

MOSES - the Mobile Service and Exploration System

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Abstract. *This paper describes the design and implementation of the mobile service and exploration system MOSES, which has been realized at the ‘State Garden Show 2004’ in Trier. The system has been designed to provide a location based service covering more than 3,000 exhibits and events for an outdoor area of 40,000 m².*

The video can be downloaded from <http://www.i3a.fh-trier.de/activities/projects/moses>.

1. Introduction

Location Based services are one of the most promising application areas of ‘Ubiquitous Computing’. The benefit of these kinds of systems is that the user, while being mobile has neither the possibility to carry large scale information devices with him, nor will she be able or willing to search through a large information base. The location context is therefore the key to deliver small pieces of information to the user, which is also strongly targeted to her task.

The ‘State Garden Show 2004’, which has been held by the federal state Rhineland-Palatinate, provided a very interesting and challenging scenario to realize such a system. More than 3,000 events were planned during this event, which took place from April 22nd until October 24th 2004. The area covered 40,000 m², mostly outdoors. Furthermore there were more than 80 numbered exhibits, which were on display during the whole period of time and many more temporary exhibits.

The requirements for such a system were hard:

- The output device had to be small enough to be conveniently carried around.
- The power supply had to be sufficient to last during a ‘normal’ visit of the Garden Show.
- The rendering of the output had to be in a way that the users could access the information and navigate within it easily. This point was extremely important, bearing in mind, that typical visitors of ‘Garden Shows’ do not necessarily belong to the group of young computer savvy people.
- Users should be able to use their own PDAs without additional location tracking hardware (e.g. GPS receiver)
- Furthermore the system had to make use of a location tracking system that could be used all over the time period with as less maintenance as possible.

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- The system had to be seamlessly integrated into the garden architecture.

2. The MOSES System

In the following we will illustrate our choice concerning the hardware, the user interface and the software used in order to realize the MOSES system.

2.1. Hardware

The choice of the output device was strongly related to the tracking method, the user interface and the information delivery. As mentioned earlier, the power supply is a crucial point for the devices. It is not acceptable to ask a user to charge or exchange the batteries during his journey. The review of different devices on the market [3], led us to the Dell X3i PDA running the PocketPC OS from Microsoft. The PDA has a bright display with a resolution of 240 x 320 pixel and decent multimedia capabilities. It has already built in support for Bluetooth, WLAN and Infrared and an extension slot for SD-Cards. We have been using infrared as tracking technology (i.e. the commercially available IR transmitters ELT 800 from the company Eyeled), which has also the advantage that the orientation of the user is exactly known and can be used to tailor information to the user's position.

The ELT 800 has eight IR diodes, the electronics and a battery case within a small box. Three AA-type batteries are used for power supply with a lifetime of more than a year. If all diodes are aligned in the same direction, the IR beacon has a coverage of 11 m at maximum in length with an angle of 40°. For the MOSES project the diodes were adjusted to get an angle of nearly 90°. As a result the beam range reduced to 3-4 meters. We also manufactured 'navigation columns' (poles to hold the IR device) for outdoor use.

The design of the columns had to be reviewed and acknowledged by the gardening architect, who was anxious to keep the technology as unobtrusively as possible.

2.2. User Interface

The user interface had to regard the corporate identity of the state Garden Show. Concerning the services offered by MOSES, we distinguished two different modes, *The Location Tracking mode* and the *Browsing Mode*.

The Location Tracking mode was invoked, once the ID of an infrared beacon was captured. In order to do so, the area of the State Garden Show has been partitioned into 15 different but homogenous areas, covering cohesive information concerning space and content. Each of these areas has been identified with a navigation column, which has been placed at a central place within this area. The resulting event on the PDA was the displaying of a surrounding map.

For the Browsing Mode, we identified six different topics of potentially high interest for the visitors, like *Overview*, *Map*, *Children*, *Catering*, *Events* and *Service*.

The *Overview* has led to different listings concerning nature, works of art, history and sport facilities. *Map* showed the map of the State Garden Show in different zoom levels. The menu *Children* led to the playgrounds. *Catering* described the different cafes and restaurants. *Events* listed the actual event calendar and *Service* showed the location of the exits and toilets.

2.3. Software

The MOSES software running on the devices has been configured to run in kiosk mode, which is a mode where the access to all other programs or functions has been disabled.

The MOSES software consists of two parts: an authoring tool and a user program able to run on Windows CE. For a prototype of the MOSES system, we have used the content management system Typo3 [4] and the Internet Explorer, installed on the PDA. This version was also online available on the web to give users the possibility to experiment with the system from home.

The version that was finally used on the productive system has been realized using the authoring tool eyeConCat from Eyeled.

Aside from 10 lend PDAs this program was also put on two different smart cards (SD and Compact-Flash) and as a download link on the web so that visitors could use their own PDAs. These versions have been running in the normal user mode.

3. Results

In the following we will present the results of the installation of the MOSES system. First we will describe the overall usage of the system. Afterwards we will present the questionnaires used to gather feedback from the visitors. Finally we will give a detailed evaluation of results.

3.1. Statistics of Usage

The State Garden Show in Trier had opened the gates for 186 days. During this time more than 700 000 people visited the show. The MOSES system started at the first day too. However due to organizational problems the public became only aware of the system after day 47, where the MOSES system has been presented in a press conference. The PDAs with the MOSES system could be lent for free on 119 days, which is six days a week. On Mondays the lending was closed. There were 10 lend PDAs available. We had 700 PDA lendings over this period of time. The download of the MOSES software was offered both on the web and via smart cards at the central information point on 138 days. 132 people downloaded the software over the internet, 15 people used the smart cards.

The small number of visitors using the smart cards were expected, due to rare advertising of this system by the organizational committee.

The average usage time of the lend PDAs was 3 hours and 23 minutes with a maximum of 8 hours. The lending started normally at 11 am and closed at 7 pm.

3.2. Questionnaires

The aim of the questionnaires, used by the MOSES project were to investigate different aspects of a mobile, location based outdoor information guide. Besides the general user acceptance, we were interested in knowing how users regard such a system in comparison with other alternatives. Furthermore we were keen in knowing how the users liked the PDA platform as information access device. Finally we were interested if typical visitors of a State Garden Show really felt that location based services are beneficial to them.

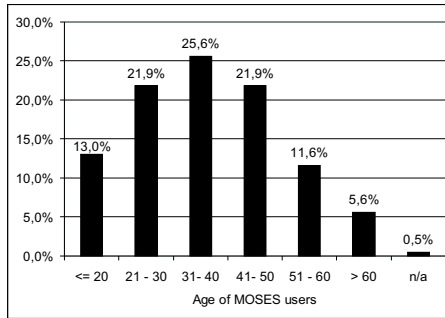


Figure 1. Distribution of the users age

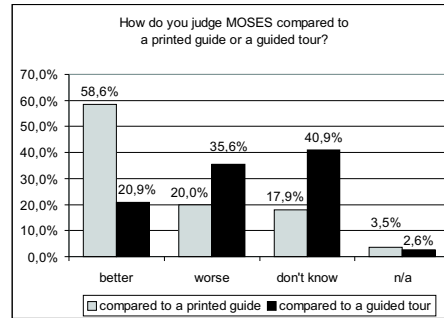


Figure 2. Estimated benefit compared to printed guide and guided tours

Each visitor using a lend PDA received a questionnaire with the return of the PDA. A Rate of 61 % of returned questionnaires was achieved which results in a data basis of 430 questionnaires.

A questionnaire had twelve questions in sum which can be divided into the following groups: *fun factor, age of user, estimated benefit, amount and presentation of content, localization, mobile devices.* For each group the results are shown in the following sections.

3.2.1. Fun Factor

The first question on the questionnaire was about the ‘fun factor’. The question was: *Did you have fun to use MOSES?* We tried to find out if a system like MOSES is more than just useful. Possible answers were *very much, much, not much* and *not at all*. More than 68 % stated that they had much or very much fun.

3.2.2. Age of User

Based on the assumption, that there is a dependency of the users age to the acceptance of MOSES, we requested the users to assign themselves to an age interval. In figure 1 the age distribution of the MOSES users is represented. The average age results to 36.7 years. Because of a missing visitor survey, the age distribution over all garden show visitors is unknown. But it is assumed, that the age structure corresponds to the normal population.

3.2.3. Estimated Benefit

The users were asked to classify the benefit of MOSES against other information systems. We have asked how they estimate the benefit of MOSES compared to a printed guide and compared to a guided tour. What figure 2 shows is, that MOSES is assumed to be better as a printed guide but worse than a guided tour. That a guided tour is expected to be better may be due to the possibility to ask questions and to have an audio-visual impression. But most of the users (40 %) where uncertain about that. We assume, that the benefit of a guided tour is heavily dependent on the guide.

3.2.4. Amount and Presentation of Content

The visitors were asked if the amount of content presented was sufficient. More than 80 % answered with yes.

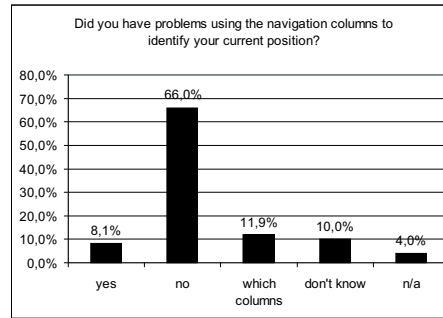
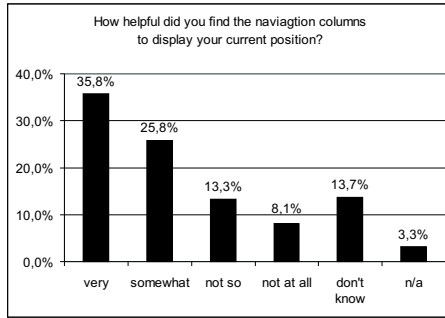


Figure 3. How helpful did you find the navigation columns to display your current position? **Figure 4.** Did you have problems using the navigation columns to identify your current position?

As indicated by the concise user interface more than 80 % of the users answered the question, how they come to grips with the content, with very much (25 %) and much (55 %). No serious problems could be identified.

3.2.5. Localization

Based on the users position, special maps with the surrounding area were displayed. We have asked the user how helpful they have found the navigation columns to display their current position? More than 60 % found it very or at least somewhat helpful as seen in figure 3. This indicates the users need of orientation within this large area.

It must be stated, that more than 13 % of the users answered with *don't know* which corresponds to the answers *which columns* and *don't know* to the question, if they had problems using the navigation columns (see figure 4). The navigation columns were seamlessly integrated into the garden architecture so that more than 20 % haven't noticed the columns or even known that there are columns. This is surprising, because every user has received printed instructions with a picture of a navigation column.

The problems aroused at the 8 % who had answered with yes couldn't be determined. Technical problems were not detected.

3.2.6. Mobile Devices

The small devices used lead to the question, how well the user could recognize the information on the screen, if they used MOSES outdoors? Nearly 75 % stated, that the display performs well or very well, even if the PDA is used outdoors.

Also the question, if the screen size is found large enough was answered with 74 % *well*, 22 % *small* and only 3 % stated, that the display was *much to small*.

3.3. Age Dependencies

All questions were analyzed against a possible age dependency of the answers given. It must be stated, that against all assumptions, we couldn't find any age dependency regarding the fun factor,

estimated benefit, amount and presentation of benefit and the localization.

The only point with a clear age dependency is the quality of the display. Elderly people have a need for brighter and bigger displays.

4. Conclusions

Looking back at our experiences from the MOSES system we first want to state, that an electronic guide was the only means to support such a dynamic environment than the State Garden Show. The system was used by a large number of people and showed a high acceptance of all ages.

We think that this might be a hint that PDAs are mature enough for serious commercial developments in general, also for outdoor usage and not only for young computer savvy people. Furthermore the findings from our questionnaires also support the assumption that mobile location based systems are regarded as beneficial from the users.

However some of the hand written remarks in our questionnaires asked for further multimedia content. Some users also asked for a pathfinder service, which shows the shortest way between two points on the Garden Show.

A crucial point for the success of the MOSES system was the press coverage. Since the system could not be intensively advertised on the premises of the State Garden Show we remarked a significant rise in the lend numbers after each TV or Newspaper report.

References

[3] Daniel Lüders: Unbeschwert unterwegs. Aktuelle Multitalente für die Hemdtasche. c't 16/04, 2004, pp. 126-135

[4] <http://typo3.org>. January 2004