ActivitySpot: engaging, activity-centered experiences for occasional visitors

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Abstract. This paper presents the concepts, implementation details, and evaluation objectives of ActivitySpot, an infrastructure and toolkit aiming at supporting localized activities performed by occasional visitors. We are particularly interested in enabling a user experience that is activity-centered and that makes the most of the available ubiquitous computing resources for carrying out a localized activity, while not imposing to visitors any specific technological requirement. We adopted an activity-centered approach to the design of the conceptual framework supporting our work and we aim to evaluate how adequate is this approach to enable an engaging user experience for occasional visitors.

1 Introduction

Pervasive and ubiquitous computing promise to transparently support people in their daily activities by leveraging computing resources existent in the surrounding environment. Among the several scenarios envisioned in the literature, we are interested in exploring those in which the physical environment provides ubiquitous computing support: a) to *localized activities*, i.e., activities having a strong association with the physical environment and which can only be accomplished in specific places (e.g., visiting a relative at the hospital or visiting an exhibition at the museum); and b) to *occasional visitors*, i.e., people that are not everyday users of that space and thus may not have *a priori* knowledge about the environment, its ubiquitous computing resources, or the locally available activities.

In order to achieve an effective support to an engaging user experience in the context of localized activities performed by occasional visitors, we identified the following main requirements:

- Lightweight activity initialization – the system should be able either to infer which activity the visitor may be interested in or to offer reasonable means – not more than a short initialization procedure – through which visitors denote their intent.
- Spontaneous user interaction – the system should promote spontaneous user interaction by providing visitors with immediate access to interaction media and to simple, constantly available clues about how to perform their activity.

We argue that spontaneous user interaction can be more easily accomplished by providing very simple user interfaces, which visitors are already accustomed to, not requiring any previous training (e.g, SMS, Web, e-mail, etc.) or exploring affordances [1] ascribed to available local devices (e.g., RFID tags, bar-codes, public displays, etc.).
- Integrating local and heterogeneous personal domains – the system should support both unequipped visitors that rely only on local resources and visitors that bring their own pervasive computing space (e.g., devices, documents, services, etc.) and expect to seamlessly integrate it into the experience. Combining both local and personal domains is a chief requirement in providing a *user-centered* functionality that explores thoroughly the resources available in the local environment. Moreover, the system should not tie visitors to a specific interaction medium, but potentially support any type of user interface.

The aim of our work is to evaluate how the approach that we are undertaking can provide an adequate support to our user population. The following sections detail the undertaken conceptual approach, the technical details of the proposed infrastructure, the evaluation scenarios, and the goals of our participation in the workshop.

2 Conceptual approach and implementation

We adopted an activity-centered approach to the design of the conceptual framework supporting our work, as we espouse the conviction that such an approach can effectively bring ubiquitous computing systems close to users [2, 3]. We particularly grounded on Activity Theory [4] as a conceptual driver and have followed two of its main concepts: the flexible structure of an activity, and, at a secondary level of importance, evolution of activity influenced by historical and social forces. A localized activity may be carried out in a variety of ways by employing different actions under different conditions. Furthermore, the same action may be reused in the accomplishment of different activities. Individual characteristics and changing local and personal context are the factors driving the structure of a localized activity. For example, the activity of visiting a museum may employ different actions and operations, depending on the visitor age, preferences, or available resources. Although we argue that social interaction and historical background should also be considered in the support to a localized activity, especially in unfamiliar environments, where sharing past experiences between users and recording experiences for future remembering are of special relevance, we prefer to lessen the focus in this issue by considering it just as another action among others within a localized activity.

Based on Activity Theory's flexible structure of activity, we are developing an infrastructure that enables the specification and development of multiple, possibly simultaneous localized activities in which the main unit of human-computer interaction is the action. An action involves several operations that may be visible to users (e.g., interacting through physical devices) or that are executed in

the backstage (e.g., querying a web service for some information). The same action may be part of different activities (e.g., orienting in the physical space may be an action of both visiting a relative and going to a consultation at the hospital). Likewise, the same operation may be a component of several actions (e.g., capturing a 2D code in a wall may be a stimulus that triggers either the capture of a photograph by a local camera or the presentation of a local description in a nearby public display).

The system architecture is composed by four main entities: action controllers, the activity manager, interaction delegates, and the data-space. Action controllers implement the functional logic of each action. An action controller reacts to specific stimuli and may have a specific workflow. The activity manager follows the localized activities' specification by coordinating the stimuli, activating appropriate action controllers, and generating output reactions through suitable media, considering the visitor's context. The activity specification describes the supported activities, the actions that implement them, the context in which they can be executed, and the stimuli to which they react. The interaction delegates interface between the physical interaction devices and the infrastructure, by using a common communication middleware: the data-space. The data-space is an EQUIP data service [5] providing an active shared state infrastructure based on tuple-spaces. The data-space is used by the interaction delegates to post tuples describing stimuli and to read system output reactions placed by the activity manager. The data-space is also used to place tuples describing current context and capabilities currently available to the infrastructure.

3 Evaluation

We are developing a couple of representative scenarios, to be implemented at the university campus, that will be used to evaluate the undertaken approach by addressing the supporting infrastructure and the user experience. The activities supported in these scenarios are scientific meetings and the regular group visits of prospective students to the university. The actions composing these activities include: orienting, supervising students, playing a game, answering an inquiry, sharing content, remembering experience, viewing meeting program, etc. Visitors are going to interact with the system through their own mobile phones or PDAs, through public displays available in several places in the campus, and other accessory means such as RFID and bar-code tags, 2D codes, cameras, etc. While some of these devices, such as tags, are just means to stimulate the system, others can be used to provide a richer user experience (Web/WAP, public displays, SMS, or e-mail).

Both scenarios will be used to assess: how adequate the activity-based concepts are to enable an engaging user experience for occasional visitors; what is the impact of using widespread technology such as mobile phones, tags, or public displays on the spontaneity with which visitors interact with the environment; how appropriate are the proposed activity initialization procedures; and what attitude do visitors adopt regarding the integration of their personal domain

with the local environment. The scientific meeting scenario is also going to be used to evaluate the proposed tools for developing and deploying the support to localized activities.

For the user-side aspect of our evaluation we are planning to study untrained visitors by recording their interactions with the system (how much and how do they use it) and asking them to answer a survey/interview in order to assess the adequacy of the activity initialization procedures and the spontaneity of the following interactions, as well as their attitude regarding the integration of the personal domain with the local infrastructure. We are also envisioning the development of an Eclipse [6] plug-in for ActivitySpot developers, that is going to be evaluated by observing how rapidly developers deploy the support to the scientific meeting activity and what is the perceived impact of the undertaken conceptual approach.

4 Conclusion

This work investigates how ubiquitous computing environments can offer user-centered support to localized activities performed by occasional visitors, i.e., activities having a strong association with a specific physical environment, which may be visited by people who are not accustomed to it.

The aim of our participation at the workshop is mainly to discuss which user experience evaluation methods and techniques are most suitable to our evaluation objectives as well as to share knowledge about the development of toolkits targeted at the deployment of ubiquitous and pervasive computing scenarios.

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