

The Smart Phone: A First Platform for Pervasive Computing

One way in which the vision of ubiquitous computing has become a reality is in the ubiquity of mobile phones. Over a billion mobile phones exist today, a third of which are in China. In many Asian countries, more mobile phones are used than domestic landlines; in Singapore, mobile phones outnumber citizens.¹ Mobile phones are thus a near-constant companion of a significant percentage of the world's population, always on and always connected. More importantly, improvements in battery life, service coverage, processor performance, and overall platform capabilities are providing new opportunities for service deployment on these devices.

Ubicomp's killer apps

Some bemoan the lack of a killer application for ubiquitous computing, but we argue that there have already been two. The first is person-to-person voice communication; significant investments from individuals and companies in this area have resulted in the ubiquity of mobile phones. The second is text messaging or SMS (short-message

service), which has capitalized on the investment in mobile phones and existing bandwidth for short text communication. In China alone, over 100 million text messages are exchanged daily.¹

In the aftermath of these established killer apps, commercial and research opportunities abound to leverage the existing infrastructure and investment. Recognizing this, *IEEE Pervasive Computing* devotes this special issue to the evolving platform of the smart mobile phone, arguably the first realistic platform for everyday ubiquitous computing applications.

In this issue

Response to this special issue was predictably strong. With many fine articles to choose from, we selected eight to include in this special issue. Several other articles on this topic are expected in subsequent issues. Here, we highlight work that presents specific smart phone applications as well as programming infrastructure for further development and studies of emergent uses.

In "Enabling Pervasive Computing with Smart Phones," George Roussos, Andy J. Marsh, and Stavroula Maglavera provide a retrospective account of their experience in developing mobile phone applications to seed the 3G phone infrastructure.

In "Social Serendipity: Mobilizing Social Soft-

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ware,” Nathan Eagle and Alex Pentland introduce a system that senses a social environment and cues informal interactions between nearby users who don’t know each other (but probably should). In “Supporting Social Interaction with Smart Phones,” Russell Beale argues that application development for a convergent device exhibiting both telephony and PDA capabilities is more likely to succeed if the applications augment what many see as the device’s primary purpose—communication.

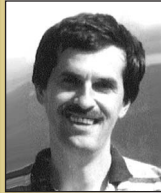
“The Ubiquitous Camera: An In-depth Study of Camera Phone Use” tackles another promising application area. By the last quarter of 2004, about 75 percent of mobile phones in Japan were camera phones, and it’s expected this number will saturate at around 75–85 percent this year.² Using a combined method of interviews and grounded discussions around a sample of actual photos, Tim Kindberg, Mirjana Spasojevic, Rowanne Fleck, and Abigail Sellen present insights into usage patterns and implications for future products and services.

Many opportunities also exist for exploiting mobile phones as a proxy for the individual, because the phone is most often carried on or near the individual and can represent information about that person—from location to affect. In “ContextPhone: A Prototyping Platform for Context-Aware Mobile Applications,” Mike Raento, Antti Oulasvirta, Renaud Petit, and Hannu Toivonen describe an open-source platform for the Symbian OS and the Nokia Series 60 smart phone platform, letting developers more easily explore the rich opportunities in this space. In “Using Smart Phones to Access Site-Specific Services,” Eleanor Toye, Richard Sharp, Anil Madhavapeddy, and David Scott present an approach to building services or applications that reside in a specific location.

Tapan S. Parikh presents an intriguing deployment study of mobile phones in



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rural parts of India. In “Using Mobile Phones for Secure, Distributed Document Processing in the Developing World,” he investigates how the mobile phone platform’s utility, usability, and durability make it an ideal bridging device between inefficient paper-based information ecologies and more modern information tools.

The ubiquity of the World Wide Web creates an obvious synergy with pervasive mobile phones, and in “A Wireless Web for Creating and Sharing Personal Content through Handsets,” Manuel Roman, Nayeem Islam, and Shahid Shoib frame the importance of this opportunity as one to enable more personalized information sharing. They present a dynamically partitioned middleware infrastructure to support the mobile capture and distribution of information for the wireless Web.

Several of the magazine’s departments also relate to the special issue theme. Keith Farkas and Guernsey Hunt discuss some tantalizing emerging trends with mobile phones in the New Products column. Two Works in Progress summaries highlight usability evaluation for context-aware applications and the development of cognitive aids on smart phones. In the Standards & Emerging Technologies department, Jonatan Tierno and Celeste Campo

present a tutorial on Java programming for camera phones, highlighting opportunities and limitations for application development using this resource.

The mobile or smart phone is ushering in the real age of ubiquitous computing, and we shouldn’t undervalue its importance. Some colleagues at Georgia Tech have pushed for considering the mobile phone as the entry-level programming platform for introductory computer science; others probably hold the same vision. While Moore’s Law will lead to impressive computational and storage properties for these devices, it’s their small form factor and constant connectivity that present the most intriguing, and sometimes worrying, possibilities. ■

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2. *Camera Phones: Disruptive Innovation for Imaging*, market report, Eurotechnology, Oct. 2004; www.eurotechnology.com/store/camera-phone/index.html.