Mobile Computing

Mobile computing — also known as pervasive and ubiquitous computing — is changing the way we live and work, as profoundly as the introduction of the automobile did almost a century ago. Our research activities are oriented toward fulfilling the vision of millions of organizations and a billion people connected by a trillion devices.

The Next Generation Mobile Web

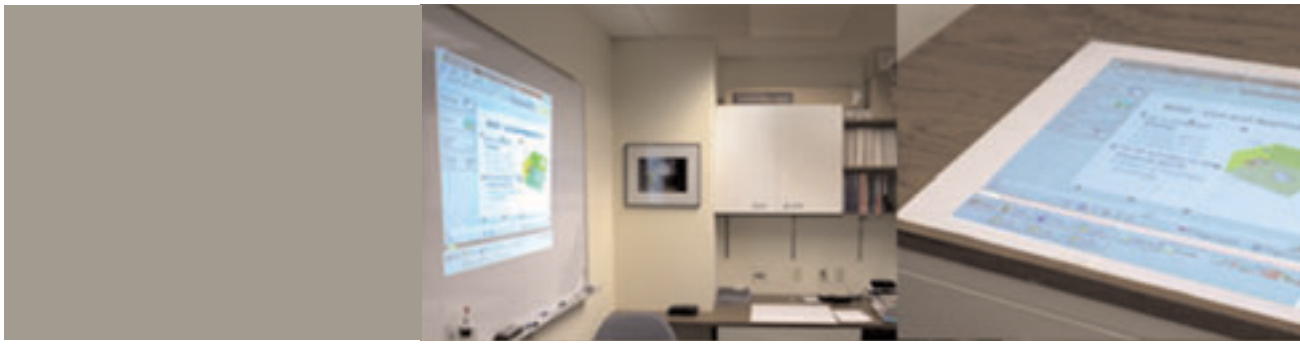
The web is expanding to include such new domains as household appliances, tools, vehicles, and other network-connected objects, many of them mobile. These objects are expected to collaborate to provide advanced services, well beyond their individual capabilities. This is a new world, full of unconventional challenges, which we have started to explore in detail. Our research ranges from the IP layer of the network and upward, and includes Internet-scale device discovery, security models, and a highly scalable platform for collaboration among devices. Our ultimate goal is to embed all necessary software in devices, perhaps as widely deployed as into every light bulb! As an example, we have pioneered a vehicle information system that provides remote fault diagnosis, wherein a collection of components across distant locations collaborate in diagnosing faults in the vehicle, and may even provide mechanisms for ensuring recovery from the faulty status.

We are also exploring the issues associated with location-based services using mobile devices. We have enabled the exploitation of location-sensing technologies, including RF sensors and Bluetooth, and are now developing the infrastructure required for the wide deployment of location-aware devices and applications. For instance, we are investigating advanced data-mining algorithms for geospatial decision support. Within this spectrum of possibilities, privacy of personal location information is a crucial issue that requires innovative solutions. We are also pursuing new user-interaction paradigms and environments featuring greater control and personalization, context-aware applications, pervasive access to workspace resources, and transparent integration of mobile devices.

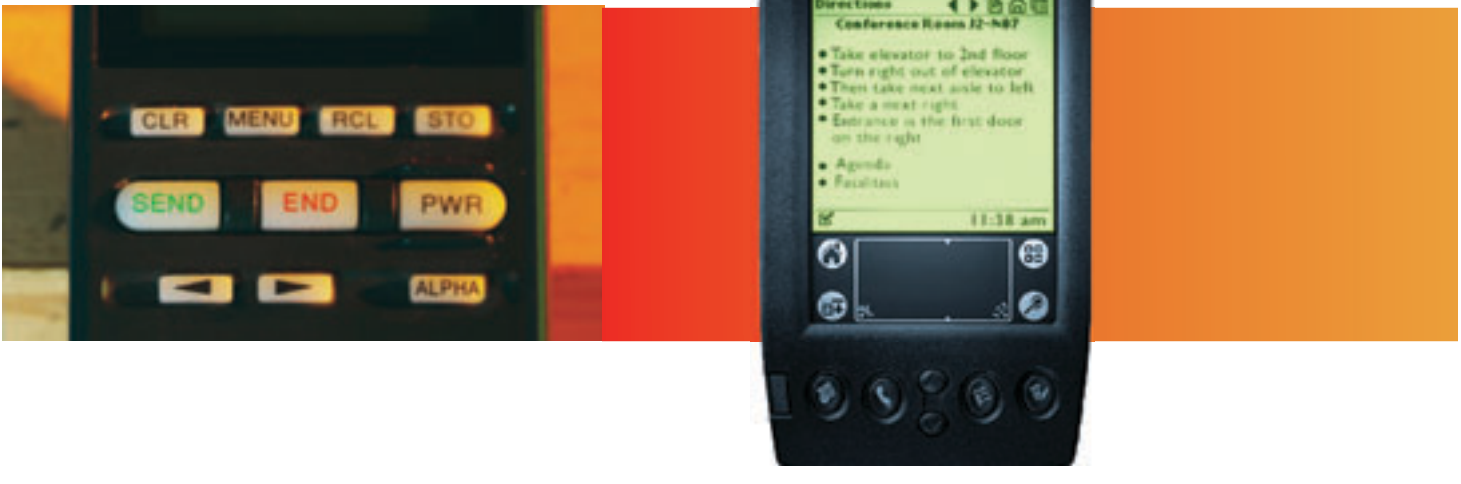
Mobile Computing Applications

Today, an application intended for a personal computer, a personal digital assistant (PDA), and a mobile phone must be written separately for each one of these devices. As the variety of devices increases, such a multiversion approach becomes untenable. To address this limitation, we have developed a workbench for building device-independent applications. Within this framework, user interfaces are automatically generated from high-level specifications and are tuned for the specific devices. Moreover, we have developed runtime engines supporting these applications on several devices.

Applications for mobile devices entail the integration of various sources of data optimized for delivery to limited hardware resources and intermittently connected devices through wireless networks. Challenges posed by telephone interfaces lead to the exploitation of speech recognition through natural language understanding and text-to-speech conversion. We are building an automated assistant that is natural to use and can be an alternative to a human assistant. The virtual assistant can arrange meetings, make phone calls, take messages, and provide access to personal-organizer information. Key components are multimodal interactions through phone, instant messaging, and pager, according to user preferences.



As mobile computing evolves, we are pushing the limits of technology in multiple dimensions through ever-smaller information appliances. We have developed — and continue to improve — a wristwatch computer that provides a display with VGA resolution, RF and IR connectivity, and that uses Linux as the operating system (See HCI on page 48). Within the context of this aggressively small platform, we are investigating connectivity, user interfaces, embedded-system software design, power management, displays and packaging. Our research focuses on technologies and components of general use in small-form-factor information appliances.



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