A system for e-learning via annotated audio/video clips and asynchronous collaboration

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Abstract

This paper presents a system that supports asynchronous multimedia communications (AMC). AMC is a combination of multimedia conferencing with asynchronous conferencing philosophy. AMC can support the collaborative 'discussion' and 'critique' of sharable representations of video, audio streaming, over time and anywhere in space, among learners, and teachers. In addition to presenting representations in textual as well as audio and video format, voice and textual annotations to these representations can be added. The use of AMC offers new ways to encourage learners to make practice of their declarative and academic knowledge.

1 Introduction

The widespread use of information and communications technologies (ICT) has enabled many new forms of collaborative distance learning activities, which are based on the integration of communication/collaboration space with information access and organisation, within a commonly accessible hyperlinked environment (Khan, 1997). There is an increasing amount of research supporting the critical influence that the choice of communication technology can have on both the process and the product of collaborative distance learning (Collis & Smith 1997). It is possible to think of two communications-based learning "worlds" which have had surprisingly little to do with each other. On the one hand, we have the world of asynchronous text-based communications - E-mail, computer-mediated conferencing – threaded discussion fora, etc (e.g. McConnell, 1994). On the other hand, we have the world of synchronous multimedia communications - live audio-conferencing, live video-conferencing, etc. Synchronous multimedia communications make it possible for people at different sites to partake in the same conference at the same time through the "magic" of two-way audio and two-way compressed video. The advantages of synchronous multimedia communications are: a) live connectability, b) availability to share data and c) synchronous and vivid interactions. Its disadvantages: a) time and space constrains, b) requires specialized equipment, c) availability of bandwidth and telecommunication costs.

Asynchronous computer mediated communications (ACMC) can effectively and efficiently support the collaborative distance learning process, due to the fact that they offer flexibility in the use of time as well as space. Taking all the above into consideration we decided to perform research in the field of asynchronous multimedia communication (AMC).

The AMC supports the creation of vivid representations of real world cases (e.g. concise digitised video demonstrations and explanations by practitioners). In addition to capturing representations in videoclips, we are also interested in voice and textual annotations to video clips. The use of voice annotations will offer new and effective ways to encourage learners to make practice of their declarative and academic knowledge (Steeples, 1995). A videoclip provides a direct and demonstrable example of a real case, while making an annotation allows the subject to focus visual attention on actions in the clip. Annotations can be used to encourage learners not only to pose questions but also to explain issues as well as to reflect upon the real world case. Thus AMC can support the collaborative 'discussion' and 'critique' of sharable representations, over time and anywhere in space, among learners, teachers and other practitioners, using audio, video and/or textual 'annotations' on a digitised video resource.

Our team has started developing an AMC system in order to serve as an integrated environment that supports the incorporation of audio-visual representations, which then serve as base material for asynchronous, multimedia discussions within a community of learners. Furthermore, the system provides a means for exchange and review of the base material and the capture and hyper-linking of multimedia annotations to this material.

This paper gives an overview of the AMC system developed emphasizing on use cases for learning. The structure of this paper is as follows: Section 2 illustrates the nature of AMC, presents some usage scenarios of AMC and provides a more concrete example for e-learning. Section 3 presents the architecture of a system and Section 4 contains some concluding remarks

2 AMC in e-learning process

AMC could be said to combine richness of multimedia communication and the possibility of quickly creating vivid accounts and demonstrations of practice with flexibility in the use of time (participants in the communication do not have to be available at the same instant; there is opportunity for reflection on what is seen and heard). The price of temporal flexibility is that asynchronous communication cannot benefit from the rapid turn-taking and negotiation which is characteristic of, and highly valued in, synchronous communication - especially face-to-face synchronous communication (Boden & Molotch, 1994).

2.1 Usage scenarios in AMC for e-learning

AMC is based on an audio-visual representation of a real world cases, the exchange and reviewing of the base material and the capture and hyperlinking of multimedia annotations to this material. Three main sets of activities need to be understood:

- Producing digitized audiovisual representations of real world cases (i.e. video clips)
- 'commenting' or 'discussion' on the video-clips. Focus should be given on the processes of annotation and linking that create a 'web' of multimedia objects thus creating hypermedia structures in an AMC environment.
- 'looking through' the materials in an AMC 'web' in order to find what is relevant; The focus here is on searching and browsing in a hypermedia web or database.

Imagine the following usage scenarios for learning. A video clip is created or just posted by a teacher for triggering a learning activity. This videoclip is accompanied with metadata for facilitating its retrieval. This videoclip can be accompanied by a series of questions that intend to make the learners describe what they see. These questions can be comments referring to the whole videoclip or annotated comments referring to a specific part of the base material. Such comments

can be in a textual (with or without attachments), audio or video format. Imagine how such a scenario in elearning, for example in language learning, for listening comprehension. The learner taking part in this learning activity must answer to the posed question either with a textual comment or using an audio message. The asynchronous mode of communication enables reflection before answering. The teacher can assess the answer and provide her/his feedback as a treaded comment

Moreover, AMC participants (learners and teacher) can initiate and/or elaborate in a threaded discussion. Apart from encouraging learners to participate to an asynchronous discussion, a teacher should moderate the discussion for keeping it at a certain quality level. AMC participants can make textual and/or audiovisual annotations upon an animation clip, offering other perspectives. Such exchanges of viewpoints in the target language offer the learners unique opportunity for practice. The teacher can intervene during the discussion in order to correct learners' misconceptions. Over time, a web of linked multimedia objects evolves as the "discussion" proceeds, and further contributions can be added, including as "topics" and "responses".

Apart from the above features of the AMC system, more specialized ones have been implemented such as:

- Keeping a portfolio of messages where the user can store for future process some of the messages appearing in the forum
- Presentation of statistics where the user can see how many messages have been posted by how many users as well as the number of the different types of messages (text, videos, audios, still images)

Of course basic functionality for the administration of the forum has been constructed (i.e. deletion of a forum, creation of new forum, user management, etc.)

3 The architecture of the AMC system

One way for describing the architecture of the AMC system is to follow the Rational Unified Process (Jacobson, Booch, & Rumbaugh 1999). According to its logical view, the first-level decomposition of the system is performed by specifying the very coarse-grained discrete subsystems in the design model, as they have derived from the use case and analysis model. The decomposition is combined with the enforcement of the "Layered Systems" architecture pattern, which helps organize the subsystems hierarchically into layers, in the sense that subsystems in one layer can only reference subsystems on the same level or below. The communication between subsystems that reside in different layers is achieved through clearly defined software interfaces.

The proposed layered architecture for the AMC system that identifies all first-level subsystems, organizes them into the following layers:
The application-specific sub-systems are:

- Login Subsystem: The subsystem that is responsible for accepting or rejecting a user.
- User Management: Adding, deleting, activating or deactivating a user or sending mail to a specific user.
- Conference Management: Creating a new conference or deleting an existing conference.
- Message Management: Deleting, adding or viewing a message.
- Statistics Viewer: Viewing statistics about the system or users.

The application-general sub-systems of the layered architecture are:

- Charts Creator.
- Upload File.
- Video/Audio Presentation: Presents an audio or video file.
- Raw Data Management: Performs raw queries to the database.

The middleware-layer sub-systems of the layered architecture are:

- Java APIs (JMF, jfreechart, Oreilly utility classes, e.t.c)

The protocol-layer sub-systems contains the software for the computing and networking infrastructure, are the TCP/IP, HTTP, RTTP protocols. The software system-layer sub-systems are:

- MS ACCESS as RDBMS
- Helix Real streaming server
- Java Virtual Machine.

The following two figures (Figures 1, 2) illustrate the user interface of system. The reader should try correlating these figures with the usage scenarios as presented in section 3.

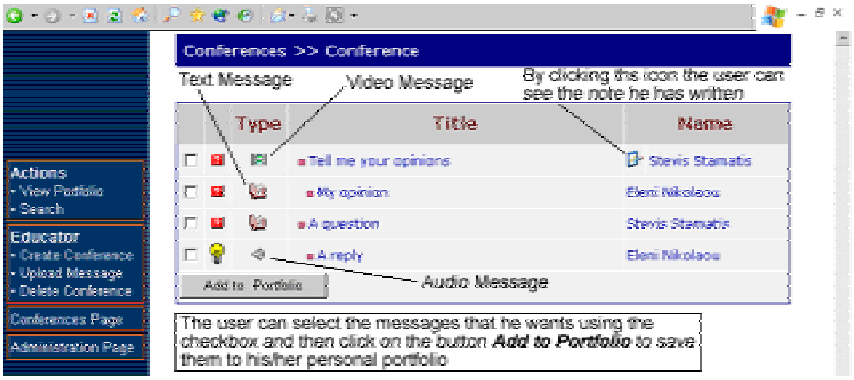

Figure 1. Screen shot with the list of messages at a forum of the AMC system

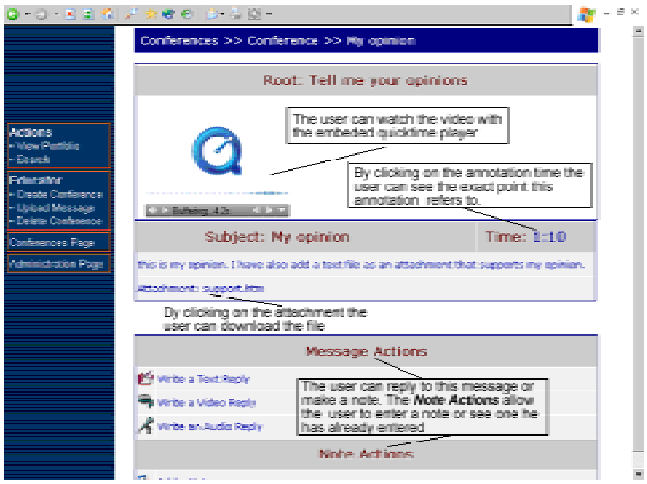

Figure 2. Screen shot of reading a message at a forum of the AMC system

4 Concluding remarks

AMC is a new and very promising technique for transferring knowledge and augmenting learners skills. E-learning can take advantage of it. Our philosophy as educators, researchers and developers in AMC is that, in addition to capturing representations of practice in videoclips, we are also interested in voice and textual annotations to video clips. We have developed an AMC whose architecture is component-based and quite open. Up to our knowledge not any similar system exists today.

This system is still in a prototype phase but fully functional in two course (undergraduate and post graduate) at the University of Cyprus. Additional improvements of the AMC system include the integration of user notification mechanisms (via e-mail and SMS) when new messages have been posted as well as for building a business model for a virtual community using such an AMC system. Very soon this system will be an off-the-shelf AMC tool and its full-scale evaluation in subject domains where it can add significant value such as language learning and vocational training on working practices.

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