DESIGN OF A HANDHELD INTERACTIVE SUPPORT FOR MUSEUM VISITORS

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Abstract – The growing availability of small devices has raised an interesting discussion on how to exploit them to support users in various contexts of use. We propose a solution that can be easily adopted for museum visitors. The basic elements are the use of a multimedia PDA whose main purpose is to support a user who can move freely about within a museum. The structure of the user interface allows users to easily orient themselves through appropriate visual representations and then sees to providing the information that can be interesting for them by exploiting the multimedia capabilities of the device.

INTRODUCTION

The growing availability of small devices whose computational and interactive resources are continuously increasing in terms of power and capacity has raised an interesting discussion on how to exploit them to support users in various context of use. In this work we consider users who freely move about a building (in particular, in a museum). In these environments the most effective support is currently provided through either interactive multimedia kiosks or interactive audio recorders. In the former case the main limitation is that the kiosk does not allow the user to move while receiving information, whereas the latter allow the user only to hear predefined texts associated with each work.
In the meantime, at a research level an increasing interest in location-aware systems has arisen with the goal of better assisting users. However, systems based on automatic generation of location-aware information suffer from the limitations of adaptive systems, in which often users interact with an interface that changes in the attempt to better support them, but which in doing so actually causes disorientation. For example, one typical problem with location-aware, in-door systems is that they can automatically generate information regarding the closest work of art while the user is actually looking at one that is located farther away. In addition, location-aware systems often require technology that is either expensive or difficult to install in a widespread manner or do not work perfectly in all circumstances. For example, infrareds need to be installed for each work of art and require that the emitters and the receivers are lined-up in order to communicate.

In our work we have designed an application that aims to overcome such limitations. We propose a solution that can be easily adopted by many museums without requiring difficult to install technology. The basic elements are the use of a multimedia PDA (without the support of location-aware technology) whose main purpose is to support a user who can move freely about within a museum. The user interface is structured in such a way as to allow users to easily orient themselves and then provides the information that can be interesting for them. In this paper we discuss and report on our initial design and the improved design based on the user feedback

OUR INITIAL DESIGN

In our approach the design is driven by three main elements: the context of use that includes both the device used for the interaction and the environment where such interaction occurs, the tasks users wish to perform and the objects they need to manipulate in their performance (both interface and domain objects).

Context of use

For the context of use, we consider both the interaction resources used and the environment where the user performs the tasks.

The application has been developed on a Compaq Ipaq 3660, with windows CE and additional 64 Mbytes Flash Memory Card. We have used Embedded Visual C++ 3.0 as programming language and the Microsoft Foundation Class toolkit for the user interface development. We decided to use text-to-speech synthesis for supporting audio comments. Unfortunately, the possibility of dynamic text-to-speech generation is not supported in these environments because the necessary libraries are lacking for Windows CE. In addition, the synthesized Italian voice was considered too unpleasant and was replaced with audio-recorded comments.

Currently, the application contains description of about 130 works of art, each of them with an associated Jpeg picture (dimensions are about 140x140 pixels). The audio files are in MP3 format. For the English version we have used text-to-speech provided by Text Aloud MP3. Overall the application requires about 30 Mega of memory.

The application has been developed for the Marble Museum. The managers of the museum decided to provide their visitors with information additional to that contained in traditional labels. They often had the problem to find guides able to provide such information and in some cases the guides were not able to communicate with foreign people. The structure of the museum forces to some extent the order of visit among the rooms. Such rooms contain many types of objects from the ancient Romans to pieces of quarrying technology of the past century. Thus, visitors need support able to interactively select those more interesting for them and receiving related information.

Tasks

In the design of the user interface we considered three types of tasks that users can perform in the context considered:

- *orientation within the museum*, for this purpose three levels of spatial information are provided: a museum map, a section map, and, for each physical environment composing the section, a map with icons indicating the main pieces of work available in the room and their location. By selecting such icons the picture of the related element is displayed along with some basic information and the corresponding audio description is activated. The purpose of the picture is not to show the details of the work of art (that is supposed to be in front of the user), but to allow users to check that the information they are receiving regards the work that they are viewing.
- *control of the user interface*, for example, to allow changing the volume of the audio comments, to stop and start them, and to move through the various levels of detail of the museum description;
- *access to museum information*, also this is provided at different abstraction levels (museum, section, physical environment, single work).

At any time the application was able to highlight where the users are in the museum area, assuming they are in the same room as the works last selected. The orientation information was triggered by selecting the “i” button on the bottom menu-bar that appears when the map of a physical environment is displayed.

Objects

The information regarding the museum and the works that it contains is provided using both the audio and the visual channel. The visual information is mainly used to allow users to orient themselves and receive some supplementary information. It provides information at different logical levels:

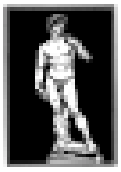
- The museum, it displays a map that shows the logical organization and the physical structure of the museum.
- Sections, the map of each thematic section of the museum is provided, when it covers multiple physical environments it is possible to select each of them to get more detailed related information,
- Environments, they are either rooms or separate environments partitioned with various techniques; the system provides a map with icons indicating where the main objects of interest are located;
- Works of art, in this case a picture and basic information are provided.

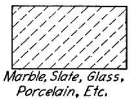
Since the museum considered is an interdisciplinary museum that contains various types of works, different icons are used to represent each type:

 for showcases containing historical artifacts, models or reproductions;

 for pictures or photos hung on the museum walls.

 for capitals.

 for representing sculptures.



for the marble exposition.

 for the reading-desks.

An alternative solution would have been to use pictures of the works considered in the room map instead of icons. However, the resolution of the PDA (240x320) would have made it difficult to interpret such images. The picture below shows an example of room map annotated with icons highlighting the main works of interest. The doors represented in the map are interactive and allow the user to change the room representation in the PDA (while physically moving in the new room).

Presentation of information and navigation

The audio part has been implemented reflecting the logical structure of the information to provide. There are comments introducing the museum, its sections, each environment and each work located in them. They are provided in two languages: English, using text-to-speech synthesis. The resulting audio message is a bit metallic, but clearly understandable even by non-native English speakers. The other language is Italian, for which a prerecorded female voice was used for the comments because the synthesised speech was considered unpleasant.

The resulting navigation was based on the museum map. The user started the visit from the museum map. Then, they selected the section of interest. Lastly, in the section map they could select the physical environment of interest and at any time they could go to the museum map to select another area. Figure 1 shows an example of sequence of accesses.

Figure 1 Levels of navigation in the first version of the guide.

THE IMPROVED VERSION

The initial version of the application was made available to the museum visitors at the beginning of the summer 2001. This allowed us to perform a usability evaluation involving many users. The test took place in the Marble Museum of Carrara during the summer, when the number of visitors is highest and it involved 95 users; 34 of whom were Italian. More details regarding how the test was performed and its results are provided in [1].
The test highlighted the need for:

- A different way to navigate that would allow users to better orient themselves;
- Better highlighting how to get into and out of the rooms;
- Different ways to provide help information
- Supporting use of videos played through the PDA to enrich the user experience.

Taking into account the results of the user tests we developed a new version. We decided to present information about user location differently. We took into account that users always start their visit from a given point and that the structure of the museum imposes a linear path to the visit. Although visitors can at any time go up and down along this path and get disoriented, they cannot take a different route. Thus, we decided to have the PDA displaying

where they are at the outset of the visit. Next, after having shown some basic information on how to use the application (such as the meaning of the icons), the application displays a map of the first museum section while providing audio information about it. Sections are made up of one or more rooms with common theme. Then, they can select a room and receive indications as to where it is, followed by its map with the possibility of selecting specific works of art and receiving related information. In the new user interface we used arrowheads on each door in the map of the room to clearly highlight the suggested order of access. In this version, when users move to the next room they can just select the related door in the map and the new room map will appear. If a new section is encountered, then a general map with related information is first provided and subsequently a map of the selected room is displayed.
One of the main differences with respect to the previous version of the application is that the museum map no longer drives user access to information. However, the overall museum map is still available on request in the event that visitors do not want to follow the path suggested by the physical museum structure.

CONCLUSIONS and FUTURE WORK

The new version is now available to the museum visitors. We are planning a new evaluation study with revised questionnaires and automatic analysis of logs of user interactions.
Technology for location detection is improving in terms of both cost and accuracy. Its introduction will be investigated in the near future, at least to automatically identify the room where the user is.
Future work will be dedicated to identifying adaptive features of the application that can increase the users' interest without disorienting them.

ACKNOWLEDGMENTS

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References

[1] C.Ciavarella, F.Paternò, Design of a Handheld Interactive Support. CNUCE Internal Report. November 1991.