

# The Wire

The Holcombe Department of Electrical and Computer Engineering

## Clemson researchers are finding ways to make every bite count

Clemson News— Two Clemson University researchers seek to make diners mindful of mindless eating.

Psychology professor Eric Muth and electrical and computer engineering professor Adam Hoover have created the Bite Counter, a measurement device that will make it easier for people to monitor how much they eat. Worn like a watch, the Bite Counter device tracks a pattern of wrist-roll motion to identify when the wearer has taken a bite of food. Think of it as a pedometer for eating.

“At the societal level, current weight-loss and maintenance programs are failing to make a significant impact. Studies have shown that people tend to underestimate what they eat by large margins, mostly because traditional methods rely upon self-observation and reporting,” said Muth. “Our preliminary data suggest that bite count can be used as a proxy for caloric count.”

The advantage of the Bite Counter is that it is automated so that user bias is removed. The device can be used anywhere, such as at restaurants or while working, where people find it difficult to manually track and remember calories.

The device is not based on what happens in a single bite (i.e. exact grams or specific food nutrients), but in how it simplifies long-term monitoring. For commercialization, Bite Counters eventually will be sold as simple consumer electronics alongside such familiar devices as activity monitors, heart-rate monitors, GPS watches and pedometers. A device is available from Bite Technologies now for professional and research use at <http://www.icountbites.com>.

“The device only requires that the user press a button to turn it on before eating and press the button again after the meal or snack is done. In between, the device automatically counts how many bites have been eaten,” Hoover said.

In laboratory studies, the device has been shown to be more than 90 percent accurate in counting bites, regardless of the user, food, utensil or container, according to Hoover. However, there are few existing data on how bite count relates to calorie count or how a bite-counting device could be used for weight loss. The device will allow for such data to be more easily collected.

This research is now being funded by a one year, \$225,000 National Institutes of Health (NIH) Small Business Technology Transfer (STTR) in partnership with the MUSC Weight Loss Center and Bite Technologies. The primary goals of this NIH-funded project are to: (i) begin to examine the relationship between bite count and caloric intake; and (ii) examine if reducing bite count leads to reduced caloric intake. If indeed bite count is shown to be systematically related to caloric intake, OR reducing bite count over time leads to reduced caloric intake, then the Bite Counter could prove to be a revolutionary tool in the battle against obesity. It would be the only tool available to automatically monitor intake in free-living humans, without burdening the individual with cumbersome methods. For clinical or nutritional studies, the Bite Counter will be combined with food diaries to provide a more comprehensive record of intake. As a tool for intake assessment, the Bite Counter will enable new research studies to be undertaken and novel weight loss strategies to be developed.



Photos by Clemson University

The Bite Counter prototype is tested during a meal. Researchers hope the device can be used as a tool for weight loss and healthy eating.



## ECE welcomes new faculty

The Holcombe Department of Electrical and Computer Engineering is pleased to announce our newest faculty hires, Dr. Eric Johnson and Dr. Kumar Venayagamoorthy.

Dr. Johnson obtained his PhD in Electrical Engineering from the University of Alabama at Huntsville, MS in Electrical Sciences from the University of Central Florida, and BS in Physics from Purdue University. As the PalmettoNet Endowed Chair in Optoelectronics, Eric Johnson serves as the head of the South Carolina SmartState Center of Economic Excellence in Optoelectronics. Before joining Clemson, Dr. Johnson held a joint appointment as a Professor of Physics and Optical Science as well as Electrical and Computer Engineering at the University of North Carolina at Charlotte, where he also served as the Director of the Center for Optoelectronics and Optical Communications. He was previously an Associate Professor at the College of Optics (Tenured) and Photonics/CREOL at the University of Central Florida, and was the Vice President of Research and Development at Digital Optics Corporation. Dr. Johnson has also held various other positions in industry for development, engineering, and management.

Dr. Venayagamoorthy received his Ph.D. degree in electrical engineering from the University of Natal, Durban, South Africa, in 2002. Prior to joining Clemson, was a Professor of Electrical and Computer Engineering, and the Founder and Director of the Real-Time Power and Intelligent Systems (RTPIS) Laboratory at Missouri University of Science and Technology (Missouri S&T). He was a Visiting Researcher with ABB Corporate Research, Sweden, in 2007. His research interests are in the development and applications of advanced computational algorithms for real-world applications, including power systems stability and control, smart grid applications, sensor networks and signal processing. He has published 2 edited books, 6 book chapters, over 90 refereed journal papers, and 290 refereed conference proceeding papers. Dr. Venayagamoorthy is a Senior Member of the IEEE, and a Fellow of the Institution of Engineering and Technology (IET), UK, and the SAIE.

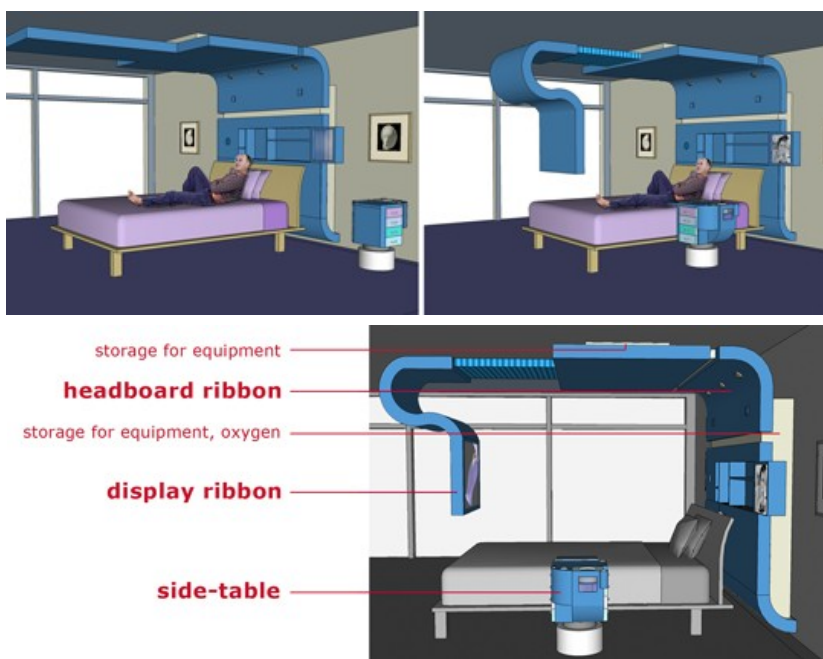
# Collaborative institute receives \$1.5 million in-kind software gift

Researchers at Clemson University will find ways to make living at home safer for aging and vulnerable people with help from a \$1.5 million in-kind software gift from Siemens PLM Software to the Institute for Intelligent Materials, Systems and Environments (CUiMSE).

Clemson Ph.D. student Joe Manganelli was central to securing the software gift, which supports his doctoral research under architecture professor and CUiMSE director Keith Green. Manganelli's work is key to research by a team of Clemson faculty members from electrical and computer engineering, human factors psychology and mechanical engineering; their graduate and undergraduate students; as well as investigators from Germany's Fraunhofer Institute for Experimental Software Engineering.

The team will use Siemens PLM Software technology to design and test "architectural-robotic" living environments supporting aging residents living in their private homes and in institutional care settings. For this research, Manganelli, Green and the team have designed and fabricated "home+," a home-lab in the Roger C. Peace Rehabilitation Hospital of the Greenville Hospital System.

"The process of developing complex, human-centered, technological living environments for vulnerable segments of the population should prove easier with these software tools," Green said. "They allow the research team



Graphics by CUiMSE  
Drawings of use scenarios and key components of an early concept assistive robotic environment developed by CUiMSE.

to design physical environments that empower people, even as their physical capabilities alter over time." "We are committed to improving the technical stature of Clemson's iMSE Institute and its ability to develop world-class engineers and technologists for our global communities, customers and business partners," said Hulas King, director of GO PLM & Global Community Relations-Siemens PLM Software. "Our relationship with Clemson will increase students' digital manufacturing skills, introduce the most advanced technologies and facilitate many ergonomic life-cycle processes. We are proud to team with Clemson's strong academic leaders and gifted students to enhance technological living environments for under-served populations."

The gift to iSME, made through Siemens PLM Software's GO PLM

initiative, provides two types of software:

- NX, a comprehensive digital product development solution for advanced computer-aided design, simulation and manufacturing; and
- Tecnomatix, a best-in-class digital manufacturing solution for virtual task analysis and ergonomics studies with avatars representing targeted segments of the human population.

CUiMSE is a partnership of Clemson's School of Architecture, its School of Materials Science and Engineering, and its Holcombe Department of Electrical and Computer Engineering, where Green holds a joint appointment.

## Clemson University engineers propose 'connected vehicle' systems

### Plan named public favorite at DOT conference

A Clemson University vision of how American cars and roads might interact in the future has been named a public favorite in a competition sponsored by the U.S. Department of Transportation (DOT).

Clemson students and faculty entered their connected vehicle plan — a detailed look at automotive and wireless technology — earlier this year in the DOT competition, which was held to generate ideas for the next generation of cars and highways. "The technology is already there. What's necessary is the will and the resources to put it all together," said automotive engineering professor Joachim Taiber. "That is what our entry in the Connected Vehicle Challenge proposes."

The public was invited to rate 76 proposals submitted by universities, corporations and think tanks across the country. Clemson emerged as one of the winners in that voting.

As a result, a member of the Clemson team was invited to deliver a presentation on the winning submission at the 2011 World Congress on Intelligent Transport Systems this October in Orlando, Fla.

The Clemson proposal focused on how cars can use dedicated short-range communications

(DSRC) technology — wireless channels designed specifically for automotive use — to share information with highway databases, emergency personnel, global positioning satellites and a host of businesses from gas stations to restaurants. The technology can be used for things like toll booths, where it allows cars to pay tolls electronically without the driver having to stop, roll down the window and toss coins into a basket or hand bills to an attendant.

The Clemson team involved students from a variety of academic disciplines: automotive, computer and civil engineering; as well as the business school.

Taiber led the team with faculty colleagues Richard Brooks and K.C. Wang, associate professors of electrical and computer engineering; Jim Martin, associate professor in the School of Computing; and civil engineering associate professor Ronnie Chowdhury.

"The electrical engineering students brought in the network expertise, the computing school students knew how to develop the software platform, the civil engineers analyzed the integration into traffic-management and road system-infrastructure," said Taiber, a research professor based at the Clemson University International Center for Automotive Research (CU-ICAR) in Greenville. "We also involved an MBA student to support the business model development."

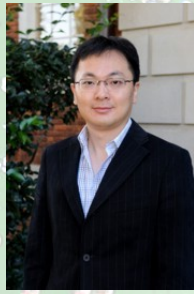
Of the more than six dozen competition entries, most described specific technical applications. The Clemson team took it one step further. In addition to describing the use of the technology, the members sought a way to pay for it using opportunities to incorporate mobile commerce to help fund the network.

An on-board computer could gauge the vehicle's energy supply and calculate exactly when and where it will need to be fueled up. The system could identify places to eat along trip routes or stream movies into the backseat video system for the kids, all paid for electronically. "DSRC technology has been known for years, but it hasn't been adopted because of the cost. No one was willing to invest in the infrastructure," Taiber said. "In the DOT challenge, we felt we needed not only to address the technology, but how to implement the technology in a feasible business model."

"To employ DSRC technology on a wide scale, you need radios and transmitters in the cars, in the highways and in the emergency response agencies. That would cost billions of dollars," he said. "What we are suggesting is a proposal for advanced safety features without the need for more taxes to fund it."

You can learn more about the group's Integrated Intelligent Transportation Platform on the [Connected Vehicle Technology Challenge Web](#)

# ECE faculty awarded National Science Foundation grants



Three faculty members in the Holcombe Department of Electrical and Computer Engineering have been awarded substantial research grants from the National Science Foundation this fall.

**Lin Zhu**, Warren Owen Assistant Professor, has been awarded a \$300,000 grant from NSF's Division of Electrical, Communications and Cyber Systems. The objective of Zhu's research is to control optical gradient forces in lightwave circuits through waveguide dispersion, to enhance optical gradient forces by using plasmonic effects, and to create novel resonant optomechanical devices. Optical gradient forces can be generated between integrated optical components by light and be used to control both optical and mechanical behavior of these components. The resulting integrated optomechanical devices provide a fascinating system to study the coupling between optics and mechanics.

Zhu and his research group will investigate new methods, such as waveguide dispersion and plasmonic effects, to manipulate and enhance optical gradient forces and explore new applications of these methods. Zhu hopes his work will lead to the creation of novel devices for information processing and fundamental physics. The outcome of his research will have significant impacts across many disciplines, such as light-controlled biomechanical manipulation and detection, photonic information processing, and strong light-matter interactions.

Dr. Zhu has also been selected to participate in the Army Research Office (ARO) Young Investigator Program (YIP). The objectives of the ARO's YIP are "to attract to Army research outstanding young university faculty members, to support their research, and to encourage their teaching and research careers." The ARO solicits proposals for basic and scientific research in mechanical sciences, environmental sciences, mathematical and computer sciences, electronics, computational and information sciences, physics, chemistry, life sciences, and materials science. This award will fund Zhu's research on high brightness broad area diode lasers for the next three years. As part of the YIP award, Zhu's research team will develop novel folded, supercavity designs that can be integrated in a diode bar to provide high power, diffraction-limited output beam by coupling grating-confined zigzag modes. The successful realization of this transformative research could have enormous long-term impacts on laser weapons, laser radar systems, and other military applications.

**Stan Birchfield**, Associate Professor, and **Ian Walker**, CoES IDEaS Professor, have been awarded a \$400,000 grant from NSF's Division of Information and Intelligent Systems to conduct research that explores the concept of interactive perception or manipulated-guided sensing. In this project, successive manipulations of objects in an environment are used to increase vision-based understanding of that environment, and vice versa. Traditional robotics research has adopted a "sense-plan-act" paradigm in which it is assumed that the sensors are capable of providing enough information in order to decide the next course of action. Humans and animals, however, frequently adopt a different approach, such as shuffling through a pile of unknown objects in order to identify an item of interest hidden beneath the pile. In particular, the project involves developing appropriate low-order models of highly non-rigid structures such as fabrics and textiles; constructing algorithms to perform real-time vision-based sensing of such objects in cluttered, unstructured environments; and building prototype robotic hardware for testing the resulting models and algorithms. The research forms an integral part of next-generation household service robots performing everyday tasks such as sorting and folding laundry.

## Department launches mentor program

At the start of the Fall 2011 semester, the Holcombe Department of Electrical and Computer Engineering initiated a mentorship program geared at student success and retention.

The ECE Plugged In Program at Clemson is aimed at connecting current CU ECE students with ECE alumni. More specifically, participating ECE alumni or strong ECE advocates mentor one to three ECE sophomore students who are interested in being a "mentee" in the program. The Plugged In program mentors contact their mentee students throughout the academic year to help keep them motivated and excited about electrical and computer engineering. The ECE undergraduate advising office strives to match student's interests with the mentor's experience.

Through this program, the mentors and the department strive to:

- Increase retention rates of ECE students past the sophomore year
- Motivate and encourage ECE students
- Improve the potential for success of ECE students
- Enhance the educational experience of ECE students

In its first year, the ECE Plugged In Program has involved roughly 40 mentors and mentee participants. The department hopes to expand the program to include all interested incoming sophomore students.

## ECE Student Achievement

**Nick Willis**, a senior in electrical engineering was one of seven students chosen to work as interns alongside the Clemson University Restoration Institute project team and partners statewide during the detailed design and initial construction of what will be the world's largest wind-turbine drivetrain testing facility over the summer. The group of students gained valuable hands-on experience on a scale they could not receive anywhere else in the world. Willis worked on electrical design simulation with electrical engineering Ph.D. candidate J. Curtiss Fox.

**Michael Juang**, a graduate student in electrical engineering, has been awarded a prestigious National Defense Science & Engineering Graduate (NDSEG) fellowship. Juang, who began his tenure as an NDSEG fellow in September, is working on wireless communications with Dr. Michael Pursley. The NDSEG fellowship program is one of the most selective in the world; just 300 winners from thousands of applications are chosen annually.

**Chen Lu**, a graduate student in electrical engineering, was chosen by Kaspersky Inc. as a finalist in their "America's Cup" security technology competition. He presented his paper, "Botnet Traffic Detection" at the finals in New York this November.

Electrical engineering graduate student **Yu Lu** won a \$250 cash prize for No 2 in the poster evaluation at the Oak Ridge Cyber Security and Information Intelligence Research Workshop in October.

## Staff News and Notes

Congratulations to ECE graduate services coordinator **Lane Swanson**, who was awarded the Hattie B. Wagener Award, the top administrative staff award in the College of Engineering and Science, at the 2011 CoES Staff Awards luncheon. This award was established in memory of Hattie Boone Wagener, a long-time ECE secretary at Clemson University, to recognize outstanding administrative staff within the College of Engineering and Science.

**Gale Black**, administrative assistant in the ECE department, completed the first year of the university's Staff Development Program (SDP). The peer-reviewed, performance-based program is designed to create more engaged staff members who have a broader view of the role they play at the university. ECE technician supervisor **David Moline** is among the university staff selected to participate in the 2011-2012 SPD program.

*The Wire* is published twice a year, by the Milton W. Holcombe Department of Electrical and Computer Engineering, for alumni and friends. Please [contact us](#) with any story ideas or alumni news.

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