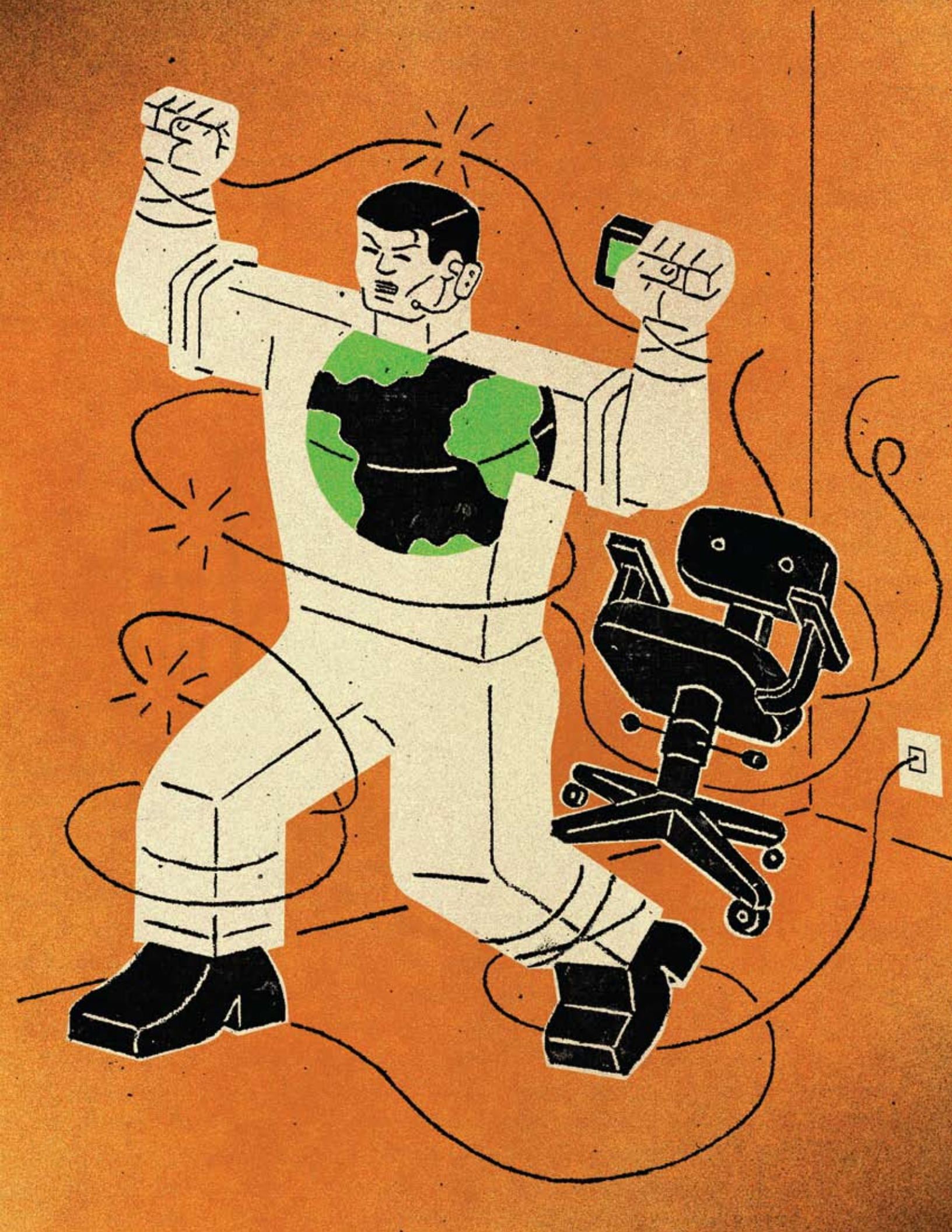
WIRELESS WORLD'09

BOOSTING BANDWIDTH, MANAGING STRESS

Not too long ago – just a few years – we marveled at having pocket-size phones for making voice calls from any location. People worldwide now take mobile voice contact for granted, and cell phones are morphing into devices for accessing information-rich broadband services anytime, anywhere.

From sharing photos to finding the best sushi restaurant in an unfamiliar city, the wireless world is headed in directions both exciting and daunting. It's a world where parents could also monitor the location of their child's school bus in real time, and sensors implanted in our bodies could conceivably signal medical professionals that a crisis is imminent. But it's also a world where safeguarding privacy is a pressing issue, and being tethered to one's job around the clock could cause debilitating stress.

ILLUSTRATION: DAVID PLUNKERT



AT THE EDGE FOR DECADES

NJIT is advancing wireless technology on many fronts as well as bringing related social issues into sharper focus. Wireless innovations have flowed from NJIT's Center for Wireless Communications and Signal Processing Research (CWCSPR), affiliated with the Electrical and Computer Engineering Department, for more than twenty-five years.

The center's founder, Yeheskel Bar-Ness, continues to direct the group's initiatives. Bar-Ness, distinguished professor and Foundation Chair, exemplifies the creative thinking that has generated dozens of patentable improvements in wireless. Bar-Ness' name is on many of the patent applications filed over the years, and his pioneering research led to being honored as a New Jersey Inventor of the Year in 2006 and receiving a 2008 Edison Patent Award from the Research and Development Council of New Jersey.

ACCELERATING WIRELESS ADVANCES

Bar-Ness' Edison Award-winning patent is iconic of the direction of wireless research toward supporting new services and applications. The patent is "STBC MIMO-OFDM Peak-to-Average Power Ratio Reduction by Cross-Antenna Rotation and Inversion." STBC stands for Space-Time Block Codes, MIMO for Multiple Input Multiple Output, and OFDM for Orthogonal Frequency Division Multiplexing. This innovation could greatly increase the data-transport efficiency of even the most advanced wireless networks now in place.

The patent also reflects a key aspect of the educational experience at NJIT – student participation in groundbreaking research. Mizhou Tan and Zoran Latinovic, former graduate students, are named with Bar-Ness on the patent. Alexander Haimovich, professor and CWCSPR researcher, says that students are recognized on virtually every patent grounded in the center's efforts. "They do much of the hard work that's always required to turn good ideas into practical technological reality."

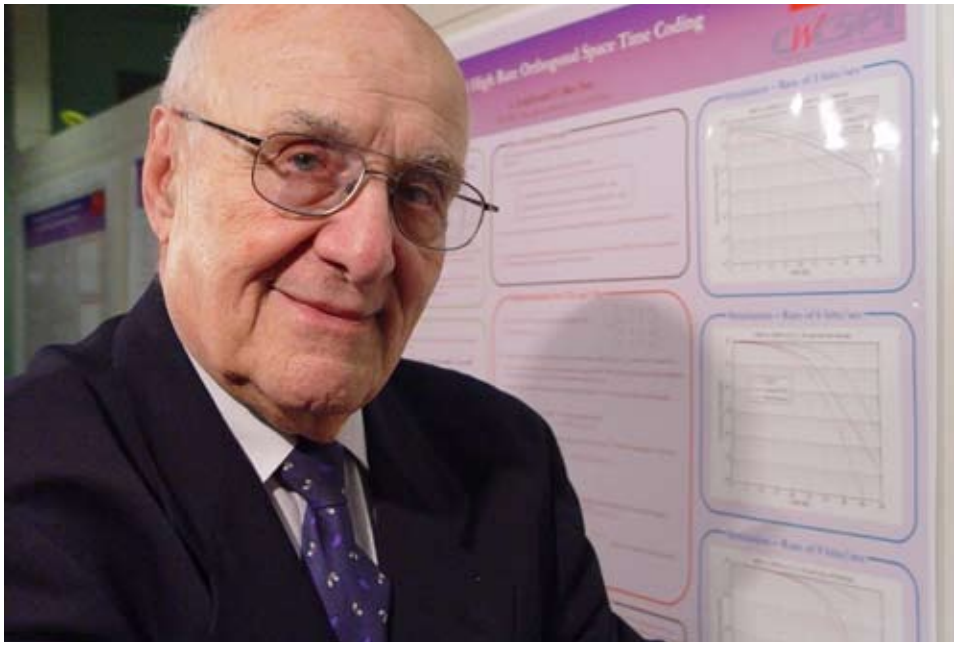


PHOTO: WINNIE YEUNG

Professor Yeheskel Bar-Ness, founder of NJIT's internationally recognized Center for Wireless Communications and Signal Processing Research

IT'S A MORE MOBILE WORLD

People around the world are definitely choosing wireless when it comes to communicating. While the global economic downturn may affect actual figures, strong upward trends projected in 2008 by the Telecommunications Industry Association and other sources are likely to continue:

- **There were nearly 263 million U.S. wireless accounts in mid-2008, up from 167 million in 2004.**
- **The total U.S. wireless market is expected to grow at an 8.1 percent compound annual rate, rising to $257 billion in 2011. Data applications will be the principal driver, generating some 35 percent of wireless revenues by 2011.**
- **Internationally, there are more than twice as many wireless subscribers as landline subscribers.**
- **The worldwide wireless account base increased to 2.8 billion in 2007. By 2011, there could be more than 4.1 billion wireless subscribers outside the United States. Markets such as China and India are seeing the fastest growth.**

COOPERATION NOT COMPETITION

NJIT faculty and students, as well as alumni active in the field, are working to develop a wide range of wireless technologies. As varied as these technologies are, however, they tend toward a common goal. According to Haimovich, that goal is optimizing the communications environment for a fast-growing number of users through cooperative rather than competitive use of network resources. For example, as Assistant Professor Osvaldo Simeone explains, this could entail cell phones and other communications devices with the electronic intelligence to boost signal strength

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for each other, and to not compete in an interfering manner for bandwidth.

GOOGLING ON THE GO

Whatever the technical solutions employed, 1970 NJIT alumnus Brian Kiernan emphasizes that wireless providers must meet the burgeoning demand for fast, reliable access to Web-based applications. More and more, we want to "Google on the go."

Kiernan, executive vice president for standards at InterDigital Inc., has had a leading role in the evolution of wireless for three decades. He points out that the majority of cellular providers have built networks that are essentially "voice-centric." They must now accommodate connecting customers with newly dominant telecom players, companies such as Apple and Google that offer the applications we seem to crave so much.

Professor Stewart D. Personick, Ying Wu Endowed Chair in Wireless Communications, agrees that the use of wireless devices to access increasingly sophisticated applications will drive both wireless industry revenue growth and the deployment of advanced wireless technologies. Personick, who has had a distinguished career in the telecommunications industry as well as the academic world, says that innovation in applications of wireless networking will provide even greater career opportunities for NJIT graduates than innovation in the underlying technology of wireless.

One example he cites is an application designed for the real-estate market by the founders of a company called Smarter Agent®. Entering an identifier such as a street address, or just standing in front of a property offered for sale and uploading your coordinates from a GPS-enabled wireless device, will give you access to multimedia databases with comprehensive information about the property. This could include a video tour, ownership history, tax records and much more. Interestingly, the founders of Smarter Agent are experts in real estate, not electrical engineering.

LIFE LESS PRIVATE?

Personick also offers observations about the social dimension of the wireless revolution. For decades, soldiers have carried wireless communication devices that also serve as relay stations for the wireless communications of other soldiers. Will consumers agree to share their electronic space in this manner? What incentives will be required to get them to agree to do this, assuming that they have alternatives? Perhaps receiving service at a discount or a guarantee of better call quality.

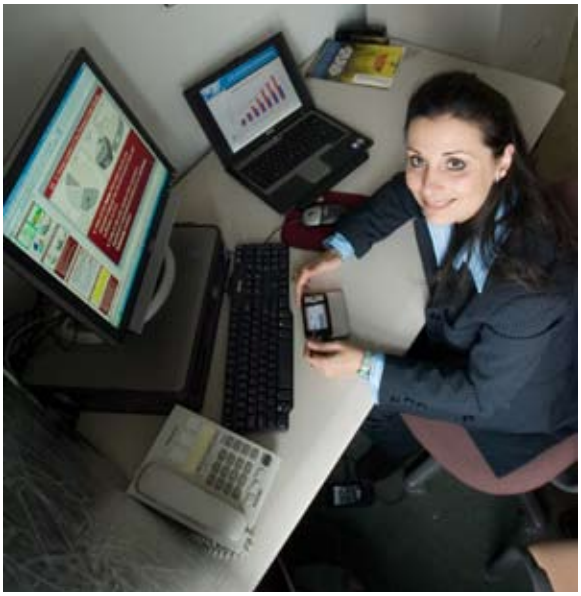

PHOTO: KAI CHAN

Associate Professor Katia Passerini

The real-estate application described earlier also highlights the privacy and security questions presented by the evolving wireless world. Even if the information is already available in public records, how would you feel about all of that information being so conveniently accessible to anyone standing in front of your home? Regarding the school bus mentioned earlier, how can knowledge of its location best be convincingly restricted to parents and other individuals responsible for the students on board? And consider the privacy implications of transmitting medical data from implants in our bodies.

WIRELESS EMPOWERMENT

It's clear that the challenges of wireless go well beyond technical innovation. They will require equally innovative legal and regulatory thinking, and even delineating new social norms for relationships such as those between employers and employees.

Katia Passerini, associate professor in the School of Management, is studying wireless communications across a wide economic and social spectrum. Her research ranges from the growing prominence of China in the industry to the implications of wireless for small businesses and the impact of 24/7 connectivity on daily life. There's much good that broadband wireless can bring about, including competitive agility for smaller businesses through increased employee productivity.

Yet to use a phrase from one of Passerini's studies, there's the "bad and the ugly" as well. Will managers routinely expect employees to be available for business every day of the year at any time? The potential to raise blood pressure as well as productivity is considerable.

On the positive side of the balance, Passerini points to the empowering influence of wireless in parts of the world where people are being electronically connected for the first time. In developing regions, wireless is proving to be a quick, cost-effective way to create a modern communications infrastructure. The many benefits of wireless encompass fostering economic development at all levels, including micro-enterprises, and sustaining culturally vital bonds when family members move from rural to urban areas for education and employment. ■

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