

Applying Mobile Technology to Portal-Based Course Management Systems

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Abstract: Portal-based course management system is becoming more and more popular. However, how to use mobile device to access portal-based course management system is still a challenge. In this paper, we propose an approach to apply mobile technology to portal-based course management system. A prototype is implemented to prove that most of the functions in portal web pages can be transferred to PDA screens. Although we built our prototype based on Chef project, we believe it is a generic approach that can be applied to other course management systems.

1. Introduction

Course Management Systems (CMS) provide easy-to-use web interfaces to share course material, facilitate communications and to access related course tools. As usage of CMS continues to increase, there is a glaring limitation in the course management system – it can only be accessed through a personal or laptop computer. Although most faculty members and students own a computer, an increasing number of people are purchasing mobile devices to access information while on-the-run. Taking this into account, the next logical step in the development of CMS is to apply mobile technology to current CMS, the *Mobile CMS*.

Moreover, with the maturity of portal technology, more and more course management systems are using Portal technology (Enterprise Information Portal) as user interfaces to aggregate class information and services and allow the users to personalize and customize their views of these classes, services and information. How to apply portal technology to mobile devices is a more challenging question.

In this paper, we propose an approach to apply mobile technology to portal-based course management system. This research is aimed to provide a mobile user interface to the users of the on-going *Sakai* project (Sakai, 2004). We implemented a prototype based on current version of Chef project to prove that most of the functions in portal web pages can be transferred to PDA screen.

In the following sections, we will first provide some background information about portal technology and Sakai project. Next, we will provide some survey results about mobile technology in Indiana University. Then we will list the challenges in displaying web portal on PDA. Finally, we will describe our solution to these problems and our prototype implementation.

2. Background

In this section, some background information about portal technology and some CMS projects will be introduced.

2.1 Portal Technology

Portal technology is a trend for future web technology. One portal page contains several portlets that retrieve information from a multitude of sources (i.e. weather, stock quote, news group). All this information can be displayed in one web page. Jetspeed (Jetspeed, 2004) and uPortal (uPortal, 2004) are two major open source portal engine providers.

Advanced Course Management Systems use portal technology to aggregate class information and services and to allow the user to personalize and customize their views of these classes, services and information. At the same time, university-wide services are migrating from independent web-based interfaces that accessed siloed systems (e.g., Bursar, Library, Registrar, CMS, etc.) to enterprise-wide portals that integrate a personalized view of the full range of the university's services and information. (Sakai, 2004)

2.2 Sakai Project

“Sakai” project is launched by the University of Michigan, Indiana University, MIT, Stanford, the uPortal Consortium, and the Open Knowledge Initiative (OKI) at the beginning of 2004. Sakai’s goal is to develop and distribute a “complete course management system that incorporates the best features of the participants’ existing systems and experiences”. (Quick, 2004)

Sakai will use portal technology as user interface so that individual users “will be able to configure the site to their own preferences”. (Quick, 2004)

2.3 Chef Project

“The CompreHensive collaborativE Framework (CHEF) initiative has as its goal, the development of a flexible environment for supporting distance learning and collaborative work, and doing research on distance learning and collaborative work.” (Chef, 2004)

As part of the Sakai project, Chef uses portal technology for its user interface. Related Course content can be put together in a single web page. One portal page can have multiple portlets. Each portlet performs a single course function for the user.

With portal technology, the instructors can use a simple web interface to decide which portlets to be included in a course web site and how these portlets are grouped. For example, in the “assignment” portal page, the instructors can make it contain the “assignment content” portlet and “drop box” portlet so that all the tools necessary to view assignments and submit assignments are in the same web page.

(Fig. 1) shows the architecture of chef framework.(Golden, 2002) The back-end has different chef services. The front-end are portal engine and web server.

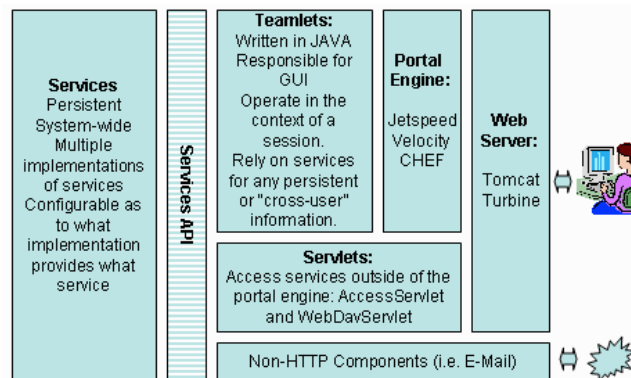


Figure 1: Chef Architecture

2.4 OnCourse

OnCourse (OnCourse, 2004) is a proprietary online CMS developed at Indiana University (IU). It allows professors to use the Web-based application to organize all of their course content through a simple yet effective interface. At

the same time, students can easily access this course information along with other built-in learning resources. In this way, OnCourse provides a medium where all course related information exchange can take place.

To access OnCourse, users simply have to visit the website and login using their university usernames and passwords. The individual course websites are generated and updated dynamically using the university's databases. Once logged in, authorized tools are provided to the user to edit information, add materials, and view class resources.

The prototype we developed accesses a chef web portal from a PocketPC device. It is designed for Indiana University with OnCourse as target market.

3. Survey on Mobile Technology Market

To get a better understanding of usage of mobile technology and OnCourse at Indiana University, we conducted an on-line survey to IU faculties and students. The survey is conducted on 57 students and 8 faculty members with 12 questions in the questionnaire. (Tab. 1) shows some interesting results of the survey about the students.

Items	Percent
Students who own or plan to purchase a PDA within 12 months	28%
Students who use OnCourse to access course material	91%
Students who found the need to access course materials on OnCourse when they are on the move or away from their computer	81%

Table 1: Survey Statistics on mobile technology and CMS

From the survey, we can see that more than 1/4 of the students own or plan to purchase PDA within 1 year. Most students use OnCourse as the CMS to access the course material and most students found the need to access course material when they are on the move or away from their computer. This survey result clearly echoes the need to put course management systems on the mobile devices.

During the survey, we also found the top 5 most used functions in OnCourse are:

- Course Announcements;
- Schedule;
- Grade book;
- Syllabus;
- Tests and Surveys.

The detailed result of the survey is available at (StudentSurveyResult, 2004) and (FacultySurveyResult, 2004).

4. Challenges to Display Web Portal on a PDA

The main challenges for a PocketPC to link to a portal environment are:

Limited screen size: All Pocket PCs have a screen resolution of 240x320. (DesignPPC, 2004) The portal web page is too large to display on the small PDA screen. Thus, users need to scroll a lot to view a web page.

Limited functionality: PocketPCs don't support CSS and iFrame tags, which are commonly used in portal technology. If a portlet is displayed using an iFrame tag, it cannot be seen on Pocket IE, which only has limited support for JavaScript. As a result, some functions, such as frame arrays, are not supported.

Interoperation between regular web browsers and a PDA browser: If a web application is created solely for a PDA screen, users cannot take full advantage of the larger regular browser. However, if we create two separate web applications, the user needs to remember two URLs to access two different versions of the web portal.

Moreover, the concept of Mobile CMS is to extend the current functionality of the CMS and provide users with a system that allows them to access course information using a mobile device. Using this model, it is clear that Mobile CMS is intended to complement the main CMS. Thus, in developing this extension, one of the main goals was to design a version of Mobile CMS that had a similar look and feel as the main system, including its font, color patterns, and layout. This will help users get acclimated to the new product by lowering the learning curve.

5. Solution to Display Web Portal on PDA

In order to solve the problems mentioned above, we developed the following architecture and strategies.

5.1 Architecture

In our design, we kept the underlying business logic layer, or Model in MVC model, untouched. Only necessary changes were made to the View and Controller layers in order to accommodate the display on the PDA screen. To change the display, we created a separate set of templates for the PDA and left the current Chef display template untouched. By doing this, we took full advantage of the previous technology that was used in developing a regular portal. (Fig. 2) shows the architecture of Portal-Based CMS with Mobile Devices.

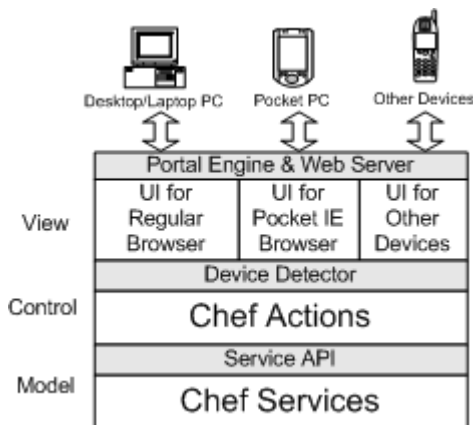


Figure 2: Architecture of Portal-Based CMS with Mobile Devices

When a web browser connects to the server to retrieve a portal page, the server automatically detects the browser type using the “User-Agent” server variable. If it is a regular desktop PC browser, it will render regular web portal content. If it is a pocket IE, it will render the PDA version of the portal content. This way, users can use the same URL to access both versions of the Chef portal.

Because we use the same underlying business logic for both versions of the web portal, the information displayed in both versions can automatically be kept in sync. When users update information in one version, it will automatically be reflected in the other version’s display. Thus, if we change the underlying business logic, it will immediately take effect in both versions.

5.2 Mapping Relationships between Regular Browser View and PocketPC View

Since PDA has limited screen size, we cannot show all the content of each portal page to the PDA screen. A solution is to show only the titles of each portlet in the first screen of PDA as menu. We mapped each portlet to a link in the menu. The user can click the link to get the content of the portlet. The left menu column is mapped to a title with bold font. (Fig. 3) shows the mapping relationship between regular browser View and PocketPC view.

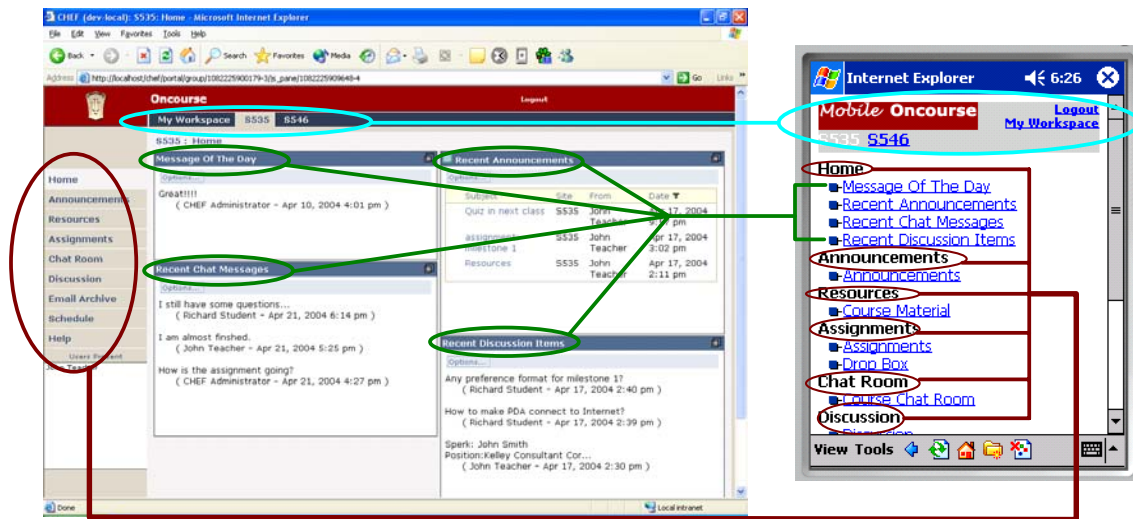


Figure 3: Mapping Relationships between Regular Browser View and PocketPC View

5.3 Function Filter

PDA users can take advantage of most of the functionality in the Chef portal by using our prototype. However, we did filter out some functions that are not suitable for PDA, like “print PDF” and uploading files, to save screen space and to enhance usability. These functions can be added or removed easily.

5.4 Content Filter

Some content in original portal doesn't need to be displayed in the PDA screen. We made following adjustment to make the content display appropriately in PDA screen.

- *Modify the data display:* For example, in Chef, the time is displayed in long format, such as “Apr 17, 2004.” Because this takes a lot of space, we changed the format to “4/17/04.” This preserves the essential information while efficiently using the smaller screen space.
- *Delete unnecessary introduction:* like introduction to some functions in Chef. We did this because we assume that the users already have some background knowledge about the functions of each portal page when they use PDA to access the portal. Since we provide similar environment to regular browser, the users can find the functions they need easily.
- *Delete unnecessary columns in table.*
- *Delete unnecessary images and links*

5.5 JavaScript Modification

Currently, the Pocket IE supports only JavaScript 1.1 while most browsers support JavaScript 1.2. We need to modify JavaScript functions to use JavaScript 1.1 version. Some functions, like form element array cannot be used in pocket IE.

One problem in debugging JavaScript in Pocket IE is the errors are hidden from the users by default. What's more, the execution of JavaScript stops silently after encountering an error. This makes it very hard to debug in PocketIE. To display the JavaScript errors, we can use some third-party software to edit the registry of Pocket PC, like RegKing (regking).

5.6 Prototype Implementation

We implemented a prototype based on current *Chef* project, which will be developed to be the framework of *Sakai* project. Although we built our prototype based on Chef project, we believe it is a generic approach that can be applied to other course management systems. As long as the course management system separates bussiness logic

from user interfaces, we can adjust the user interface to fit the mobile device screen. Also, we can always separate a portal page into several portlets and adjust each portlet to be displayed in a PDA screen.

6. Conclusions

In this paper, we propose an approach to apply mobile technology to portal-based course management system. We implemented a prototype based on current version of Chef project to prove that most of the functions in portal web pages can be transferred to PDA screens. The user can access portal-based Course Management Systems while they are on the move or away from computers. We believe this is a trend in future development of Course Management Systems.

7. Acknowledgements

This research and prototype implementation is part of the mobility technology competition and S535 course project sponsored by UITS of Indiana University and Hewlett-Packard Company. It was evaluated by experts from the industry and academia. Our design and implementation won 2nd place in the competition.

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