

Managing Data for Disaster Relief

- ASHOK AGRAWALA
- LOUIQA RASCHID
- AMOL DESHPANDE
- DANA NAU

The inability of searchers to communicate at the World Trade Center in 2001 and the chaos on the ground after Hurricane Katrina highlighted the need for good ways to share information during and after disasters.

Six weeks after 9/11, Ashok Agrawala—using his expertise in wireless communication and location detection—put together Draco, a rapidly deployable system for helping emergency personnel communicate.

Agrawala's system allows members of search teams to communicate with each other and with a central commander and to leave virtual tags about problems like broken bones or structural damage.

"The situation was nothing short of chaotic on 9/11. Since then, a lot of people have been developing individual technologies" says Agrawala. His system offers a complete communication package that can be deployed rapidly and is particularly good at tracking individuals' locations using time-of-flight wireless signals, whether people are indoors or outdoors.

(l-r) Dana Nau, Ashok Agrawala,
Louiqa Raschid, Amol Deshpande



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To contact any researcher in UMIACS, go to www.umiacs.umd.edu.

This kind of communication system is valuable not only in disasters but in law enforcement. Agrawala is working with University of Maryland police to test some technologies. He is also working with the Washington-Baltimore High Intensity Drug Trafficking Area (HIDTA) program to develop an information brokering system to expedite communication among different law enforcement agencies. Dick Baer, who works for the Washington-Baltimore HIDTA says, "Ashok's work has been very effective in achieving integration. He is able to take existing capabilities and put it all together."

UMIACS researcher Louiqa Raschid, who specializes in integrating information from various sources, was the principal database architect for Sahana, open-source software for disaster management that is now used around the world. "Disaster relief isn't done by one company solving a problem," says Raschid, "Information systems tend to fail because of the difficulty of sharing information among all the organizations that are involved."

Sahana helps match resources with those who need them by bringing

together data about victims, volunteers, organizers, emergency requests, and shelters. Because Sahana is open-source, people in different regions can tailor the program to their needs and can integrate Sahana with the software they are already using.

Versions of Sahana have been used in the United States, Pakistan, the Philippines, Indonesia and Sri Lanka. Among its diverse capabilities, the software can send out alerts to large numbers of people. For example, after a recent earthquake, people in Sri Lanka received text messages warning them of possible tsunamis. In 2007, Sahana received the Free Software Foundation's award for Social Benefit.

"Louiqa is very passionate about using information technology to help solve humanitarian problems," says Kristina Lerman, a computer scientist at the University of Southern California, who recently wrote a research proposal with Raschid. "Sahana is being used by New York City. FEMA is considering it. It is quite exciting, and Sahana developers are not profiting from it."

Another researcher in UMIACS, Amol Deshpande works on methods to manage data generated by tiny, wireless sensors using statistical modeling. Whether sensors are deployed for intense, short-term use such as monitoring a wildfire or for long-term, preventative tasks, such as observing a bridge, being able to obtain data in an energy-efficient way makes sensors much more usable, and Deshpande also works to create energy efficient algorithms for sensor networks.

Deshpande's methods need to cope with the abundant but noisy and incomplete data continuously generated

by sensors and must be able to detect anomalies in real time. "Our goal is to make the analysis faster and more efficient," says Deshpande.

One of Dana Nau's main research interests is how to generate plans. David Aha, a computer scientist at the Naval Research Lab, says, "Dana is one of the preeminent people in the world of artificial intelligence planning." In collaboration with Aha, Nau helped develop methods for planning evacuations of noncombatants in emergencies, creating a system that Nau describes as "a sort of intelligent bookkeeper."

"At certain points, you could ask the system to use our SHOP software to do some of the planning for you," says Nau. SHOP, for Simple Hierarchical Ordered Planner, can generate plans for tasks in many different kinds of problem domains, provided that a user gives it information about how to do so.

SHOP and its successor SHOP2 are open-source software and have been used in hundreds of projects by government, industry, and academia. A company in Minneapolis called SIFT, for Smart Information Flow Technologies, has adapted SHOP2 to create plans for running unmanned aerial vehicles. A user can enter plain-language instructions for the vehicles, which the program decomposes into computer commands. Robert Goldman, a senior scientist at SIFT, says. "One of the most appealing things about the SHOP system is that it's adaptable. It doesn't rely on a very rigid problem structure. To do that, you have to be open to the complicated and messy aspects of real problems."

— Profile written by Karin Jegalian