Information Appliances

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Producing a special issue on the rapidly evolving area of information appliances proved more difficult than we imagined for two primary reasons: the field is moving quickly, and there is much commercial activity. The first makes it difficult to determine the approaches and applications likely to be successful. The second makes it difficult to recruit authors who are actually willing and able to discuss their work.

Until a few years ago, the term "information appliance" didn't even exist. Certainly many, if not all, of our appliances and consumer electronics contained computing devices. However, we didn't view them as information appliances because they didn't have much information in them. What they had was the ability to play a CD, follow instructions we tapped out on some buttons, or allow us to place a phone call. All this changed when the World Wide Web came on the scene. Now, information can flow around the world using standard protocols and be rendered on a variety of devices from desktop machines to

Mr Java

Joseph Kaye and Niko Matsakis
MIT Media Lab

Mr Java is a smart coffee machine, part of a new breed of connected and information-enabled appliances. When you put your mug under the spout (Figure A), the machine recognizes an RFID tag glued to the base. It greets you, makes you the coffee you prefer, and plays your prespecified choice of news or information.

For example, when Kaye puts his mug under the spout, the machine's LCD screen displays "Hi Jofish." It makes a double tall latte and plays the latest RealAudio news feed from London. A delay between displaying the greeting and starting to make the coffee lets users pick a different selection from their usual while maintaining their standard preference.

Mr Java demonstrates how a single appliance can present a different interaction for each user, customized and personalized to them. The physical form of the machine itself is specialized to perform a particular function, and the digital augmentation serves to create a richer and more enjoyable experience. It presupposes a networked world and, importantly, the ability to identify the users to personalize their interaction. The availability of this combination will stimulate and modulate the propagation of information appliances.

Mr Java was first installed at the Media Lab in 1997. It is also on display at EDS's Marketplace of the Future in Plano, Texas.

Current research continues to look at the role of information appliances in the kitchen of the future through the Counter Intelligence research project at the MIT Media Lab.

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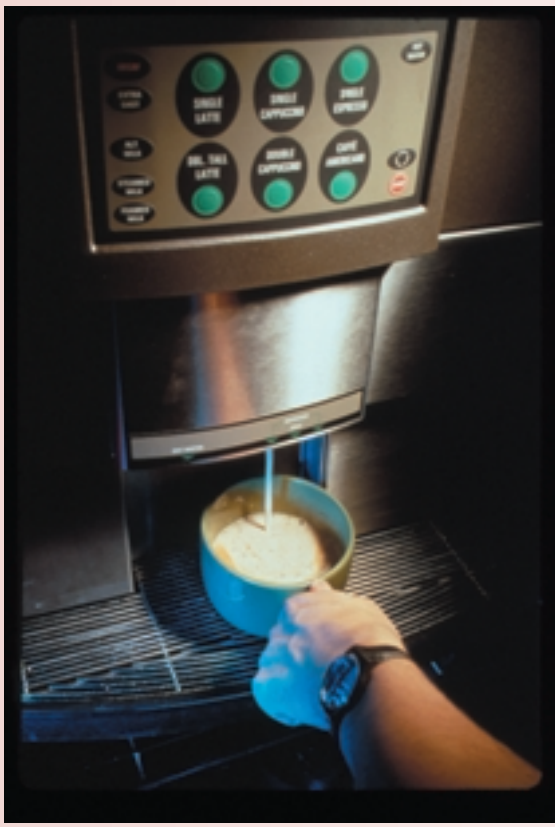

A Mr Java serves up your preferred mix of coffee and news.

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personal digital assistants to cellular phones. Second, Moore's Law has given us the ability to implement these protocols on increasingly inexpensive, small, and power-thrifty devices. Third, we've seen the emergence of low-cost wireless communication technologies both in the infrared and radio spectrum.

Together, these three developments have unleashed a new wave of applications and business models. As solutions emerge that streamline the interoperability of these devices, opportunities appear for entirely new commercial enterprises. It's important to remember that interoperability is much more than the physical standards of wireless communication—it also includes the higher-level protocols that make the data transmitted meaningful to the software that will receive it and to the users who will view the distilled results. Efforts like XML (Extensible Markup Language) and WAP (wireless application protocol) are only just beginning to tackle this space. Much work remains in this area.

In this special issue, we've collected five articles that present a range of information appliances. The first surveys the appliances and some of the issues in their design and use. The other four cover different types of information appliances in more detail: electronic books, personal digital assistants, automobile navigation, and smart rooms. Electronic books face the enormous challenge of displacing one of the most successful technologies of all time, paper and ink. New interfaces for PDAs promise to make them even more useful and easy to use by taking advantage of the fact that they are held in a user's hand and don't just sit on a desk. Automobile navigation is entering a new era in which sensors in

Exploring Mobile and Desk-Based Gaming Appliances

Thad Starner, Bastian Leibe, Brad Singletary, Kent Lyons, Maribeth Gandy, and Jarrell Pair
Georgia Institute of Technology

Thanks to continued miniaturization of portable consumer electronics, powerful mobile information appliances will appear on the market in the next couple of years. These devices can exploit a much richer set of interactions than the pen-and-pad metaphor popularized by Palm Pilot. The interesting upcoming application area of augmented reality gaming extends many dimensions of the mobile interface.

Georgia Tech's Contextual Computing Group (http://www.cc.gatech.edu/ccg) has created a prototype system in which the mobile user can interact through gesture, head movement, and voice. The Wearable Augmented Reality for Personal, Intelligent, and Networked Gaming (Warping) architecture explores how augmented environments may be shared between mobile and stationary users. The mobile user wears a see-through head-up display, earphones, and two cameras—one looking forward and one looking down toward the user's hands.

In the game application shown in Figure B, the mobile player is attacked by flying blocks graphically overlaid on the environment in front of him. The forward-looking camera tracks features in the environment so that the flying "monsters" appear situated in the physical environment. To defend himself, the player yells and forms "martial arts" gestures (see lower-left image) that are recognized by the downward-looking camera.

Another player controls the blocks remotely, using the Perceptive Workbench. This Fakespace Immersive Workbench is outfitted with a near-infrared computer vision system that can identify and track objects placed on its surface, track 3D pointing gestures, and reconstruct objects on its surface in 3D. The stationary player may attack the remote mobile player by directing physical models of the monsters on the workbench's surface. The resulting interface explores collaboration between two very different scales of future information appliances—the augmented physical desktop and the wearable computer.

B **The mobile player sees flying blocks overlaid on the environment (top), against which he defends himself with martial arts moves (lower left). The opposing player controls the blocks remotely using the Perceptive Workbench (lower right).**

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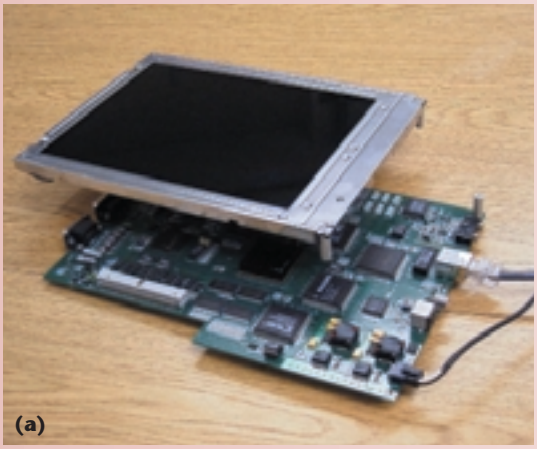
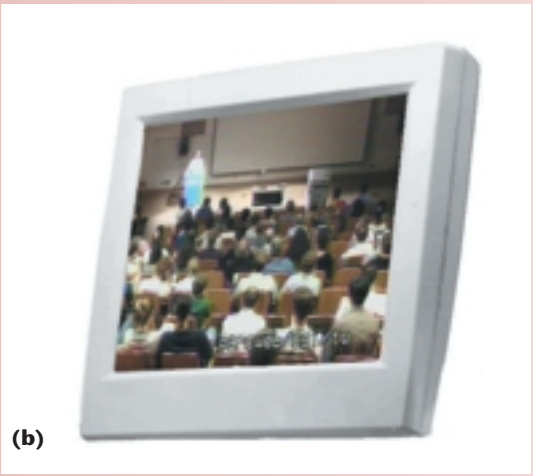
roadways can help drivers avoid congestion and bring new efficiencies to transportation. The increasingly sophisticated information architecture of smart rooms let them seamlessly coordinate the variety of devices that users carry and use within the space.

The three sidebars accompanying this introduction provide a condensed explanation of two other information appliances: Mr Java, a smart coffee machine, part of the Counter Intelligence project at MIT; an augmented reality gaming appliance described by Thad Starner and his team at Georgia Tech; and EVA, a digital video appliance developed at Xerox PARC. We included them to further round out our survey of the information appliance space—they give a flavor of the new classes of devices you can expect to see in stores in the not-so-distant future. This work is ongoing, and the details will be described in later publications.

We hope that you enjoy the articles we have collected here and find inspiration for your own activities. This is an opportune time to experiment and discover how the new world is being fashioned by information appliances. ■





Courtesy of Xerox PARC

EVA

Alan Bell
Xerox PARC

EVA (Ethernet Video Appliance) is a prototype information appliance that serves as a video portal between users and lets them create and view stored video content. Because EVA directly attaches to an Ethernet as an information appliance and has a desk-compatible form factor, users can integrate high-quality video communication into their usual work practices without disrupting the use of their workstation.

EVA was developed in the Embedded Systems Area, part of the Computer Science Laboratory at the Xerox Palo Alto Research Center, by Ron Frederick, Paul Stewart, and Alan Bell.

C EVA, showing (a) the prototype hardware and (b) the envisioned form factor for wide-scale deployment.

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Want received his BA in computer science from Churchill College, Cambridge University, UK in 1983 and continued research at Cambridge into reliable and distributed multimedia systems. He earned a PhD in 1988. While at Olivetti Research (1988-91) he developed the Active Badge, a system for automatically locating people in a building. He joined Xerox PARC's Ubiquitous Computing program in 1991 and developed an information appliance called the ParcTab. A more complete summary of his work can be found at http://www.parc.xerox.com/want.

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Borriello received an MS in electrical engineering from Stanford University in 1981 and a PhD in computer science at the University of California at Berkeley in 1988. In between he spent four years at the Xerox Palo Alto Research Center in the VLSI Systems Design Area. He is a member of IEEE Computer Society and ACM SIGDA. His home page can be reached at http://www.cs.washington.edu/homes/gaetano.

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