Adaptive Support for a Mobile Museum Guide

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Abstract:
The paper aims at supporting human activities with mobile information technology. Supporting activities over time, space and different social settings requires information technology to give seamless network access in different environments and to model the user's implicit and explicit interaction history to adapt to the current situation. As a pro totype for a system meeting these requirements a mobile museum guide is introduced.

1 Introduction

The paper describes a mobile information system under development in the HIPS[1] project that supports nomadic activities adapted to the individual visitor of a museum. Nomadic activities are a widespread class of human activities. In contrast to print media till now electronic information and communication media did not support nomadic activities. The worldwide Web, wired and wireless connectivity to networks, and small mobile devices now allow for supporting nomadic activities by information and communication technology to an extensive degree. The paper describes support for art excursions as an attractive class of nomadic activities. For the fit of user's interests and needs adaptation facilities are described. These adaptations reflect the current user's local environment (contextualisation) and interaction history (individualisation).

A challenging feature of current IT development is mobile information technology [1]. Mobile information technology may be a chance to support ongoing activities from the beginning to the end. Traditional media like files, literature, memo-books are limited in their availability. On tour, for example, the user can only read those office files or private books that he or she has put into the suitcase before leaving for a journey. Many activities are distributed over time, over space and between actors. Nomadic media allow for accessing information that are needed in any period of the activity at any place and together with any partner involved. The actor is not released to plan his/her activity but he or she is not required to plan the access to all information and all co-actors needed in several phases beforehand.

Another challenging feature of current research is the adaptation of the selection and presentation of information according to the user needs [2] [3]. The user uses different devices with specific characteristics and restrictions both for information access (bandwidth) and information presentation (size and resolution). For mobile information technology the particular challenge for adaptivity is the support of users at different locations of the user's interaction with the system. Accordingly, nomadic adaptive systems require both a user model where the information according to user needs, knowledge, and preferences is evaluated and a usage model where the information about the user's environment and client hardware and software is held up-to-date. To achieve this, mobile information technology can be combined with technologies to identify the users' working environment and his or her position in the physical space [4]. Infrared or General Positioning System (GPS) allow for contextualising the device of the user. The position and the movement in the physical space can be observed and evaluated for required information [5]. The navigation in the physical and the navigation in the information space are used as indicators for the user's interests, preferences, and the knowledge acquired so far.

In this paper we want to illustrate the application of a mobile adaptive information system for art

[1] The project Hyperinteraction within Physical spaces (HIPS) is an EU-supported LTR project in ESPRIT I3. The partners of the consortium are University of Siena (co-ordinating partner), University of Edinburgh, University College Dublin, ITC, SINTEF and GMD, CB&J, and Alcatel.

excursions including the preparation, the execution, and the evaluation of a museum visit.

2 Activity processes distributed in time, space and social setting

Most human activities are not fixed to a particular point in time and space. Many activities evolve and by their nature they are distributed in time and space. They may be executed at different places and the execution may be interrupted by other activities. Activities often involve several people. Activities are planned by and for several individuals or groups. They are more than individual short term acts at one place. Extension of activities can thus be described in three dimensions: extension in time, extension in space, and extension in communities. For analytical reasons the process of activities can be divided into phases like preparation, execution and evaluation. New technologies allow for a more comprehensive support of activities no matter where, when and by whom each (part of an) activity is accomplished. For an information and communication system to support human activities it is central to consider an integration of the requirements of the described features. For an appropriate support it is not enough to provide any information at any places in any time for anybody. The specific tasks and goals of an individual and his or her communicators, co-operators or competitors at specific points of time and space have to be taken into account. The adaptation has to consider the demands from the phase of the activity.

3 Adaptivity for navigation in the physical space

Mobile adaptive information systems should support human activities considering time, location and social constellation in the physical space and the user's navigation in the information space. Nomadic activities–by its definition–take place at different places. Different devices support access to information technology at different places. In the office the user typically uses a well-equipped multimedia PC. At home the user has possibly low connection to the Internet via modem. During a journey the user is equipped with a laptop or a palmtop with low connectivity and display size. The system can be adapted to the specific conditions of the given place. It can prepare the connection to the Internet, adapt the composition of textual, graphical and video elements and adjust the presentation to the environmental conditions.

Activities at different places allow for different interaction with an information system. In the office or at home the information system is the central focus of the user's attention. He or she is sitting in front of the system, selecting, reading and writing information presented on the screen. Outdoor the user interacts with objects within a physical space and the attention is directed towards the physical and social environment. The presentation of information by an information system should reflect the absorbed (mostly visual) sense of the user. Instead of visually displaying information audio output via headphones may be more suitable for a user while additional visual cues may be designed to complement the understanding of or the navigation through the audio information.

Audio presentations allow for viewing the physical environment supported synchronously by complementary information. Different modalities of perception have advantages and disadvantages for the recipient. Audio presentation is weak in providing control for the user. Control only allows for start, pause, move back or forward, and stop. Selection of parts of information and information about the kind and the length of the information are not supported. Compared to visual information audio output has to be received by the user sequentially.

4 Adaptivity for navigation in the information space

For the selection and presentation of information during nomadic activities additional indicators for the user's needs can be obtained from the context of use during the nomadic activity. Preparing an activity needs information different from the execution of the activity and the evaluation of an excursion needs yet another set of information or editing demands of information. During the execution of an activity the physical environment provides objects the user can refer to. During the preparation or evaluation phase of the activity the physical objects probably need to be visualised by a graphical representation. Following the user's activity process the user model of the system can evaluate the history of navigation both in the physical space and in the information space. The model can describe the information used by the user and the places visited by the user.

The adaptation of the selection and presentation of the information to the user supports the combination of new and familiar information for the user. For information behaviour in general and for learning behaviour in particular it is preferable in terms of effectiveness, efficiency and satisfaction for the person to learn new elements embedded into a familiar frame. The connection between already learned and still to be learned elements is essential for the learning success. Repetition is a reinforcing factor for learning. Combining new and familiar

items can augment not only learning results. Also the enjoyment of attraction environments can be increased when the person gets new aspects of an already known topic.The navigation of the user in the physical space is performed by movements of the user with his or her feet. The information selection and presentation follows this movement. The user can also move with his or her hands, navigating in the information space. Both kinds of control have to be combined and to be communicated to the user to avoid confusion or to limit information access.

5 Information system for art excursions: A scenario

A visitor is assumed to prepare the excursion to a museum at home by consulting the system via internet reading descriptions and recommendations, viewing representations of paintings and so on. The user's information selection is the initial basis for the user model developed for the adaptive behaviour of the system. On site the visitor enters the museum and gets a mobile device connected by wireless LAN to a server and location aware by infrared emitters at the exhibits. The user can select an individual guided tour by the system based on an inference of interest and knowledge developed by the user model. The visitor can also walk through the exhibition following own ideas while the system supports the exploration by contextualised (adapted to the current position) and individualised (adapted to the interest and knowledge) descriptions and comments. Before, during, and after the visit in a museum the user can enter and exchange own notes, comments, and communications about his or her impressions for own or others' benefit. The evaluation of the selected objects and the selected information about the objects allow the system to update the user model continuously.

The art domain is attractive for mobile information technology first because art excursions require nomadic activities from visitors. Second, art can best be enjoyed when the art recipient can combine the impression of an art exhibition or an art event with meta-information synchronically explaining aspects of the art not being presented by the artwork itself.

During the journey the system should offer seamless access to the previously collected information, for example, on a palmtop via a wireless local network. The presentation can take into account the already provided information and the current position of the user identified by infrared (indoor) or GPS (outdoors). In front of an artwork a high-resolution representation of the work is dispensable. If at all the user needs a silhouette of a painting and opportunities to address areas of the painting he or she wants to ask questions about.

For a system that users can use at several places the input and output of the system have to support immersive interaction. The user can concentrate on his or her activity in the physical and social space and is supported by an additional information layer of a virtual space with complementary information. For the viewer of a painting, for example, several options of verbal comments about the artist, the art period, the art style, the art technique etc., are provided to increase the intellectual benefit of the viewer without reducing his or her visual gusto. Roughly on site, in more detail before or after the visit the user can explore the painting style by overlaying the painting with typical outlines specific for the given or for a contrastive style. Virtual copies of a painting allow for exploring and manipulating its composition and presentation characteristics including explanatory support by remote experts via the net to increase the benefit of the viewer.

The ideas described in this abstract will be implemented and evaluated empirically (A prototype has been prepared for a "castle day" of GMD at the end of September 1998.) Massive prototyping in the consortium will allow to follow different approaches in the design of the system and to evaluate the alternatives at different levels.

6 References:

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