased to report that several of our faculty and alumni have been honored recently for their research and other career achievements. For example, three professors in our department have been named fellows of professional associations (page 3), alumnus **Chad Bouton** was named the Battelle Inventor of the Year (page 15), and alumnus **Mark Law** received the very prestigious J. J. Ebers Award (page 16). From developing iPhone apps (page 11) and excelling on internships (page 10) to winning IBM PhD fellowships (page 13), our students are continuing to do impressive work as well.

We are justly proud of the accomplishments and impact our alumni, students, and faculty are making on the technology that we use today and will use in the future.

Have a wonderful spring and summer!

David Jiles

David C. Jiles
Palmer Department Chair in Electrical and Computer Engineering
Anson Marston Distinguished Professor

about the cover photo

iPhone apps created by computer engineering students have been downloaded thousands of times since last November. Photo by Kenzie Brennan.

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Department Chair: David C. Jiles
Newsletter Editor: Dana McCullough

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three ecpe faculty
elected fellows

Srinivas Aluru (MSComS '91; PhDComS '94), Mehl Professor of Computer Engineering, was elected a Fellow of the American Association for the Advancement of Science (AAAS) "for distinguished contributions to high performance computational biology, particularly for enabling large-scale genome analysis and systems biology through creation and application of novel parallel methods." Aluru has pioneered the development of parallel computing methods to solve large-scale problems in biology. He has developed parallel methods and software that greatly reduce large genome assembly time, and developed the first parallel method for inferring whole-genome networks of complex organisms. His work to sequence the maize genome was featured in a 2007 *Science* magazine.

Vikram Dalal, Whitney Professor in Electrical Engineering and director of the Microelectronics Research Center, was elected a Fellow of the American Physical Society (APS) "for pioneering applied research in physics of thin-film photovoltaic materials and devices and for invention of industrially important photovoltaic devices." Dalal invented two of the basic device structures used today in thin-film silicon photovoltaic devices, has made many advancements in research on growth physics and electronic properties of amorphous and nanocrystalline silicon materials for use in photovoltaic devices, and recently invented a novel device structure that uses a superlattice between an amorphous and a silicon semiconductor.

Doug Jacobson (BSCpE '80; MSEE '82; PhDCpE '85), university professor and director of the Information Assurance Center, was elected a 2011 Fellow of the Institute of Electrical and Electronics Engineers (IEEE) "for contributions to information assurance education and practice." Jacobson is an expert in information assurance and large-scale cyber attack simulation, and established the world's first virtual cyber defense laboratory, the Internet-Scale Event and Attack Generation Environment. He also is involved with numerous outreach programs, such as IT-Adventures (see page 4) and annual statewide cyber defense competitions, that create interest and excitement among high school and community college students in the areas of information technology and engineering.

Overall, nine ECpE faculty are IEEE fellows, two are APS fellows, one is an AAAS fellow, and five are fellows of other organizations. •

more online

For more information on the three fellow awardees and their career achievements, visit *www.ece.iastate.edu/news/honors-and-awards*.

Arend J. Sandbulte (BSEE '59) and his wife, Verna Sandbulte

electrical engineering alum establishes new faculty fund for
professorship in electric energy

Long-time Iowa State University supporters **Arend "Sandy" and Verna Sandbulte** of Duluth, Minn., have gifted more than $500,000 to establish the Arend J. and Verna V. Sandbulte Faculty Fund at Iowa State University. The faculty fund will benefit ISU's College of Engineering, and the Arend J. and Verna V. Sandbulte Professorship in electric energy will be created from the fund.

"Iowa State has had an enormous impact on our lives and establishing such a faculty position is a wonderful way for us to give back and provide outstanding learning opportunities for Iowa State students," the Sandbultes say.

Arend Sandbulte is a 1959 bachelor's degree graduate in electrical engineering and went on to a successful career in the electric utility industry in northeast Minnesota with Allete, Inc., most recently serving as chairman and CEO.

This professorship will be awarded to an elite faculty member, allowing the college to recognize the greatest need for faculty support in electric energy. This area encompasses all applicable engineering disciplines within the various stages of the electric cycle, including, energy generation, energy storage, energy transportation, energy application, and energy efficiency.

"During *Campaign Iowa State*, the College of Engineering has been fortunate to receive a number of endowed faculty positions, such as the Sandbulte Professorship," says Jonathan Wickert, dean of the College of Engineering. "We are grateful to the Sandbultes and their long-term commitment to our college, which will allow us to recruit the very best teachers and researchers to this campus."

The gift is part of *Campaign Iowa State: With Pride and Purpose*, the university's $800 million fundraising effort. •

—ISU Foundation Communications

calendar of events

APRIL 11-17
VEISHEA
Event times and locations vary; *www.veishea.iastate.edu*

APRIL 19
ISU Undergraduate Research Symposium
Memorial Union, 8 a.m.-4 p.m.

APRIL 20
ECpE Scholarship, Honors, and Awards Banquet
Scheman Building, 5:30 p.m.

APRIL 29-30
IT-Olympics
Hilton Coliseum, event times vary; *www.it-adventures.org*

MAY 6
Master's and PhD Commencement Ceremony
Stephens Auditorium, 7:30 p.m.

MAY 7
Undergraduate Commencement Ceremony
Hilton Coliseum, 1:30 p.m.

MAY 12-14
ISU Alumni Days
Event times and locations vary; *www.isualum.org/en/events/alumni_days*

SEPTEMBER 27
Fall Engineering Career Fair
Hilton Coliseum, 12 to 6 p.m.

more online

For more details on events and seminars, visit *www.ece.iastate.edu.*

IT-Adventures high school students build robots that battle at the annual IT-Olympics competition.

it-olympics interests high school students in
tech careers

Iowa State University is hosting the fourth annual IT-Olympics competition at Hilton Coliseum April 29-30. The competition culminates a yearlong IT-Adventures program that engages high school students in learning about robotics, cyber defense, and video game design. Last year, nearly 500 students from 45 Iowa high schools competed, and similar numbers of students are expected to compete again this year.

The program's goal is to generate more interest in information technology (IT) and related careers. High schools throughout Iowa establish local IT-Clubs and arrange for local IT professionals to mentor the students and their teachers. Iowa State provides the IT-Clubs with the tools they need to run the clubs at no cost to the students or schools. Corporate sponsorships, foundations, and donations from individuals provide financial support for the program.

So far, nearly 80 students who have participated in IT-Adventures and related programs in the past five years have enrolled at Iowa State in an IT-related area. More than 30 of them enrolled in electrical, computer, or software engineering majors. •

professor gains new perspective, research ideas
working in industry

Associate Professor **Srikanta Tirthapura**'s research focuses on building scalable ways to process large data sets, so when an opportunity came for him to work for a year at San Francisco-based Oracle, a leading database company, Tirthapura jumped at the chance to get insight and experience in industry to help him with his research and teaching efforts.

industry project

In April 2009, Tirthapura took leave from Iowa State and started his position as a consulting member of technical staff at Oracle. He worked on two main high-performance database projects during his time there. In one project, Tirthapura worked on a team that investigated how best to take advantage of the single instruction multiple data (SIMD) parallelism provided by recent server chips made by manufacturers such as Intel. In particular, Tirthapura designed database software to take full advantage of the hardware's parallelism. "While hardware manufacturers are providing more parallelism in their chips, it is a current and future challenge to make effective use of this parallelism in the software," he says.

He also says he liked working on this project because he and his team came up with a novel parallel algorithm for a critical problem within the database and implemented it within the system.

"I could directly see the new code helping to speed up other database components," he says.

For another project, Tirthapura designed effective strategies to manage database buffer cache, the portion of the main memory set aside for temporarily storing popularly accessed data in the database, and speed up data retrieval.

"We worked on a database module that decides which pages to keep in the cache, especially in the presence of multiple tiers of secondary storage technologies, with varying latency and throughput, such as slow disks, fast disks, and SSD drives," he says. "This is essentially an optimization problem, but one that has to be solved online and with limited information about future accesses."

lessons learned

By taking time away from researching and teaching to work in industry, Tirthapura gained a better perspective on what is currently happening and how different processes work in industry. He also previewed upcoming challenges in computer systems research.

"Some of the main lessons I learned were about how their software was constructed, developed, maintained, and tested," he says. "It is really a massive effort to develop and synchronize such a large piece of software, and it was really impressive to see the process by which Oracle did it."

Tirthapura hopes to bring this renewed perspective into his research lab and classroom. He is planning to pursue future research to address the challenges of designing algorithms and writing effective software for modern massively parallel multicore architectures. He's also planning to use more real-world examples in class to help his students learn more about industry software development practices and processes. •

Julie Dickerson, *center,* received an Iowa Women of Innovation Award.

dickerson wins women of innovation award

In November, **Julie Dickerson**, associate professor, received the Technology Association of Iowa's Women of Innovation Award for Research Innovation and Leadership for her work in systems biology and fuzzy logic. Specifically, Dickerson was honored for her work in developing a sophisticated data analysis tool that helps researchers understand and test hypotheses in the context of entire biochemical pathways, chromosomal locations of genes, and a large array of experimental and field conditions. She also specializes in applying fuzzy logic theory to identify groups of co-regulated genes, and to infer their genetic network interactions. •

electrical engineering PhD program receives high marks

In September, the National Research Council (NRC) released a new ranking of doctoral research programs. Iowa State's electrical engineering program tied for 28th out of 136 programs in those rankings, an improvement of 23 positions from the last ranking released by NRC in 1995, and the second biggest improvement among the top 40 ranked programs in the country.

Data for the rankings was collected from 2005 to 2006. Programs were evaluated on research publication statistics, citation information, research funding, and GRE scores of students. The NRC is the research arm of the National Academies that includes the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. While the NRC did not give specific numbers to programs, the 28th place ranking was determined by averaging the ranking number range for programs provided by the council. •

—Randall L Geiger

faculty and staff recognitions

Congratulations to the following faculty and staff on their recent professional awards and honors:

- **Tom Baird** (MEngEE '76), program manager of Electric Power Research Center (now retired), won the ISU Extension Annual Conference Meritorious Service Award in October.
- **Sumit Chaudhary**, assistant professor, received a 2011 National Science Foundation CAREER Award for his research project titled, "Utilizing Ferroelectrics for Multifaceted Device Engineering of Polymer Solar Cells."
- **Ahmed Kamal**, professor, and **Aditya Ramamoorthy**, assistant professor, received a U.S. patent for "1+N Network Protection for Mesh Networks: Network Coding-Based Protection Using P-Cycles and Protection Paths" (no. 7,869,344).
- **Diane Rover**, professor, was named the director of Strengthening the Professoriate at Iowa State University, and will serve as a single contact on campus to gain knowledge in developing quality National Science Foundation Broader Impact programs.
- **Ruth Shinar**, adjunct professor, won the ISU Professional and Scientific Research Award.

more online

For more details on faculty and staff recognitions, visit *www.ece.iastate.edu/news/honors-and-awards.*

course spotlight on vertical design

The ECpE department is starting to implement a vertical design approach into the undergraduate curriculum. The goal is to provide students team-oriented design experiences in the context of real applications throughout their college experience, rather than just in their final year. The students take a sequence of courses on a specific theme that provides hands-on learning experiences on state-of-the-art platforms in their sophomore, junior, and senior years. The course sequence builds up to the students' capstone design project in their final year.

"This provides students with a system-level thinking about engineering design in the early stage of their education that can excite them to be an engineer and relate concepts learned from multiple courses in the context of solving real problems," says **Manimaran Govindarasu**, professor.

The vertical design approach was first tested in the embedded systems area, and because of its success, the department plans to incorporate the approach into other areas such as robotics, communications, software systems, and computer architecture. The approach may add two, 1-credit-hour required courses for students.

Akhilesh Tyagi, associate professor, says students in the department's senior design courses have helped develop labs for the vertical design courses. In particular, they developed a module that emphasizes hardware assembly, robot programming, and logic design, as well as another module that focuses on operating systems, algorithms, and software engineering. •

pandey develops technology to help neuroscientists

observe cells and understand diseases

When neuroscientists grow live cells today, they place a petri dish of cells in a temperature- and gas-controlled incubator and hope the cells grow without problems. They can observe the cells only by removing them from the incubator and placing them under a light or electron microscope.

Santosh Pandey, assistant professor, is working to give neuroscientists the first-ever tool that allows them to observe live cells—down to a single neuron—without the aid of a microscope and at real time as the cells grow. Pandey's tool is a flexible platform that can perform high-resolution sensing of surface charges and ionic currents of living cells. These two measurements provide important information about cell membranes and underlying membrane proteins (aka ion-channels), which could lead to a greater understanding of diseases related to dysfunctions in ion-channels such as Alzheimer's, epilepsy, cystic fibrosis, migraines, cardiac arrhythmias, and hypertension.

"Understanding the pivotal role of ion-channels and their encoding genes in diagnostics requires measurement tools with high-resolution and distributed sensing," Pandey says in his research proposal. "This project is motivated by the need to miniaturize arrays of devices with higher resolution and the present lack of integrated measurement tools for advanced cellular studies."

The tool Pandey is currently developing is a 2 mm x 2 mm silicon chip (about the size of a pinhead) that will house hundreds of thousands of super tiny devices called floating-gate field-effect transistors (FETs) that act as electronic charge sensors. Each of the FETs will be 1 micron in size—roughly the size of a very small dust particle, and 100 times smaller than the diameter of an average strand of human hair.

"Currently, there is no technology to observe continuous growth of live cells at real time," Pandey says. "The silicon chip we're creating will have hundreds of thousands of devices, and each device will be capable of remotely monitoring spatial and temporal changes during cell growth."

The FET devices will be able to detect miniscule fluctuations in the electrical charge of the cell membrane, thus allowing electrophysiologists, molecular biologists, and neuroscientists to observe at real time and with high resolution the evolution of surface and ionic charges, as well as electronic cell-to-cell communication, which is an important aspect of a properly functioning nervous system.

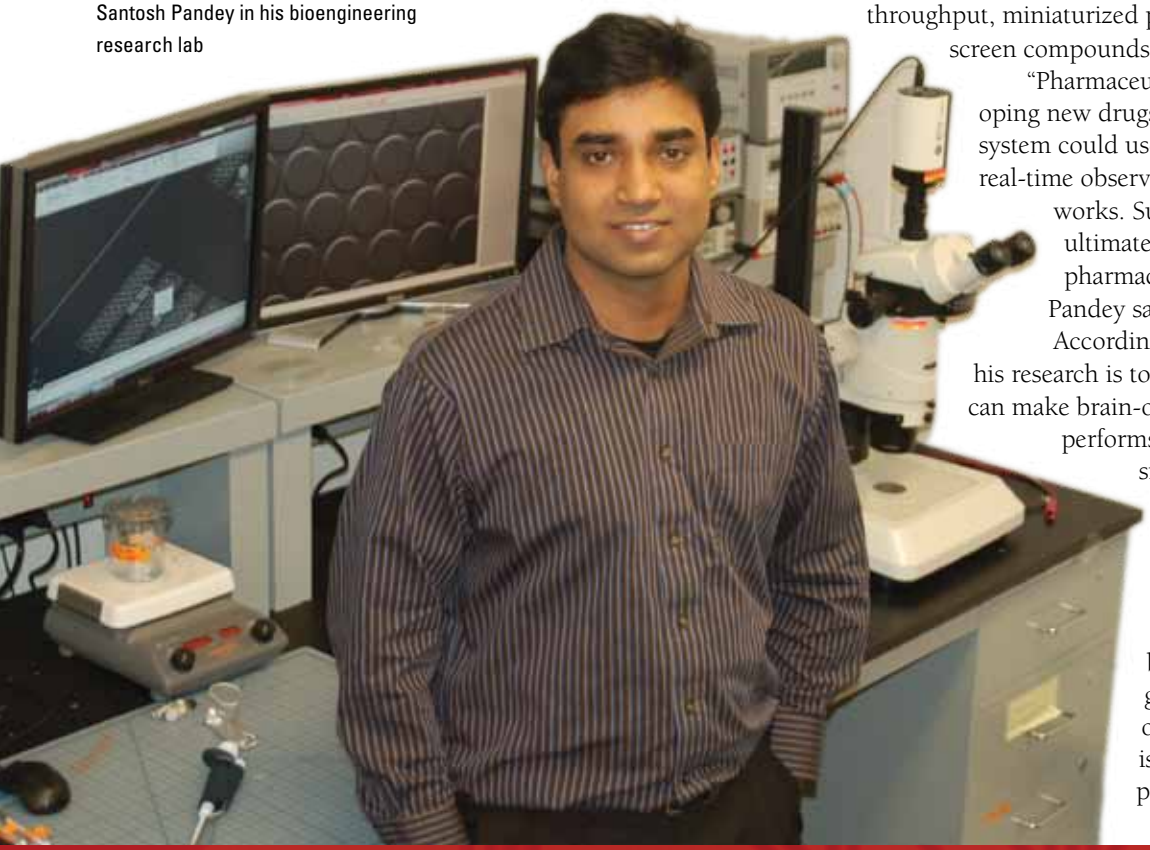
"We are focusing on neuronal cell lines and neural networks to study how, when, and why they form connections (or synapses), and how these connections are disrupted in the presence of external factors," Pandey says. "The understanding of neuronal growth and evolution of neural networks on a high-resolution electronic imaging platform will help speed the process of new drug discovery for neurodegenerative diseases."

The composition of Pandey's FET devices, which include an integrated system of various charge sensors, sites for accessing the cell membrane, and instrumentation amplifiers to process the recorded signals, will allow each neuron growing on the device to be imaged by at least 16 different devices. He says areas such as neuroscience and pharmacology can benefit from his high-throughput, miniaturized platform because it can help them screen compounds faster.

"Pharmaceutical companies working on developing new drugs for dysfunctions of the nervous system could use this in vitro testing platform for real-time observation of drugs on neuronal networks. Such high-throughput bioassays will ultimately help speed medical research in pharmacology and ion-channel diseases," Pandey says.

According to Pandey, the ultimate goal of his research is to create technology that some day can make brain-on-a-chip (a 'neural' computer that performs like the brain but on a much smaller scale) or a brain-computer interface (technology that could assist, augment, or repair human cognitive or sensory-motor functions) a reality.

Pandey's research is supported by a National Science Foundation grant. Richard Martin, a professor of biomedical sciences at Iowa State, is a co-principal investigator on this project. •



Santosh Pandey in his bioengineering research lab

Sumit Chaudhary, *left*, and Kanwar Singh Nalwa, *right*, in their research lab

Photo by Leah Hansen.

chaudhary and nalwa fabricate

more efficient polymer solar cells

Researchers from Iowa State University and the Ames Laboratory have developed a process capable of producing a thin and uniform light-absorbing layer on textured substrates that improves the efficiency of polymer solar cells by increasing light absorption.

"Our technology efficiently utilizes the light trapping scheme," says **Sumit Chaudhary**, assistant professor and an associate of the U.S. Department of Energy's Ames Laboratory. "And so solar cell efficiency improved by 20 percent."

Chaudhary says the key to improving the performance of solar cells made from flexible, lightweight, and easy-to-manufacture polymers was to find a textured substrate pattern that allowed deposition of a light-absorbing layer that's uniformly thin—even as it goes up and down flat-topped ridges that are less than a millionth of a meter high.

The result is a polymer solar cell that captures more light within those ridges—including light that's reflected from one ridge to another, he says. The cell also is able to maintain the good electrical transport properties of a thin, uniform light-absorbing layer.

Tests indicated the research team's light-trapping cells increased power conversion efficiency by 20 percent over flat solar cells made from polymers, Chaudhary says. Tests also indicated that light captured at the red/near infrared band edge increased by 100 percent over flat cells.

The idea of boosting the performance of polymer solar cells by using a textured substrate is not a new one, but this is the first time the idea has been successfully implemented in polymer solar cells, Chaudhary says. The technology is commonly used in traditional, silicon-based solar cells.

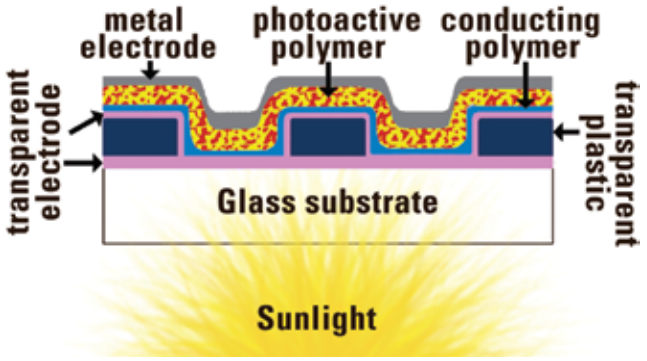
But previous attempts to use textured substrates in polymer solar cells have failed because they require extra processing steps or technically challenging coating technologies. Some attempts produced a light-absorbing layer with air gaps or a too-thin layer over the ridges or a too-thick layer over the valleys. The result was a loss of charges and short circuiting at the valleys and ridges, resulting in poor solar cell performance.

But, get the substrate texture and the solution-based coating just right, "and we're getting more power out," says **Kanwar Singh Nalwa**, ECpE graduate student and student associate at the Ames Laboratory.

Researchers working with Chaudhary and Nalwa on the solar cell project are Kai-Ming Ho, Distinguished Professor of physics and astronomy and an Ames Laboratory faculty scientist, and Joong-Mok Park, assistant scientist with the Ames Laboratory. The research was supported by the Iowa Power Fund, Ames Laboratory, and the Department of Energy's Office of Basic Energy Sciences. Details of the fabrication technology were recently published online by the journal *Advanced Materials*.

The Iowa State University Research Foundation has filed a patent for the substrate and coating technology and is working to license the technology to solar cell manufacturers. •

—ISU News Service



Researchers discovered that by reducing the height of a polymer solar cell's underlying topographical features and increasing the pitch, they could put a thin, uniform light-absorbing layer on the textured substrate. In these solar cells (pictured above), the sunlight enters through the glass substrate. The researchers' discovery results in a 20 percent increase in the efficiency of polymer solar cells due to increased light absorption.


Tien Nguyen working in his office

professor helps developers prevent, detect

software bugs

Bugs are the nemesis of software developers and users everywhere. And now **Tien Nguyen**, associate professor, is creating three novel tools to help developers identify and fix bugs faster and earlier in the development process, and prevent bugs from reoccurring in the same type of systems. Software users will benefit, too, because the software they use will be more reliable and secure, and less expensive due to Nguyen's new tools.

The tools Nguyen and his two PhD students **Tung Thanh Nguyen** and **Hoan Anh Nguyen** are creating include a tool to collect and characterize the prior known bugs in several software systems, a tool to automatically prevent recurring bugs by identifying locations of potentially recurring buggy code in a system, and a tool to provide recommendations and guidelines to fix buggy code by propagating prior known fixes to new buggy code locations.

Nguyen's tools are unique because his team's approach is the first to capture the essence of prior known bugs and fixes and leverage them to help prevent and detect potential recurring bugs in other systems. His approach combines empirical studies, advanced program verification, and program analysis techniques to discover the connections between recurring bugs and software reuse.

"Our empirical techniques enable us to leverage historical information on prior bugs while our advanced program verification and analysis techniques facilitates the capture of semantic similarity among bugs and fixes, and the propagation of known fixes to the new locations of recurring bugs," Nguyen says.

Nguyen's research, which is funded by the National Science Foundation, could have a great impact on the software industry. For example, his tools will help developers prevent and detect software defects early in the software's life cycle, which will save time and effort in fixing bugs, as well as enable developers to more quickly locate potential buggy code. The tools also will allow programmers to be more active in fixing bugs, because they will be able to refer to recommendations and guidelines from Nguyen's tools rather than wait to see answers on discussion boards from others who have faced similar problems. Developers working in industries where software plays a key role, such in embedded systems and mobile software, could use the tool, too.

"More efficient test cases will be produced to earlier reveal and prevent similar software security vulnerabilities in different systems," Nguyen adds.•

ecpe faculty

research in brief

using ultrasound to prevent premature births

Premature birth is a leading cause of infant mortality in the United States, and **Timothy Bigelow**, assistant professor, is developing a noninvasive ultrasound technique that could diagnose the risk of premature delivery earlier during pregnancy, allowing doctors to better help their patients. Specifically, the technique Bigelow and his collaborators from the University of Illinois-Chicago and Rush University Medical Center in Chicago are developing could detect tissue property changes in a woman's cervix using new signal processing methods on ultrasound echoes. With a grant from the National Institutes of Health, Bigelow and his collaborators are testing algorithms they have developed by comparing ultrasound echoes from the cervix before and after giving patients drugs to induce delivery. Results from this research could transform how pregnant women at risk of pre-term delivery are treated and monitored.

stimulating the brain with magnetic fields

David C. Jiles, Palmer Department Chair, and his research team recently have invented new coil designs for magnetic field generation that could help treat patients recovering from strokes. The coils they have developed can generate magnetic fields within the brain to determine which part of the brain is responsible for certain functions. By influencing the brain's plasticity, responsiveness, or excitability with magnetic fields, doctors may be able to improve a patient's feeling, movement, or language skills lost after suffering a stroke. The new coil designs overcome the principal challenges faced in improving the performance of stimulator coils: the ability to stimulate the brain at depth and increasing the localization of stimulation. The research is a United Kingdom government-funded project and two companies, The Magstim Company and Gatmetrix, are collaborators on the project.

managing power for analog and RF loads

Ayman Fayed, assistant professor, has developed a new control technique that allows engineers to directly power sensitive analog/RF modules in battery-operated portable electronics, thus eliminating energy inefficient linear regulators and expensive noise filtering. This significantly improves power and thermal efficiency of portable devices used in military and commercial applications, leading to longer battery life and lower costs. The Grow Iowa Values Fund and Rockwell Collins funded the research.

increasing engineering enrollment, retention

Since 2008, **Diane Rover**, professor, has been leading a National Science Foundation-funded effort to increase the number of engineering graduates at Iowa State University by 100 per year, as well as increase the number of women and minority students in engineering at Iowa State to 20 percent and 10 percent, respectively. Rover and her collaborators have implemented two programs—an engineering orientation course at Des Moines Area Community College (DMACC) and Engineering Admissions Partnership Program for community college students—that have resulted in increasing enrollment of transfer students in engineering at Iowa State.

more online

See more details on this faculty research at *www.ece.iastate.edu/news/ecpe-connections.*

keep in touch!

We want to hear about your career moves and personal news for future issues of *ECpE Connections*! Please fill out the form below or online at *www.ece.iastate.edu/alumni* (click Alumni News Form) to share your news.

Name: _____ Graduation year(s) and degree(s): _____

Address: _____ City: _____

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News I'd like to share: _____

support the department

The ECpE department relies heavily on the support of our alumni and friends to ensure that students have access to scholarships and the latest lab facilities and classroom spaces, that faculty can continue to support graduate students and conduct state-of-the-art research, that department facilities remain updated for staff to do their jobs efficiently, and that student organizations and department events can continue to thrive.

If you would like to help the department continue to be one of the best in the country, you can support the department through several funds. Additional opportunities are available to support endowments and building space. Please check the appropriate box below if you want to offer your support today, or visit *www.foundation.iastate.edu*. For more information about the funds, contact the College of Engineering Development Office at 515 294-2416 or jmeseke@iastate.edu.

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Electrical/Computer Engineering Excellence Fund (0549612)

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❑ ECpE Coover Hall Building Project

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Credit card number: _____ Name as shown on credit card: _____

Expiration date: _____ Cardholder signature: _____

Thank You!

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Mailing Instructions: Detach this form along the perforated edge. Fold the form in thirds so that the ECpE address shows on the outside. Tape the form closed and place your stamp in the labeled box. If you're mailing a check, remember to completely seal the edges of the form or send the form along with your check in a standard envelope.

student profile:

anna grimley

why did you want to study electrical engineering?

I was an undeclared engineering major in my first and part of my second semester. The career fair helped me decide that electrical engineering would be a good fit. I asked companies I knew of and liked what kind of engineering majors they were in need of and most of the responses were "electrical." I also feel with electrical engineering that it's an extremely well-rounded degree, which will allow me to go on to almost anything. I know bank owners, politicians, and great business owners with electrical engineering degrees.

tell us about your Rockwell Collins internship.

I worked in the Digital Signal Processing group. I tested and researched different uses for Rockwell Collins' model of high-frequency modem that is used commonly in submarines, as well as many other places. I learned all about high-frequency modems, their uses in the real world, and what different types of standard waveforms are used for. I learned a tremendous amount in one summer.

what was the most fun thing about your internship?

At an intern/co-op picnic I met Clay Jones, president and CEO of Rockwell Collins. While I was talking with him, another ISU intern asked him if he arranges lunches with interns and he accepted the offer. Arrangements were made and I had a two-hour lunch with Clay Jones with a small group of interns and co-ops. It was a really neat experience to talk to him and hear about his thoughts for the future of engineering and Rockwell Collins.

what are your career plans after Iowa State?

My dream job is to be at a place where I feel like my contributions are meaningful, to work on projects in collaborative team environments, and be with a company where I can have the opportunity to do outreach activities to promote technology-based careers to youth. Right now, I like government systems-related work, and I could see myself becoming a systems engineer at a government engineering firm. •

Anna Grimley at her Rockwell Collins internship

Special thanks to Rockwell Collins for allowing the ECpE department to take Anna Grimley's photo in its laboratory.

quick bits

Major: Electrical Engineering **Year:** Junior

Hometown: Springville, Iowa

Activities: Alpha Gamma Delta sorority, choir, STARS (Student Admissions Representatives), 4-H Foundation, Fall 2010 Engineering Career Fair co-chair, 2011 E-Week general co-chair

Internship: Rockwell Collins, Summer 2009

Scholarships: ISU Academic Achievement, VEISHEA Community Involvement, and National Defense Industrial Society scholarships

IOWA STATE UNIVERSITY
Dept. of Electrical and Computer Engineering
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computer engineering students' iPhone

apps generate thousands of downloads

Since November, thousands of people have downloaded the iAnimal series, Zombie Strategies: Prepare, and D&D Helper iPhone applications. Users of those apps may be surprised to learn that the apps were created by ISU computer engineering students. The students developed the apps as part of a course assignment in a new embedded systems class on mobile platforms. As of February, the students' apps had been downloaded more than 2,800 times and generated more than $200 in sales.

"I originally created iGiraffe as a simple app that students would recreate during their first lab," says **Chad Nelson**, a teaching assistant for the course and member of a student senior design team that developed labs for the new course. "When I put it on the App Store, it started making money, so I added the others in the [iAnimal] series."

Nelson's four apps now generate about $5 a day in sales. "The most important thing to understand about the iGiraffe app, or any of the iAnimal apps is this: the skills the students learn in the class, even in the very first lab, have real market value," Nelson says. "You can take the app you create in the very first lab, sell it, and turn a profit."

The new embedded systems course on mobile platforms was introduced last fall and the students' final project for the class requires students to create their own iPhone app. Students were given extra credit for submitting their apps to the iTunes App Store.

Associate Professor **Akhilesh Tyagi** designed the course, which teaches concepts using the iPhone platform and focuses on fundamental aspects of embedded programming and development. The course takes students through the process of creating applications for the iPhone in 11 weeks.

Ben Holland, a recent graduate in computer engineering and now a graduate student in electrical and computer engineering, has seen a great deal of success since he released his free app, Zombie Strategies: Prepare (ZSPrepare), last Thanksgiving Day. ZSPrepare has been downloaded more than 2,000 times. The app is targeted toward individuals interested in post-apocalyptic survival scenarios and is an extension of ZombieStrategies.com, a website he created about a year and a half ago.

"ZombieStrategies.com became a hobby to which I devoted most of my free time, and having already built the ZombieStrategies.com framework before I started taking the course, it seemed only natural to extend the service to mobile devices as well," Holland says. "ZSPrepare works by determining the user's real-world location using Wi-Fi, cell tower, or GPS triangulation and then sending that location information to ZombieStrategies.com, which responds with a collection of survival supply locations surrounding the user."

Holland says he is pleased with the success he's seen so far, but ZSPrepare, which is downloaded nearly 40 times each day, wasn't as successful at first. "Apple features new applications for the first day or two so that people can notice them, but after that you need to rely on the momentum of your app to keep your sales going," Holland says. "I noticed that after about a week, my download numbers dwindled to only a few sales a day, so I started reading about marketing strategies online. I submitted my app to as many free app review sites as I could, which started to build a good Web presence."

Cory Schwarting, senior in computer engineering, also has been pleased with the success of his app, D&D Helper, a tool that aids individuals playing the tabletop game

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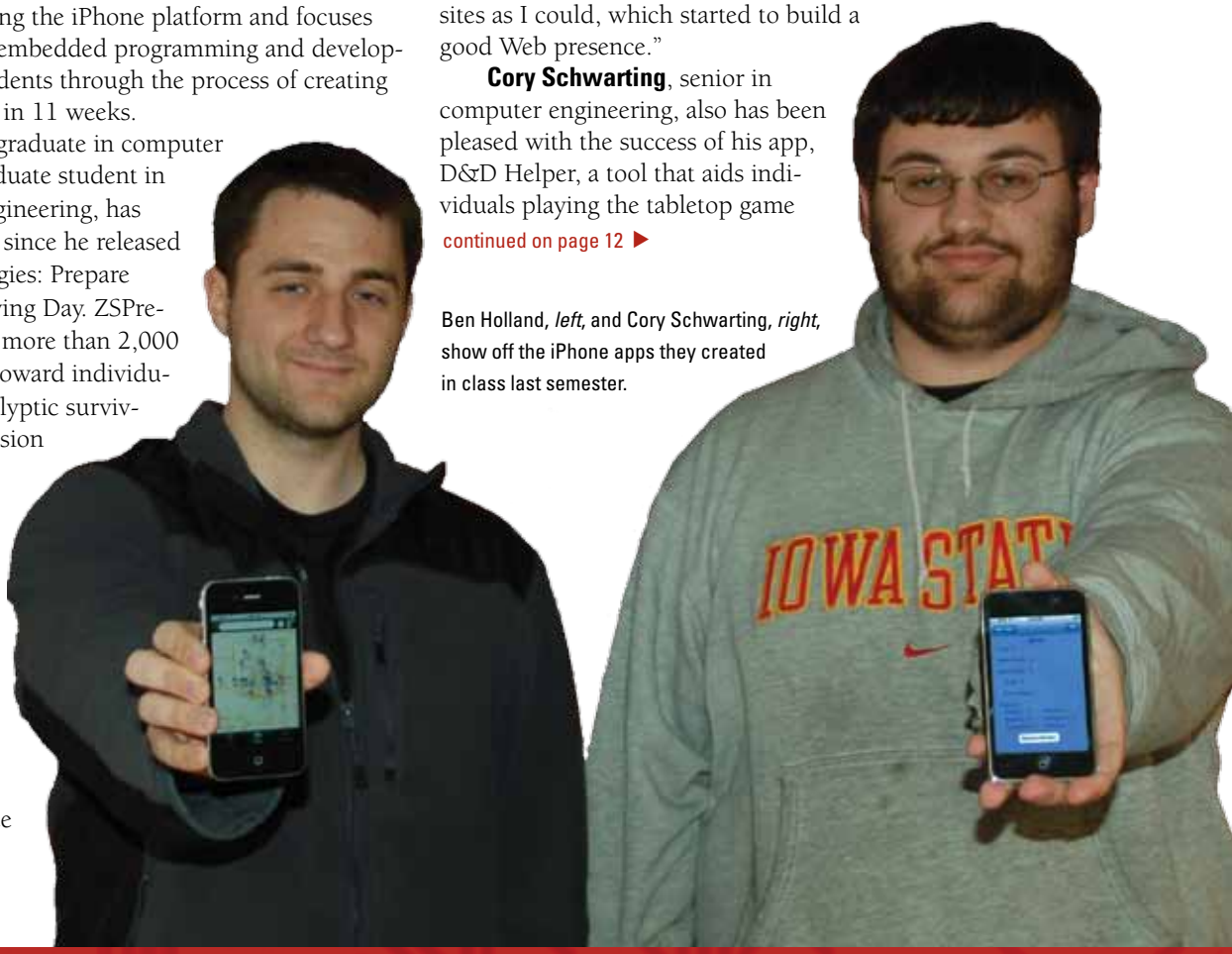
how to download the students' apps

You can download the Zombie Strategies: Prepare for free at the iTunes Apps Store. The iAnimal series apps (including iGiraffe, iPenguin, iPlatypus, iDonkey, and iSalamander) and D&D Helper can be downloaded for 99 cents each at the iTunes Apps Store. Additionally, Ben Holland has created two additional apps—Christmas Elf Quiz (free) and Lint: The Game (99 cents)—also available for downloading at the iTunes Apps Store.



Ben Holland, *left*, and Cory Schwarting, *right*, show off the iPhone apps they created in class last semester.

Photo by Kenzie Brennan.

▶ continued from page 11

Ben Holland shows the Zombie Strategies: Prepare iPhone app that he created last fall. The app has been downloaded more than 2,000 times since November.

Dungeons and Dragons. D&D Helper, which costs 99 cents, has been downloaded more than 800 times. The app allows users to quickly record and store game information and to modify it easily in a user-friendly interface. "I expected it to be somewhat successful since I even looked for an app to do the same thing, but there weren't any on the market," Schwarting says. "I did not expect it to be downloaded so many times, but I find it cool that there are plenty of people who are looking for similar apps."

For Schwarting, the most exciting parts of developing his app were going through the design process, laying it out in an appealing way, and making it quick to use. However, actually building and programming the app was the most challenging.

"I ran into a few issues with storing the information onto the device that took some time to figure out," he says. "The other challenge was looking into all the legal aspects of building the app. Some information is open for public use, and I wanted to make sure it was legal."

Both Schwarting and Holland agree that while the class was a lot of fun, it was also a great learning experience. "I was reminded that if you really want to learn and conquer a technology, you just have to jump in and do it," Holland says. "Anyone can learn it; you just have to have the patience to stick with it." •

—By Kenzie Brennan

how a freshman adjusts to college life

Adjusting to college life can be a challenge for some students, but for students like **James Robinson**, a freshman in electrical engineering from Chicago, getting involved in activities on campus is a good way to meet new people and adapt to living independently.

Robinson went to the ISU Club Fest event last fall and learned about two organizations—the Black Student Alliance and National Society of Black Engineers—that he quickly became involved with. Also, in an effort to earn some extra money to pay for college, Robinson started refereeing flag football and dodgeball intramurals.

"It's fun to watch students go out and enjoy themselves," Robinson says. "For the most part the students are just there for fun, but it does get a little competitive at times."

Robinson says he first became interested in studying electrical engineering when he came to Iowa State for a campus visit as a prospective student.

"I met professor Mani Mina and he had a huge passion for electrical engineering that I did not feel from other professors," Robinson says. "I figured electrical engineering was more fun and interactive."

He says that during his first year of college he has enjoyed being out on his own and experiencing a taste of the "real world." He also says the engineering course load at Iowa State is very demanding and rigorous, but he is learning to adapt to the demands of his classes. •

student honor roll

Congratulations to the following student award winners:

- **Ben Cao** and **Michael S. Svendsen**, both seniors in computer engineering, were awarded the annual International Engineering Consortium's William L. Everitt Award of Excellence for 2009-2010.
- Graduate students **Fu-Gang Hu**, **Amit Pande**, and **Abhinav Sarje** each won a 2010 ISU Summer Research Excellence Award.
- PhD students **Naveen Kumar**, **John Van Hemert**, and **Songyan Xu**, as well as master's degree student **Tao Zeng**, each won a 2010 ISU Fall Research Excellence Award.

more online

For more details on student awards, visit *www.ece.iastate.edu/news*.

electrical engineering student wins leadership award

Kaila Krieser, senior in electrical engineering, was one of three students selected to receive the 2011 Dean's Student Leadership Award. Juniors and seniors are nominated for the award based on their exemplary leadership in one or more college, university, community, or professional organization.

"I am surprised, but I feel extremely honored," Krieser says. "I am appreciative of having the opportunity to attend Iowa State. The university provided a variety of avenues that allowed me to excel."

Krieser has been an events chair for The Engineering Ambassador and Mentor Program (TEAM) since 2007, and was a student representative on the ECpE department's Infrastructure Planning and Development team and an electrical engineering peer mentor from 2007-2009. She is also active with her sorority, Pi Beta Phi.

After graduation, Krieser wants to explore her passion for traveling and move to the United Kingdom to find a technical marketing job. She also may pursue an advanced degree.

Photo courtesy of Kaila Krieser.

two students receive

ibm phd fellowships

For the fifth time in the past seven years, IBM has awarded PhD fellowships to Iowa State ECpE students. This year, two computer engineering PhD students—**Cory Kleinheksel** and **Joseph Idziorek**—each have been awarded an IBM PhD Fellowship for the 2011-12 academic year. The awards come with a $20,000 stipend and $10,000 education allowance for each student.

Karl Erickson (MSEE '98), a manager of Micro Processor Technology Development, IBM Rochester PhD Fellowship Coordinator, and an IBM Campus Relationship Manager with Iowa State, says the IBM PhD Fellowship program is extremely competitive and attracts hundreds of applications from students at universities worldwide.

"To earn two awardees from ISU is clearly an acknowledgement of the strength of the university, the College of Engineering, and the Department of Electrical and Computer Engineering," Erickson says.

Kleinheksel, who is specializing in data stream processing, will use the award to pursue research in the performance optimization and security of streaming data analytics.

"Challenges exist in making data stream processing scalable for the 1,000s (or millions) of streams required for future complex systems. While taking the next step in scalability, the challenges of security in data stream processing needs to be a forethought, not an afterthought," Kleinheksel explains. "I will be working to achieve that scalability through the use of heterogeneous resources and optimization, while working to provide security in the system."

Kleinheksel was introduced to this research challenge by his major professor, **Arun K. Somani**. Additionally, Kleinheksel's 2010 summer internship at IBM in Rochester, Minn., not only provided him with practical experience, but also allowed him to make several connections with researchers and developers in industry.

"While I was at IBM, I connected with several industry PhDs and made numerous other industry contacts. One of those contacts was directly in my area of research and has invited me to work with his team this upcoming summer in 2011," Kleinheksel says.

One of the people Kleinheksel met was **Sam Ellis** (BSComS '83), program director for InfoSphere Streams Development and an IBM Campus Relationship Manager with Iowa State. Ellis, who will serve as a mentor for both Kleinheksel and Idziorek during their fellowships, says Kleinheksel's research addresses important challenges in emerging data stream processing technology.

"From social media to machine-generated data to 'sensors-everywhere,' we're in the midst of a data explosion," Ellis says. "As the volume, variety, and velocity of information increases, organizations are challenged to effectively and efficiently distribute the right information, at the right time, to the people, processes, and applications that analyze and act upon that data. Stream processing provides a framework for analyzing this 'data in motion,' reducing decision time and increasing effectiveness for organizations."

Idziorek's award is a renewal of an IBM PhD Fellowship he received last year. He is specializing in secure and reliable computing, and his research focuses on cloud computing, which Erickson says is a strategic priority of IBM's Smarter Planet initiative. Specifically, Idziorek's research addresses an emerging computer security niche called Fraudulent Resource Consumption attacks.

In the cloud computing model, as he explains it, the cloud consumers forgo maintaining their own computing resources while renting services from a cloud service provider—paying for metered computing hours or bandwidth, for example. A malicious user, however, could attack the financial viability of the cloud model by "fraudulently consuming computing resources in excess of normal activity," Idziorek says. "Attackers succeed when the cloud consumer is driven to the point that they can't economically sustain their business in the cloud."

Idziorek, whose major professor is University Professor **Doug Jacobson** (BSCpE '80; MSEE '82; PhDCpE '85), already has had two conference papers accepted for publication since first receiving the fellowship. He also is grateful to the mentors and supporters he has had.

"There is a healthy and proud contingency of former ISU graduates working at IBM in Rochester and they are more than helpful at connecting interns with people at IBM that match their career ambitions," Idziorek says. "There are numerous people who have helped me in various ways to get to the point where I could even be considered for such an award, let alone actually be awarded. There are simply too many names to list but these people know who they are and they know what they did and for that I would like to sincerely thank them."

After graduate school, Idziorek plans to pursue a career in computer and network security. Kleinheksel hopes to obtain a faculty position at an institution that emphasizes research and teaching. •

fellowship winners snapshot

Cory Kleinheksel
Hometown: Wilton, Iowa

Research interests: Data stream processing

Internships: Rockwell Collins co-op and Garmin International internship while an ISU undergraduate; Summer 2010 internship at IBM

Awards and honors: National Science Foundation Graduate Research Fellowship; elected ECpE Graduate and Professional Student Senator

Joseph Idziorek
Hometown: Duluth, Minnesota

Research interests: Cloud computing and security

Internships: IBM Rochester in 2007 and 2008; Summer 2010 internship at IBM's T. J. Watson Research Center in Hawthorne, New York

Awards and honors: ISU Teaching Excellence Award (2010); ISU Graduate and Professional Student Senate Peer Teaching Awards (2010)

Photos by Kenzie Brennan.

alum discusses his career and his role in

developing fax machine technology

Alumnus **David C. Nicholas** (BSEE '67; MSEE '68; PhDEE '71) had always been interested in science. Before he came to Iowa State in the early 1960s, he had participated in several science fairs and had an interest in ham radio. He thought about majoring in chemistry, pharmacy, or electrical engineering. Lucky for him and office workers everywhere, he chose electrical engineering.

"Probably the most career changing course was the 1-credit-hour IE 109, taken as a freshman engineer, in which we got to program the Cyclone Computer in EERIE, which was a mnemonic assembler with symbolic addressing," Nicholas says.

After he graduated with his bachelor's degree, Nicholas had accepted a job at Rockwell Collins (formerly Collins Radio), but before he began, he received a four-year National Science Foundation Traineeship through the ECpE department. The traineeship allowed him to return to school to finish his master's and PhD degrees, during which he developed the technology that would become essential to fax machines.

"My dissertation involved parsing linear delta-modulated voice at 50 kbps into 7 bit words, and then re-encoding these using a Huffman code to obtain 20 to 40 percent compression in real time with minimal buffering," Nicholas explains. "So I built a simple computer interface, and I would push my delta modulation and recording equipment on a cart from Coover over to the chemistry building and use their computer for real-time compression. I had 140 microseconds to process a word, which was about 140 instructions, and I wrote code to do it in about 120."

patent process

In 1970, Nicholas's co-adviser Professor Tom Scott encouraged him to file for two patents. The patent for a "method and system for synchronizing the transmission of digital data while providing variable length filler code" (patent no. 3,777,066) was awarded to him in 1973. Fast-forward about a decade to the 1980s, and Nicholas, who was working in the Advanced Technology group at Rockwell Collins, decided to tune-up his resume by publishing his dissertation. In the process of researching what had happened since completing his dissertation, he discovered that his patent had been written into the group 3 facsimile standard.

"This patent provided a filler/synchronization sequence for Huffman codes, and was a minor, but essential part of the dissertation work, in that it took care of the situation when the source under-ran the encoder and there was nothing to send," Nicholas says. And so began what Nicholas calls a "10-year adventure" helping the ISU Research Foundation (ISURF) enforce his patent. ▶

career at a glance

Here is a brief look at alumnus **David C. Nicholas**'s achievements and honors throughout his career:

Employer: Rockwell Collins (retired June 2009)

Key accomplishments: Developed Huffman coding sequence essential to all fax machines as a graduate student; contributed to Rockwell Collins' Automatic Call Distribution system, which was the first commercial digital telephone switching system in the world and was used by most major airlines, MCI, ITT, and the Royal Netherlands Air Force

Patents: 16

Member of: Eta Kappa Nu, Tau Beta Pi, Phi Kappa Phi, and IEEE (senior member), and is a Professional Engineer in Iowa

Awards: Inducted into Iowa Inventors Hall of Fame (1992), ISU College of Engineering Professional Achievement Award (1993)

Photos courtesy of David C. Nicholas.

Left: Alumnus David C. Nicholas stands next to a cardboard cutout of himself at an Iowa State University exhibit at the Iowa State Fair.

Right: In the 1970s, David C. Nicholas used a PDP-15 computer acquired by the chemistry department and U.S. Department of Energy's Ames Laboratory to conduct his research, which led to the discovery of a process to more efficiently convert text into digital information for fax machines.

"This enforcement got into high-gear when Steve Price took over as head of ISURF. The foundation had no money, but Steve knew lawyers who would work on contingency," Nicholas recalls. "After going through one lawyer who turned out to have a conflict, we connected with Rolf Stadheim of Chicago, who promptly sued about 30 facsimile manufacturers and got their attention."

At that time, Nicholas says the patent had only six months left before it expired, but under the law Iowa State and Nicholas were able to collect royalties for up to five years prior. The university eventually collected more than $36 million for the technology Nicholas invented. Nicholas received a portion of the patent proceeds, and the ECpE department also received a portion, which it used to create the endowed David C. Nicholas Professorship in Electrical and Computer Engineering. The professorship supports research and scholarly efforts of a faculty member in the department. Because of the portion Nicholas received, he says that his three children and six grandchildren all had or will have the opportunity to go to college. The patent is Iowa State's highest earning patent ever.

career success

Back at Rockwell Collins, Nicholas worked on the development of an Automatic Call Distribution (ACD) system, which he believes was the first commercial digital telephone switching system in the world.

"This system was used by most of the major airlines as an ACD, and by MCI and ITT as a tandem switch," Nicholas says. "This switch also was used by the Royal Netherlands Air Force in a redundantly connected military system, which was mutually synchronous, a part of which is the subject of U.S. patent no. 4,144,414."

Nicholas says that throughout his career, he is most proud of the ACD project at Rockwell Collins and his dissertation thesis project and the resulting two patents. His project at Rockwell Collins that resulted in U.S. patent no. 4,922,206 for a "method of demodulation using split delay line" is also special to him.

"Most patents arise incidentally out of solving a new problem, and one does not necessarily recognize instantly which parts of the solution are patentable," he says. "Patent 4,922,206 is special to me as I set out to solve a specific isolated problem."

After suffering a heart attack while awaiting a triple bypass in February 2009, Nicholas retired from Rockwell Collins in June 2009 after 38 years with the company. He still resides in Cedar Rapids, Iowa, and is spending time reading some fiction. He also has something he wants engineering students to know: "Most engineers write for a living." •

abc inventors named to *electronic design*'s hall of fame

Electronic Design magazine inducted John Vincent Atanasoff and **Clifford Berry** (BSEE '39) in their 2010 Engineering Hall of Fame for "inventing the Atanasoff-Berry Computer (ABC): a benchmark digital computer." Atanasoff and Berry developed the computer at Iowa State between 1937 and 1942. The computer was the first to use a binary system of arithmetic, separate memory and computing functions, regenerative memory, parallel processing, electronic amplifiers as on-off switches, circuits for logical addition and subtraction, clocked control of electronic operations, and a modular design.

Electronic Design recognizes innovative engineers each year in its Engineering Hall of Fame who are "idealists who looked beyond the next project to imagine how their designs would improve the world."

Additionally, Atanasoff and Berry's work is chronicled in a new book, *The Man Who Invented the Computer* by Jane Smiley. •

ecpe alumni class notes

1950s

James Fancher (BSEE '56) of Naperville, Ill. says after six years in electronics, he landed at Commonwealth Edison in Chicago and stayed almost 30 years. He retired in 1992 and continued his activity (which started at ISU) in IEEE. In 2009, he was awarded an IEEE-USA Citation of Honor for service on Energy Policy Committee, where he represents IEEE Region 4. He served there from 1984-1994 and 1999 to present. (In between he served from 1995-96 on IEEE's Board of Directors as Region 4 Director.) He also is active in other professional work, currently as vice chair of the Public Policy Committee of the American Nuclear Society (nearly half of his ComEd career was devoted to one aspect or another of nuclear power generation). He says he still enjoys making a difference.

1990s

Chad Bouton (BSEE '93; MSAerE '96) of Columbus, Ohio, was recently recognized in Congress for his technical contributions to the medical device industry and for receiving Battelle's Inventor of the Year Award in April 2010. Battelle is the largest independent R&D firm in the world, and is headquartered in Columbus. Bouton developed neural decoding algorithms that allowed the first human to control a wheelchair with a brain implant. He also has developed medical device technologies used in cancer detection systems and noninvasive sensors for medical applications. Bouton has filed more than 47 patents in the United States and abroad.

Correction: In the fall 2010 alumni newsletter, the Class Notes section incorrectly stated **Jerald Johanson**'s degree information. Johanson received a Bachelor of Science degree in electrical engineering in 1960 and Bachelor of Science degree in mechanical engineering in 1961. We apologize for the error.

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celebrating
alumni awards

Congratulations to the following alumni who recently have received awards and honors for exceptional work in their fields:

Mark Law (BSCpE '81) received the highest award from the Institute of Electrical and Electronics Engineers' (IEEE) Electron Device Society—the 2010 J. J. Ebers Award—for his "contributions to widely used silicon integrated circuit process modeling." The award is presented annually to honor an individual who has made either a single or a series of contributions of recognized scientific, economic, or social significance in the broad field of electron devices. Law co-authored SUPREM-IV, which became the most widely used 2-D process modeling tool. He also was part of the research group that developed FLOOPS and FLOODS object-oriented multidimensional tools for process and device modeling. The tools won the 1993 Semiconductor Research Corporation's Technical Excellence Award and have been commercialized as Sentaurus-Process. Law was an honors program student when he attended Iowa State. He is now the associate dean for the University of Florida's College of Engineering. He also is an IEEE Fellow.

Andrew Riha (BSCpE '05; MSCpE '08) has been named a 2011 ISU STATEment Maker. This ISU Alumni Association award recognizes young alumni's early personal and professional accomplishments and contribution to society. Riha is a Telemetry and Command Systems engineer at Boeing's Satellite Development Center.

John S. Sadowsky (MSEE '81) was elected a Fellow of IEEE for "contributions to commercial and military wireless communications." Sadowsky works for General Dynamics.

A. J. Van Dierendonck (MSEE '65; PhDEE '68) will receive the ISU Alumni Association's Distinguished Alumni Award in April. This award is the highest honor given to alumni by Iowa State University through the ISU Alumni Association. This award honors ISU alumni who are nationally and/or internationally recognized for preeminent contributions to their professions or life's work. Van Dierendonck made major contributions to Global Positioning Systems (GPS) technology spanning 37 years. In particular, he is the co-inventor of the use of narrow correlator technology, which is now an industry standard for GPS receivers for multipath mitigation. He has received awards from U.S. Institute of Navigation (ION) including the Burka Award (which he received twice), the Kepler Award, and the Thurlow Award. He also is an ION Fellow, IEEE Fellow, and is in the U.S. Air Force's GPS Hall of Fame. He is currently the owner of AJ Systems and a partner of GPS Silicon Valley in Los Altos, Calif.

more online

For more information on recent alumni honors and awards, visit *www.ece.iastate.edu/alumni.*

Photos courtesy of Mark Law and A. J. Van Dierendonck.