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CAMPUS NEWS – an Information Network for Pervasive Universities

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CAMPUS NEWS - an Information Network for Pervasive Universities

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Abstract: In this paper we describe a network for distributing personalized Information within a pervasive University. We discuss the system architecture of our Bluetooth-based CampusNews-system, both, from the administrator and the user viewpoint. We furthermore present first statistical data about the usage of the partial installation at the Koblenz campus together with an outlook to future work.

1 Introduction

”In which rooms are my lessons?” - ”Do they start this week or next week?” - ”Where is the examination office or the office of the registrar?” These are typical questions students, both, freshmen and senior students, are asking at the beginning of each new semester. Our concept of developing a campus information systems supports the student live cycle in a personalised way at any time, at any location. CampusNews helps the user on campus to find and access information, which is of interest and relevant to her; she only needs a Bluetooth enabled mobile device, which could be either a PDA or a mobile phone.
This information network is only one piece of the puzzle of our view of a pervasive university. Previous steps had been done at the Koblenz campus: In a series of projects funded by the EU (Trial Solution) and BMBF (In2Math) we developed ”Living Books”, personalized, intelligent teaching material, which also is available at PDAs and smart mobile phones. There is also an approach to use mobile devices for interaction during class-room teaching[1]. Altogether we find a situation on Campus, where students use their mobile device for learning and interacting and for localtion based, personalized information.
Other groups researching pervasive applications on mobile personal comuters have come to the same conclusion as we have, that the main attention with pervasive applications has shifted from a ”use anytime, anywhere” perspective to a location-based, personalized view [GRM05]. A lot of work is happening in this area at the moment. Using a Bluetooth mesh for positioning to send data over non-local wireless links like GSM or GPRS is one avenue to take [AGKO04]. In our approach we opted for positioning and transmission over the same channel. The local wireless link can also be skipped completely, which leads to different usage models [FV02]. A bit closer to our usage scenario of a pervasive university

[1] www.mobilearn.org

than these mentioned projects is the project ”mobile cafeteria menu”[2], although there are neither location-based nor personalized aspects involved.

2 CampusNews – Concept

The Campus News System is based on the result of the research project IASON[3], funded by the ”Stiftung Rheinland-Pfalz für Innovation”. Motivated by the development of powerful mobile devices and the semantic web, we defined a *Semantic Mobile Environment*. In such an environment, so-called service nodes are installed at chosen points of interest. These service nodes broadcast messages to nearby mobile users using bluetooth wireless technology. The kind of message depends on the location of the broadcasting access point. For example a bookshop could send its latest offers, or the University restaurant could present its menu or a faculty presents the schedule of events to the students.
The huge amount of information which will be sent is filtered by the mobile device according to a profile set by the user. For that we annotated the messages semantically with a logical concept in Description Logic (DL) [BCM$^+$03, BHS03]. We also gave the users the opportunity to build their individual interest profile. The user profiles and the semantically annotated messages are based upon the same terminology. The first usable prototype of the project (see [Mar05]) was implemented in J2ME, such that the user profile and the inference engine for the personalization was stored in the mobile device.
During several tests in the University and in the City of Koblenz within the framework of an EU-project Spatial Metro[4] it turned out, that most mobile phones did not yet fulfill our system requirements. They could not access the Bluetooth wireless functions from Java. Apart from that we learned that the barrier to install software on mobile phones or PDAs is higher than with computers. The users aren't yet used to software for these devices and as such distrust them more. To overcome both the technical shortcomings of mobile devices and the need for application installation, we chose to move the decision process (the ”reasoning engine”) from the mobile phone onto a server, thus eleminating the application. The profile of the user now needs to be entered centrally on a web page.

3 System architecture

The architecture of the Campus News Information System, consists of 3 components (as shown in picture 1): a web application as the user frontend (blue), a server application (red) in the middle and a freely scalable number of service nodes (green) for deliviering the information to the mobile devices. We implemented two different kinds of frontends, one for each group of users. We need an administration interface for the group of users which want to offer the information to the public. We call this frontend the Management

[2] http://www.studentenwerk-dresden.de/mensen/handy.html
[3] www.uni-koblenz.de/~iason
[4] www.spatialmetro.org

console. We also need a user interface for the recipients of the information, in our case the students. This is called the Userweb; it is depicted in picture 2.

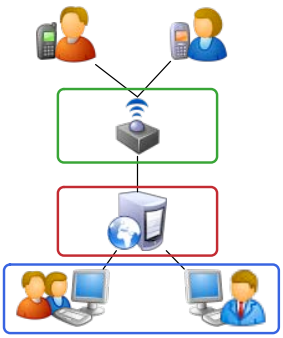

Figure 1: System architecture

Both access the backend, consisting of a relational database and a server application. The database acts as central storage for message data, profile data and service node information. Both web frontends store changes made by the users here. The server application also accesses the database, but uses this data to drive the service nodes. As soon as mobile devices are recognized by the service node, the server looks up the profiles of the corresponding users. This lookup uses a combination of several aspects of the mobile phone to ensure that this matching between mobile phone and user is correct. Using a subsumption check on the annotations of the messages and the users' profile, the server decides on which information conforms to the users' interests. In the next step a history query is made to ensure that no mobile device receives the same information twice. All relevant messages are then transferred to the service node by either wireless or wire-bound networking. The service

Figure 2: CampusNews management console (left) and CampusNews Userweb (right)

nodes scan for mobile devices with activated Bluetooth visibility. After handing this information to the server and receiving the messages, they attempt to transfer this data. After two successive rejections by the mobile device no further attempts will be made for a certain duration, to adapt to students that are not interested in the service.

4 Usage

Currently the Campus News System is used by the Studierendenwerk Koblenz and the Administration of the University of Koblenz as distributors of new information. This information comprises the daily cafeteria menu, special offers by the bistro (Studierendenwerk Koblenz), interesting news on the Campus, additional lectures or special events. At

the moment there are eight service nodes distributed around the campus, four in the bistro and cafeteria, three are outside of the main building and one inside the main building. We are planning to increase the service node count step by step (see figure 3) until we achieve a campus-wide network with each building sporting at least one service node. Thus all information could be transported location-based and context-sensitive, i.e. information regarding physics can be broadcast in the physics lab. The buildings inform everybody about themselves.

Apart from these service nodes the information is also displayed on two large screens in the cafeteria and on the web page. These devices are handled internally exactly like standard service nodes, so that not all information is displayed there. Up to now, most information is sent campus-wide. Information on the cafeteria menu is not sent in the cafeterias. As soon as the network is available across the whole campus, we will more clearly define information categories, which are geographically spread out. The steps to use the system are very simple for both administrators and end-users. An administrator would simply open the Campusnews Management Console web site in his web browser. There he will find a text form to enter text messages and the possiblity to upload files for multimedia notifications. All news can be added in multiple languages (see figure 4).

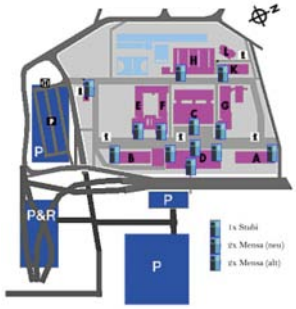

Figure 3: Campus University Koblenz

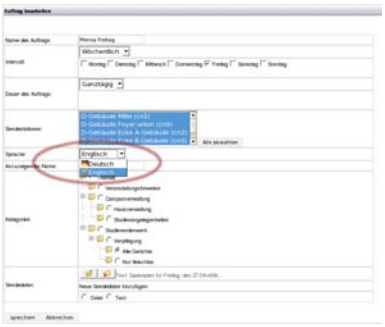

Figure 4: Form for adding new Information

On the end users' side the steps are even more intuitive. As soon as the mobile phone is in range of a service node for the first time, a welcome message with a link to the projects web site[5] is sent, along with a short explanation of what can be gained from joining. This message will only be sent once per mobile phone. If the user enters the link in a web browser on his computer or his mobile phone, he can create a Campusnews account by entering their university email address and selecting their mobile phone brand and model. The next step is selecting interests and disinterests (see figure 2 right), which are organized in a hierarchy to cater to specific and broad interests/disinterests. This step is recommend to ensure that the users receive the information personalized, this means the will only get the amount of messages they are interested in. The connection between university email address and Campusnews account enables us to only store and maintain a minimum of personal data while still retaining enough to be open for extensions, as will be shown in the next chapter. This connection is completely optional, though.

[5] http://www.uni-koblenz.de/campusnews/

5 Results and outlook

Now, ten weeks after introducing the Campus News System at the University of Koblenz, we are pleased to say that the usage and acceptance by the students is very high. The ratio of found devices to devices that received information was at 12.8% in April 2007. This ratio climbed to 44.8% in June. We consider this to be the number of Bluetooth capable devices owned by users willing to activate Bluetooth functionality, divided by the number of CampusNews adopters. We detected over 2100 different mobile devices with Bluetooth activated and served 590 of them. 164 Students are registered users of the new system. We transmitted over 3600 different messages in this short time frame (see table 1).

	April	May	June (26/06)	since Roll-out (16/04)
found devices	1079	785	948	2154
served devices	139	163	425	590
transmitted data	828	903	1871	3602

Table 1: Usage of the Campus News System

The next step is building a pervasive community by extending the system for reception of messages. Every registered user will be able to inject messages into the system directly from her mobile phone. This will require extended filtering mechanism for exclusion of unacceptable (i.e. insulting or hateful) messages. The connection between email account and Campusnews account would also make personal messaging possible.

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