

Multimedia Classroom Including Distance Learning Features

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Abstract. A lot of models for distance and computer assisted e-learning have been suggested and discussed currently. This paper addresses a new model for creating and using Multimedia Classroom Including Distance Learning Features. The suggested model will give an opportunity to students to be in touch with the latest technologies and access to the multimedia education from anywhere in the world using Internet. Another possibility is foreign teachers to have conference classes and to teach our students. All these lectures are recorded and put into a multimedia learning content management system (MLCMS). Also the feedback from student to teacher in real-time is one of the best options that will increase distance learning students' satisfaction. The model is performed and is in use at the moment in Sofia University.

Keywords: E-learning, Distance learning, Multimedia classroom, Computer assisted education

1 Introduction

With the development of technology and the use of new devices, a lot of research and experiments have been made. The satisfaction among traditional and distance learning students increases. Multimedia and e-learning become a must for almost all universities and high schools. A multimedia classroom model meeting the contemporary requirements set by new technologies is presented in this paper. A performance of such a classroom in Sofia University is described. The classroom can be accessed virtually as well as physically.

There are many definitions of multimedia. But for our purposes the following definition is the most appropriate - the multimedia is the integration of text, graphics, animation, sound, and video [1]. According to this definition, multimedia in the classroom could include Power Point presentations created by the teachers, commercial software (such as multimedia encyclopedias) that is used for references or instructions, or activities that directly engage the students in using multimedia to construct and acquire knowledge. Our goal is this multimedia to be accessed all over the world with many and different kind of devices. The plan is to support devices such as desktop computers, laptops, cellphones, tablets, smart TV. Another requirement that we set is the multimedia to be presentable from a small size, low resolution devices to big tv screens with ultra high definition. With such devices and growth of technologies multimedia video conferences are getting more accessible and efficient.

In learning process the interactions are mostly between teachers, students and learning materials [2]. Students will have the opportunity to contact teacher online during the lecture and ask questions, or ask for additional information, learning materials and explanations.

The model of the classroom we plan have to be compliant with so called Blended learning. "Blended learning" designates the range of possibilities presented by combining Internet and digital media with established classroom forms that require the physical co-presence of teacher and students [3].

2 Background

There are a few models describing different multimedia classrooms with distance learning features - see [4, 5, 6]. Some of them accent on multimedia materials and the lecturer is behind them. Other accent on computer technologies and use them as a base for the learning. Creating and managing educational content for distance learning students is common part of all these models.

The advantages and disadvantages of these models are presented in table 1.

Table 1. Characteristics of the classroom models

advantage	disadvantage
<ul style="list-style-type: none"> • Publishing recorded lecture to wide spread LCSM supporting SCORM; • Inexpensive to implement; • Many tools for course management; 	<ul style="list-style-type: none"> • No interactions with distance learners during lecture; • No support for distance teacher; • No blackboard interactions; • Big hardware requirements • No full support for mobile devices • Single stream publishing

Note that the above models make a significant difference between reality and virtual reality.

3 The proposed approach

To be more close to the real education the proposed classroom model has to perform the following minimal functionalities: view of the lecturer and his actions, showing presentations and multimedia materials on a readable size, good audio and voice, ability to ask questions and ask for extra explanations and materials on one hand. On the other hand we apply mostly the potential of multimedia playing devices such as desktop computers, laptops, cell phones, tablets, smart TVs.

On this base we construct the architecture of the classroom with the help of 7 groups of devices: digital input devices (1), multimedia board (2), signal encoder device (3), recording devices (4), multimedia streaming server (5), viewing devices (6), videoconferencing devices (7).

In more details each group consists of:

1. Digital inputs are as follows:
 - 1 manageable HD IP camera;
 - 1 lapel microphone;
 - 1 or 2 aero microphones;
 - 1 presenter's computer
2. Multimedia board is in the form of touch-screen 65`` or more inches monitor/TV, connected to the presenter's computer for playing PowerPoint presentations, text, animation or video. It can also be used to demonstrate working with specific software, creating multimedia, writing computer code, etc. Touch-screen option will reduce the needs for additional presentation control.
3. Encoder is a hardware or software device which is able to collect digital input streams such as video and audio and create a single output stream. It is better if the mixer is a hardware device with ability to manage more than one collection of streams. Encoding the stream will compress the containing data of the stream and will save network bandwidth.
4. Recordings can be made on different points according to hardware and software abilities. The first suitable point is the encoding device. For doing this, it is desirable the encoding device to support that option. In this case we can record only streams which pass through the encoding device. In the next point a special communication service can be created. It is responsible for re-directing the stream to the multimedia streaming server and create a local copy of the stream. This is not a very good solution, but it is acceptable when we are experiencing a high load of systems. The best point to make recordings is on the multimedia streaming server. This will add extra opportunity to create and manage online learning materials for the course.
5. Streaming subsystem is accessible from all computers and devices installed in classroom. For mobile devices a WiFi network is provided. Chat usage will need additional information about students, so they will have an opportunity to log in the system using their university accounts, managed by a third party university systems. For distance users log in into the system with their university account is required. For a public lecture there is no need for log in. System generated nicknames are assigned to chat visitors. The streaming server is based on Wowza server. Wowza Streaming Engine is robust, customizable media server software that powers reliable streaming of high-quality video and audio to any device, anywhere. Whether you deploy it in the cloud or on premises, Wowza Streaming Engine software offers powerful components to tailor your streaming workflows with confidence. Wowza software is platform-agnostic, multi-format, and multi-screen. It takes in any video format, transcodes it

once, and reliably delivers it in multiple formats and with the highest possible quality to any connected device, anywhere.[6]. The streaming server accepts two streams for redistributing: the stream from the encoder and the stream from the teacher's computer. The stream from teacher's computer is encoded using ffmpeg software encoder.

6. Several screens are available for viewing. One of them is a screen put on backside of the classroom for feedback to the teacher. There is another screen outside the classroom for participants who could not enter in time. Computer and smart phone users can access this view and one more video stream, containing presentation shown on the multimedia board. They can switch between streams and choose the one they found interesting as a primary. The teacher's desk is a custom developed desk containing two touch-screen monitors. One of them shows the same picture as on the multimedia board. This will help the teacher to control the multimedia board content without standing in front of it, and facing the students. On the second touch-screen monitor the teacher can play auxiliary materials, read chat questions, etc.
7. Videoconferencing module [8] is used for distance teachers. Camera, multimedia blackboard and microphones are attached to it. It can work as a VC module or as a simple mixer of the input streams. Using it as a videoconferencing module will allow remote teachers to be shown on a multimedia board. They will have a view to our room using the camera. The camera is manageable and can be controlled by a remote controller. The VC module supports more than one participant.

The hierarchy of devices and the information streams are shown on fig. 1.

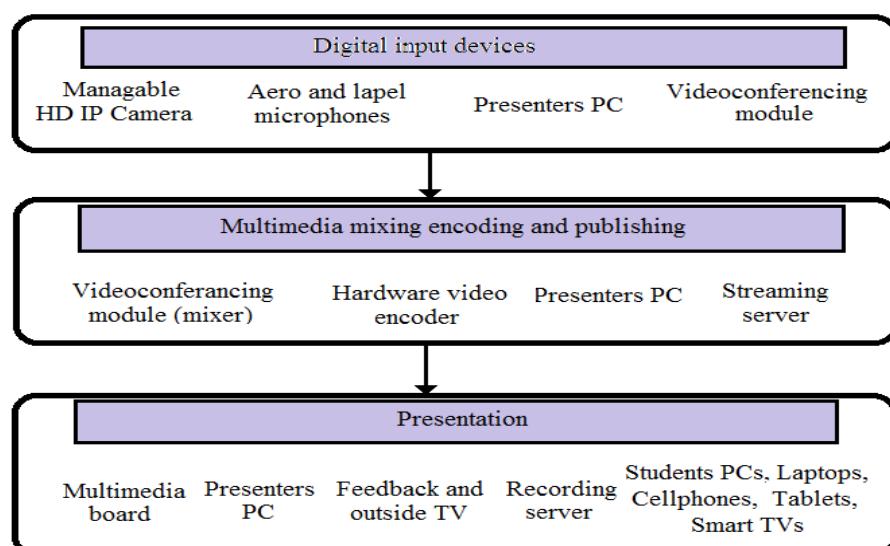


Fig. 1. Hierarchy of the devices

According to the above architecture a performance of the classroom model is done for Sofia University - see fig. 2. Its characteristics are as follows:

- Video camera AVER attached to AVER videoconferencing module with microphones.
- Multimedia board - 65' SAMSUNG TV with touch-screen overlay.
- Video encoder - TERADEK HD video encoder. It supports H.264 for direct publishing to web.
- TVs for feedback and outside view - 23'/32' Samsung TV.
- Teacher's desk - a modified desk with two openings for 23' touch-screen monitors.
- Chat and LCMS - custom developed web based system.
- Authentication server - LDAP based.

4. Conclusion

The proposed multimedia classroom architecture offers the following distance learning features:

- Collecting audio, video and presentations from input devices;
- Mixing, encoding and transmitting encoded streams to multimedia server;
- Recording and publishing multimedia streams for online viewings;

- Feedback from distance learning students to teachers;

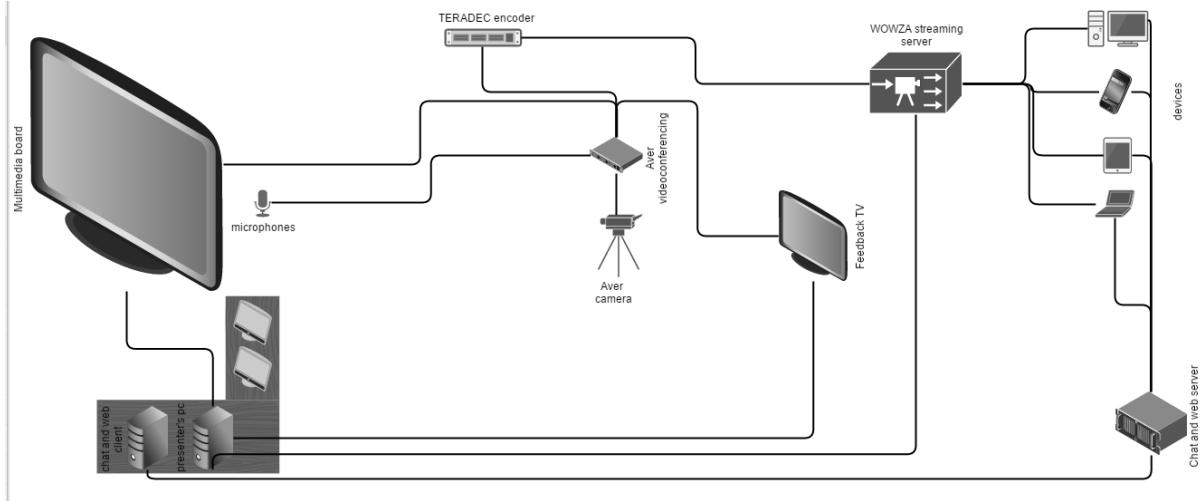


Fig. 2. Classroom Architecture

It gives a lot of possibilities to local in-room students to have more complex multimedia experience. Teachers can add a huge set of interactive multimedia materials available offline and other educational materials available online. Using PC as a presenter's station gives an opportunity to demonstrate in real time software coding, drawings and live demos of commercial software. This can be done using the teacher's desk touch-screen or multimedia board in front of the students. Switching between streams gives a better view of the presenter's actions, or the presented materials. Chat functionality requires some additional actions such as reading questions by the teacher or by some other person such as a moderator. Videoconferencing may be used to invite lecturers from all over the world to do classes. Using custom LCMS (Learning content management system) provides us the opportunity to create more powerful learning materials.

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