



Notes from the Community

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3D Printing, Smart Cities, Robots, and More

Jason Hong and Mary Baker

Welcome to the latest column of Notes from the Community! We have some interesting items to report on from the pervasive computing forum, starting with a device that will help you track down that lost TV remote.

NEW GADGETS AND INTERACTION TECHNIQUES

A reader pointed us to StickNFind, a small device about the size of a US quarter that you can attach to anything—luggage, a pet, keys, or shoes, for example—and if you lose the item, you can then use a smartphone app to find it (see Figure 1). The gadget uses Bluetooth Low Energy, and the smartphone app has a radar mode for finding the gadget, as well as a leash mode for making sure the gadget is kept within a certain distance. See more at www.sticknfind.com.

Microsoft Research sponsored the User Interface Software and Technology (UIST) student innovation contest, offering the PumpSpark Fountain Development Kit (FDK) for creating water-based user interfaces. The kit includes eight miniature water pumps and a prototype PumpSpark controller, letting developers create interactive water-based interfaces. Students from RWTH Aachen

University, National Taiwan University, and Technical University of Munich won first place in the People's Choice category, Creativity category, and Usefulness category, respectively. Student teams created a number of cool systems, including several water-based games, a water bottle bagpipe, and a t-shirt printer. Learn more about the FDK and see videos of the contest entries at www.acm.org/uist/uist2013/contest.php.

A reader directed us to Aireal, a system developed by Disney Research and presented at SIGGRAPH 2013. Aireal sends out puffs of air in a specific way to give expressive tactile sensations in midair. Users can feel virtual objects, textures, and feedback without having to wear any kind of physical device. Most of Aireal is 3D printed, making it easy for others to replicate and build on. You can see a video and more details at www.disneyresearch.com/project/aireal.

3D PRINTING

There was a burst of links about 3D printing, looking at new gadgets, food, and economics.

One reader shared a link to the 3Doodler, a pen that lets you draw and create things in 3D space (see Figure 2). You just

hold down a button on the pen, and it continuously outputs a thin wire of colored plastic. The product has been shown in several 3D print shows, and there's also an artist on Etsy creating and selling items she has created using the pen. Learn more about it at www.the3doodler.com.

Reader the0therbk pointed us to a 3D food printer called Cornucopia. Currently, it's still a concept design, but the basic idea is to have canisters of ingredients that can be deposited and then cooked and cooled layer by layer. Such a food printer could let people control taste, nutritional value, and appearance. See more at <http://phys.org/news199080001.html>.¹

Reader caliburn666 shared another link to 3D printed food. A journalist tried to print everything needed for a dinner, with the original goal being to print plates, forks, place mats, napkin rings, candlesticks, a tie, and food. The results were a bit mixed, with novel kinds of shapes for food, including gears and springs, but also leaving some printed food left uneaten. Read more about the self-imposed challenge at www.nytimes.com/2013/09/22/opinion/sunday/dinner-is-printed.html.²

There was also a discussion of the emerging economic impact of 3D printing. Member tarquiniusmaximus82 (apparently a fan of classics) directed us to an *Economist* article about how mainstream companies are integrating 3D printing technologies into their manufacturing pipelines, including Airbus, Boeing, GE, Ford, and Siemens.³ According to the article, these technologies were

JOIN OUR SUBREDDIT

This column offers a 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, at www.reddit.com/r/pervasivecomputing. 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 all aspects of pervasive and ubiquitous computing

—Jason Hong and Mary Baker

a \$2.2 billion market in 2012, and the market continues to grow. The article discusses one of the advantages of 3D printing, which is the ability to create hard-to-find tools or spare parts. The article also discusses how many companies are experimenting with printing electrical circuits, facilitating the rapid prototyping and creation of smart objects. However, the article points out that there are still skeptics, perhaps the most prominent being the head of Foxconn, who has vowed to spell his name backwards if 3D printing truly takes off.

TheOtherbk also shared a link to a Quartz.com article entitled “It’s the End of Walmart—And Mass-Market Retail—As You Know It.”⁴ The article makes a large claim about trends, arguing that the big advantage Walmart had was its supply chain, and the big advantage for Amazon is its analytics, but in the future, these advantages will be negated by small production houses that can combine robotics with 3D printing to offer just-in-time manufacturing of goods. The author points to Ponoko as an example, which connects designs and designers to local manufacturers that can use their laser cutters and 3D printers to create and deliver goods, vastly cutting shipping and labor costs. In such a world, production and distribution costs go down, while design costs might go up.

As an aside, one of us (Jason Hong) can’t help but notice parallels between microprocessor design houses that only create intellectual property (like Rambus and ARM) and fabrication companies (like Taiwan Semiconductors). Perhaps new kinds of pipelines and new categories of jobs will emerge due to these sorts of technologies.

THE DOWNSIDE OF SMART CITIES

A reader pointed us to a *Boston Globe* newspaper article on what the metropolis of the future might be like, and whether we would want to live there.⁵ The article discusses research in making urban areas smarter—for example, with



Figure 1. StickNFinds are small Bluetooth devices that you can attach to anything and then find using your smartphone. (Source: StickNFind; used with permission.)

various sensors that help with parking, pinpointing gunshots, and monitoring sewage flows. However, the article also raises serious questions about privacy, data ownership, the software for processing and visualizing the data (most likely private corporations), and political issues (such as what hard problems will and won’t be addressed by these new technologies). The article goes into special detail regarding the advantages and trade-offs of emerging technologies.

For example, mass data collection in the form of sensors and cameras can help with safety but can also be used to track citizens. The article further mentions disagreements between top-down approaches for smarter cities, where there is a central brain for collecting and managing all of the data, versus

a bottom-up approach that instead empowers citizens.

SMARTPHONES

Reader theOtherbk shared a link showing the fragmentation of Android OS.⁶ The webpage contains interaction visualizations that let you see what are the most popular devices, the most popular smartphone brands, and what percent of people are running what OS version and how that has changed over time. The webpage also has cool visualizations showing the popularity of different screen sizes, and offers comparisons to iOS (which has far less fragmentation). See the visualizations and the full report at <http://opensignal.com/reports/fragmentation-2013>.

Another reader sent in a humorous link to a rejected iOS app called

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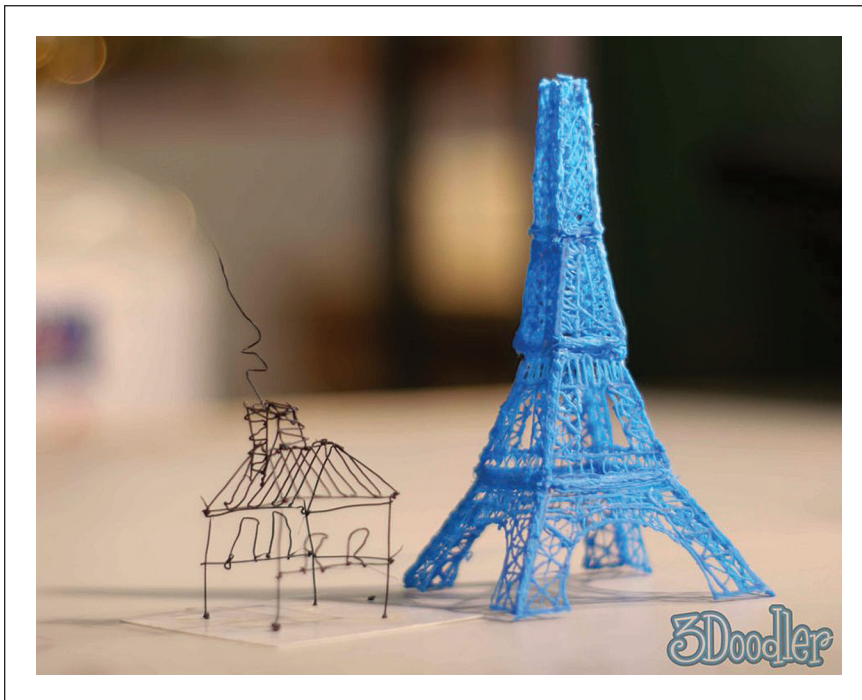


Figure 2. Two example objects created by 3Doodler, a pen for creating things in 3D. (Source: 3Doodler; used with permission.)

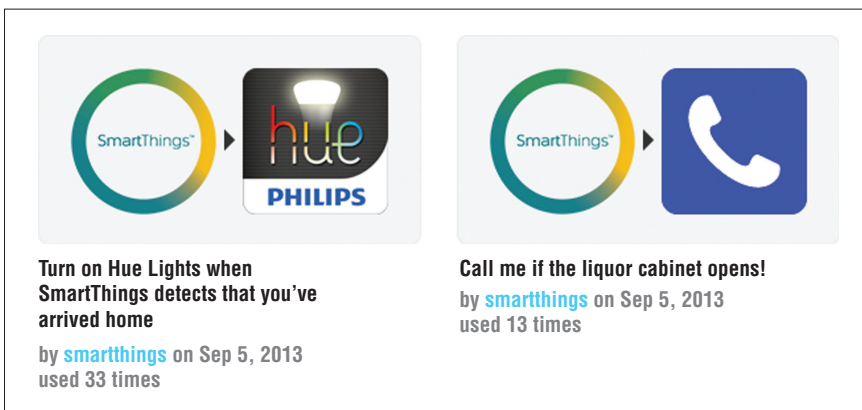


Figure 3. Two example recipes offered by IFTTT (If-This-Then-That) for programming behaviors of SmartThings. (Source: IFTTT; used with permission.)

Send Me To Heaven.⁷ The app uses the accelerometer to estimate how high you can throw your smartphone. There probably isn't a special prize for getting first place, but you're welcome to try. Send us any screenshots of your successes and failures.

CREATING UBICOMP SYSTEMS

Reader jlinphd shared a CNET article about how If-This-Then-That (IFTTT)

has a new feature for supporting home automation (see Figure 3).⁸ IFTTT was originally created as a sort of glue between various Internet-based apps, using a simple graphical if-then syntax. Using the IFTTT website, people could create simple recipes—for example “if it's going to rain, then send me an SMS,” or “if I tweet a picture, then also copy it to my Dropbox account.” IFTTT now includes support for smart

products, including select light bulbs, motion sensors, door locks, whether something is opened or closed, and presence sensors (<https://ifttt.com>).

WEARABLES, ROBOTS, AND THE IOT

Reader jackfruitfan pointed us to an article arguing that wearable technologies are going in the wrong direction.⁹ The author observes that most wearable technologies are centered on notifications of phone calls, text messages, and more, but these end up just being yet another distraction in an already distraction-laden world. Instead, the article talks about alternatives to distractions, like the Nymi wristband that facilitates authentication, or a wearable sensor for infants for detecting and preventing sudden infant death syndrome.

Member jlinphd shared an article on *The Verge* with an intriguing title: “If an Explosives Robot Becomes Your Friend, Can You Still Send It Off To Die?”¹⁰ Researchers have found that soldiers in explosives ordnance disposal become rather attached to their robots, with some treating their robots like team members and talking about funerals for their robots if they die. Even seeing your robot as a pet might influence or limit an operator's decision-making process.

One reader directed us to an article in *Wired* magazine entitled “Welcome to the Programmable World.”¹¹ This article discusses what the world might be like if everything around us—including light bulbs, TVs, exercise machines, medical devices, and cars—were all programmable, particularly in terms of making data about their internal state available to others. The article argues that this Internet of Things will happen in three major stages. The first stage is to just make everything connected, which is being helped by smartphones (which offer a near-universal interface) as well as many companies who see these networked devices as a way of selling more products and services. The article cites some estimates by industry analysts that we might have over one trillion

connected devices by the year 2025. The second stage is to make things more programmable. Here, the opportunities might include relatively simple things (something analogous to Facebook's social graph), simple if-then based programming languages, and standardized notions of presence in a location. The third stage is support rich applications on top of the other stages, for example having closed feedback loops or coordinating hundreds of sensors and actuators together. **P**

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