Contextual Design of Mobile Services to Support Knowledge Workers in Library Settings

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Abstract
In this paper we report the results of our work exploring the design and implementation of mobile services to support knowledge workers. The purpose of these efforts was to investigate and identify how contextual information extracted from everyday activities can be used to generate the content of a mobile service to be delivered to smart phones. In this particular effort, 10 librarians from Växjö public library participated in this trial during a period of 30 days. Generally, the service we developed integrated very well into the librarians’ daily work.

Keywords: contextual design, mobile learning applications, context awareness.

1. Introduction
Pervasive computing is gradually having an important impact on the ways people communicate and interact and it also serves as a basis for the development of sustainable and usable mobile services. One of the main challenges we are facing as educational technology designers is how to properly grasp the context in which mobile services will be used. The main reason for using context as the starting point for the development of a new service is based on the idea that attractive and useful services should have a high level of embeddedness and mobility [1]. These two concepts are strongly connected to the ideas and visions of ubiquitous computing environments. Mobile phones’ usage is just a particular example of this perspective [2].

Based on previous results of our own research regarding the design and use of mobile services and smart phones with university students [3, 4], we identified that the degree of usability of a service is closely related to its content and the situation in which the service has been used. The results of the surveys we conducted with students from two courses at Växjö University that participated in our trials during a period of 3 months indicated a decrease of usefulness of the service if the instructor didn’t adapt the content of the service to the new context (learning on the move supported by the use of the mobile phone). Guided by these findings, we decided to explore the idea of how to use context as the base for content generation for the new mobile service. Thus, we designed another trial aiming at testing these ideas together with librarians to partially support knowledge activities in the context of a library setting.

2. About the MUSIS project
In order to explore the ideas described in the former section, we took advantage of the platform we developed for the MUSIS project, as it served very well for our research purposes. The MUSIS project was designed to explore, identify and develop a number of innovative mobile services with rich multimedia content to be distributed over wireless networks in university campuses [3]. The content included general such as music video and radio clips and news feeds, and also campus-specific information such as reminders and announcements of changes in the class schedule, summaries of lectures (in audio an video format), and preparatory notes for upcoming sessions.

3. Problem domain
Our problem domain comprises aspects related to contextual information, content and mobile services. Based on previous research in the field of contextual information, there are a number of definitions dealing with what context is. Chen and colleagues [5] define context as the “Understanding of a location, its environmental attributes (e.g. noise level, light intensity, temperature and motion) and the people, devices, object and software agents it contain”. Another explanation is given by Raento and colleagues [6] in which context can be defined based on location and personal attributes. Our definition of context slightly differs from these definitions because we conceive context as a three layer structure having 3 different dimensions defined as
follows: location/environment, activity/task and personal/interpersonal.

In the rest of the paper we will describe our efforts that focus on both, activity/task context (defining the content of the service) and technical context (delivering the service) to support the activity of knowledge workers. The coming section introduces the activities we conducted regarding the design and use of mobile services in a library setting.

4. Method and procedure

Ten librarians at Växjö Public library (http://www.växjö.se/bibliotek/) were equipped with Nokia 6630 smart phones with 128MB and with GPRS access (free of charge) to the MUSIS channels (including text, audio and video material) for a four weeks trial during the period October-November 2005.

We used different data gathering techniques in order to identify and define the context in which the new service will be developed. The data gathering techniques consisted of questionnaires, interviews and observations. All data we collected provided us with a solid base to define the user’s context. The contextual information we gathered was used to define the content of the new service.

4.1. Subjects

The group contained five females and five males, ranging from 40 to 50 years old. One subject left the trial due to illness during the first week. Only two subjects didn’t previously have a mobile phone. All of them had basic IT proficiency. The test group represented 14% of the total workers. With this focus group we conducted two surveys at the start and end of the trial, individual structured interviews, and two workshops. The interviews were conducted during the second week of the trial. Workshops were held at the beginning and at the end of four weeks trial. All these activities, combined with our observations, provided a good empirical foundation for the service design and implementation phase. Besides information about the user’s profile, we collected data about users’ mobility perception and use and some basic information about their activities and tasks.

4.2. Interviews

We conducted nine interviews with all participants during the second week of the trial. For these interviews, we developed a well-structured questionnaire in order to get more specific information about their personal experiences in this trial. In general they regarded the Smartphone and the MUSIS services as interesting tools that have the potential to assist them in their work and communication with their readers. Based on the questionnaire, we found that most of the librarians (seven of them) spend most of their working time giving their readers specific information about the content of the different books.

Together with the librarians, we came with the idea of creating a repository of audio clips containing material related to book reviews (content of the service) that can be delivered to mobile phones via cellular networks using GPRS (technical context). All librarians we interviewed were very positive to this idea, mainly because in this way they can find new ways to be in contact with their readers independent of time and space constrains (it should be noticed that a vast majority of the Swedish population has mobile phones that can play digital audio).

5. Implementation

The core technology used in the MUSIS project is the MUSIS server, consisting of a multimedia repository and a content management system defined as CCS (Collect, Convert and Send). This latest software component has been developed by us at Växjö University [3, 4]. During the trial, one of the librarians created a number of audio clips in order to test and evaluated this content. The audio clips were then uploaded to the MUSIS server and then delivered to the mobile phones.

![Figure 1. A Conceptual schema of the contextual service](image-url)
The top layer of the schema illustrated in figure 1 represents the MUSIS server. The object with the number 1 in this diagram represents the CCS module. The database with the audio clips containing the book reviews is marked with 2 while number 3 represents the content and technical context of the new service. As the audio clips contain metadata associated information, the same content could be delivered to different users and profiles. It should be noticed that the CCS system allows generating different instances of the same content (like podcasting or MMS).

Figure 2 – MUSIS interface

Figure 2 illustrates the NOKIA 6630 with the interface of the MUSIS client to access the different mobile services we have developed. As shown in the illustration below users could access the content related to cultural news (Kulturnyheter), audio book reviews (Caroline tipsar) and information about new books (Tredyna bocker).

6. Evaluation

In order to assess the quality of the services and the impact of this trial we conducted a final survey during the last day of our project. Our main issue focused on the usefulness of the audio clips containing the book reviews, and whether this service should be offered to the readers on a regular basis (a couple of times a week). Seven subjects thought that the audio clips with the book reviews would be very interesting and useful but they needed more time in order to explore these ideas. One participant was so positive that wished that such a service could be introduced within a year, while another questioned the librarians’ ability to find time and resources to produce the digital content. None of the trial subjects thought that the audio book reviews service would not be useful, although that option was listed on our questionnaires. These initial findings support to some extend our early claim that for higher usability of the mobile service, contextual information should be used as the basis for generating the new content.

7. Conclusions and further developments

Using different data gathering techniques and a contextual design approach, we were able to identify one particular activity in the context of knowledge workers in a library setting that could be supported by a mobile service. The content associated to this activity/task basically represented for us the content of the new service. The proper channel for delivering the service was defined as technical context. The new service has been well accepted by the users providing some indications that right content in the right situation is an important factor for mobile services adoption and acceptance. This fact indicates that contextual design techniques can be useful in circumstances where content and services should be designed for supporting tasks in new “nomadic” situations (e.g. learning on the move, listening to a book review or watching a podcast episode about a lecture during a trip).

We will continue our research activities within the field of contextual information, mobility and learning as part of the efforts we will conduct in two new research projects where we will explore other dimensions related to contextual information such as location (using GPS) as well as personal/interpersonal attributes.

References