Preliminary Evaluation of Ubicomp in Real Working Scenarios

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INTRODUCTION

Hospitals are complex information-rich environments that include a significant technical and computational infrastructure; the need for coordination and collaboration among specialists with different areas of expertise; an intense information exchange; and the mobility of hospital staff, patients, documents and equipment. This makes them ideal application environments for pervasive or ubiquitous computing technology.

Not surprisingly evaluating ubicomp systems is a difficult challenge as it often requires costly and complex implementations [1]. In our work we aimed to evaluate in a cost-effective way the core characteristics of an ubicomp environment that integrates interactive public displays and PDAs with context-aware hospital applications [3]. In the next section we briefly describe this environment.

SYSTEM DESCRIPTION

The context-aware hospital information system addresses the following aspects:

1) Ubiquitous access to medical information. The medical staff may access medical information from several ubiquitous devices, such as a PDA or a public display. For instance, a physician may request a lab analysis from his PDA, and later, he may visualize lab results from a large-public display to discuss them with a colleague.

2) Context-aware access to relevant medical information. To provide relevant information for users, our system takes into account the contextual information, such as user's identity, role, location, device used, time, and status of an information artifact (e.g. availability of a lab result). Thus, when a physician, carrying a PDA, is near to one of his patients, then the system presents clinical information.

3) Awareness of user's location and devices. The system enables users to be aware of other users' location and devices' status. This information is displayed as a list or in a map in the user's PDA or a public display. The users' location is estimated by reading the signal strength of the PDA to the wireless access points [5].

4) Content adaptation and personalization. Contextual information is also taken into account to adapt and personalize the presentation of information to the user. Thus, when a user approaches the public display, it shows only the patients assigned to her, messages addressed to her, and the location of users and device with which she may require to interact.

5) Collaborative Work. In a hospital, physicians often ask for second opinions, or need other specialist to help them solve a problem. The system supports this by showing a map where the user can locate coworkers, send messages to them, and share an application or lab studies.

6*) Information transfer between heterogeneous devices:* The context-aware hospital system enables users to transfer information from public spaces to personal spaces. For instance, after two colleagues discuss a clinical case by using the public display, one of the physicians may want to keep a link to this case in his PDA for further review. The user only needs to drag the information to her picture in the display to transfer information between the display and her PDA as showed in the figure 1.

Figure 1. A resident working with a PDA and then collaborating with a male nurse on a public display.

STUDY DESIGN

The study was conducted at IMSS General Hospital in Ensenada, Mexico. The subjects of study were 35 people, 24 were residents and the rest of them were doctors.

We evaluated the acceptance and use of technology through video scenarios, which were designed as a result of a three months case of study in the same hospital. Three scenarios, showing real working situations augmented with ubicomp were produced and two of them used in the

evaluation session. Roles in the videos were played by hospital personal to make them more realistic.

PROCEDURE

An evaluation session lasting about an hour included the following phases:

Phase 1: A 10 minute introduction.

Phase 2: Three video sequences were shown to the participants: A 5 minute video explained the main features of the system, and 2 videos showed scenarios of use of the technology. Figure 1 shows a scene from one such video. The aim of this was to put in context the use of the technology to the medical staff. Following this, we performed a live demo showing them the features of the system. A Q&A session followed the videos.

Phase 3: In this phase the participants were asked to complete a survey with 7 Likert-scale assertions, which included topics such as their perception on how realistic were the problems presented on the scenarios, the obstacles to adopt these technologies in the hospital and, finally, the perception of ease of use and usefulness of the proposed system.

Phase 4: Finally, the subjects were given time to freely use the technology.

The entire session was videotaped. Comments while using the devices were also collected.

RESULTS AND DISCUSSION

Here we present some results obtained through the survey.

Obstacles for the adoption of the technology

Figure 2 shows the main obstacles foreseen in the use of the technology. The subjects identified lack of training as the main potential obstacle, followed by the hospital's ability to acquire the technology and the availability of appropriate technical support.

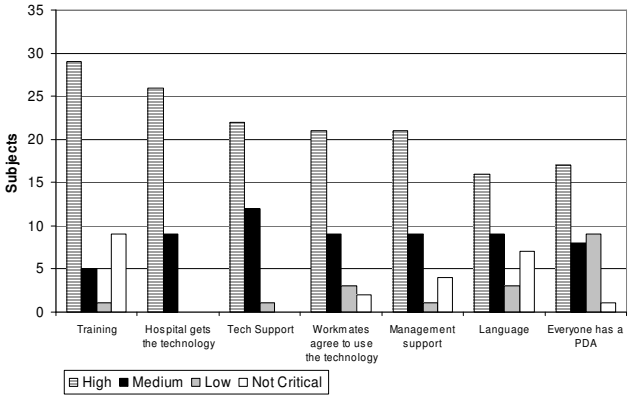

Figure 2. Obstacles for adopting ubiquitous technology

Comparison between current vs. proposed practices

We asked the subjects to assess the usefulness of the ubicomp environment to address threes significant problems they face everyday in their working environment: asking for a second opinion; locating co-workers; and sending and receiving alerts the availability of the results of clinical test. They all agreed that these are actual problems they face everyday and are not adequately addressed by current technologies. They felt that the ubicomp technology shown to them would be significantly better than their current solution.

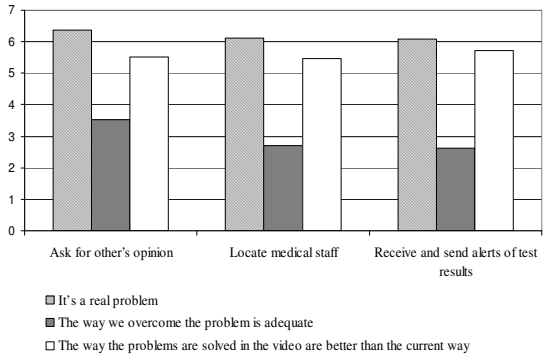

Figure 3. Current vs. proponed practices

Perception of ease of use and usefulness

The questionnaire included questions to asses the subjects' perception of usefulness and ease of use of the technology, which according to TAM [2] are important predictors of system's use. The participants found the technology to be useful (5.6 in a 7 Likert-scale) and easy to use (5.8), which indicates that they might indeed use the technology, and has motivated us to initiate an adoption phase.

CONCLUSIONS

The potential advantages of ubiquitous technologies cannot always be perceived until the users are situated within a new context of interaction. Preliminary evaluation of ubicomp based on video-scenarios is then an ideal mechanism to go beyond current practices and let users to get involved in the design process and the envisioning of novel schemes of application while remaining relatively simple and inexpensive. We consider that this process is fundamental for ubicomp when applied to large spaces of interaction such as hospitals. Our evaluation also promotes a consideration of challenges beyond those purely technical. As our results indicate obstacles for adopting those technologies should be brought to the process of design and be managed in a sensible way in order to guarantee the success of an implementation.

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