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Wearable computer symposium at Tech offers first look at a 'wired' future

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Fans of "Star Trek" might call it Borg chic. Last week, Thad Starner, associate professor in the College of Computing and Chris Thompson, senior research engineer in GTRI-EOEML, Convergent Media Branch co-chaired the Institute of Electrical and Electronics Engineers' (IEEE) fourth International Symposium on Wearable Computers (ISWC). The two-day conference at the Sheraton Colony Square attracted attendees from 15 countries – mostly academicians and researchers, but also fashion designers, hobbyists and the curious.

"IEEE's International Symposium on Wearable Computers is the largest peer-reviewed conference in the field, bringing together academic and industrial researchers in one forum," said Starner. "By hosting ISWC in Atlanta, Georgia Tech has shown itself as one of the main driving forces behind wearable computing."

Carnegie Mellon University, Georgia Tech, and Massachusetts Institute of Technology began the first ISWC conference in 1997 to provide a forum for wearable computing research. Both Starner and Thompson have been involved in the organizing committees for all four ISWC conferences.

Photo by Sue Clites

One of the exhibitor demos at the recent ISWC conference, hosted by Tech.

"From the very start Georgia Tech has been one of the driving forces behind ISWC, helping to shape the conference and legitimize the whole field of wearable computing as an important future component of everyday computing," said Thompson.

Program Chair Blair MacIntyre, an assistant professor in the College of Computing, felt that the quality of papers presented at this year's conference was exceptional. The program was expanded to accommodate 18 papers, a record for ISWC, yet only 32 percent of submissions were accepted. Georgia Tech presented two of 18 papers and two of the 17 posters.

This year ISWC enjoyed the greatest industry involvement to date. Corporate sponsors and exhibitors donated significant amounts of money to IEEE to improve the caliber of the conference. These funds went primarily toward providing travel and housing for a pool of student volunteers who would otherwise not be able to attend the conference as well as ensuring that the event ran smoothly. This year's record number of 18 exhibitors provided larger and more professional exhibits than in the past. The growing interest from students, researchers and corporations prove the ISWC to be a

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Tech physicists recreate 335-year-old clock experiment for modern application

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While recovering from an illness in 1665, Dutch astronomer and physicist Christiaan Huygens noticed something very odd. Two of the large pendulum clocks in his room were beating in unison, and would return to this synchronized pattern regardless of how they were started, stopped or otherwise disturbed.

An inventor who had patented the pendulum clock only eight years earlier, Huygens was understandably intrigued. He set out to investigate this phenomena, and the records of his experiments were preserved in a letter to his father. Written in Latin, the letter provides what is believed to be the first recorded example of synchronized oscillators – a physical phenomenon that has become increasingly important to physicists and engineers in modern times.

More than 300 years after Huygens' letter, Georgia Tech physicists have recreated his original experiment. Beyond the historical curiosity, the researchers hope this straightforward mechanical system of gears, springs, weights and levers may help them gain insights into more modern and complex synchronized oscillators.

"Having a system available that lends itself to an intuitive and physical understanding could be quite useful," said Kurt Wiesenfeld, a Georgia Tech professor of physics. "We might be able to learn how this system is like laser systems or superconducting electronic systems. If there are general mechanisms affecting coupled oscillators, then perhaps we can learn about these mechanisms by using the clocks as mechanical analogs for electronic systems."

In particular, Wiesenfeld says the clocks may offer a new way to look at a type of electronic device known as a Josephson Junction.

"It's a very old-fashioned idea, not the way people who study coupled oscillators have been thinking about nonlinear dynamics over the past decade or so," he added. "Classical physics still has things to teach us."

The system under study consists of two spring-powered pendulum clocks attached to a wooden platform with metal weights added. The platform is set on wheels, free to move along a level metal track. Though the clocks are much smaller than those built by Huygens, the relationship between the masses of the pendulum bobs and that of the overall platform is similar. The clocks' period – time between ticks – is also approximately the same.

The modern clock system includes a feature not available to Huygens: laser monitoring that records the pendulum swings for computer analysis.

So far, the clocks have shown an ability to synchronize only in anti phase – that is, with their pendulums swinging in opposite directions. This is true even when the pendulums are started in-phase — swinging in the same direction. The 1665 letter

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Guess the total and win!

It's not too late to be part of the thousands of faculty and staff who contribute to hundreds of locally based charitable organizations. After last year's final count at more than $266,000 in donations, the goal for this year's campaign is $290,000 — what do you think this year's total will be? Write in your guess below along with your name and contact information and send it via campus mail to The Whistle at mail code 0181. The person who comes closest to the actual tally without going over will win a Sunday brunch for two at Prime Meridian. One entry per person. The deadline for submissions is Nov. 10.

Helping Others: A Tech Tradition
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My estimate of this year's total: _____
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Kimberly-Clark Corporation recently committed $100,000 to the Women in Engineering Program for use in the Excellence Award Banquet that honors female engineering students who have earned a 3.5 GPA and above. The funds will also support two faculty awards to honor those faculty members who have made a difference in the lives of female students at Tech. Pictured left to right are Tong Zhou, assistant professor in Electrical and Computer Engineering and a past faculty award recipient; Wendy Anderson, undergraduate chemical engineering student and Kimberly-Clark intern; and Cheryl Perkins, vice president and senior technical officer at Kimberly-Clark, and Tech alumna.

Photo by Stanley Leary

Photo by Stanley Leary

This group of seventh graders review their plan one more time before presenting it to their fellow middle schoolers in the Student Center Ballroom last week. Georgia Tech was one of the sponsors of the two-day event, known as the Prejudice Awareness Summit, that focuses on reducing prejudice in schools by initiating productive dialogue exploring ethnic and cultural differences. This award-winning summit, organized by the Anti-Prejudice Consortium, encourages students not only to listen, but also to be active in developing an action plan to implement in their schools. Students from more than 30 area public and private schools worked with corporate leaders, educators, counselors, diversity specialists and conflict resolution experts.

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sustainable event that will continue to attract an international audience of participants.

Starner and Thompson each had their personal favorites. Thompson said he particularly enjoyed the AR (Augmented Reality) Quake paper by Bruce Thomas, University of South Australia. This project combined wearable computing and gaming to produce an augmented world of synthetic characters interacting with real participants.

"Imagine being able to see the real world with the addition of computer-generated characters to interact with who appear to walk behind buildings and doors as a real person would," said Thompson.

Starner admitted to being partial to his students' presentations — the gesture pendant, a lightweight wireless camera system worn around the neck to control home devices such as a stereo or lights through hand gestures; the location awareness from a camera sensor project, and a poster on wireless contextual awareness. Starner also noted two papers that he found most engaging – Oxford University's Wearable Visual Robot (a neck worn, walnut-sized, computer-controlled camera that automatically stabilizes itself as the wearer moves) and a new 320 pixel by 120 pixel head-up display mounted in a pair of "granny" eyeglasses by Minolta.

Starner and Thompson seized the opportunity to show off how the Institute is applying wearable technology to its research projects. "During the conference, Tech hosted an open house, demonstrating the research being performed in our Graphics, Visualization and Usability Center and exposing some of the world's leading researchers to both the culture and academic foundations of the Georgia Tech program," Starner explained.

The highlight of the Tech open house was the transformation of the Broadband Institute Residential Laboratory (Aware Home) into a Halloween-themed Beware Home. The Interactive Media Technology Center and students in the Building Mobile and Ubiquitous Computing class converted the first floor of the Aware Home into a haunted house with ghostly effects, magic mirrors and more. The goal of this project was to install the next level of sensors and computational infrastructure into the Aware Home and for students to learn rapid prototyping skills not often taught in traditional undergraduate computing courses.

Computing doctoral student Brad Singletary studies under Starner and attended his second ISWC here in Atlanta. As someone who frequently wears his computer, Singletary enjoyed seeing the "useful clothing" manufacturers, featuring products with integrated biosensors in clothes and other worn products.

"It was nice to see that industry is steadily gravitating towards wearable computing markets and applications," said Singletary. "Conference topics ranged from core wearable computer issues to applications such as health, military, industrial, commercial and even recreation."

To learn more about wearable computer research at Georgia Tech visit the Contextual Computing Group's website **http://www.gvu.gatech.edu/ccg/** and Thompson's home page at: **http://wearables.gatech.edu/**

Photo by Gary Meek

The DuPree College's Brooks Pearson Distinguished Lecture was established to give students, faculty and Atlanta executives exposure to recognized innovative and entrepreneurial business leaders and distinguished academicians. The second annual Pearson lecture on October 20 featured 1979 Georgia Tech graduate Charles (Garry) Betty, CEO of EarthLink, Inc., the second largest Internet service provider in the U.S., now headquartered in Atlanta. Speaking to a full house in Tennenbaum lecture hall, Betty reviewed the history of computers, the Internet, and EarthLink and MindSpring, which merged in February 2000. Betty made a few predictions including that wireless technology will augment, not replace, today's computing technology. A webcast of Betty's talk will be available at http://www.dupree.gatech.edu/newsinfo

November 1 deadline to initiate updates for Banner clients approaching

On Nov. 1, 2000, access to the Banner production character mode clients via a telnet application will no longer be permitted. Examples of these client applications include WinQVT Terminal (PC), OnNet Terminal (PC), Comit (Mac), NCSA Telnet (Mac) and more. Any user who needs to continue accessing Banner in character mode or to execute processes from the UNIX command line will need to install an SSH client. These clients include Secure CRT (for PC and Macs running Virtual PC) and NiftyTelnet 1.1 (for Macs not running Virtual PC). Please note that with NiftyTelnet 1.1 there is no banner keyboard mapping. Information on these clients can be found at **http://www.eis.gatech.edu** under 'Information And Downloads.'

If you have not installed the appropriate client and do not have Banner GUI installed you will not be able to access Banner on Nov. 1. This means that if you are involved in entering permits, overloads and hold processing for registration, which starts Nov. 1, you will not be able to do so.

On the same date for Banner character mode, the login procedure will change. Under current operations, after entering your UNIX username and password, you are presented with a menu of terminal/keyboard types to select from. As of Nov. 1, after entering your UNIX username and password, you will be presented with a number of text message lines and be at the UNIX prompt. Within the text message will be instructions for entering Banner in character mode.

All this information was provided at the last Registrar's Information meeting (in September) and to CSRs/CSSs in town hall meetings that were held on Oct. 9. Users should contact their CSR with any questions.

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recounts that Huygens also observed only anti phase synchronization, helping confirm that the Tech researchers have successfully duplicated his experimental conditions.

But the Georgia Tech clocks also display behavior Huygens did not describe: what the researchers call "amplitude death." Instead of synchronizing, one or both pendulums ultimately stop moving altogether. This becomes more likely as weight is removed from the platform carrying the clocks.

Working 20 years before Sir Isaac Newton formulated the now-familiar laws of mechanics, Huygens was hampered in his ability to explain what he saw. Because the clocks are attached to a platform able to move, Huygens suggested that the swinging of the pendulums somehow caused the platform to move "imperceptibly." He also ruled out other theories, including the possibility that air currents caused the synchronization.

Unlike Huygens, Wiesenfeld and collaborators Michael Schatz and undergraduate student Matthew Bennett do have theories to explain what they see.

"In modern terms, the general motion of pendulums can be roughly described as a combination of in-phase and anti-phase synchronized motions, which are 'normal modes,'" explained Schatz, an assistant professor of physics. "A key feature of our understanding of Huygens' clocks is that the in-phase motion doesn't couple to the platform in the same way as the anti-phase motion. In-phase motion can drive the very small platform movement, which drains energy out of the system through friction between the platform and the surface on which it rests."

But when the clocks are synchronized in anti phase, the swinging pendulums balance each other, generating no movement in the platform. This conserves their energy, thus, providing a mechanism for favoring anti phase motion by the system, he suggested.

"The heavier the platform, the smaller the coupling between the two clocks," Schatz said. "If it's really heavy, the platform doesn't move at all and there is no coupling and no synchronization. But on the other hand, if the platform is too light and there is too much motion, it will damp out the clocks' energy and create 'amplitude death.'"

Photo by Gary Meek

Undergraduate Matthew Bennett makes adjustments to one of the clocks involved in the recreation of Christiaan Huygens' experiments in synchronized oscillators.

Despite the differences introduced by improved clock-making, the fact that both systems display stable anti phase synchronization shows the robustness of that feature, Wiesenfeld pointed out.

Recreating the system required considerable research that spanned not only 335 years, but also two languages. Heidi Rockwood, chairperson of Georgia Tech's Department of Modern Languages, worked with Wiesenfeld to decipher the original Latin — which turned out to be not as scientifically clear as the researchers had hoped.

"Only with Kurt's help did some of the passages make sense," said Rockwood. "Since he understood the physics, he could ask questions like, 'could this mean such-and-such?' And then things often fell into place." From Rockwood, Wiesenfeld learned that the Huygens letter actually described two different experiments.

But questions remain. "There's a lot of detective work in this," said Wiesenfeld. "You can get some pieces of it, but you're not sure what to fill in. The more you think about it, the more you can imagine other possibilities."