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User Requirement Analysis and Interface Conception for a Mobile, Location-Based Fair Guide

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Abstract. This paper describes the first phase of user-centred design for a mobile, location-based fair guide which is developed in the research project SAiMotion. The user requirements analysis based on a usage scenario and a formalized use case model developed in the beginning. A focus group and interviews were conducted to gain empirical insights on the potentials and probable acceptance of a location-based fair guide. Among the results of these user participation activities, are the integration and visualization of spatial data, temporal data and user-specific information as well as the support of activity planning. On this basis, an interface conception was worked out. One of it's central parts are interactive maps. Derived principles for visual layout and interaction design of maps on small screens are presented.

The goal of SAiMotion[1] is to develop a fair guide as location-based service for mobile devices. The technology to enable indoor-localization, and online data-access, as well as it's integration in a mobile client is one of the research focuses. On this basis, an application supporting users in the highly dynamic and information-rich environment of a business fair is planned.

This paper describes the first phase of the usability engineering process covering the analysis of user requirements and the conception of the graphical user interface. As we followed a scenario-based approach [2], the first steps were to work out a usage scenario, to formalize it in a use case model, and to investigate user requirements empirically. In the derived interface conception, interactive maps visualizing spatial data as well as dynamic attribute data take an important role. The process of assessing requirements and developing the user interface for small screens, in particular interactive maps, is described in the following sections.

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1 Scenario and Use Case Model

Starting from the basic technology described above a detailed scenario was worked out to explore possible functionalities and application settings. It described several concrete activities of fictitious users like planning a number of stand visits, joining a product presentation, or navigating to a known person.

The work on this scenario occupied a crucial role in the first phase of the research project. It focussed the communication between project partners on a concrete application setting and lead to a creative but efficient discussion about what would be nice to have and what is achievable. So it fostered the early fixing of a concrete, joint project goal. Furthermore, the description of activities of a fictitious user with the system helped to structure the user participation and served for the use case model and functional specification.

The informal description of activities in the scenario were formalized in a use case model [3] describing in detail user roles and actions with the planned application covering the whole functionality.

2 User Participation to Collect Requirements

In order to get first impressions on the probable acceptance of the planned system and requirements of the target group a focus group and interviews were conducted.

Method. Five potential users working as consultants and researchers in the IT field were invited to a focus group. First, the two moderators gave a brief overview over the project and the planned basic functionality. To illustrate the potentials of a mobile location-aware system, two short parts of the scenario were presented. Afterwards, the participants were asked to write down individually "ideas about useful functions" and "conditions for using and possibly buying such a system". This phase lasted about half an hour. In the next step, the participants presented their ideas and a discussion was initiated by the moderators. This discussion took 70 minutes and was recorded. The proposals written down individually or stated in the discussion were categorized and were used to specify functional and non-functional user requirements.

In addition, a semi-structured interview was made with three visitors of a German book fair. Similar to the focus-group, subjects were given a brief overview over the planned system and were asked about expectations, useful functions, and conditions for usage. The interviews lasted between 35 and 50 minutes.

Results – User Requirements for a context-aware mobile fair guide. In general, the participants were very positive about the planned system and generated a lot of ideas how to use the basic functionality for the scenario of visiting a business fair. The most significant features described were:

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- *Information browsing and up-to-date information:* Information typically included in a fair catalogue like lists of exhibitors and their products, events, facilities, services etc. should be available in the system. In order to browse these information and use them e.g. for planning, a decisive feature would be a topic ontology. To get or order brochures or product materials electronically from exhibitors was said to be helpful as well. The participants also stressed the advantage to have also up-to-date information that can be retrieved online.
- *Navigation and use of spatial information:* One of the most valuable features for the users are spatial information. One should be able to display locations in order to get an overview and to be navigated by the system. The integration of spatial and attribute data like the catalogue information, e.g. to offer route planning and navigation to locations selected from the catalogue, was seen as a major strength of a mobile system, especially for visiting business fairs because of difficult locations, and great time pressure.
- *Activity planning and scheduling:* The participants wanted to have a schedule for events, meetings, and other appointments that uses semantic data of the fair catalogue and spatial data. The system also should remind of important appointments and offer navigation to the location in question.

  Furthermore, the system should be able to make proposals how to sequence activities, considering fixed dates as well as activities without temporal constraints like visiting stands. Ideally, an "intelligent scheduler" takes events and activities selected by the user and deduces an optimal sequence of activities using spatial and temporal information like distance, estimated walking time etc. It is noteworthy that some participants where quite enthusiastic about such a planning tool, whereas others (nearly one third) where sceptical about its usefulness.
- *Localization of persons and communication:* An important insight from the focus group and the interviews concerned the importance of groups coming to a business fair together but walking jointly only in part. Nearly all participants claimed that to localize peers and to get navigated to them could be an advantage. However, the danger to be monitored e.g. by superiors was discussed extensively, and people described settings were social constraints would force to use such a service if it was available.

As a non-functional user requirement, the usability of the mobile application was discussed. Some participants were critical about the quality of displayed information, maps or routing information because of previous experience with mobile guides. Also to browse abundant content like lists of exhibitors, events, products etc. in order to plan activities was expected to be rather inconvenient. In this context, the issue of preparation at home was raised: About two third of the participants usually prepare a visit on a business fair in advance. Most of them stated that they would use catalogue data and location-data to plan at home on a PC and expected the mobile client mainly to support the execution of previously planned activities.

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3 Planned Functionality

According to these empirical results, the strengths of a mobile, location-aware system on a business fair are browsing of spatial information connected with catalogue data, activity planning, and wayfinding. To support these needs, a heuristic tour planner that proposes routes and temporal sequences for selected activities, an information browser to access catalogue information, and interactive maps are planned.

A number of different data sets have to be integrated in the map visualizations: spatial data organized in a geographic information system, catalogue content like ontologies of exhibitors, products, events etc., and user-specific data like the individual tour. Dynamic data, first of all the location of the mobile client must be used as well. The following functionality is planned for the map views: showing different types of facilities or exhibitors falling into particular topic categories; showing the tour a user has planned, including locations and the route; switching to a navigation mode showing an aligned map of the area surrounding the user's location for wayfinding.

4 Interface Design: Principles for Map Visualization

The use case model formed the major input for the conceptual model of the user interface. In a first step, main objects were identified. Among them are the information browser containing catalogue data, the tour planner, and the interactive maps. For the interactive maps, we specified the visual design, usage of cartographic variables, and the interaction style on the map views. Guidelines for displaying maps on small screens were used for specifying how to use visual variables for symbolization (see e.g. [1]). As the planned visualizations are highly interactive, a major concern was to derive principles about how to organize the user interaction considering the restriction of the small screens of mobile devices:

- *Information focussing with tooltips:* Many situations of map use require the user to read and integrate a lot of spatial and non-spatial information. The most complex example in the business fair scenario is the understanding of a tour, either planned in advance by the user himself or proposed by the system. All the discussed information types—spatial information, attribute data, and temporal information like appointments or walking times—have to be elaborated. A map giving a spatial overview presumably supports this process, but it is impossible to display all required information on a small display at once. We propose tooltips as a simple technique to "zoom" into additional data to map objects without leaving the spatial overview. In the case of a tour view, the name of an tour element, and e.g. starting times of fixed appointments can be presented in tooltips (see fig. 1, a).
- *Control of displayed information:* The user must switch to the list browser to change the displayed information. After selecting items or categories in the list views, a new map can be requested. As an exception, we chose few categories

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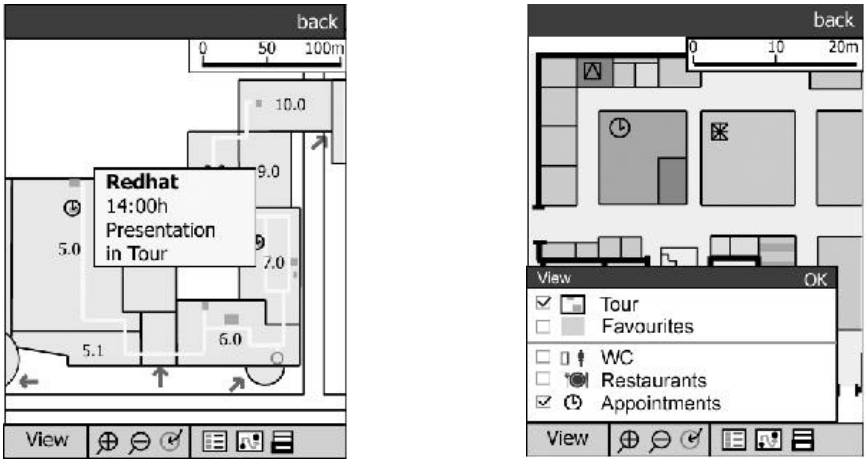
that are offered in an interactive legend (see fig. 1, b) to support actions that are specified in the use case model as most important or frequent.

– *Adaptation of scale and scroll area:* an important usability issue is to display the requested information in an expected way. When a user requests a set of locations displayed on a map the scale and scroll area should be adapted so that all relevant objects and, if known, the own location can be seen. If the objects matching the request are scattered to the fairground, a small scale results and the user has the responsibility to zoom in.



(a) (b)

Fig. 1. Prototype views of SAiMotion interactive maps, showing tour elements and route together with additional information in a object-specific tooltip (a) and an interactive legend (b).

5 Further Steps

The reported principles for interactive map visualizations on small screens are currently investigated by empirical user testing. Based on these results, the prototypes will be integrated in a mock-up prototype that covers the whole graphical user interface and can be used for usability evaluation in a mobile setting.

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