

## **Better computing, communication for emergency personnel at disaster sites**

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Hurricane Katrina. The Southeast Asian tsunami. Now the killer earthquake in Haiti, which has claimed upwards of 50,000 lives. In each case, the response to a natural disaster has been further complicated by the difficulty delivering medical care in a chaotic environment where the communications infrastructure on the ground is seriously damaged or completely destroyed.

To address that problem, researchers at the University of California, San Diego have launched a project to find better ways for emergency officials and first responders to talk to each other and share data on the ground at the scene of a natural or man-made disaster ? even when the local communications infrastructure is out of commission.

Approximately \$1.5 million annually over two years in "stimulus" funding under the American Recovery and Reinvestment Act (ARRA) from the National Library of Medicine (NLM) will underwrite the WIISARD SAGE project. NLM is one of the National Institutes of Health (NIH).

The new project picks up where the original Wireless Internet Information System for Medical Response in Disasters (WIISARD) left off. That four-year project (2004-08) developed a testbed consisting of devices and software for use by first responders and command center personnel dealing with triage and other medical decisions after a disaster. Building on the WIISARD testbed, the new project (SAGE stands for "Self-scaling Architecture for Group and Enterprise Computing") will explore group or collaborative computing in mobile environments, as well as self-scaling systems for disaster management (no matter how many personnel and agencies respond to a disaster).

The new project brings together an interdisciplinary team of faculty ? most of whom also worked on the original WIISARD ? from computer science, cognitive science, electrical engineering and emergency medicine in the UCSD division of the California Institute for Telecommunications and Information Technology (Calit2).

"As the aftermath of the earthquake in Haiti has demonstrated so starkly, communication is a critical ingredient in any medical response to a disaster," said William Griswold, principal investigator on the WIISARD SAGE project and a professor in the Computer Science and Engineering department of UCSD's Jacobs School of Engineering. "A critical issue for disaster response is group or collaborative computing in mobile environments. With this new project, we hope to overcome several inter-related problems that inhibit the successful use of information technologies at disaster sites to manage medical care."

Added Calit2's division director at UCSD, Ramesh Rao, who is a co-investigator on WIISARD SAGE: "Our goal is not to create systems but to identify and test approaches that will make it feasible to use medical informatics technologies to address the myriad challenges in disaster environments."

The UCSD researchers will test their solutions with emergency response agencies during large-scale disaster drills in San Diego County ? the first one scheduled for mid-May 2010, under the auspices of the federally funded San Diego Regional Metropolitan Medical Strike Team (MMST). MMST is comprised of various police departments, fire departments, hazmat, bomb squads and S.W.A.T. teams throughout San Diego County and was created to coordinate and enhance care of mass casualties in a terrorist attack or natural disaster.

In addition to MMST, the UC San Diego team will also participate in drills organized by California's Disaster Medical Assistance Team (DMAT). The drills will allow the researchers to measure how successful their new approaches are in terms of key benchmarks, including network and application performance, speed of transmission of information, and the effects on clinical work flow.

The existing WIISARD testbed includes triage and medical data, treatment aspects of field care, and personnel and mass casualty tracking.

According to Theodore Chan, M.D., a professor of clinical medicine in the UC San Diego School of Medicine's Department of Emergency Medicine, there are three critical obstacles that need to be overcome if information technology is going to improve communication and decision-making after a disaster. "Disaster sites often have a noisy and chaotic electromagnetic environment that makes wireless networks unreliable, so we need to find a way to allow first responders to continue their work ? even if their connection to a central server is down," said Chan, who is the lead medical expert on the WIISARD SAGE project as well as Medical Director of MMST and the emergency departments at UC San Diego Medical Center.

The second problem to be overcome: First responders typically arrive at disaster sites at staggered intervals, and depending on the size of the disaster, emergency personnel could reach into the thousands. So the UCSD researchers are developing systems that are interoperable and self-scaling with progressive growth of capabilities as responders arrive at the scene.

"The third problem is that the capabilities of computer systems in disaster environments will change from moment to moment based on connectivity and infrastructure," added Chan. "So we want to convey this information to users and also design applications that will use this information in a seamless way to enhance the work flow of emergency medical personnel."

Ahead of the May disaster drill, the UCSD researchers recently pre-tested some of their new ideas. They include: mobile phones that are equipped with custom software; Bluetooth barcode scanners that allow responders to scan a patient's paper triage tag to bring up their on-site medical record; radio frequency identification (RFID) technology to help track where responders are located at a

disaster site; and new network protocols, including Grapevine, a "gossip"-based protocol that allows communication even if not all network connections are functioning. WIISARD SAGE will also add GPS units to the nodes of the ad hoc CalMesh network developed at Calit2, for estimating the positions of responders or disaster victims by triangulating signal strengths.

UC San Diego Medical Center assistant clinical professor Colleen Buono, M.D., is a co-investigator on the WIISARD SAGE project (as she was on the original WIISARD). She will play a critical role in the clinical effort in upcoming disaster drills, as a member of both MMST and DMAT, and in integrating the testing of new approaches with the drills.

"Our pre-drill tests went as well as we could have hoped," said Griswold. "We coped with a lot of uncertainty as far as GPS, windowing systems and cell phone reception, but barely two months into the current project, we now have a platform we can deliver on."

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