This is Pervasive Computing’s second special issue focusing on Smart Phones. For the past 10 years, mobile computing in general and smart phones in particular have been topics of great interest and innovation within the research and business communities. Last year, despite the economic downturn, well over a billion mobile phones were sold worldwide. At the same time these phones are getting smarter.

Perhaps the most obvious advances continue to be the rapidly increasing computational power of handheld devices. CPU speed, memory size, storage capacity, and network speed continue their rapid improvement. Mobile phone cameras are much more powerful—they have more pixels, better optics, and faster capture times. And the imaging technology on phones has been significantly improved using computational photography techniques. New connectivity options such as mini USB and new sensors such as low-power accelerometers and magnetometers have become commonplace. Geo-location, based on assisted GPS, Wi-Fi, GSM, and other techniques that came out of the research community, is becoming a “must have” feature of smart phones. There have also been dramatic innovations in mobile user interfaces, such as the multi-touch and motion sensing interface that was popularized by the iPhone.

To the surprise of some industry watchers, rapid innovation in the areas of operating systems and application platforms for mobile phones continues. Android and the iPhone platforms have become available within the last three years, with Apple selling more than 17 million phones in under two years (30 million if you include the iPod touch). Today’s device designers can choose between Symbian, Brew, Windows Mobile, iPhone, Android, BlackBerry, as well as a variety of lesser known software platforms. Although this proliferation of application platforms presents some challenges for application developers, it also encourages competition and innovation. These new full-featured operating systems, with downloadable marketplaces for applications (the iTunes App Store, Android Marketplace, and BlackBerry Marketplace, as examples), are changing end users’ perception of these devices: from simple phones to small, mobile computers.

Mobile phones tend to be very personal devices. They’re intended to be carried wherever we go. It’s this property, as much as anything, that makes mobile phones so interesting to pervasive computing researchers. The hope is that powerful, personal mobile devices and related technologies will enable whole new classes of adaptive, context-aware applications. Many of the papers in this special issue offer new architectures, tools, and applications that point the way to this exciting future of the Smarter Phone.

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For example, in this special issue the authors of “Smart Phone Interaction with Registered Displays” describe a method for using mobile phones to interact with PCs and intelligent displays. Their approach supports a variety of interactions including a “flying mouse” (a la the Nintendo Wii controller) or screen cloning (PC ⇒ Smart Phone). In addition to enabling these proof of concept applications, such a system might make it easier to create new applications such as smart signs that adjust to each user or shared displays that let multiple users simultaneously interact with the display.

Outdoor localization is becoming an increasingly common technology on mobile phones. Even using cell tower IDs is good enough for many applications. There has been considerable research into many different ways of determining one’s location indoors. As of today, no solution is widely deployed. The article, “Indoor Positioning and Navigation with Camera Phones” discusses the design and some trial deployments of a simple, low-cost solution for indoor navigation. The system uses off-the-shelf camera phones and no special infrastructure. Such an architecture has the potential to open up a number of interesting applications, from navigation to finding lost objects to assisting the cognitively impaired.

In “What’s on Users’ Minds? Toward a Usable Smart Phone Security,” the authors attack the important problem of security and privacy on mobile devices. If we have our phones everywhere we go, we will want to collaborate with others around the information we are carrying. Prior attempts at solving this problem have created systems that are either unusable or not powerful enough to adequately express the desired sharing policies. The work described in this article tries to balance these two concerns in a way that leverages the social relationships and the security policies that end users tend to associate with those relationships.

Although smart phones are becoming powerful mobile computers, they are also still phones. In “UbiPhone: Human-Centered Ubiquitous Phone System,” the authors describe how context-awareness can make even the day-to-day voice communication experience more powerful. By using context, such as location, calendar entries, or social relationships, the phone can easily reroute callers, connect to contacts using the best available communication channel, or find the right callee from the members of a group.

“In this month’s Spotlight column, the authors present an overview of the Mobile Heart Health project. This system, which detects changes in stress levels and launches mobile therapies in response, is built on top of a context-aware data collection tool called MyExperience, which is similar to BeTelGeuse. This project offers a glimpse of the types of health-related applications that smarter phones will enable in the future.

Mobile phones are an extraordinarily successful technology. Their use has spread worldwide and despite recent economic troubles, the number of mobile phone users continues to grow. Most of the phones currently deployed might not meet the criteria of “smart phones,” but the sales of smart phones continues to grow at a fast rate and the cost of the technology needed to build a smart phone gets smaller every year. One lesson we can take from Apple’s recent success is that there is room, perhaps even a hunger, for innovation in the mobile phone market.