

Improving E-Learning Using Distributed User Interfaces

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ABSTRACT

As we can observe day after day the m-Learning methodology has become an exciting art of using mobile technologies to enhance learning skills. Mobile phones, PDAs, Pocket PCs and the Internet can be joined together in order to engage and motivate learners, anytime anywhere. The society is entering a new era of m-Learning, which makes important to analyze and innovate the current educational tools so they can be used correctly and as it is needed in the application domain of the work "learning". This article proposes the way in which MPrinceTool, that aims to improve the deficiencies identified in the usual analysis, can provide a new means to interact via mobile, desktop and Web by applying distributed user interfaces to the application design, so it facilitates users to participate in educational activities and communication with working groups. These advantages will be clearly adapted by our tool and part of it will be explained.

Author Keywords

M-Learning, distributed user interfaces (DUI), HCI technology, mobile devices, context awareness, and collaborative environments.

ACM Classification Keywords

HCI; DUI; MDA; MB-UIDE; user interfaces, mobile devices, context awareness, collaborative environments, and user-centred design.

General Terms

Design, experimentation, human factors.

INTRODUCTION

By the end of 2009, there were an estimated 4.6 billion mobile cellular subscriptions, corresponding to 67 per 100 inhabitants globally [5]. This is more than three times the number of personal computers (PCs), and today's most sophisticated phones have the processing power of a mid-1990s PC.

The main idea of this proposal is to present an innovated

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interaction way, while using MPrinceTool [4], where users can be able to interact with the environment to build knowledge from relationships acquired from the ambient. And after searching for the best way to improve the implementation of this system, we find that it can be done by supporting distributed user interfaces by the educational tool. The system with several modifications in its user interface design by making it a distributed user interface design to enrich the classroom study allowing students to work in a collaborative way as it is indicated in European Higher Education Area [3].

One of the main concerns for distributed user interfaces is the complex and dynamic world of managing user interactions, from different types of devices. One of the main proposals for the development of new devices and systems that support DUI is to provide users an interface divided between devices, introducing new forms of interaction and collaboration [1, 2, 8 and 9].

WallShare (one of the tools that MPrinceTool is based on it) itself [6], implements DUI, so MPrinceTool as well. In this paper we have improved the DUI part of the system by adding new users' interfaces and functionalities which are more appropriate for educational environments.

The structure of the paper is as follows: first we describe the system (server and client functionality and exhibit its architecture), secondly, the state of art is presented, thirdly, the system and the different user interfaces, fourthly, how MPrinceTool supports DUI is discussed and the advantages are explained with a case study. And finally, the conclusions that have been observed and obtained after using the tool and the future work upon it will be presented.

STATE OF ART AND MOTIVATION

There are more and more educational tools for mobile device use, and each is specialized in a particular field. The two tools that we developed and merged together are: Interactive Learning Panel [8] and WallShare [6].

Interactive Learning Panel

Using this device, the students can relate information that is presented by the mobile application to a physical region of a panel. It is based on the idea of relating concepts with lines, or multiple choice questionnaires.

Concretely, they have implemented a PDA web based application where users have to relate a flag to a region on a

map. For instance, if a flag is given on the PDA screen, students have to relate it to the country depicted on the map and vice-versa.

These panels are equipped with RFID tags that represent concepts on the panel and the PDA is equipped with a RFID reader that is able to read these tags and detect how user relate these concepts through their readings. So, to relate the concepts exposed in the PDA screen to those on the panel, users have to put the reader (mobile device) over the graphical representation in the panel.

WallShare

Is a system based on a shared zone, that is projected on a wall or screen, which is clearly visible by the participants of the meeting.

In order to interact with the system, each participant connects his mobile device to the system.

Once the connection procedure was accomplished successfully, a pointer representing the participant is shown on the wall or screen.

An interesting aspect of WallShare is the possibility of providing each participant with the capability of controlling the movement of his cursor on the screen by performing dragging gestures on the mobile device screen. Thus, users can use the mobile device as an enhanced X-Pointer device.

Therefore, connected participants can download and upload all kind of resources from and to the shared zone.

Thus, participants are able to share a resource just by uploading it to the shared space. To perform this task, users select a resource on the mobile device through the client application and upload it performing a simple gesture. When the resource was uploaded, it is shown on the screen.

Distributed User Interfaces (DUI)

A Distributed User Interface is a user interface with the ability to distribute part of its components, or all of them, across multiple screens, devices, platforms and users. DUI is divided into several parts that cooperate to facilitate the user work. Its main objective is to provide the users, of the mobile devices, all the tasks they need, providing them an optimal configuration of the available interaction resources around them [7 and 9].

DUI can be used for several reasons, such as: sharing information between users, assigning tasks, divide the public and private information and display it on different screens, dividing the work space into several parts and on multiple screens. Here in this paper we will demonstrate that MPrinceTool take into consideration all these points which make it supports DUI correctly.

Following, the explanation of how we have used the distributed user interfaces in the system in order to improve it.

SYSTEM DESCRIPTION

MPrinceTool system is presented in a projected area onto a wall or large screen, which is clearly visible to students who use the system.

The functionality of the system can be divided into two parts. First, we have the functionality of the client and, second, we have the server functionality (see Figure 1).

The Server Functionality

The server application (MPTServer) is responsible for controlling the customer interaction and display all the information that students and teachers need.

MPTServer shows, or projects, in a split screen the questions that teachers asked to students, who are connected to the system; they make use of the chat room to comment on the required question at a given time and about the resources that the teachers share with their students.

Thus the shared area that is projected is divided into four parts as shown Figure 1.

The upper left region is the reserved area for the presented question by the teachers. It shows the formulation of the question and all its possible answers.

One of the uses of the tool is that, next to each answer there is a counter that indicates the number of students who have selected this response. Each user can select from his device the answer that he think it is the correct choice using his associated pointer in the shared pool.



Figure 1. General view of MPrinceTool

The upper right region is reserved to indicate students who are currently online at MPTServer. Each student, who is connected to the server, is represented by his name and an image in this region. So the participants can easily identify each other.

The bottom left corner contains the resources (images, video, audio, or other file type) that teachers and students share; these materials are usually uploaded to help them in answering the questions.

Finally the lower right region is a chat room where students can talk to each other to interchange ideas or to explain

their opinion from the current question in order to answer the question correctly.

The Client Functionality

It has six client applications, some versions that offers the functionality that the student can perform are: MPTStudent, MPTW Student and MPTD Student; and the others versions includes additional functionality that only teachers can do: MPTTeacher, MPTW Teacher and MPTD Teacher. The mobile interfaces: MPTStudent and MPTTeacher were presented in [4]. In this paper we present the new interfaces of the system. The Figure 2 shows the whole system.

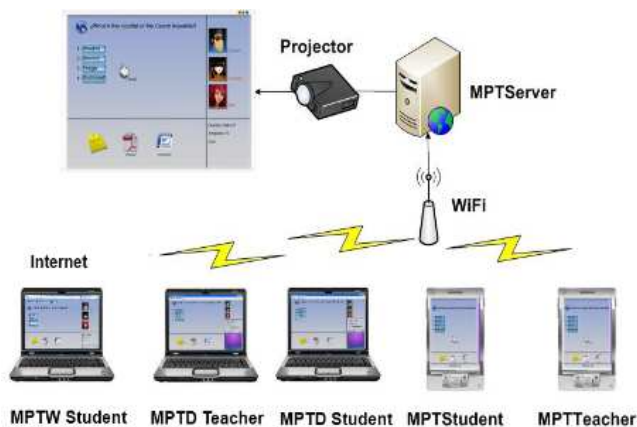


Figure 2. Functionality of MPrinceTool system.

The server system runs on a desktop computer that it is connected to a wireless network via a Wi-Fi connection. It is also connected to the visualization system, i.e. a projector or large screen, which supports the shared zone visualization by the participants.



Figure 3. MPTD Student interface

The desktop-client has two different interfaces, one for the teacher and other for students: MPrinceTool Desktop Teacher Interface and MPrinceTool Desktop Student Interface, which are identical (see Figure 3).

Both desktop interfaces have the control of the pointer from the shared pool at the bottom left. Before using these interfaces users have to install the software on their personal computers.

In order to make the system multi-platform **Web Interfaces** have been created for both users: MPrinceTool Web Teacher (see Figure 4) and MPrinceTool Web Student (MPTW Student). Both interfaces have the same functionality as desktop applications, with the exception of the control panel of the pointer for the system's shared interface as the Web implementation of this functionality is more complex. Unlike desktop and mobile applications, the Web applications don't connect with the Wifi server, they connect to the system via internet.



Figure 4. MPTW Teacher interface

In the four interfaces presented in this paper, users have to log on before starting to use the application.

SUPPORTING DISTRIBUTED USER INTERFACES

As we can observe, in all the figures presented in this paper in the explanation of the system description, MPrinceTool facilitate the tasks, to be used by the users, by implementing the concept of distributed user interfaces. This is done through the interaction performed by the users on their personal computers and mobile devices affecting the whole system. This improvement is clearly seen by comparing the use of a digital whiteboard in class, used by a single individual student and how many students can make use the system at the same time.

MPrinceTool its build as a distributed user interface system using some of the most widely extend hardware elements: like personal computers and mobile devices, which make it better than the many emerging technologies, and other already established in human-computer interaction, which needs unpopular hardware elements. for example: the Microsoft Kinect, Nintendo Wii., Microsoft Surface etc., by making use of infrared cameras, remote controllers etc. which makes it be used just by specific systems (as example: Wii remote controller).

Case Study

As a case study, the *help support* among students is presented. This functionality has been enhanced thanks to the implementation of DUI.

Applying this task, users can ask for help typing it in the chat as in old versions, the possibility of asking for help is introduced in this new version of the system. Therefore other classmates could offer their help in another way and not just by using the chat tool. Also, since this support is supervised by the teacher in his desktop application, he can accept the help request as well. The way in which it works is like this: first a student asks for a help, and any of the classmates could respond to his request. After that, the help communication takes place at the students' devices, letting the shared zone for chatting free for the rest of the class.

For example, when *Pedro* tries to resolve the mathematics problem (who to obtain the area of a cycle), he was not able to perform it alone. So *Pedro* asks for a help using the communication area and *Sebastian* offer himself as a voluntarily to lend him a hand. Once the teacher, *Jose*, accepted this communication, *Pedro* and *Sebastian* start a chat in a private way, without disturbing the rest of the class.

We can observe that, the tool has progressed by supporting DUI. Now, the private groups of students using MPrinceTool can have freer and cleaner chat than before, letting the rest of the class continue with its usual pace.

CONCLUSION AND FUTURE WORK

This paper presents the improvement of MPrinceTool by supporting distributed user interfaces. The system has six different interfaces which give the system advantages: The Web interfaces offer the application platform independence, and using Mobile interfaces offers all the advantages of the mobile technologies and as well its disadvantages which are compensated by the functionality of the desktop-pc interfaces. Besides this, with the implementation of the Web interfaces we have got a target of past works: that MPrinceTool can be used in another platforms and operating systems.

In the educational part, this tool helps students to participate more in class and join and help each other in the educational activities. It allows them to interact with the learned subjects, and teachers can have more detailed information about student's progress. These details can be extended in future versions adding some kind of gift or note to those students who help classmates.

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