Mobile Learning: the Virtual "Paper" Advantages and Characteristics

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ABSTRACT: *Even in distance learning institutions, the students choose in 80% of the cases paper as data medium. Researches have shown that they are primarily motivated by the mobility of the medium itself and the mobility granted to its user. It seemed interesting to examine to what extent currently available mobile devices can offer the students greater mobility and to evaluate their multimedia integration. Paper is the most used data medium in e-learning, but also offers the least possibilities from a technological point of view.*

At the University of Applied Sciences Valais, several experiments were conducted on mobile technologies (mobile phones, PDA1, Pocket PC), enabling students to interact with an e-learning platform. The development platform used was i-learn, the platform implemented at the University of Applied Sciences Valais.

This paper points out the concrete advantages of mobile learning and describes the development of two types of PDA in relation to an e-learning platform: Palm Pilot and Pocket PC. The technologies and languages used were .net and C++.

The pedagogical, technological as well as communicational aspects were taken into account.

MOBILITY AND LEARNING

The development of distance learning and particularly e-learning (online version) in Europe and Switzerland is increasing. This learning method offers access to the learning media any time and anywhere by means of pedagogical web platforms.

Since the success of the Internet and its implementation in homes, applying the concept of lifelong learning to everyone is not illusory any more. As with any technological "revolution", the hopes for e-learning are very high. Thousands of scientific publications, hundreds of web platforms and thousands of courses presented on such platforms are offered to the public and to companies. In the United States, e-learning represents 60% of the education expenditure and 92% of the big companies intend to set up such a solution in 2000[2].

Actually even though the performance of the logistical aspects increases (powerful and inexpensive computers, high speed lines, video streaming) and the costs decrease thanks to better market analysis and simpler resource developments, the "usability" of these resources does not meet the hopes of companies and schools specialised in this field.

The reasons why the use of e-learning and the cognitive outcome of using the developed resources is slowed down are threefold: The pedagogical approach (e-learning courses often consist of long texts to be learned, combined with exercises, which is a simple transposition of presential teaching methods), the lack of integration into a group during the learning process (which partly explains the high percentage of drop-outs (80%) in distance learning courses) and the medium. Our analysis will focus on paper data media.

Most pedagogical resources consist of simple text transfers from paper data media to computer data media. The reasons for this include a lack of time, of financial resources and sometimes a lack of technological know-how. Whereas simple text is adequate for paper data media, its readability on a

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[1] Personal Digital Assistant
[2] Le Monde, 2001

computer screen decreases by 30% (flickering, horizontal reading, vertical reading). The developed courses mainly consist of long html pages, which sometimes contain applet windows aimed at supporting the reading and memorisation process. However, they also lead to a loss of attention, of comprehension and, above all, of implication in the course. Searching for pertinent information, bookmarking pages and highlighting information to be remembered are difficult due to the text volume and the number and organisation of the html pages. E-learning courses would certainly be more pertinent and interesting if they contained more specific web objects and electronic media such as multimedia elements (videos, audio comments, interviews) and interactive elements (manipulations, tests other than quizzes etc.), which can be developed relatively easily with IT technology.

Instead of a new pedagogical concept with added value, e-learning could simply be a new method of distributing education. To achieve this, the system must replicate the classroom (interaction, exercises, explanations, adaptation to the needs, levels and expectations of the students) and, above all, integrate multimedia and interactive resources.

VIRTUAL PAPER : GUARANTEE OF MOBILITY

In the last few years, studies at the Centre Romand d'Enseignement à Distance (CRED) have shown that according to students, paper is the best data medium. 80% of them prefer paper to videotapes, audiotapes, CD-ROMs and online-courses. This choice is comprehensible: If the Internet has to be used like a book or a course document, people rather use "real" paper. The students' preference for paper is also due to the fact that they have essentially used paper throughout their education – people tend to stick to what they are familiar with. The many qualities of this medium include **mobility**. A book can be taken and worked with anywhere (train, in front of TV, during short breaks etc.). It is small and can be annotated (large parts of texts can be copied with a scanner pen and inserted into a standard text processing programme to make summaries). The book's mobility also contributes to the student's mobility. Distant learning students are often professionally active adults with a family and little time, who wish to take advantage of the small breaks in their day to study. This objective can thus perfectly well be achieved thanks to the mobility offered by paper. As a matter of fact, the interest of offering courses over the Internet must not be questioned, and the course development habits continue to focus essentially on the production of texts. Therefore, it becomes crucial to investigate the means of increasing the mobility of these courses and to allow their logistic integration into the daily life of the students.

From this point of view, **mobile learning** becomes an essential research and development focus. The main Office software includes options for transferring documents to mobile data media. Downloading e-learning resources from a website to a mobile device in order to read these resources elsewhere than in front of a computer screen would thus be very interesting. Not only the students, but also the teachers would benefit from this technology, as they would be able to distance manage their courses, to download resources to be published, to use their PDA to correct exercises published on the e-learning platform, etc.

PRACTICAL EXPERIMENT

The University of Applied Sciences Valais has acquired large experience in the field of e-learning (participation in the development of an e-learning platform (i-learn), implementation of this platform since 2000, publication of course resources on this platform by 25% of the professors, development of e-learning courses, etc.) and is interested in applying the research conducted in the field of mobile devices to its e-learning platform.

In the framework of the projects developed by the third-year students of the HEVs, two groups were chosen to develop a mobile application to access i-learn, the e-learning platform used at the HEVs, from a PDA.

I-learn includes two environments: a dynamic website dedicated to learning and a local application connected to the Internet, which allows the professors to manage their courses (creation of courses, affectation of students, setting up of learning resources).

Administration tool

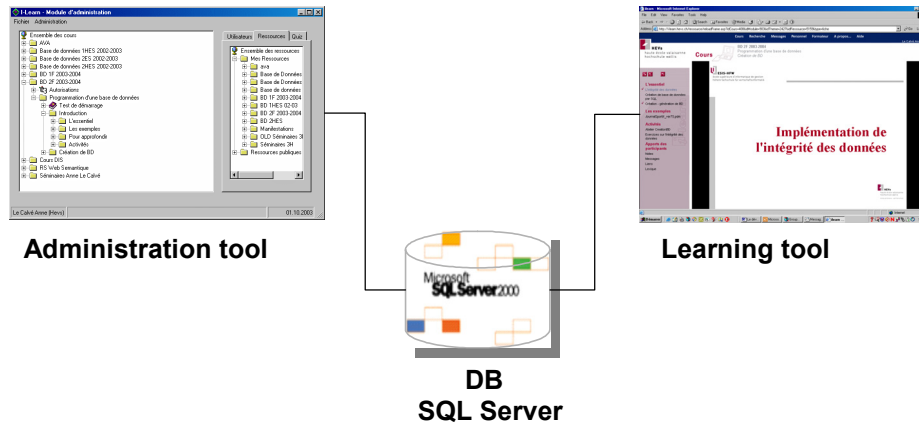**Learning tool**

**DB
SQL Server**

Fig. 1: I-learn

The objective of the first phase consisted in identifying the needs, in defining the mobile devices to be used and in choosing the adequate development languages.

A large number of mobile devices are available on the market. According to their representation on the market, the studies focussed on two devices: Pocket PC and Palm V.

To test their limitations and advantages, two different development environments were chosen: asp.net mobile for the Pocket PC and C++ for the Palm Pilot. It would have been interesting to consider Java and to use for instance MIPD (Sun), which offers a whole range of functionalities for mobile applications (user interface, network connectivity, local data storage, management of the application's life cycle…). Due to the limited length of the projects, however, the students did not have time to learn a new language and thus used familiar environments.

First experiment: Pocket PC (asp.net)

The students' task consisted in developing the administration application of the i-learn platform in order to update it from a mobile device. The end users were the professors.

They used the framework Visual Studio 2003 released in April 2003 by Microsoft. It allows the development of applications for mobile devices in the same way as for a classical Windows environment. The programmers quickly and easily familiarised themselves with the software and thus developed several functions in a short time. Almost the entire administration tool and the i-learn platform were made accessible via WAP-enabled mobile or a light browser. The navigation and the screen design were adapted to the constraints of small displays.

In order to maintain the same environment philosophy as i-learn, the administration tool can be downloaded from the web platform to the mobile.

The learning website, which is independent from the mobile devices, works on Pocket PC as well as on any WAP-enabled mobile or i-mode. Thanks to asp.net mobile, the interface automatically adapts to the device chosen.

The architecture uses web services to access the database, and the documents can be transferred via sockets as xml files.
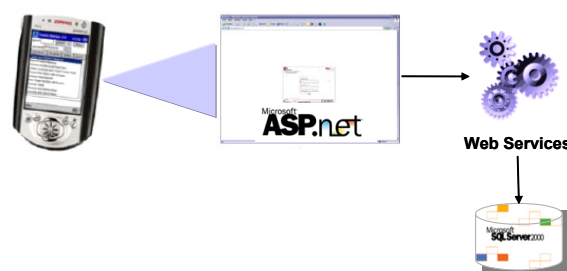

Web Services

Fig. 2: Architecture of the learning website

The features of the learning website are the same as on the original platform. The students can log on, search for and view courses and resources, send exercises to be corrected, use the forum and manage their personal profiles. The professors can also download the administration tool. Upon completion of the authentication procedure, the user sees the different courses and a toolbar for accessing the different features of the site.

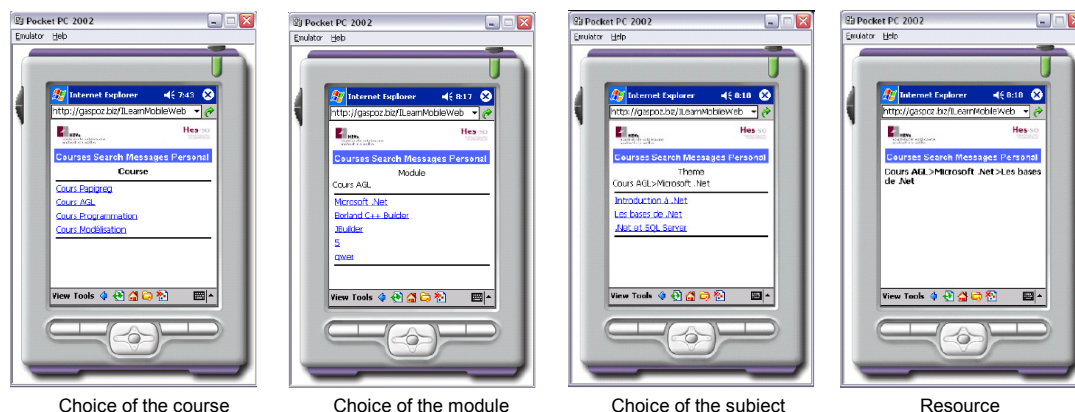| Choice of the course | Choice of the module | Choice of the subject | Resource |

Fig.3: Navigation screens of a course

On the main page, the user can access all his courses in a tree structure. A light tap on the screen opens the tree structure and, according to the node chosen, a longer tap gives access to the context menu. After selecting a course, the user can add resources via the screen. The resources can be chosen individually or in groups by ticking the file. Like the administration tool on the PC, the Pocket PC tool needs to be permanently connected to create courses, to affect users and to set up resources. This deliberate choice made by the students is obviously constraining and still expensive for the user. These constraints have been reduced thanks to the success of wireless, a default feature of most of the latest PDA.

The connectivity aspects will be reconsidered by the students within the 2003-2004 projects.

Second experiment: Palm Pilot (C++)

Given the increased difficulty of the development environment, the specifications of the second experiment were less extensive. The students had to develop a feature for Palm Pilot to access the forum of the platform.

The native Palm environment (SDK C) was chosen, which offers the possibility to write C++ classes. Without frameworks (e.g. Borland), everything had to be created "manually", as the available information was more rudimentary. Windows, for instance, require more resources and are complex to realise. Unlike the first experience, the application development for Palm Pilot differs considerably from the PC environment. It is more similar to MFC developments with more rudimentary design elements.

The architecture however is more flexible, the communication protocol is standard (http) and the pages developed in ASP could well have been developed in PHP, JSP….
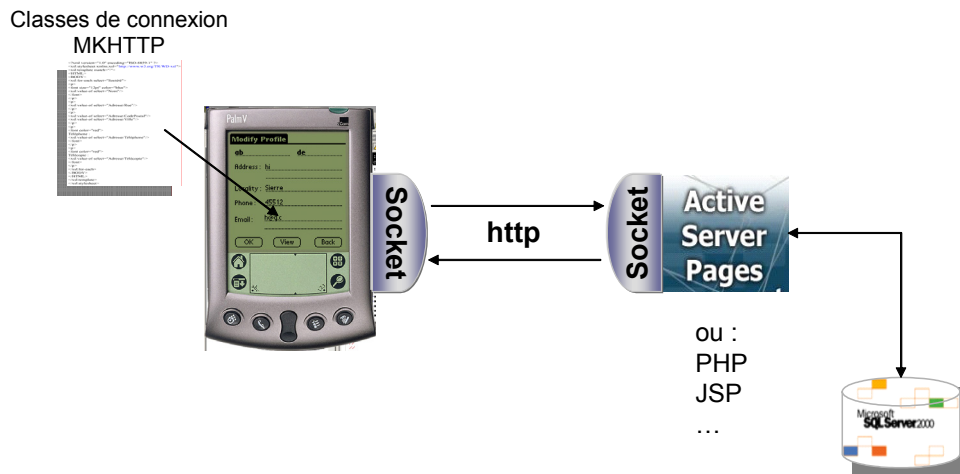
Fig. 4: Chosen architecture

With the developed application, the users can log on the platform, manage their user profiles and use the classical functions of a forum: list questions, read replies, write new questions and reply to messages. The tree structure of the forum is respected as much as possible.

List questions   Read replies   Write questions   Reply to questions
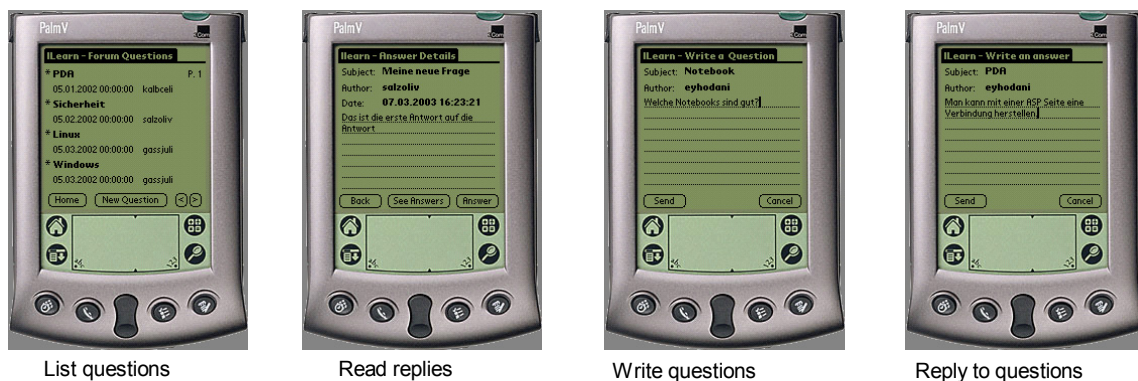
Fig. 5 : Main features of the forum

These two experiments, which both consisted in developing e-learning applications for mobile devices, can obviously not be compared. One uses a mobile oriented proprietary framework with all its features, and the other uses exclusively the native Palm environment. Nonetheless, they have demonstrated the interest and the portability of e-learning tools to PDA.

THE FUTURE OF LEARNING

These experiments sould be extended : it did not take into account security (increased authentication) or connection modes (work offline). These aspects will be developed in further projects. The developments will focus on three areas: the download of learning resources previously adapted to small screens (Word, Excel and PowerPoint can thus be read and edited via the DocumentToGo application), the security and connection management for the applications developed and presented in this paper, and the handing in of exams in form of quizzes by text messaging. This last aspect will allow the combination of two of the before cited elements: documents that are recognized and adapted to mobile devices and the security of data transfer and of the signature of documents (public and private key).

It would also be interesting to examine the document production standards in relation to the readability of the mobile medium.

The connection fees are still too high and activating the Internet connection remains complex for the average user. However, the advantages of mobile devices are manifold: mobility, preservation of the complete course structure, navigation thanks to hypermedia resources (in contrast to paper), download and viewing of advanced resources (video, sound, etc.). Using this type of media will make the notion of learning any time and anywhere come true. It will be based upon new societal habits (taking advantage of

short time spans, working for short periods of time to avoid boredom). With his mobile device, the user can surf the Internet, enrol in a course, pay online. Once the enrolment has been approved, he can physically attend the course (blended learning) and, at the same time, receive practical information on his mobile device (room number, meals at the cafeteria, etc.).

The flexibility of paper and the extended features of e-learning platforms or electronic media are thus combined. The main problem of e-learning developments is neither the technology nor the lack of mobility offered to the students, but the technical quality and the pedagogical value of the courses presented on the different learning platforms. This is where the notion of PLA (Personal Learning Assistant) comes into play. This tool will increase the value of the downloaded resources, e.g. by integrating intelligent agents able to summarize the important points of a text or to reorganise the e-learning platform according to the needs, interests or cognitive competence of the learners.

By adding acoustic text input, we move from the era of Digital Man [NEGROPONTE] to the era of Connected Man. This life style will allow people to live at different places at the same time and is the logical continuation of the trend introduced by mobile telephony: to detach from a restricted work environment and to cumulate several functions and interests at the same time…

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