MOBILE FEEDBACK SYSTEM FOR SUPPORTING INTERACTIVE LEARNING

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Abstract: Nowadays in some environments cases the lack of interaction between teacher and students is a huge challenge. Because of this the teachers may have difficulties to diagnose the level and preliminary knowledge of the students. In this paper we take a look at the wireless web-based education system supporting the traditional learning environment. We have earlier developed a pilot that can be used to develop the interaction between different parties. First virtual learning applications have had an approach where studying is independent from time and place. The goal for our application instead was to develop the current learning event and lecture. Our solution is founded on a WWW-based service. Students have access to the application for participating using their devices. Teachers as well as students have their own interfaces. Based on a questionnaire we completed, there is a need for these types of applications. This paper introduces a pilot application and its usage in a Wireless Service Platform. The platform gives completely new possibilities for taking advantage of the eLearning application. Lack of end-user devices is still a limiting factor but this solution at least reduces the need for existing network infrastructure.

1 INTRODUCTION

Online learning and different applications related to it have been hot topics for years. Currently there are numerous virtual learning environments implemented and being used. Most of them aim to make the learning insignificant from place and time. In these systems the material, including presentation slides and maybe even video or audio recordings, is stored in the network and the students can have access to this source anywhere they want through the Internet. Students can also access the material any time they want during the period when the virtual course is set to be online. Students may have to do some homeworks or they may have to fill in quizzes from time to time. This may be the only choice for many busy people who may be studying in addition to their everyday work. Distance-education course designers face the challenge of replicating the in-lab experience over the Internet, in a manner of speaking (Leitner, Lee J, 2005). One thing is often missing from this kind of approach: real-life interaction.

The application that we describe in this paper was implemented during the year 2002. The biggest problem that we considered at the time was the lack of end-user devices. The belief was that the number of handheld devices providing access to the Internet with reasonable price would increase more rapidly than it has. Consequently although the amount of wireless devices has increased the situation is more or less as it was a few years ago.

New and more developed approach is to use a wireless service platform to provide a mobile WLAN (Wireless Local Area Network) at the space where the actual event is taking place. Although the application was originally developed to support teaching it has several other targets where it can provide added value for the participants. Taking conferences as an example; Most of the participants are carrying a laptop with an easily accessible network connection, but these locations are often missing an Internet connection. Conference presentations are normally not interrupted and the questions will take place at the end of the presentation. With this kind of an approach, listeners are able to send the questions for the presenter at the time when the question is current. If the presenter has a view for the given feedback in real time, he can respond to these issues if it fits the current topic or he can leave the answering to these questions at the end of his presentation. However, this type of

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interactive presentation requires much more attention from the presenter.

In this paper we take a look at the "ITSE" (Interactive Teaching Support Environment) application and take a look at its operation as a part of a Wireless Service Platform. In chapter 2 we present the current situation as well as the opinions of the interviewed actors in teaching. In chapter 3 we take a look at the application itself, its features and usability. In chapter 4 we present the Wireless Service Platform concept where the application can be installed in. In the last chapter we summarize the whole system and the possibilities that it can provide.

2 CURRENT STATE FOR THE NEED OF APPLICATIONS

We completed a quick research over the virtual learning applications. The research was performed among different actors in education in Finland, mainly at the university level. Based on the results, there seems to be a real need for virtual learning tools. Although several applications have existed in this field for a long time, they are poorly known. Thus, there is not a single application that has dominating market position. The reasons why these applications have not come off so far in Finnish universities are probably be diverse.

2.1 Interaction in Teaching

According to many experienced teachers one of the biggest differences between younger and older students is the level of interaction. For the more experienced ones teachers may only give some topics for discussion and based on their knowledge the students take care of sharing the information themselves. The experienced participants are not shy to express their opinions or ask questions. The freshmen in universities instead are often insecure about their knowledge and do not have a courage to take part or ask questions in fear of loss of face. Technical solutions can give added value for these kinds of environments.

Our approach is not to affect on the information and material that is presented or how it is presented in the lectures, but to strengthen the current learning atmosphere and give better pedagogical tools for the teachers. The main idea of our approach is to take away the boundaries between the different actors and to make the students to participate actively in the session.

2.2 Current Applications

There are lots of implementations in this field but most of them have not concerned the support for the real-time activities. The early systems, such as "Classroom Communication System", (Dufresne et al., 1996) were hardly hardware dependent. Latter web-based systems were more or less platform independent requiring only a web-browser in the client side. "Student Response System" (Numina, 2003) and "ActiveClass" (Trompler et al., 2002) have these features and are clearly not designed for distance learning. As usual,

2.3 Survey for Demand

The feedback that we got from the questionnaire was encouraging. Almost 90% of the interviewed persons would be interested in using this type of application to support their presentations. Over 80% of them had no experience of these types of applications of supporting the teaching. One issue they pointed out was the chance of storing the feedback into a database. This gives a possibility to answer the questions later and to make a good use of those to improve their presentations for future purposes. This way the participants would have a chance to get the correct answers afterwards.

The main problems and challenges according to this research are the lack of devices and the missing tradition from this kind of interaction. One of the interesting questions is the listeners' attitude towards this kind of technology. Does it possibly require too much attention to type a question with a handheld device causing disturbance in ability to concentrate? Does this set the students in different position depending if they have the equipment or not and does this in the end decrease the interaction from earlier? It is definitely not suitable for all kinds of environments, but in some cases it may give totally new potential for the interaction.

3 SYSTEM REQUIREMENTS

The goal of the project was to create an application that is as easy to use as possible and for as many people as possible. The client application is ran on users' own portable devices (e.g. PDAs, laptops and even mobile phones), not with just some standard equipment provided by the event or lecture

organizer. Therefore we ended up implementing a WWW-based application.

Before the system was implemented there were some factors that had to be concerned as a guideline in design. The most important of these were platform independency, scalability and usability of the application to give the possibility to use for as many people as possible

3.1 Platform Independency

Presumably this kind of an application is used with variety kinds of devices, operating systems and platforms. Therefore the solution has to be on as high level as possible. There is no sense for implementing separate software for each device and consumers are rarely willing or even capable to install any additional software into their devices. For this purpose we considered a pure HTML-based web application as the most functional solution. Since the devices have different types and versions of web-browsers, the implementation has to be based on common standards and has to be simple enough to guarantee the functionality on each device.

3.2 Scalability

Selecting the technique as common as possible does not guarantee the scalability on each device. Smaller devices have very limited screen resolution and the shape of display device may be dissimilar. Therefore scalability is also an important factor to be concerned.

The layout of the client software was designed as simple as possible. It was necessary to avoid techniques that are not necessarily supported by each client, such as JavaScript. Simplicity often improves also the learnability, one of the most important factors in a field of usability in this field.

3.3 Usability

Before paying any attention to the usability components, the presumable users and user groups had to be defined. Probably most of the potential users are newbies and they may also be non-technology oriented. This sets some headlines for the usability. Nielsen defines the usability by five quality components:

- Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?
- Efficiency: Once users have learned the design, how quickly can they perform tasks?
- Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency?
- Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
- Satisfaction: How pleasant is it to use the design? (Nielsen, 2003)

We came into conclusion that the application has to be as easy to use and learn as possible. Therefore we paid most attention into the learnability at the cost of other factors. While simplifying the system there is also less need for memorability. In courses the students may be using the application constantly, but e.g. in conferences there may be only one instance of use requiring rapid learnability.

4 THE "ITSE"-APPLICATION

Students in some cultures are too shy to ask questions publicly in front of hundreds of people. Therefore one of our ideas has been anonymity towards other students. It may also cause misuse of the system. Therefore all the users may be required to log in. Even though the feedback they give is anonymous publicly, teacher or service administrator has access to the information through which user account each message has been sent.

The current system consists of different features that are implemented as separate modules and each of them are used optionally. These modules enable

- Sending real-time feedback and question for the teachers. Students can write text and send it to the server. The questions and comments can be presented publicly for all the audience via a data projector. These comments are shown anonymously to the public so everyone should have courage to send questions in any level. These questions are also stored in the database and the teacher has access to this information also later on.
- Evaluating lecture and quick-quizzes. A simple tool gives the users a chance to vote one of the pre-defined options. This tool can be used for evaluating the current presentation or to guide the presenter to specify the presentation. It can also be used to ask the students to answer multiple-choice questions while the options are given orally.

- Quizzes. Students can be asked to answer the pre-implemented quizzes. The questions may be multiple-choice questions where the alternatives of answers have been listed before or open questions with a demand to give answers by their own. Using this tool teacher can more easily order some quick exams and analyzing the results, especially of those ready-given alternatives, is efficient. The quizzes can be used to get a general overview of the knowledge or even to evaluate single student's know-how.
- Sharing files. Nowadays most of the material and presentation are stored in electronic format. Even now there are many cases where the lecturers who have no deeper knowledge of computer systems experience it hard to maintain the course web-page and to add files to be uploaded. If a teacher is using our feedback system in his lectures, its also easy to upload the material related to the course. As well as the students have access to the functionality being offered, they also can download the material to their devices from the same service easily.

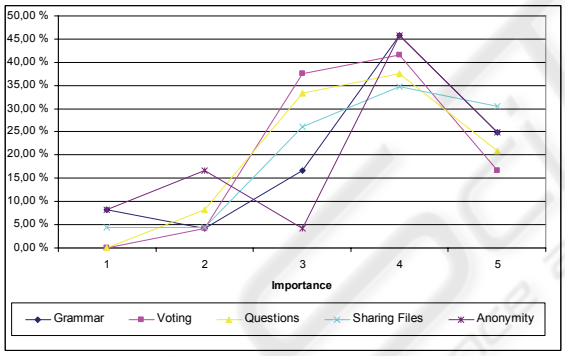

Figure 1: Evaluation of the usability of the implemented features in teaching.

We asked the need and usability of these features in our questionnaire and the results are presented in Figure 1. We can perceive from the table that the respondent have positive attitude towards the use technological instruments in teaching. Actually the interest towards more interactive learning processes is higher than we even expected. We can also see that they see some features more usable than the others. Anonymity was the one that caused most clearly differences in respondent's opinions.

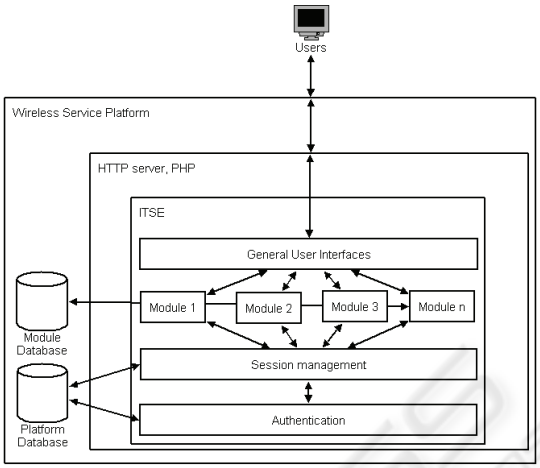

Figure 2: Application platform and modules.

As described in figure 2, all the modules are separate from each other. The "ITSE"-platform offer the common functions for all the modules such as identification and session management. Each of the new services can be added later to the system. The platform also includes the different templates that are being used to present the information for the students via teachers interface depending on the chosen modules that are being used. Information related to the user accounts and configuration is stored in SQL database. The modules may also use separate databases to store the related information into it. This database is nevertheless virtually separated from the database of the platform, as presented in figure 2, to prevent errors and to increase the security and data controllability. The platform also includes the general layout, such as placement of each feature in the screen, for all the different user groups.

System has originally been designed to be run in its own window when all the questions and summaries are shown to everyone including the audience. However often there are no two separate data projectors in use so the application must be ran on the same computer as the presentation. In this case there are two possibilities. Speaker can run the system in a separate web-browser and run the presentation on the top. This case does not give the interaction and instant feedback to him, since the summary is hidden from him as well as the audience. So another possibility is to run the presentation through the application in its own frame as presented in Figure 3. This both minimizes the need for speaker's equipment but still gives a change to access and see the feedback instantly.

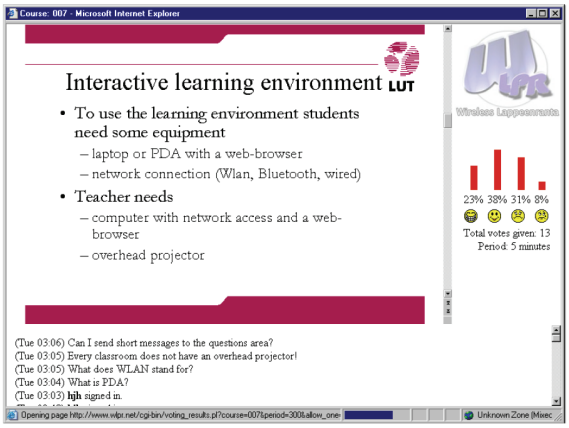

Figure 3: A screenshot of the shared user interface with presentation, feedback and voting features.

The application can be used as an ASP (Application Service Provider) service. In this case the "ITSE"-application is installed in a server located on the Internet. The users can have access to the same information all over the network and the access is independent from the technology that is being used. The other option is to use a Wireless Service Platform.

5 UTILIZATION OF THE WIRELESS SERVICE PLATFORM

In this work, we utilized the Wireless Service Platform concept for the original "ITSE"-application. The Wireless Service Platform concept consists of a basic, off-the-shelf wireless router as a basis for the wireless service platform and a suitable custom firmware for the service delivery. The wireless service platform consists of a wireless router and optionally some external peripheral mass storage components (memory stick, external hard drive) connected most commonly as a USB-peripheral (Universal Serial Bus) bus to allow more number of versatile wireless service applications to be deployed for the platform and to extend the scarce resources of the wireless router device itself. The wireless router environment and the related peripherals are presented in figure 4. The wireless router hardware used in this work was Asus WL-500gP including 802.11b/g WLAN-adapter with 5 port 100Mb Ethernet LAN switch, 32Mb RAM (Random Access Memory) and 16Mb Flash memories connected to 1Gb external memory stick through of the two included USB-bus connectors (Asustek, 2006).

The system kernel and operating system software platform is based on OpenWrt firmware (OpenWrt, 2006), which provides customizable and highly modifiable and modular core software platform for the provision of different wireless services for different communities. OpenWrt-project is creating a Linux-kernel based open, GPL-licensed (General Public Licence) firmware, which is highly customizable while offering the flexibility and the modern features of the Linux kernel. Currently OpenWrt-firmware is applicable only to the certain Broadcom-chipset based wireless routers but the aim of the project is to extend the support for as many different wireless router hardware platforms as possible in its upcoming firmware versions. The OpenWrt-project offers currently four different firmware images for flashing the compatible routers. It also includes packet managing system for easy packet installation and removal along with a few other features for easy utilization of the platform. OpenWrt-project provides a reasonable number of installable packets, and there are more to come in the future. In addition, the project offers the OpenWrt SDK (Software Development Kit), custom firmware image builder and the system buildroot to cross-compile custom applications for the platform. The firmware was chosen to the work for its basic principle features and technical properties, which were suitable and compatible for the initial idea of the wireless service platform concept.

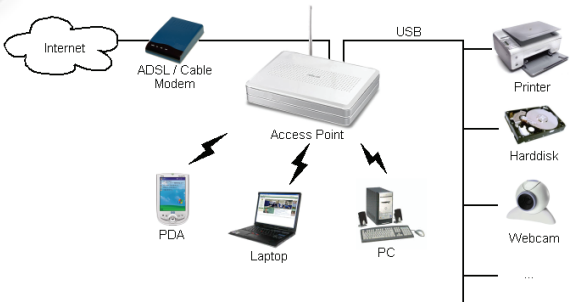

Figure 4: Access point and samples of peripherals that can be attached and used.

While utilizing the "ITSE"-application for the wireless service platform, only little essential core networking software is required. These include all the core software for the basic operation of the platform, e.g. DNS (Domain Name System), DHCP (Dynamic Host Configuration Protocol) and other basic networking services for the fundamental operation of a wireless network. In addition for the

application itself, a PHP-interpreter was installed on the wireless service platform. The database backend for the system was based on SQLite-database (SQLite, 2006). Among the other features the access point is naturally also able to provide Internet connection through different wired and wireless network interfaces that are shared between the users.

The basic idea of utilization of the Wireless Service Platform was to ease the general deployment of the learning environment where no network infrastructure is available. The hardware of the wireless service platform provides almost all the required hardware components, only the audio-visual component (e.g. video projector) is needed in addition. The utilization of the wireless service platform provides an easy to use and affordable solution when deploying the learning environment, where no external network (usually Internet) connection is available. In addition to the basic software, data encryption, authentication and authorization can be added to the platform for better security and for restricting and controlling the permitted clients.

The practical results from the utilization of the Wireless Service Platform indicated that the resources available at the wireless router device used in the tests (Asus WL-500gP with the peripherals) were sufficient for the application. The tests with the Wireless Service Platform are supposed to be arranged to make the final conclusions about the usability and applicability of the platform.

6 CONCLUSIONS

Based on our research there is a need for this type of application we presented in this paper. Some basic principles have not to be forgotten. First of all, all the features that are included in the application must serve the eventual target: support the lecturing. All kinds of fancy features could be added, but this may easily cause a circumstance when the features are overlapping the features of another online education application already being used or disrupt the teaching in another ways.

By making this service more independent from the network infrastructure by using Wireless Service Platform, the utilization is easier and the service can be accessible in different kinds of environments. The "ITSE"-application can really gain benefits of the mobility that is made possible. However, the original purpose of the router devices must be kept in mind: the capability of the device hardware is often suited to serve the purposes of the basic networking functions and thus is sets severe restrictions about the service usability. Thus the device is best suited only to sufficiently low resource consuming services, where more heavy-weight services require more hardware resources to be available.

Mobile phones with GPRS and WLAN interfaces and web-browsers are becoming more and more common all the time. To install the "ITSE"-application into the Wireless Service Platform does not bind the application into a certain technology but utilizes the existing technology and its best sides to make the life of the user more comfortable and less demanding.

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