

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 teaching¹. Altogether we find a situation on Campus, where students use their mobile device for learning and interacting and for location 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

¹www.mobilelearn.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 IASON³, 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 Metro⁴ 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 eliminating 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 delivering 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>

³www.uni-koblenz.de/~iason

⁴www.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.

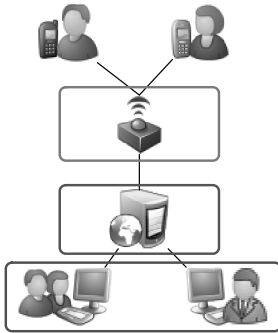


Figure 1: System architecture

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

The figure shows two screenshots. The left screenshot is the management console, featuring a table of messages with columns for ID, Name, Benutzer, Intervall, and Dauer. The right screenshot is the Userweb interface, showing a section for 'INTERESSEN' with a list of categories and checkboxes for selection.

ID	Name	Benutzer	Intervall	Dauer
145	Mensa Montag	Studierendenwerk	Mo	Durchgehend
146	Mensa Montag vegetarisch	Studierendenwerk	Mo	Durchgehend
156	Willkommen	Verwaltung	Durchgehend	Durchgehend
164	IVV	Verwaltung	20.04.2007 - 02.05.2007	Durchgehend
167	Statistik Semesterstart	Verwaltung	Durchgehend	Durchgehend
171	E-Learning Tage	Verwaltung	18.04.2007 - 03.05.2007	Durchgehend
172	Business Management	Verwaltung	19.04.2007 - 26.04.2007	Durchgehend
173	Promotionszentrum	Verwaltung	19.04.2007 - 24.04.2007	Durchgehend
174	Kinder-Uni	Verwaltung	Durchgehend	Durchgehend
176	Robbie 8	Verwaltung	23.04.2007 - 04.05.2007	Durchgehend

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

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).

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.

	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

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