Cell phones become handheld tools for global development

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Members of the Surui tribe in Brazil test Open Data Kit as a tool to raise awareness of illegal logging on their lands. The tribe also plans to use the tool to take an inventory of its forests so it can participate in global carbon markets. Credit: Carl Hartung, University of Washington

Mobile phones are on the verge of becoming powerful tools to collect data on many issues, ranging from global health to the environment.

Computer scientists at the University of Washington have used Android, the open-source mobile operating system championed by Google, to turn a cell phone into a versatile data-collection device. Organizations that want a fully customizable way to, say, snap pictures of a deforested area, add the location coordinates and instantly submit that information to a global environmental database now have a flexible and free way to do it.

UW computer scientists were already working on mobile tools for the developing world when Android, the first comprehensive open-source platform for mobile devices, was announced two years ago by the Open Handset Alliance, a group of companies of which Google is a member. For the past year UW computer science and engineering doctoral students Carl Hartung, Yaw Anokwa and Waylon Brunette have worked at Google's Seattle office using Android to create a data-collection platform for use in developing regions.

Their free suite of tools, named Open Data Kit, is already used by organizations around the world that need inexpensive ways to gather information in areas with little infrastructure. Seattle's Grameen Foundation Technology Center is using it to evaluate its Ugandan text-messaging information hotline; D-Tree International, a Boston-based nonprofit, is using it in Tanzania to guide health workers treating children under 5 years old; the University of California, Berkeley's Human Rights Center is using it to record human rights violations in the Central African Republic. This fall the Jane Goodall Foundation in Tanzania and the Brazilian Forest Service signed up to use it to monitor deforestation.

"Many organizations need to be able to make evidence-based decisions, and to do that they need data," Anokwa said. "We hope our toolkit enables organizations to gather the data quickly so they can analyze it quickly and make the best decisions for the communities they serve."

They tool is described in an article published this month in the *Institute of Electrical and Electronics Engineers' Computer* magazine. Gaetano Borriello, UW professor of computer science and engineering, and Adam Lerer, a graduate student at the Massachusetts Institute of Technology, are co-authors.

In the past some researchers have harnessed individual cell phone

models to collect data in the field. But when the phone gets outdated, so does the software. Instead of creating a tool for a single phone, or even a single purpose, the UW team built something that would provide a reusable platform to collect all types of mobile data.

"We found a lot of organizations were building a lot of one-off tools that were very similar," Hartung said. "We're trying to make ours as compatible and flexible as possible."

Open Data Kit's versatile suite of tools can collect data; store, view and export data on remote servers; and manage devices in the field from a central office. The output is compatible with emerging data standards such as the Open Medical Records System, which aims to coordinate health records in the developing world.

Many organizations are using Open Data Kit, but the biggest project so far is a major effort to track and treat HIV patients in Kenya. Led by the Academic Model Providing Access to Healthcare, a U.S. Agency for International Development-funded partnership between Indiana University and Kenya's Moi University, it is one of the most comprehensive HIV treatment programs in sub-Saharan Africa. AMPATH trains Kenyan community health workers who conduct door-to-door testing in rural areas for HIV, tuberculosis and malaria, and offer ongoing personalized health counseling.

Hartung and Anokwa traveled to Kenya this summer to meet with AMPATH's community health workers and do a trial run with 10 phones. They spent two weeks working with Kenyan collaborators, then accompanied community health workers on home visits to see the phone being used in the field.

"It's a pretty amazing experience to be sitting in a mud hut seeing someone get counseled, maybe for the first time, on HIV, and the

counselor is using your tool to record information," Hartung said. "It gives a whole new perspective on the need for reliable software."

For the past two years AMPATH workers have conducted field visits using a Palm Pilot and separate GPS unit. This required workers to key in a 10-digit identifier for each patient, stand outside and wait up to two minutes to get location coordinates, and at the end of each day return to the main office to upload their information to a central database, which adds travel time and expense.

Phones running Open Data Kit can record location in seconds, scan a barcode rather than requiring the numbers to be entered by hand, and upload the data automatically using a cellular network. AMPATH plans to deploy 100 Google-powered phones by the end of this year. Ultimately, it aims to use 300 phones powered with Open Data Kit to reach 2 million people.

"Adopting this technology was kind of a win-win-win in terms of direction for our organization," said Dr. Burke Mamlin, an assistant professor of medicine at the Indiana University School of Medicine and research scientist with the nonprofit Regenstrief Institute, which supports AMPATH. "This opens doors by allowing us to bring data collected in the field directly into our medical records system. And now we have a phone, all the personal digital assistant capability, the ability to read barcodes, and the ability to capture images or video, all in one unit."

The device also opens up new possibilities for the future. If one family member is absent during a site visit health workers can schedule a follow-up visit and have it automatically appear in their calendars. Health workers could cue up public-health videos if they thought the family could benefit. Program managers in a central office could track data in real time and send updates to field workers without them having to come back to the base.

Building technology for use in the developing world offers new challenges for computer scientists. Power and connectivity may be intermittent, and users may have poor eyesight or literacy.

There are also other issues specific to mobile devices. Web developers in the Western world generally create white text on a dark background, but it turns out dark text on a white background works better in bright sunlight, where most of these devices will be used. And touch-screen phones rely on an electrical signal from users' fingers, but that signal gets blocked by calluses. UW students found some rural users needed to use a softer part of the finger pad, and this meant designing bigger buttons.

The team is now back at the UW, where they are part of a group called Change that studies technology in the developing world. Funding for the project comes from Google.org, the philanthropic arm of the company. The code is freely available and ongoing research will be based at the university. Hartung and Anokwa are co-teaching a new course this fall, Mobile and Cloud Applications for Emerging Regions (http://www.cs.washington.edu/education/courses/cse599y/09au/), in which undergraduate computer science and engineering students learn skills and then apply them by creating new features requested by Open Data Kit users.

"We've only seen the tip of the iceberg in terms of the types of applications we can run that are really customized to the person who's holding the device," said Gaetano Borriello. "For places where resources are constrained, where data is unavailable and where large problems exist, this technology is very powerful."

Source: University of Washington (news : web)