VIRTUAL WHITEBOARD AND CHAT FOR A LEARNING MANAGEMENT SYSTEM

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ABSTRACT

In this work we present a virtual whiteboard and chat tool which has been developed and integrated in a learning management system (SWAD). It is being used as a teaching aid for several degrees at the University of Granada (UGR). Since it started being used, at the end of academic year 2006/2007, it has been successfully used in several courses. This new tool solves some of the disadvantages that appear in other similar chat systems. We may remark as its main features the following: user identification by the use of photographs and full names, chat and whiteboard sessions storage, its ease of use and its accessibility, in the sense that it is able to work in a wide variety of platforms and does not require any installation process. In this paper we intend to motivate its usefulness and to describe the application itself, giving some details about its implementation; besides, we will show some use statistics and will propose some future work.

KEYWORDS

Chat, virtual whiteboard, e-learning, synchronous communication, learning management system.

1. INTRODUCTION

It is a fact that telecommunications have become an active part of our lives, we are the so called "information society". Teaching is one of the areas in which the new technologies show their value by offering new mechanisms to make easier the job of students and professors. In this way, they contribute to the development and improvement of teaching and learning 0. Within this scope, we have developed an application for real-time communication. It combines a virtual whiteboard with a chat tool and is integrated into a learning management system (LMS) called SWAD.

SWAD 0 (in Spanish, it stands for Web System for Education Support) is a web-based system for learning management developed at the UGR. It includes several tools to help professors and students to develop their teaching and learning tasks and to aid student data management.

This type of application is especially useful with the current implantation of the EHEA, due to:

- The new teaching model intends to foster the student's self-learning, leaving the professor the task of advising. Such task requires effective communication mechanisms for a good professor-student interaction.
- In the same way, team-work becomes more important and may be aided by real-time communication tools.
- Moreover, the increasing need of tutor sessions due to the new educational model makes this type of applications especially useful for those students who are unable to attend classes or tutor sessions.

Furthermore, it is clear that the sought tool cannot be like the chats we are used to find on the Internet, but it must satisfy some special characteristics that will make it be really useful for educational purposes.

2. BACKGROUND

At present many chat applications exist and are being used in many areas, but they are not education-oriented. Besides, many e-learning systems do use their own applications for synchronous communication, although they do not always meet all the desirable requirements for their use in teaching.

2.1 Background in Other Systems

The following list presents some of the tools for synchronous communication employed by the most successful e-learning systems:

- *Virtual Classroom* 0: application is used in Blackboard, a web system for e-learning employed by several American universities. It offers both chat and whiteboard utilities.
- *Horizon Live Classroom* 0: tool which includes chat and whiteboard, developed by Wimba Inc. As the previous one, it is used by some American Universities.
- *Dokeos* 0: learning management system used in more than 600 companies and public administrations to manage e-learning. It includes a chat application and a videoconferencing system which allows users to share slides and graphics.
- *Moodle* 0: the open LMS most widely used. It offers a chat system, but not a virtual whiteboard.
- *ATutor* 0: open system developed by the University of Toronto. It includes a web-based chat tool. *Manhattan Virtual Classroom* 0: open system developed by the Western New England College; it offers a simple chat application, but not a virtual whiteboard.
- *SUMA* 0: LMS developed by the University of Murcia, which includes a chat application, but not a virtual whiteboard.
- *ILIAS* 0: open software developed by the University of Cologne, which has been adopted by many European universities. It offers a chat tool, but not a whiteboard.
- *NetChat* 0: chat and virtual whiteboard tool that is included in the NetAuthor Environment system.

Table 1 compares these systems with the new tool that we have developed.

Table 1. Chat and virtual whiteboard applications comparison

	Virtual Classroom	Horizon Live Classroom	Dokeos	Moodle	ATutor	Manhattan Virtual Classroom	SUMA	ILIAS	NetChat	SWAD's chat
Chat	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Virtual whiteboard	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes
Session storage	Somehow	Yes	Yes	Somehow	No	Somehow	Yes	Yes	Yes	Yes
User identification	Name	Nickname	Name & photo	Name & photo	Nickname	Name	Nickname	Nickname	Nickname	Name & photo
Platform independent	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Yes
Access control	Yes	No	No	No	No	No	Yes	No	No	Yes
Multiple rooms	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes
Private rooms	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No
Incoming/outgoing alarms	Graphical	Text	Text	Graphical	Graphical	Graphical	Text	Text	Text	Graphical & sound

2.2 Background in SWAD

Other tools for synchronous communication have been used in SWAD previously 0, although they showed some important lacks. The first version was "swadCHAT" (2004), a basic chat application which did not offer a virtual whiteboard. It allowed users to use emoticons in their messages and to establish private talks or sessions for reduced groups of people. User identification was made by the only use of nicknames, which made difficult for users to recognize who they were chatting with. A prototype of virtual whiteboard was developed for this tool, but it was never integrated in the system.

In the second version (2005), a basic virtual whiteboard module was added to the previous chat utility, keeping the same server. The system kept its old method to identify users. None of these applications were widely used within the system, because of the user identification difficulties, some working problems and the need to install an advanced version of Java and a Flash player.

3. TOOL DESCRIPTION

This section is devoted to the functional description of the tool that we have developed. Firstly we will present the requirements established at the beginning of the design process, then we will comment the main features of the new system. We will emphasize those characteristics which are more innovative compared to similar systems used in other LMS.

3.1 Application Requirements

At the beginning of the development a set of requirements were established to guide the entire design and implementation process. The most outstanding among them were portability and ease of use, because the main objective was obtaining an application widely accepted by its end users. Nevertheless, functional requirements were also set carefully; the following list shows the most important of them:

- Real-time message exchanging between users connected to the same chat room.
- Use of emoticons to make the communication more expressive.
- Improved user identification, so users can be easily recognized by the rest of people. The best mechanism to achieve this is the use of their photograph and their full name.
- Display of alarms when users go in or out of a chat room, so the rest of speakers are aware of these events.
- Coexistence of several independent chat rooms, since the system is used in many different courses.
- Session storage, to allow users to recover their talks and use them for future queries. This is very important because the main aim of the chat system is to be an aid for teaching and learning.
- Scheme and diagram drawing and freehand drawing, as using a traditional blackboard. This feature is very important because there are many areas of knowledge which handle abstract concepts that would be hard to explain by the only use of words. The drawing process must allow users to undo their actions.
- Drawing storage, which is useful in the same sense that session storage, since diagrams and figures are a way to make the oral explanations clearer.
- Information about the number of users connected to a chat room must be shown before connecting to it.

3.2 System Components

The new system is composed by two parts which are integrated forming a single system: a chat module, used to keep written conversations, and a virtual whiteboard module, which allows users to draw diagrams and figures to support written explanations. Both components are important to make the tool really useful for teaching aid: on the one hand, the whiteboard is essential to treat any subject that requires diagrams, graphics or mathematical formulas, as in the case of Computer Science, Physics or Mathematics. On the other hand, the chat utility is fundamental to develop the main core of the explanation. Figure 1 shows the application's appearance.

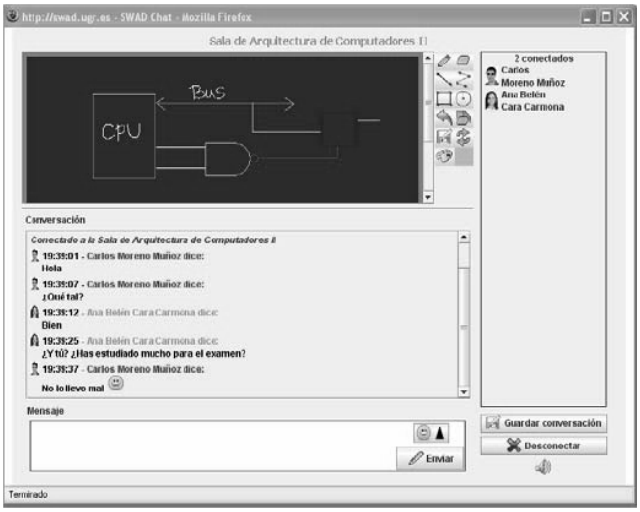

Figure 1. Chat and virtual whiteboard application appearance

3.3 Visual User Identification

User identification was one of the main problems that the new application intended to solve. In usual chats and in most e-learning environments, the only mean employed for this task is the use of a nickname. This makes difficult for the rest of users to know who they are talking to, which is not adequate for an educational environment. To solve this, our application makes use of photographs and full names, as shown in Figure 2.

Figure 2. Use of photographs and full names to identify users

This identification model is especially useful in university environments, where the number of students enrolled in each course is very high. In these cases, professors find themselves unable to remember all their students' names, and much less, their nicknames. However, remembering faces is much easier, so being able to see their students' photographs will help professors to know who they are speaking to.

Due to the importance that photographs have, their quality and correctness must be guaranteed. To achieve this, a two-stage process is applied to all the photographs in order to detect faces and to improve the quality of the image 0. Furthermore, the system rejects those photographs which do not show a human face.

3.4 Session Storage

Another interesting point is the possibility given to users of storing their chat sessions and whiteboard drawings on their computers. Most similar applications which we have analyzed do not offer any type of storing mechanism and, in the cases they do, such techniques are not as versatile as desired: many of them automatically store all the conversations and make them available for all the users in the system, which may

cause privacy problem; in other cases, user must start himself the recording process at the beginning of the conversation, which causes that in case the user forgets, part or the entire session content will be lost.

We have solved this problem by allowing the user to decide whether or not saving the session, which will be stored on his local machine. Furthermore, the user will be able to make this decision at any time.

3.5 The Virtual Whiteboard

The virtual whiteboard module is essential for many areas of knowledge which require the use of diagrams, figures and schemes to transmit concepts which are difficult to explain. Our tool offers options to draw the most common elements of this type of graphics, such as squares, lines, circles, etc. It also allows the user to freehand draw, as if using a traditional blackboard.

All the users connected to a certain chat room must be able to see the drawings in real-time, so they can follow the professor's explanation. Furthermore, every user is allowed to draw, which may be useful to motivate students participation. In addition, each user is able to undo his own actions, but not those performed by others; in this way, we avoid problems related to accidental or malicious deleting.

3.6 Ease of Use and Portability

Another important fact is the ease of use of our application and the possibility of using it on a wide variety of heterogeneous systems. The use of communication technologies in teaching requires that both professors and students develop certain capabilities that allow them to take advantage of these tools and to improve their effectiveness 0; our objective has been to minimize the learning and adaptation effort. According to the philosophy of SWAD, we intend to offer a set of basic but useful services, which are easy to use and learn.

For this reason, the application shows a simple design, based on the use of buttons and graphical icons. Complex menus or line commands have been avoided in order to keep simplicity; we have considered that, although they may increase the application's functionality, in practice users only make use of functions offered by the graphical interface.

It is also important to notice that SWAD is widely used in the UGR and this demands that it must work on a wide variety of systems, referring both to the hardware (RAM memory, CPU, monitor type, etc.) and the software (operating system, web browser, etc.). For this reason, our application has been tested in several environments, so we can offer a service that will be available for most members of the university community.

3.7 Other Features

We will conclude this section with a brief comment about some other features present in the application.

In first place, users may include emoticons in their text, making communication more expressive. This is necessary due to the lack of eye contact between speakers, which causes the loss of visual information and may lead to misunderstandings and interpretations mistakes. The use of emoticons may help to reduce this barrier, making the written conversation closer to an oral one.

In second place, the application reproduces sound alarms to inform about incoming and outgoing people and new posts from users connected to the same room. This helps users to follow the conversation and avoids the need of continuously checking if these events have taken place.

Last, it is remarkable the existence of separate chat rooms with different levels of admission. At the most restrictive level there is a room for each course; in this room users discuss issues concerning their course (virtual classes, tutoring or discussion that could be used with evaluating purposes). There are also rooms for each degree and for the entire university; these rooms allow discussions related to more general subjects.

4. IMPLEMENTATION

Due to the characteristics of the application, the most suitable model for its implementation is the client/server architecture 0 (see Figure 3), which is formed by an application that provides services (virtual whiteboard and chat) and a set of clients (web browsers) that require those services over the network.

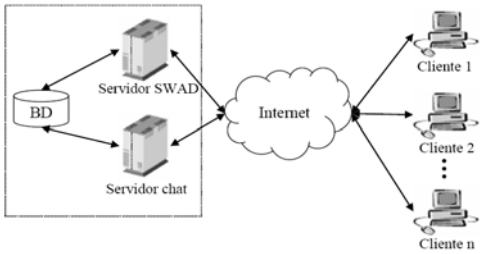

Figure 3. Client/Server architecture for this application

The server takes care of the actions which are common to all the clients: connection and disconnection control, message broadcasting to all clients in the same room than the sender and data coherency control. On the other side, the client interacts with the user, processing incoming messages and preparing outgoing ones.

Since server and client are independent systems, they have been designed and developed separately. The language used to write the server code was C++, so its execution would be more efficient. The client has been written in Java, in order to allow its execution in a web browser and the system's portability.

To communicate the clients and the server we have established a protocol based on sockets, which guarantees the reliability in the communication process. In the implementation of both systems a set of standard elements have been used. For the server, we have employed the STL library (Standard Template Library), the API for communication with *MySQL*, the *BSD* API (*Berkeley Software Distribution*) for sockets and the *Posix Thread* library. In the client we have used several of the packages provided by Java.

Integrating our tool in SWAD was quite simple, since it has been designed as an independent system. Although the chat server runs in the same hardware than SWAD, they are independent applications: SWAD only needs to generate a HTML document with the right parameters in order to start a chat session for a client. This fact makes reasonable to think that our tool could be integrated in other LMSs without problems.

5. USEFULNESS FOR E-LEARNING

The new application is very important from the pedagogic point of view, since it represents an innovative teaching method. In first place, it is a flexible way for professors and students to have tutor sessions and virtual lessons. One of the reasons argued by students for their low attendance to these sessions is the time needed for the trip to the professor's office. The electronic mail is becoming an alternative to solve concrete questions, but it presents two drawbacks: firstly, no immediate answer is guaranteed and secondly, it is not adequate for complex questions which require long explanations. Our application allows students to make their questions to professors without going to their offices, in real time and in a way similar to a real meeting. Using a chat helps the interaction in teaching, allows the immediate exchange of questions and answers and creates a useful feedback process 0.

Another problem for students when they have to make questions to their professors is the fear to public speaking. In this sense, it has been proved that the lack of physical contact with the professor increases the student's self-confident. This issue is known as communicating on a "protected environment" 0.

From another point of view, the possibility of saving chat sessions has benefits for both students and professors. In the first case, students will be able to go over the professor's explanation after it took place. The analysis of this material may be seen as a mean for learning self-control 0, since it will help the student to think over his own participation in the discussion, and how well he did. For professors, saved chat sessions serve a double objective: firstly, discussions may help them to keep track of students learning and may be used for evaluation purposes. Secondly, professors may decide to publish those sessions which may be useful for the rest of his students and may use them as a mean to improve his own teaching material.

Finally, the fact that both professors and students are able to see their interlocutors' photographs promotes the relationship between them and reduces the high depersonalization level existing in university classrooms.

6. EVALUATION

Many studies concerning the usefulness of synchronous communication tools for educational purposes have been developed. For example, 0 shows the results of a survey made to university students regarding how useful this type of applications are for their learning process. Table 2 summarizes its results.

Table 2. Students' opinion regarding scheduled chat sessions 0

I found scheduled chat sessions were:								
Useless	1 (9%)	2 (17%)	3 (7%)	4 (23%)	5 (16%)	6 (14%)	7 (15%)	Rewarding
Revealing	1 (15%)	2 (22%)	3 (18%)	4 (31%)	5 (4%)	6 (10%)	7 (1%)	Confusing
Complex	1 (2%)	2 (7%)	3 (12%)	4 (37%)	5 (15%)	6 (16%)	7 (11%)	Primitive
Supportive	1 (18%)	2 (21%)	3 (14%)	4 (33%)	5 (5%)	6 (5%)	7 (4%)	Redundant

Another point that must be analyzed for this type of application is how easy it is for students to access to an Internet connection. A survey made to Spanish university students at the beginning of year 2008 0 showed that 97 % of them use the Internet to study, to prepare class papers and to communicate. These results show that Internet access is not a problem in order to apply innovative techniques to education.

Our application was integrated in SWAD at the end of the academic year 2006/2007, after several months of testing with real users. Since that moment, a continuous use has been observed, with a significant increase in key periods, as the beginning of the academic year or the weeks before final exams start (Figure 4).

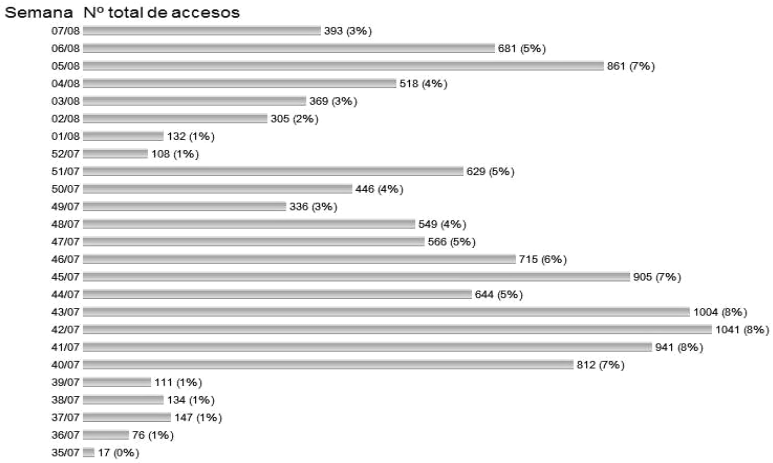

Figure 4. Use of the chat and virtual whiteboard application since 01/09/2007

It is also interesting making a qualitative analysis of the tool, based on its users' opinions. On the one hand, most students think that it is very useful, because it allows them to participate in lessons from home, at the time that not being in a classroom increases their self-confidence, allowing them to participate more actively in the discussions. On the other hand, professors have considered that virtual classes have been very positive, because they have allowed them to continue giving lessons during the last weeks of the academic year, at the time that students' participation was bigger than usual.

7. FUTURE WORK

The result of this project is a starting point which opens a wide range of future working paths. The functionality that is currently offered is very basic, but it may be increased in the future to improve the service given to users. Future work is summarized in the following proposals:

- Dynamic establishment of private conversations and/or for reduced groups.
- Message encoding, to ensure the communication is secure and thirds cannot intercept the messages.

- Development of algorithms to improve freehand drawing (e. g. automatic shape detection).
- Adding new built-in figures and shapes to aid complex diagrams elaboration.
- Showing inactivity time of connected users, to inform the rest of participants who is joining the discussion.
- Allowing the use of web links in the conversation.

8. CONCLUSIONS

The European Higher Education Area (EHEA) has caused a change in the educational philosophy, as now the main objective is focusing on learning more than on teaching. This is forcing professors to change their traditional teaching techniques, since the duties will change from simply teaching to guiding, tutoring and advising. In the same sense, students will leave their current passive role to become an active part of their own learning process. To put this new philosophy into practice innovative management and communication tools are needed. In this context we have developed a new virtual whiteboard and chat application, which has been integrated in SWAD, a learning management system widely used in the UGR.

The new application offers a dynamic a flexible mechanism for synchronous, real-time communication, which makes it more advanced than similar tools used in other LMS. On its design process we have taken special care for issues such as portability and ease of use, in order to make it available for most members of the university community. It also includes an improved mechanism for user identification, based on full names and photographs and the possibility of saving both chat sessions and whiteboard drawings.

Because of all this, our application may be seen as an important vehicle for teaching and learning aid and innovation, with advantages for both professors and students.

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