


Notes from the Community

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From GPS Shoes to Instrumented Cities: Food for Thought

Jason Hong and Mary Baker

Welcome to the latest installment of Notes from the Community! This column offers a curated summary of interesting news and research in pervasive and mobile computing, with content drawn from submissions from a shared community on the social news site Reddit, available at www.reddit.com/r/pervasivecomputing.

Here, we offer a slice of what community members have contributed to date. We encourage you to join our subreddit and spread the news of this site to others, so that together we can build a sustainable online community for pervasive and ubiquitous computing. We hope you find the contributions interesting and will submit your own material for the next issue of *IEEE Pervasive Computing*.

NEW PROTOTYPES AND APPS

Several contributors posted interesting systems implemented by researchers.

User nemanja_memarovic shared a video about the best paper from the 11th International Conference on Mobile and Ubiquitous Multimedia (MUM 2012). The video illustrates Ubi Displays, which let users drag and drop interactive Web content into the world, offering a programming environment for physical spaces. For hardware, Ubi Displays use a Microsoft Kinect and a projector. The video, available at www.youtube.com/watch?v=df1NO7MoAUY, shows several examples of how these projected displays could be used, including illustrating current water-use levels, lighting up floor tiles to show where people walked, showing messages on a door, and creating interactive displays on plain walls. Source code for Ubi Displays is available at https://code.google.com/p/ubidisplays.

One reader shared a link to custom-made GPS-enabled shoes (www.designboom.com/design/shoes-with-gps-by-dominic-wilcox). A wearer can set his or her destination by uploading the location data via USB to the shoes. Clicking the heels together turns on the GPS. One shoe shows a progress meter of how close the wearer is to the set destination, while the other shoe indicates which direction to go.

Reader mavoir6 posted a link to Lockitron, a Kickstarter-funded project for keyless entry using a smartphone (https://lockitron.com). Lockitron offers a smart lock for doors that can be opened wirelessly anywhere in the world. Owners can also share access to their lock with friends and family. Lockitron was also designed to be fitted on top of many kinds of existing locks. The Lockitron seems to be part of the larger convergence of makers (people who use a combination of laser cutters, 3D printers, electronics, and software) and Kickstarter to create commercial products. It's likely we'll continue to see this convergence grow as design tools get better.

Several readers also shared links to items from Google. Of particular interest was Google Glass, wearable computers in the form factor of glasses. One item was a video featuring several spoofs of Google Glass' user interactions, showing ads overlaid on top of everything, accidentally sent text messages, having life mimic video games (with life bars), and injuries due to people being distracted (http://searchenginewatch.com/article/2166559/6-Funny-Google-Project-Glass-Parody-Videos). Another reader shared another video showing a more streamlined user experience, with Google Glass offering simple video recording, picture taking, and just-in-time translation (www.theverge.com/2013/2/20/4008180/google-glass-ui-previewed-in-new-video). Glass could also mesh well with Google Field Trip, a system Google is working on for giving local information before you ask for it. Field Trip sounds conceptually similar to Google Now in terms of proactively offering potentially useful information, but it's focused more on factoids and specific venues (http://bits.blogs.nytimes.com/2012/09/27/a-new-google-app-gives-you-local-information-before-you-ask-for-it).

User wizjason shared a link to Facet, a multisegment wrist-worn system

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featured at the 25th Symposium on User Interface Software and Technology (UIST 2012). Facet is similar to a watch but has many more screens, which are all touch sensitive (http://dl.acm.org/citation.cfm?id=2380134). It also supports multiscreen touch gestures and lets wearers expand apps to fill multiple screens, or shrink them down to one screen. Digits is another system featured at UIST 2012, which is a wearable hand sensor developed by researchers at Newcastle University and Microsoft Research. Digits uses off-the-shelf components to sense different kinds of hand gestures in free space. Although the packaging is currently quite large, it's easy to imagine the hardware being optimized to fit in a form factor roughly the size of a modern watch.

Reader jlinphd shared several neat demos. One was a creative Lexus ad that combines tablets with print magazines (http://8ninths.com/social-trends/when-paper-meets-tablet). The print ad asks you to download an app for your tablet. If you then place the tablet behind the printed page, it animates the ad, making the car look like it's driving through a landscape, replete with fireworks and high-tech screens.

User jlinphd also shared another link to LocalData, an app that lets communities collect and analyze place-based survey data, to help people do their own urban planning (www.fastcodesign.com/1670954/localdata-an-app-that-helps-communities-do-their-own-urban-planning#1). LocalData came out of the Code for America fellowship.

SECURITY AND PRIVACY

User ianoakley posted a link to a talk about ATM skimmers, observation attacks, and haptic passwords. ATM skimmers are small devices that thieves add on top of bank ATMs for stealing bank account numbers and PINs. These devices are often crafted to be placed over the existing card reader mechanism, surreptitiously reading a person's bank account number when he or she puts in the card. Sometimes, a separate camera is also placed in an innocuous location to capture a person's PIN when it's typed in. In the talk, ianoakley and his colleagues explore using haptic feedback as a way of signaling information to users in such a way that the current generation of ATM skimmers couldn't capture the data.

Another reader shared a link to a 2009 *Wired* article, "I Am Here: One Man's Experiment with the Location-Aware Lifestyle" (www.wired.com/gadgets/wireless/magazine/17-02/lp_guineapig). In the article, Mathew Honan talks about his experiences in being an early adopter of location-based services. He also talks about some privacy issues—in particular, how many people are probably unintentionally leaking sensitive personal information. He gives an example of how he saw a woman taking pictures with an iPhone and correctly guessed that her photos were being geotagged and shared on Flickr. With a little bit of sleuthing, he found the photos she had taken as well as a cluster of photos likely centered on where she lived. In other words, with only a little bit of work, Honan found the home of a stranger he saw in a park.

Mathew Honan talks about... how many people are probably unintentionally leaking sensitive personal information.

One surprising aspect of privacy and security was reported by jas0nh0ng, which pointed to an article about how a photo taken by a soldier in Afghanistan might have led to a pinpointed attack that destroyed an Apache helicopter. The issue at hand was that the photo had a geotag in it showing where the photo was taken. After the photo was shared on social media sites, the belief is that insurgents saw the photo and geotag and used them to direct mortar fire to that location.

TEACHING UBIQUITOUS COMPUTING

Readers shared two links about courses on ubiquitous computing, both from Carnegie Mellon University. The first (www.cs.cmu.edu/~15-821) is a course on mobile and pervasive computing focused on systems issues, such as ubiquitous data access, virtual machines, sensing and actuation, mobile hardware technologies, and end-to-end application considerations. The second is a syllabus for a reading seminar for HCI and privacy (https://docs.google.com/spreadsheet/ccc?key=0AhOJSAMjQq1sdGQ5SERjbzVMUkRJZE51RDlVQ2NuOEE&hl=en_US&pli=1#gid=0), one part of which focuses on privacy and ubiquitous computing.

Jason Flinn has also published an overview of cyberforaging, as part of the Morgan Claypool synthesis lectures on Mobile and Pervasive computing (www.eecs.umich.edu/eecs/about/articles/2012/mobile_pervasive_book.html). Cyberforaging lets people opportunistically use fixed computing infrastructure in the surrounding environment, offering much greater computing resources than those offered by small, battery-powered mobile devices. Flinn's overview is the 10th synthesis lecture offered by Morgan Claypool, with the others covering topics such as standards in pervasive computing, quality of service in wireless networks, location systems, managing power consumption, and RFIDs (www.morganclaypool.com/toc/mpc/1/1).

UBICOMP'S HISTORY AND FUTURE

Jimmy Lin shared a fun *ComputerWorld* link presenting the history of the

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keyboard (www.computerworld.com/s/article/9233085/Past_is_prototype_The_evolution_of_the_computer_keyboard). The article talks about some of the designs of typewriters, some of the underlying mechanisms used to read in typed keys (including reed switches, capacitive switches, springs, and rubber domes), the continual trend toward thinner keyboards, as well as ongoing work in making touchscreen keyboards more effective.

Mickey McManus shared a link to a book he coauthored with Peter Lucas and Joe Ballay, entitled *Trillions: Thriving in the Emerging Information Ecology* (http://trillions.maya.com). The book looks at the design issues that we as a society will face as we approach an era with trillions of microprocessors and data objects. This book is targeted primarily at businesses and their customers but also addresses topics relevant to our community, including user interfaces, interaction design, system architectures, data storage, and comparisons to nature. McManus also shared a link to a short video (https://vimeo.com/49392667) that talks about containerization, drawing a path from how standardized containers revolutionized global shipping to our need for standard containers for data objects.

Another reader shared a link to a fun article by sci-fi author Charlie Stross, who looked at what we might do with trillions of microprocessors (www.antipope.org/charlie/blog-static/2012/08/how-low-power-can-you-go.html). Stross observes that a modern iPhone is far more powerful than a supercomputer from the 1970s, and more efficient with respect to power consumption. If we continue to follow current trends in the increase of CPU capabilities and decrease in power consumption, then we could easily embed computers in every square meter of a modern city for a relatively small amount of money. (Stross estimates that in 2040, it would be 150 million euros to instrument all of London.) Stross proposes a number of possible applications, including real-time monitoring, identification, and tracing of diseases; monitoring air quality and other environmental conditions down to the square meter; traffic control on a level that could protect small kids running into the street to get their ball back; real-time traffic routing of pedestrians, bicyclists, and cars; instantaneous alerts for injuries, fires, and other incidents; and more. Many researchers have talked about how science fiction is like a low-fidelity prototype of the future, and Stross offers much food for thought about where we might be headed with all of the systems we are building and deploying.

WORKS IN PROGRESS

Although this department replaced the Works in Progress department, we still welcome WiPs. Moving forward, please submit them to the Pervasive Computing subreddit.

Angel Torrado-Carvaja submitted a brief note about his team's work on developing a standalone app for visualizing electrophysiological data, such as electroencephalography (EEG), magnetoencephalography (MEG), electrocardiography (ECG) data. The app can read in data from files, Bluetooth, or Ethernet. The team is continuing the work by expanding functionality and adding more digital signal processing. For more information, contact Torrado-Carvaja at angel.torrado@urjc.es.

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