Supporting Informal Computer-Human Collaboration: the K22 Kiosk Platform

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Abstract

Spontaneous, informal gatherings among colleagues often spur greater exchanges of ideas than formal meetings. The K22 project aims to support these spontaneous collaborative interactions by embedding *intelligent kiosks*, small networked Intelligent Environments (IEs), in hallways, break rooms, and other informal meeting spaces. These kiosks will enable private capture and indexing of casual meetings, and permit access to relevant, context-sensitive information and agents in other IEs. This paper describes the K22 platform, and discusses challenges and design criteria associated with designing K22 applications.

1. Introduction

Informal spontaneous gatherings, such as running into colleagues in the hallway, meeting someone waiting for an elevator, or while at the water cooler, occur countless times in the workplace each day. These unplanned meetings frequently involve exchanging information, whether it be personal contact information, requests for favors, or references to interesting information. Occasionally, these meetings may also end up in mini brainstorming or collaborative problem solving sessions, such as when someone seeks a colleague's expert advice.

With all of these situations, it is immediately evident that being able to capture these interactions, interpret them, and refer to them conveniently later would dramatically improve the effectiveness of these opportunistic meetings. Furthermore, individuals in situations such as the last scenario, where someone is seeking another's advice, could greatly benefit from being able to spontaneously access, visualize, and manipulate their relevant information. Indeed, Project Oxygen's vision of ubiquitous computing already presumes these capabilities, since it would just be another way that computation could be "as freely available, anytime, anywhere, as air." (Dertouzos, 1999)

Project Oxygen already has one platform that could be used for augmenting day-to-day impromptu interactions possible: H21. While H21s have already demonstrated their utility in many applications, several factors limit the H21's applicability to capturing unplanned, informal collaborations. First, for this application, an H21 would have to be available on hand at all times. Thus, we would have to believe the unrealistic assumption that individuals carry H21s with them constantly, even during brief rest breaks. Second, the screen size of H21 devices is inconvenient for simultaneous multi-person viewing and manipulation. On top of these physical limitations, the computational resource limitations inherent in handheld computing devices such as H21 makes developing sophisticated user interfaces for them extremely prohibitive.

These limitations have led us to design a platform called K22 (for "next-generation Kiosk") that embeds its displays, sensors, and processing nodes into the physical architecture of buildings. Within each building, these kiosks will be embedded in the most convenient high-traffic spaces, such as the walls of hallways, elevator lobbys, and break areas. Interactions that occur in these spaces could be augmented with any computational resources offered by the kiosks.

2. Design Challenges

An examination of the nature of interactions between K22 kiosks and their users reveals a number of basic differences between K22 and its siblings E21 and H21. First, K22 kiosks are *transient environments*, where users will usually stay for only a few minutes, as opposed to a few hours, at a time. This implies the increased importance of interface responsiveness, and quick, intuitive navigation that respects user context. Furthermore, a kiosk may be used by a larger number of different people per time period, each with varying backgrounds and skill levels. This suggests that K22 application UIs must expect and adapt to people's varying expertise with the application, respecting the needs of first-time users or visitors. Another difference is that while H21s accommodate at most one simultaneous user, K22s must support small groups of two or three people huddling around the kiosk displays. When such a situation occurs, it is likely that several people that may wish to manipulate the interface simultaneously, and may interact with each other in addition to the kiosk.

Many of these expectations for kiosk applications and user interfaces can be fulfilled with modern techniques from the Intelligent User Interface (IUI) research community, such as dynamic user modeling and interface adaptation. To support and explore new IUI technologies, the architecture of K22 contains facilities for both detecting and identifying users, and for dynamic UI adaptation. The next section describes the kiosk architecture in detail.

3. Architecture

The K22 architecture relies on a number of Oxygen hardware and software technologies. The basic kiosk hardware configuration will comprise the following: one or more touchscreen LCD displays, one or more processing units (CPUs), a camera, a microphone, speakers, X10 motion sensors, and Network and Mobile Systems' Cricket hardware for detecting proximate H21 devices (Priyantha et al., 2001). Each kiosk will be customized to fit its environment, and specific hardware configurations depend on environmental constraints.

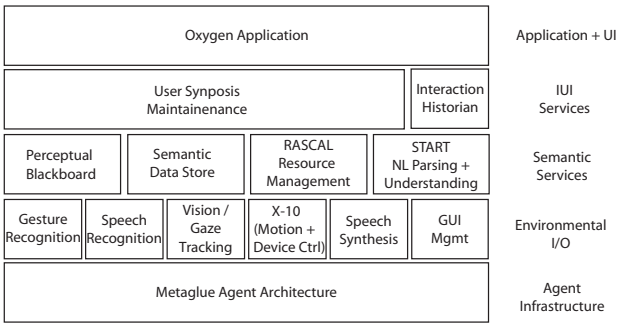

Figure 1. Kiosk Software Stack

The core software for K22 is a Metaglue environment (Phillips, 1999), in a configuration similar to that of E21. As shown in Figure 1, all other Kiosk applications and services reside as agents on top of the base Metaglue system. Prototypes of the low-level IE system services (shown as the bottom two layers in the figure), as well as the RASCAL and START semantic services in the third layer are already complete. The rest of the components are being introduced with the K22 project, and are discussed in the following section.

3.1 User Interface Architecture

3.1.1 Semantic Services Agents

The agents in the Semantic Services layer provide access to data structures and engines that operate on semantic networks. The Semantic Store agents maintain all contextual information relevant to the kiosk, its applications, its users, and its environment as partially-structured data in semantic-network format. The Perceptual Blackboard agent derives high-level hypotheses about the kiosk's current context from environmental sensory inputs and contextual history from the Semantic Store. The RASCAL system grants agents access to physical kiosk resources based upon availability and priority (Gajos et al., 2001).

3.1.2 Intelligent User Interface Services Agents

The agents in the Intelligent User Interface (IUI) Services layer offer assistance to IUI-enabled Kiosk applications. These applications typically maintain a User Synposis (USS), which is a model of the current user, including her preferences and interaction history, to help infer her current task context and intentions. The USS contains both an application-specific profile, and her general properties, such as her preferred output modality. The Interaction Historian indexes and logs all interaction history into the Semantic Store for later USS inferencing.

3.1.3 Kiosk Application Agents

The top level of the K22 application suite is the kiosk application itself. K22 applications featuring contextual, adaptive UIs will rely extensively on layers beneath it to supply it with its necessary context, such as the identity of its users, the user's current task .

4. Applications

Although no K22 applications have yet been developed, designs are underway for a number of early kiosk applications. The first will be an incoming student orientation system that will provide situated, location-context sensitive navigational and administrative information to new graduate students at the AI Laboratory. Other planned applications include a special event capture and access system which allows remote access to annotated talks and seminars, and a personalized news and announcement filter for lab and world events based on user interests.

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