CiNetVideo: Video Sharing Application for Educational Use

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***Abstract* — Video technologies are well suited for increasing flexibility of participation in education. On the other hand, use of videos limits the interactiveness of teaching. Studying with the help of videos can be made more effective and meaningful by making distance students' telepresence visible in face-to-face teaching situations and by enabling interactivity in the context of video viewing. Thus, support can be provided for both study and students' formation of groups. The best means for carrying out these activities is the video sharing application developed precisely for this purpose. The application must support both the viewing of on-demand videos as well as participation in face-to-face education with the help of real time videos. For the lecturer, the application must also offer a straightforward interface that is suitable for a classroom. This study describes the implementation of the first phase in the development of a video sharing application (CiNetVideo) built for these purposes and the practices related to it. In addition, experiences gained from the video application used in pilot teaching are examined.**

Keywords-video lectures; video application; interaction; telepresence

I. INTRODUCTION

Development of flexible solutions that take into account students' individual needs is currently aimed at by many educational programs. Increasing flexibility allows one, among other things, to meet the challenges of time use created by life-long learning and studying alongside work. In fact, increasing flexibility in education means, first and foremost, enabling new, flexible participation modes. Flexibly arranged teaching must be made available regardless of time or place. This can be influenced by the utilization of diverse teaching technology solutions and pedagogical practices connected to them. One way to diversify study and participation in education and to make them both more flexible is to provide education utilizing video technologies.

With video technologies, flexibility can be increased for example by transmitting face-to-face teaching situations in real time or by offering recordings made of face-to-face teaching to students. Video technologies naturally also enable production and provision of self-supporting teaching videos that are not dependent on face-to-face teaching. However, there are many challenges related to the use of videos in teaching.

Study with the help of videos differs from traditional study with the help of face-to-face teaching, mainly where interactivity is concerned. Usually the video players used do not offer the viewer any means for interactivity. Thus, even at its best, a real time video transmitted from a face-to-face situation provides the viewer only with the interaction recorded on the video from the teaching area with a small delay. Typically, viewers of real time videos do not have any opportunity to participate in the communication taking place at the venue of the lecture. Interaction in the case of recordings is even more challenging. Interaction, nevertheless, plays a significant role in the process of study and learning [1][2][3][4][5]. In order not to allow studying with the help of videos significantly weaken the opportunities for interaction, it is necessary, one way or another, enable an interaction channel alongside videos for distance students. For the same reason, an interaction channel between the lecturer and distance students is also needed alongside real time videos transmitted in connection with face-to-face teaching. In connection with education, interactivity can be realized separate from videos, for example by the use of social media tools. This kind of solution, however, is not necessarily the most straightforward and functional as far as its usability is concerned. The problem with many tools is the delay related to transmission of real time video.

Another challenge related to study with the help of videos is how to realize the sense of presence and togetherness, i.e., group forming. According to earlier study, the students referred to their feelings of isolation as the main obstacle for learning. [6]. Due to the invisibility of distance students participating in a face-to-face study situation with the help of real time video, it is easy for both the lecturer and the students participating directly in the face-to-face study forget the presence of them. It is important to make the telepresence of distance students visible in face-to-face study situations. Visibility of distance students will motivate the lecturer to pay more attention to them. Similarly, from the viewpoint of group forming, it is essential for the students participating in a face-to-face study to be aware of who their fellow students who participate in the lecture with the help of real time video are. Also the students who participate with the help of video must be able to see who the other students who participate similarly are. A positive impact on group forming can be achieved also by enabling students' mutual interactivity during video viewing.

This article examines the functionality of the CiNetVideo application, which enables efficient utilization of lecture

videos, interactivity and telepresence. The application was built in connection with the Master Studies in Mathematical Information Technology at Kokkola University Consortium. The paper describes the solution achieved as far as the practices and the technology related to it are concerned. Use of the video application was piloted in a teaching use, and the experience gained from the pilot is dealt with from the viewpoints of both the lecturer and the students. Finally, the conclusions and some guidelines for future work are presented.

II. CiNetVideo

To resolve several challenges related to the use of videos in teaching, an interactive CiNetVideo application suitable for the purpose has been under development at the Kokkola University Consortium. This section presents some motivation factors for the development work, the operation of the application both in distance study as well as face-to-face teaching situations, the technical implementation of the application and user management related to the application.

A. Motivation

All students in the Master's degree program are adult working students. This presents many challenges, particularly to achieve increases in flexibility and for ensuring the availability of teaching. The education model in use currently is based on a so-called hybrid model, which combines various teaching methods and makes good use of information and communication technology. Already for many years, all Master's degree teaching has been arranged as intensive face-to-face teaching, which has been videoed and offered as real time and on-demand video for students. The use of videos in studying is thus already a standard practice for them. Slightly over a half of the lecture participations takes place with the help of recordings, and nearly 15% with the help of real time video. Fig. 1 shows the portions of the students' participation modes in all lecture participations.

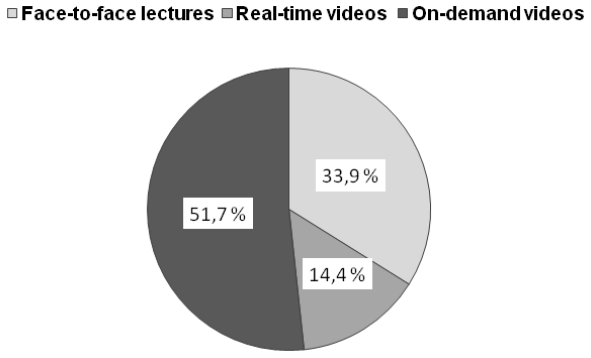

Figure 1. Relative shares of participation modes of all lecture participations

The earlier video-related practice lacked two-way interaction between the lecturer and the student participating with the help of a video. Similarly, possibilities for mutual interaction between video-viewing students and for transmission of presence have been inadequate. In fact, the results of a student survey of all master's students of information technology done in 2010 have been an important motivation for the development work. According to the results, nearly a half of the students would like more interactive teaching modes for lectures. To be successful in this, there must naturally be an interaction channel. Moreover, about one-half of the students stated that they participate in face-to-face study because it enabled interaction between the students and the lecturer. Therefore it is natural that almost one-third of the students told that they would participate, with the help of real time video, in the study offered if it were possible to communicate alongside the video.

More than a half of the students responding to the survey would like to keep in touch with their fellow students through the web especially. In the earlier practice, communication between students took place principally through a learning management system (LMS). According to the survey, nearly 40% of the students felt however that LMS functioned fairly poorly in the communication between students. In fact, more than one-half of the students saw LMS as a bad solution for grouping among students. Perhaps it was due to this that more than 45% of the students named the possibility for interactivity with other students as their reason to participate in face-to-face study.

B. Development Work Approach

During the first phase of the development work, it was hoped that the application would enable flexible participation in organized teaching and, in addition, would offer some functions by means of which study can be made more efficient and meaningful. At this stage, attention is paid especially to making interactivity and telepresence possible. The development work will continue in the future, by developing the application in accordance with the user experience obtained from the students and the lecturer.

The hope has been that the application to be developed would, already at its first development stage, fit as nicely as possible to the existing practices and learning environment. This means, above all, integration of the application to the Learning Management System currently in use. This enables central distribution of material and user management.

To make studying with the help of the application increase flexibility, it must be Internet-based and support also mobile devices. Thus the application would be available whenever it is connected to the web. Also, during the development work for the video application, attention has also been paid to usability. The premise, in fact, is that the video application should satisfy the users' idea of and expectations about a modern video-viewing environment.

C. The Application in Distance Study

In practice, to use the video application, the student should log in through a web browser to an Internet-based LMS. LMS provides course study material, schedules for discussion forums and, in addition to other information, a link to the video application. When the student uses the link, LMS automatically transfers the metadata, which is needed by the user ID and user rights, to the video application. After this, both LMS and the video application are made available for the student. When the student wants to watch a video, the application finds the correct video, which is to be shown with a player that is embedded to

the application from the media server. The use of the video application is shown in Fig. 2.

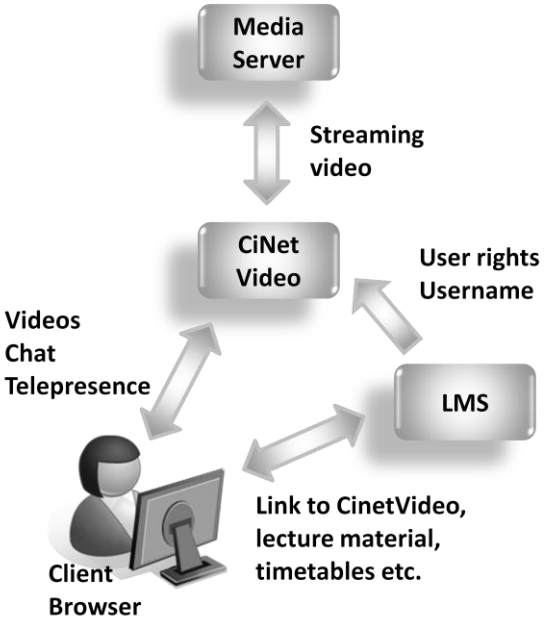

Figure 2. Use of the video application

For the students, the application appears as a web page through which the student has access to the lecture videos of all his/her study courses (Fig. 3).The application provides a profile for each student, who can add there a photo of him/herself, for example. The application naturally includes all normal video player operations.

In the application, in addition to assessing video viewing, communication and the telepresence property, users can assess the technical quality of videos. This is done by estimating the technical quality of the lecture video on the scale between 1 and 5 during its viewing. The evaluations given are recorded in a database, and they are used in the quality evaluation of a practice related to lecture videos.

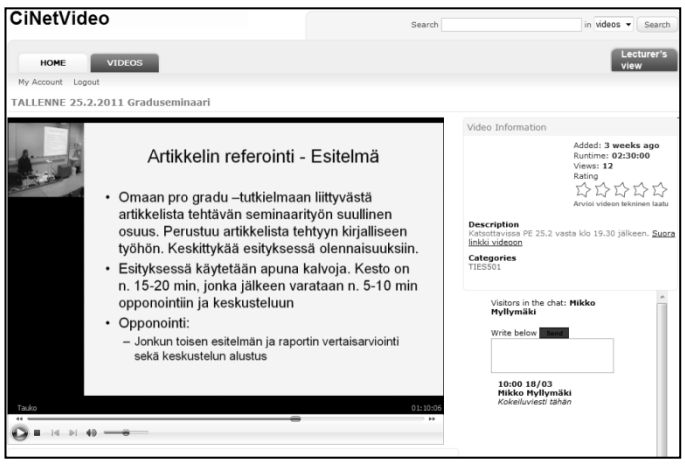

Figure 3. Student's view to the video application

1) Participation with the help of real time video

A student who participates in education with the help of real time video has, via the application, at his/her disposal an easy-to-use interaction channel to the lecturer and other students watching the direct video transmission in question. Interaction allowed by the application has been implemented by enabling chat alongside video. Chat discussions are seen by all the students watching the same real time video as well as by the students in the classroom and by the lecturer. Chat discussions are specific to a particular video; thus each real time transmission has its own chat channel. In this way, the debate concentrates only on the lecture video concerned. Students who participate with real time video become aware of the telepresence property when the application during video viewing offers, in addition to the video itself and the communication channel, information about who else are viewing the same direct transmission. At this stage of the implementation, the viewer of the real time video does not know who of the students are attending the face-to-face teaching event. This property will be implemented at the next development phase of the application.

2) Participation with the help of on-demand video

Also for students who participate in education with the help of on-demand video, the application offers an interaction channel in the form of chat. Because chat is video-specific, communication between students watching the same on-demand video transmission is possible. The messages emanating during discussion move to the server storage at 4am.At that point of time, the message list is emptied. In this way, documentation for later use is left about the discussion held and questions asked. A student watching an on-demand video is able to see, in addition to seeing the students watching the same video, all other students who have logged in on the application

D. The Application in a Face-to-Face Setting

Communication in a traditionally realized real time video transmission is one-way, from the lecturer to students. With the help of a chat linked to the video application, a two-way communication channel can be implemented. As such, however, this does not make one any more aware about who might be the students who are present, video-assisted, at the teaching event. Naturally, in chat one can see the persons who write messages but through it one cannot get information about persons who do not use that communication channel. It is possible, with the help of the telepresence property, to present the profiles of all the students who are logged in on the video application.

To obtain the added value aimed at with the use of the application, the interactivity and telepresence offered by the application must be deployed in face-to-face teaching situations in such a way that it is becomes available to both the students as well as the lecturer. For the lecturer and the students participating in face-to-face education, the application appears as a view through which all those present in the event can see both the students participating with the aid of video as well as the discussion held with the help of the application. The view about the CiNetVideo application shown at the classroom does not contain the video itself; this so-called lecturer's view only

shows the chat discussions and those at present with the help of video (Fig. 4).In a face-to-face teaching situation, the view to the application is realized by projecting the video application, in a sufficiently large size, with the help of a data projector to the back wall of the teaching area (Fig. 5)Thus, the lecturer can keep track of the students participating with the help of video and of the messages sent by them – naturally, without moving his/her eyes away from the face-to-face students.

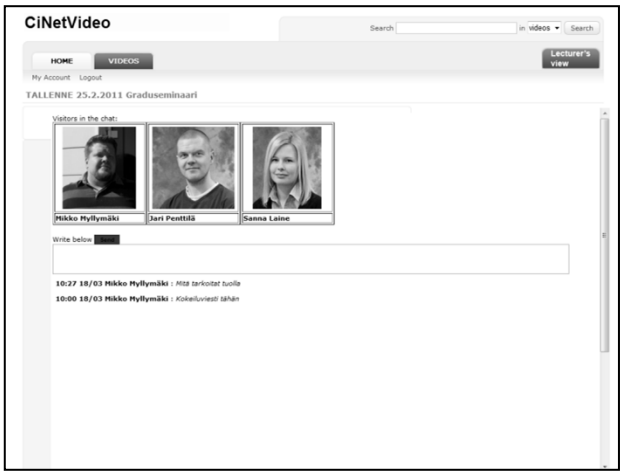

Figure 4. Lecturer's view to the video application

Figure 5. A face-to-face teaching situation where the lecturer's view to the video application is being used

E. Technical Implementation

An Open Source project called ClipBucket was chosen as the video platform. It is based on the Open Source and thus can be freely modified. The implementation of the video application is for the PHP language, and the application is installed on the Apache web server. As its data store, the application uses the MySQL database engine.

As interactivity was designed and constructed, ClipBucket's own video-commenting function was replaced with real time chat. The telepresence property is implemented with the help of user profiles. The names and profiles of video-viewing students are shown alongside the video and the discussion related to it. For lecture situations, a separate view, which includes the telepresence property and interactivity, was built into the application. A tool for the evaluation of technical video quality was already included with the application, but it was modified to fit for the purpose.

Also many other functions, such as uploading students' own videos to the environment, are possible with the application, but at this stage of development all such properties which had no use were removed from the application.

Here the default format for videos is Flash, but it is possible also to embed players that play other formats. These include Windows Media Player, which was used in this application context. The video files are stored on a dedicated Windows Media Server. Video links to the system are added with the help of some embed code. When the user's browser comes across an embed code, it automatically launches the Windows Media Player on the user's workstation to play the media stream transmission. Fig. 6 shows the video application's architecture.

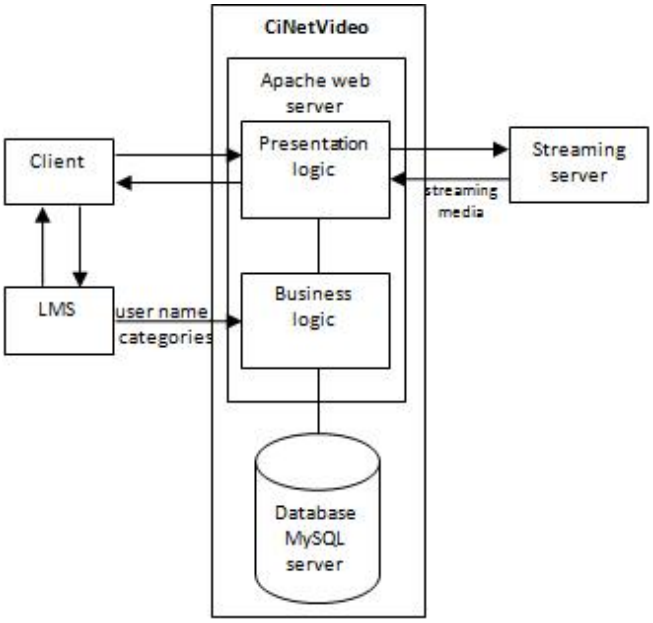

Figure 6. Architecture of the video application

F. User Management

User management in the degree program has been implemented with the Learning Management System (LSM) which has been in use for quite a while now. LSM has established itself as a standard tool among the students of the education program. For some time already, all material offered for the courses and a major part of communications related to them have been distributed through it. As LMS contains tools that enable student management, it has been possible, with the help of it, to grant students rights for only those work spaces and materials for which they have enrolled through LMS.

Consequently, it was quite a natural solution to allow student access to the video application specifically through LMS. A link to the video application has been added to LMS. The link carries information to the application about students trying to use the application and about the courses the students have enrolled into.

To enforce information security on the operation of the login link, when the link is formed a checksum is created. The checksum is based on a secret key known to both sides, on random character string, timestamp, the student's user ID and the names of the workspaces the member of which the user has been using the HMAC-MD5 algorithm. Each checksum that is created with the help of a random character string and a time stamp is unique. This information is transmitted via the link to the video application, which, employing the same principle, forms a checksum from the information and key transmitted. If the checksums agree, the user is logged in automatically, and the application offers only those videos that the student has the right for viewing. Thus there is no need to log in separately to watch the videos or use the application's interactivity or the telepresence property.

When a video is being viewed, information about the user viewing the video is transferred also to the log data collected at the media server. This allows the solution of problem situations and enables research related on the use of videos and on their effects.

The joint user management of LMS and the video application has significantly reduced the amount of work. Previously, distribution of the rights for lecture videos was carried out with the help of the University Consortium's Active Directory, and it was kept separate from the course user rights included in LMS. This caused management overlap and error situations due to information flow problems, which can be avoided in the new solution. Moreover, the student doesn't need to log in separately on LMS and the media server.

III. User Experience

Experiences about the use of the video application have been collected in connection with Master Studies in Mathematical Information Technology at Kokkola University Consortium. The video application was piloted in a seminar course arranged at the beginning of 2011. There were 17 students participating in the course.

Judging from the experiences of the lecturer, the video application was a very useful solution in face-to-face teaching situations. Projection of the telepresence property and the discussions on the back wall of the classroom brought the students studying with the help of real time video to the face-to-face teaching in a natural way. The questions presented could be seen clearly, and it was easy to respond to them without disturbing the face-to-face teaching situation. There was no special screen display for the lecturer to follow. This made lecturing possible in a fairly straightforward manner. Being aware of who the students who participated with the help of video were motivated the lecturer to pay attention also to them in the teaching. This is important especially in situations where there are not many participants in face-to-face education.

Our first impressions are that students adapt the video application for their use quite nicely. Already after two lecture sessions, all 17 students had tried the application. Altogether, a total of 13 students had watched videos: of them 7 had watched real time video and 10 on-demand. The interactivity property had been used by 8 students. At the beginning stage of the course, communication in reality mainly focused on matters related to the functionality of the application.

According to the feedback from students of seminar course, the interaction between students and lecturer as well as between distance learners implemented with the help of the application functioned well. All the respondents were of this opinion. The telepresence property augmented the feeling of presence and the presence of the lecturer's view in the classroom brought added value to the face-to-face study situation. According to the comments, chat is the appropriate communication channel, because it does not interfere with classroom teaching situation. However, questions which are intended for the lecturer could be highlighted in some way from the interaction between the students. One student suggested that the audio feature could be one target for development in future.

IV. Conclusion and Future Work

As the dependency on time and place is reduced, education can be arranged in a flexible manner with the help of teaching technology applications and pedagogical practices related to them. From the perspective of cost-efficient quality education, new teaching technology solutions which take advantage of new technologies, their development and implementation, as well as pedagogical practices related to them, are essential. It is nevertheless important that teaching organized in this way and the tools used for it support interactiveness and new kinds of community requirements.

Based on the pilot carried out in connection with the Master's program in information technology, the CiNetVideo application provides better conditions for the organization of flexible education. With its help, a natural interaction channel and a telepresence property can be added to video viewing. The lecturer's view built in the application carries these properties also to the face-to-face teaching situation. By using a suitable solution, the video application's added value can be brought to serve both the lecturer as well as the student, so that the application becomes a natural part of the face-to-face teaching situation.

The video application can be integrated to the existing LMS, and thus it is possible to gain considerable advantages, e.g., as far as user management is concerned. Moreover, integration to a broader system makes the deployment of the application easier.

From the viewpoint of the lecturer, use of the video application increases motivation for paying attention to video-aided participants in a lecture situation. In a face-to-face teaching situation, it is easy to respond to incoming communication arriving through the application, so that the teaching itself can continue undisturbed. Among the students who participated in the pilot, the application was found useful. This is partially evidenced by that many of the pilot course

participants used the application and its interactivity feature already at the beginning stage of the course.

The video application is at its first development stage, and the development work related to it will continue intensively in future. As the targets of development, one can point at solutions making activation of distance students possible and introducing properties of sound to the interaction in connection with on-demand videos.

The video application will be introduced and applied to the whole education program in 2011. Material of its use will be collected for later evaluation and used as a base for development work. Also, the suitability of the video application for its use purpose must be assessed not only from the perspective of functionality but also from the perspective of its impacts when used.

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