iPhone: Smarter Than the Average Phone

Roy Want

EDITOR'S INTRO

To begin, I thank Franklin Reynolds, the previous Smart Phones department editor, for a most interesting and insightful collection of articles. He recently stepped down after serving eight years on the editorial board. Likewise, at the beginning of this year, I reached the end of my term as editor in chief, passing the torch to Nigel Davies, and at that time we discussed the option of me continuing as the Smart Phones department editor in 2010. This article is the first in this series.   *—Roy Want*

Cell phones—and, in particular, smart phones—are tangible embodiments of pervasive computing that can be used as invaluable tools in our daily lives. Though the mobile phone market's growth has been spectacular since the 1990s, the recent recession took a bite out of the total available market. According to the Intel Library, in 2008, 1.2 billion cell phone units shipped; in 2009, this number fell to 1.15 billion. However, the unit trend in 2009 between Q3 and Q4 saw an increase of 15.5 percent shipped, which might indicate that, in the economic recovery, cell phone sales will continue on their previous upward trajectory, with 1.3 billion units projected in 2010. If correct, the 2009 recession's impact will only have been a temporary setback.

From a research perspective, the smart phone category within the cell phone market is particularly interesting, with an estimated 220 million units shipping in 2010, representing a 35 percent increase from the previous year. By 2015, the market could expand to 700 million units, and clearly will impact our expectations of what the average cell phone should be capable of. An important development for smart phone technologies is how they integrate key aspects of what has traditionally been pervasive computing research, including location-based services, context-aware applications, and

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sensor-driven computing, and most significantly, that they're being delivered to customers as fully honed products.

SMART PHONE CHOICES

Although many smart phone products currently available in the market are based on Linux, Windows Mobile, and Android, the phone that has drawn the most attention is Apple's iPhone running iPhone OS 3.0. By any measure, you have to give Apple a lot of credit for the iPhone's design; it's clearly very well thought out in several design dimensions and is fully extensible through the Apple App Store, which keeps the novelty and fun factor very high while leveraging the developer community's huge talent pool. Furthermore, these applications aren't just games—they provide customers with indispensable productivity tools for everyday work. Though I have owned several smart phones, my recent iPhone acquisition has been a very empowering experience. In particular, the ease of adding new applications and the consistent and straightforward user interface make the device a joy to use. I bought the 3GS model, which has a GPS, an accelerometer, and a compass, and is thus fully equipped to support various context-aware applications. Further, the integrated 3-Mpixel camera is first class and has a higher resolution than a typical camera phone, enabling detailed image processing of optical tags not possible with earlier phones. The capacitive touch screen along with the iPhone navigation software, including the two-finger zooming mechanism, provides a level of intuitiveness that clearly outshines earlier smart phone models.

Another reason the iPhone works well for my life is that it provides a mechanism to sync and store my work and home e-mail, calendar, and contacts separately, and I can select which account I wish to view when required. In particular, a feature that's worthy of mention is the ability to display my personal calendar side-by-side with

my work calendar. This is the first smart phone that really does a good job of integrating home and work. The only thing missing is a dual subscriber identity module (SIM) capability to separate corporate and home billing for my phone calls.

One aspect of the iPhone design that really changed industry perception is the Web browser interface. Before the iPhone browser, nobody really believed you could have a first-class Web-browsing experience on a mobile phone. The combination of the capacitive touch surface, the zoom interface, and the adaptive soft keyboard lets you select a standard webpage, view, zoom, and pan—all by just sliding your fingers around. Today, browsing the Web when I'm mobile is an intuitive and straightforward task, and in contrast to a few years ago, I'm now very likely to use the Web to look up information on the go.

Following are my experiences with various iPhone applications.

iPHONE APP STORE

The simplicity of being able to search for software in the App Store from the phone itself, then download it at the touch of an icon, has to be one of the iPhone's most compelling capabilities. From a user perspective, it maintains the device's novelty level and builds greater utility over time; from a business perspective, it provides an ongoing revenue stream to the device manufacturer (rather than service provider) after the main product has been sold. The more traditional and laborious approach of loading applications—finding the device's website using a desktop computer, downloading the application to its local disk, uploading it to the phone with a USB cable, and then installing it—is a thing of the past. With many apps being free, or only 99 cents, the temptation to try out new software on a whim is very strong, and I'm sure this drives business opportunities that wouldn't be possible any other way.
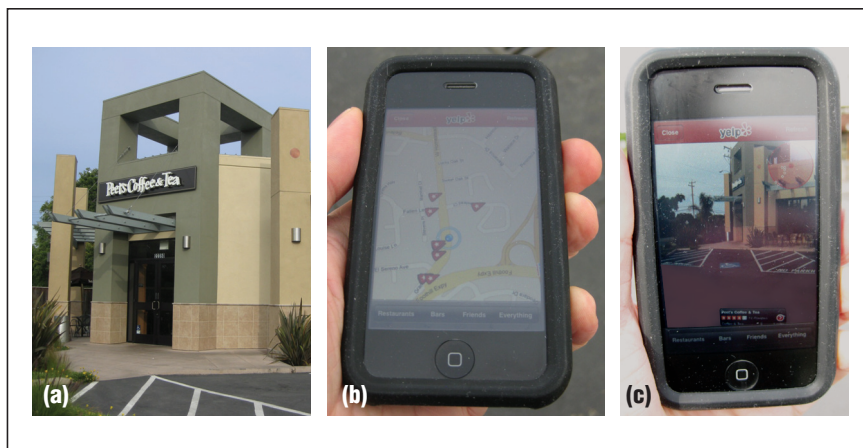

Figure 1. Yelp. (a) The user faces a Peet's Coffee & Tea shop in Los Altos, California. (b) Yelp displays a street view of the neighborhood relative to the user's position. (c) Yelp's augmented-reality view (Monocle mode) labels the camera image with a link to 14 online reviews.

MY TOP FIVE iPHONE APPLICATIONS

Although I've only been able to try out a relatively small fraction of the more than 150,000 iPhone applications, the short list below represents some core capabilities that I value and that are particularly relevant to pervasive computing. I found them from a variety of sources, including keyword searches on the Web and the App Store, as well as recommendations from other iPhone reviewers, friends, and colleagues. If you aren't an iPhone user, I hope that you'll find this list informative, and if you are, I hope there's something new here for you to try.

Yelp

Yelp is a popular website for reviewing restaurants, bars, stores, and so forth, enabling user reviews to be combined and providing future customers an averaged score for each venue. One of the coolest aspects of the mobile Yelp application (shown in Figure 1) is that it's location-aware, using the device's on-board assisted GPS to determine your position and the compass to find the direction the iPhone is pointing. In addition to receiving the standard list of businesses near your location, you can also select Monocle mode. When the device is laid flat, it shows a street-view map with businesses marked relative to your position and orientation. But when you lift the phone to a vertical position, the application provides you with a camera view, and a compass circle superimposed in the top right corner indicates the direction of businesses available in its database. If you pan the phone around and point the camera in the direction of these businesses, icons will appear on the screen labeling what you're seeing. You can press one of these icons for a detailed review of that establishment.

I first saw this type of mobile augmented-reality (MAR) application demonstrated as an HP Labs research project in 2001. Roughly 10 years later, it's a readily available iPhone app that everybody can use in earnest.

RedLaser

In the pervasive computing sense, the RedLaser app (shown in Figure 2) bridges both real and virtual worlds. It provides a camera view of what you're seeing while continuously image-processing the scene, looking for standard UPC (Universal Product Code) and EAN (European Article Number) bar codes. A graphic with a rectangular box helps you position your phone the optimal distance from the tag and maximize the chance of its

Figure 2. RedLaser. (a) The user positions the camera recognition system over a bar code on the back of a book. (b) A moment later, RedLaser recognizes the book's bar code, links to online data, and provides a list of links to vendors.

Figure 3. Bump. (a) Two iPhones run the app and are ready to bump. (b) After bumping, the two devices are connected and will exchange contact profiles when their users provide a final confirmation.

recognition. Once a match is found, the app confirms what the product is and lists key information about its price, the online stores where it can be bought, and links to those stores. If it's a grocery product, facts about its health and nutritional value are also provided. For example, scanning a package of Petit Écolier cookies reveals that it may contain potential allergens such as tree nuts and that it includes gluten and lactose. When scanning a copy of *Mostly Harmless* by Douglas Adams at a friend's house, the app provided links to new and used booksellers with price availability from US$1–14. This was further augmented by a list of local libraries with the book on file, listed by increasing distance from my location. As the product code database grows, in the future I believe this will be an essential tool for comparative shopping.

Bump

The Bump application (shown in Figure 3) lets two iPhone users exchange contact information using an intuitive approach—you simply bump the two devices together. It's the modern equivalent of exchanging business cards, except that it's completely electronic, and the information is inserted into your standard contact list when you accept the transfer. For the app to be operational, Bump must be loaded and running on the two iPhones. The process of bumping them together triggers a wireless transfer, identifying them uniquely from other devices because they both experience an impulse at the same time. When infrared communication was available on most mobile devices (before Bluetooth) in the late 1990s and early 2000s, infrared beaming of business cards was a selling feature of PDAs. However, in practice, this never really caught on. Given that most business users are likely to have an online contact list these days, and sensors such as accelerometers are now a must-have mobile device feature, bumping could become the new standard for exchanging business cards.

Shazam

This amazing Web service, available through the iPhone, can identify songs by listening to a snippet of the sound, then analyze it and provide you with the name of the song, the artist, and the album it's on (see Figure 4). Further, it gives you the opportunity to buy the song through the iTunes store right there and then. This service would be useful from any PC, but on a phone it's particularly valuable because the device is always with you. Shazam provides a solution for those unexpected moments when you hear a piece of music that you would like to identify in a coffee shop, a store, or a movie theater, and there really is no other way of finding out what it is. With a smart phone that you carry everywhere, the opportunity will never be lost.

Zillow

Building on the popular real-estate website that provides data on house pricing, lot size, square footage, number of rooms, and so forth, the Zillow iPhone app (shown in Figure 5) goes a step further and allows you to see

all this information while mobile. It makes house hunting a totally new experience, letting you see estimated prices superimposed on a street map or satellite view while you're walking around a neighborhood. Using coded icons, the display also shows which houses are for sale, those that were recently sold, and those available for rent. Pressing any of these symbols yields a page of information that might even contain a link to a slideshow, providing a detailed view of the house's interior. When I think back to earlier periods in my life when I was looking for a house to rent, studying local classified ads in detail, then setting out by car for a drive-by of prospective venues, the process seems primitive compared to what can be done so easily on a smart phone today.

For future installments, I'll keep an eye out for new smart phone apps that exemplify pervasive computing and bring them to your attention. I'll also compare and contrast applications created for other operating systems, such as Android from Google and Meego from Intel and Nokia, as well as the latest developments from Microsoft with Windows Mobile 7. If you discover a mobile phone application that you feel is worthy of bringing to the attention of the research community, please send the details to roy.want@intel.com so I can consider it for discussion in a future issue.

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Figure 4. Shazam. (a) The app listens to a song on a nearby radio. (b) After 10 seconds of listening, the Shazam online service analyzes the song and presents details.
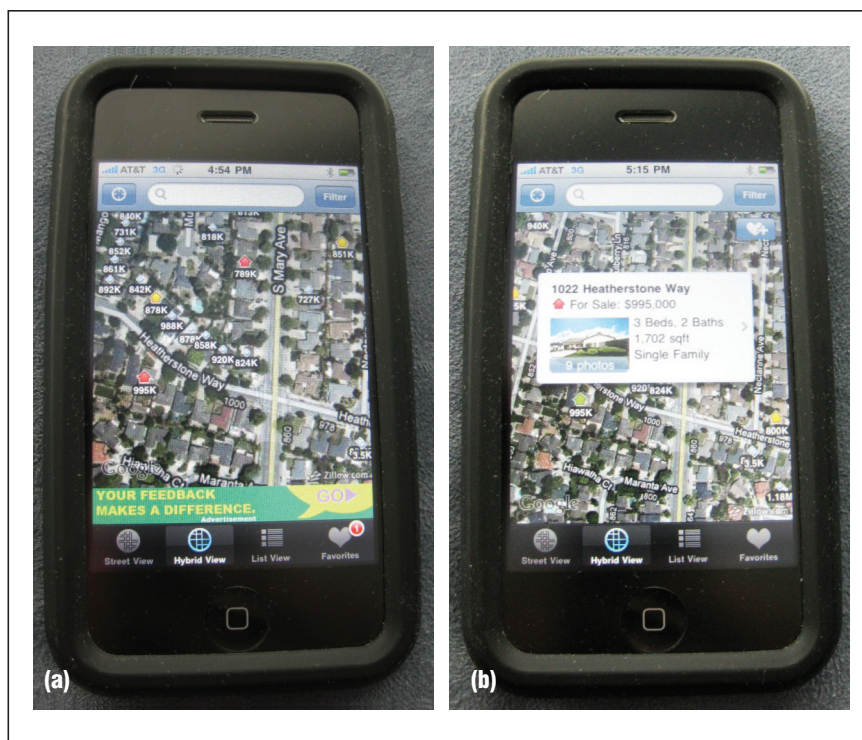

Figure 5. Zillow. (a) The app shows a hybrid plan of the local neighborhood based on its current location (Sunnyvale, California). The red icons are houses for sale; (b) pressing one provides address, lot size, and an option to see photos—in this case, Zillow has nine detailed photos of the house's interior.