APPLICATIONS

CAMERA PHONES AS SCANNERS

It’s natural to want to use mobile phones with cameras as portable document scanners and copiers. However, these cameras tend to produce photos exhibiting background noise, soft focus, shadows, and poor alignment, and they have relatively small resolutions. ScanR and NEC are addressing these limitations.

ScanR is offering a service that uses proprietary image processing and data refinement technology to improve the readability of document images taken using mobile-phone cameras. You email ScanR images you’ve taken, and the service returns the enhanced images as PDF files (see figure 1). Alternatively, ScanR will fax the resulting documents to a number you provide.

NEC is developing technology in collaboration with the Nara Institute of Science and Technology in Japan that lets you easily generate a high-precision scan of a document. Using the technology, you take a movie of the target document with a camera phone. Software running on the phone analyzes the movie, derives several dozen still images from it, and stitches them together into a high-resolution scan. With a one-megapixel camera, scanning takes three to five seconds and produces 21 to 35 still images. To address copyright concerns, NEC plans to have phones equipped with this technology sound an alarm while it’s in use. NEC says commercialization of the technology is three years away.

CELL PHONES AS ENVIRONMENTAL SENSORS

Researchers at the University of California, Berkeley are leveraging cell phones’ ubiquity to build massive geographic information systems that could help reduce pollution or monitor radiation levels. The key idea is to outfit cell phones with inexpensive environmental sensors while leveraging the phones’ existing networking capabilities and ability to track handset location, either via GPS receivers in the handsets or technology within the cellular network. Together, these capabilities provide an opportunity to gather...
geospatial data at a higher granularity and with greater coverage than previously possible. The researchers are developing a carbon monoxide sensor for cell phones and anticipate that, in time, a cell phone-based CO detector could enable environmental scientists to monitor and track pollution in densely populated areas.

HYPERLINKING THE REAL WORLD

NeoMedia has developed a system called PaperClick that maps physical objects to Web pages, letting objects serve as hyperlinks. You create a machine-readable identifier by, for example, scanning an associated bar code, specially designed symbol, or keyword phrase. The PaperClick Resolution Service then maps this identifier to a URL. Although the system can support a variety of usage modes, NeoMedia is offering a mobile phone-based service. Using special software, you capture the identifier by taking a picture of it or entering the identifying information manually. The software then forwards the identifier to the PaperClick Resolution Service. The service maps the identifier to the target URL and returns this URL to your phone, which opens the URL. Based on the company’s Web site, it doesn’t appear that end users can select the content that the company returns. Rather, the returned content is determined by the consumer-product manufacturer or other entity that establishes the mapping between the physical object and the URL.

ENCODING COLOR IN BLACK-AND-WHITE IMAGES

Xerox has developed a technique that lets you recover a document’s original colors from a gray-scale version. When a color image is converted to gray scale, colors with the same luminance (perceived brightness) might be mapped to the same shade of gray, rendering them indistinguishable. The Xerox technique maps the colors in a color image to low-visibility, high-frequency textures that are then applied to the gray-scale equivalent image (see figure 2). The technique can be used to increase the discernability between regions of similar luminance in a gray-scale image. In addition, by reversing the mapping, the color information can be retrieved from an encoded gray-scale document. Practically, the encoding technique could be integrated into black-and-white printers and the decoding algorithm added to scanners. Xerox hasn’t announced plans to incorporate this technology into its products.

MULTIDEVICE FILE SYNCHRONIZATION TOOL

Transparent Synchronization (Tsync) is a tool that automatically synchronizes files on multiple devices (for example, laptops, home and office desktops, and PDAs), removing the need to move data back and forth by hand. James Anderson, a PhD student at the University of California, San Diego, created Tsync. The tool uses peer-to-peer and overlay techniques to provide scalable, efficient transparent synchronization of multiple devices even when the machines aren’t simultaneously connected to one another. Tsync organizes computing devices into an overlay network with a tree topology and relies on probing and a root fail-over protocol to propagate updates. Tsync is written in C++ and Mace and supports transactional updates and conflict resolution. A beta version of the open source tool is available under the GNU General Public License at http://tsyncd.sourceforge.net.

NOKIA NSERIES PHONES

Nokia has announced three new mobile phones in its multimedia Nseries, each targeting a different market seg-

Figure 2. A technique developed by Xerox lets you recover a document’s original colors from a gray-scale version: (a) the original image, (b) the gray-scale image with texture embedded, and (c) the recovered image.
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ment. The N71, N80, and N92 offer a long list of features. The N71, from the Nokia XpressMusic family, offers an FM stereo tuner, a five-band equalizer, and support for audio and video formats including MP3, AAC, eAAC+, WMA, JPEG, and MPEG-4. It offers a 240 \times 320\text{-}pixel display and two cameras, one 2-megapixel (1600 \times 1200 pixel) and the other VGA (640 \times 480 pixel). It operates on dual-mode wideband code division multiple access (WCDMA)/GSM and triband GSM. The N80 offers a 352 \times 416\text{-}pixel display and a 3-megapixel camera with features including four flash modes, 10 scene modes, manual exposure correction, and four color tones. The N80 is designed to work on 3G (WCDMA 1900 or 2100) and four GSM bands (850/900/1800/1900). According to Nokia, it’s the first handset to include universal plug and play technology. This technology lets you use the phone seamlessly with compatible PCs, audio equipment, and TVs—for example, to display video stored on the phone on a TV. According to Nokia, the N92 is the first mobile phone with a built-in DVB-H (Digital Video Broadcasting: Handhelds) receiver, letting you watch and record live TV. It also offers a quarter video graphics array, 16-million-color display, a 2-megapixel camera, and 90 Mbytes of internal memory. It operates on the same bands as the N71. The N71 and N80 will reportedly be available in Q1 2006 in Europe, Asia, and Africa, and the N92 will be available in mid-2006.

DIGITAL CAMERA NEUTRALIZER

Researchers at Georgia Tech have devised a system that prevents digital cameras from recording still and moving images and doesn’t require cooperation from the recording device. The system consists of a camera tracker that detects the presence of digital cameras and a camera neutralizer that directs a localized beam of light at each camera’s lens to obstruct its view of the scene. The camera tracker takes advantage of the retroreflective nature of the charge-coupled device sensor most digital cameras have, which causes light to reflect directly back to its source. The camera tracker consists of a video camera out-

Figure 3. Nokia Nseries smart phones (clockwise from left, the N71, N92, and N80).

Figure 4. An image taken using Georgia Tech researchers’ camera-neutralizing system.
fitted with an array of infrared transmitters. The camera tracker projects an infrared light beam and uses computer vision to detect retroreflective surfaces, which appear as bright white circular speckles on the video camera’s field of view. The camera neutralizer consists of a projector that emits a pulsing localized light beam at each camera lens. The result is an effect similar to taking a picture against the sun, where the concentrated light source overwhelms the picture (see figure 4). To prevent the camera from adjusting to the light beam, the neutralizer alternates the pixels in the projected image between white, red, blue, and green. The research team presented a prototype of the system with an operating range of five meters at the 7th International Conference on Ubiquitous Computing (UbiComp 2005) in Tokyo.

COMPACT GSM/GPRS RADIO

The Si4209 transceiver manufactured by Silicon Laboratories is a compact dual-band GSM/GPRS radio with complete quad-band support. The Si4209 is targeted for the ultra-low-cost handset market. The solution reduces cost at the receiver front-end and reference oscillator interfaces and requires only 10 external components. When coupled with an antenna switch and Silicon Laboratories’ Si4300 power amplifier, the Si4209 transceiver creates a complete radio in only 2.3 cm². The Si4209 transceiver is available in a compact 5 × 5-mm, 25-pin, quad flat no-lead (QFN) RoHS-compliant package. Pricing begins at US$2.99 in quantities of 10,000.