# OVERVIEW OF CSE RESEARCH DEMOS

## WIRELESS POWER

**Joshua Smith, Ben Waters**

The Sensor Systems Lab at UW has developed a flexible, adaptive wireless power transfer system that will enable new capabilities in a range of areas, from health to consumer electronics — with potentially life-saving results. This new technology is being tested as a power source for implanted heart pumps ("Left Ventricular Assist Devices," or LVADs), which consume too much power for batteries and carry a high risk of infection due to the need for a transcutaneous cable. Wireless power will allow providers to fully implant the LVAD system, making the therapy accessible to, and safer for, more patients. The same technology can also be used to wirelessly recharge robots, enabling them to operate for long periods of time without human assistance. A spin-out company formed to commercialize this exciting innovation, Wibotic, is already putting the technology in the hands of users.

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## MOBILE HEALTH & SUSTAINABILITY SENSING

**Shwetak Patel, Tien Lee**

Imagine being able to detect blood-related diseases by placing a finger on a camera, to monitor pulmonary diseases like asthma with just a microphone, and to diagnose patients with tuberculosis by just the sound of their cough. Imagine also the ability to monitor conditions such as home energy and water usage at the appliance level. Researchers in UW's Ubiquitous Computing Lab have imagined those things and created advances in energy and health through the convergence of sensing, machine learning and human-computer interaction. Their work has produced a new generation of sensing systems that are capable of providing electricity and water consumption data down to the individual appliance or device from single sensing points. The technology, which is being deployed in homes across the country, led to Belkin's WeMo product line and the WeMo Labs in Seattle. The team also collaborates with clinicians on projects that leverage the sensors on mobile devices, such as microphones and cameras, to enable the self-management and study of diseases — innovations that are being used by health care providers around the world.

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## TECHNOLOGY FOR PEOPLE WITH DISABILITIES

**Richard Ladner, Catherine Baker**

Accessibility research is a fast growing subarea of human-computer interaction (HCI). Companies such as Apple, Google and Microsoft provide ways for people who are blind to interact with mobile and desktop devices, including touch screens. Advances in accessibility research at UW are helping industry leaders to create products that are more accessible to people with disabilities. For example, Apple's iOS 8 introduced a Braille-based keyboard that is similar to one that was developed by a UW graduate student, Shiri Azenkot, in 2012. Other noteworthy projects developed at UW include Tactile Graphics with a Voice and Digitaps, which enable blind and low-vision people to access digital information by "seeing" with their fingers and ears — making technology accessible to more users.

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## SENSORIMOTOR ASSISTANCE

**Rajesh Rao, Nile Wilson, Justin Vrana, Maitham Naeemi**

Vestibular and balance disorders affect up to 10 percent of the general population; up to 40 percent of the elderly and 15 percent of children suffer from such disorders, significantly decreasing their quality of life. A new app developed by researchers at UW's Center for Sensorimotor Neural Engineering, Symbalance, assists people suffering from these disorders. It uses an inertial measurement unit (IMU), which measures orientation and gravitational forces, to detect onsets of imbalance and instability. Once Symbalance detects the onset of a fall, the app helps reorient the user through music piped in via headphones — saving people from potentially debilitating injuries.

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## TECHNOLOGY FOR THE DEVELOPING WORLD

**Nicola Dell, Trevor Perrier, Waylon Brunette**

To date, many of the world's biggest technological advances have primarily benefited people living in developed regions, like North America and Europe, that contain only a small fraction of the world's population. As computing technologies become affordable and accessible to larger and more diverse populations across the globe, it is critical that we broaden the scope to study the social, technical, and infrastructural challenges faced by these diverse communities and build systems that address problems in critical domains such as health care and education. The UW Change group aims to design, build and evaluate new technologies that have a positive impact on the lives of low-income people in developing countries. Two projects that are doing just that are the Open Data Kit (ODK), a toolkit that allows organizations to collect and visualize data from target populations, and Mobile WaCH (Women and Child Health), an SMS-based communication platform that gives women the ability to communicate directly with health professionals.

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## COMPUTATIONAL PHOTOGRAPHY

**Steve Seitz, Ricardo Martin**

Computer vision and computational photography have made astonishing progress in the past decade. The students and faculty of UW CSE's Graphics and Imaging Laboratory (GRAIL) have been at the center of this — much of the work done in collaboration with scientists at Microsoft and at Google. UW CSE researchers have produced some remarkable advances that have garnered widespread media attention, including the creation of time lapse videos mined from millions of online tourist photos, and software with the ability to predict how a person will look many years into the future.

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## GAMES FOR LEARNING & DISCOVERY

**Zoran Popović, Matthew Burns, Dun-Yu Hsaio, Roy Szeto, Nova Barlow**

UW's Center for Game Science aims to solve hard problems facing humanity in a game-based environment. The center develops games that discover optimal learning pathways for STEM education, advance scientific discovery, promote human creativity, and more. One of the center's popular learning games, Treefrog Treasure, enables players ages 4 and up to explore different worlds as a frog while teaching them fractions and numberline concepts. Another game, Foldit, encourages players to tackle the problem of protein folding, contributing to our knowledge of the 3-D structure of proteins (or how they "fold") to better understand their function — knowledge we can use to combat disease, create new vaccines and even identify novel biofuels.

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