Creating and using computer generated video materials in educational environment

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Abstract - Computer generated video materials are primordial elements in day-by-day entertainment life and become an important factor in the educational environment. They bring diversity and modern ways to present spaces (laboratory, classrooms and buildings). On the other hand, they offer enthusiasm and a new challenge in teaching and learning. We show our first experience consisting of the tutorial, animated video and interactive/dynamic video materials developed for teaching part. We present 3D videos, virtual tour and time-lapse used to promote our faculty building and some classrooms. We bring in discussion the video concepts, the equipment and software used for each digital content and the distribution medium. We make some recommendations and extract some conclusions.

Keywords: video, interactive, 3D, virtual tour, video lectures, time-lapse

I. INTRODUCTION

Information and Communication Technology is under change every month, every year. The continuous transformation in this field and the increasing power of personal computers offer the possibility of new video materials. The teachers and the administrative have the chance to develop attractive materials. Students have the opportunity to see modern and interesting video content. People from outside and high school students can make an opinion about faculty buildings, about the classrooms, infrastructure (devices and equipment used) through videos. The computers change our life many years ago and continue to the present. Creating and using computer generated video materials, as part of ICT becomes a major player in several areas.

With the help of computer and appropriate software, we build tutorials, animated instructional videos, interactive educational materials, 3D classroom presentation, virtual tours and time-lapse. We define

terms, and we present the concepts in chapter 2. The process of content creation and the videos are the subjects of chapter 3. Recommendation and conclusions complete the landscape.

II. CONCEPTS

A tutorial represents a video demonstration about a subject/software/technology/business and aims to emphasize the formative aspect of the education process [1]. It is an application rich in multimedia content and details any topic/subject from the practical-applicative point of view. Video tutorials are based on systematic screen capture, and the author of the material gives an explanation in real time on the audio channel [2]. A tutorial consists of "short lessons that introduce basic (and sometimes advanced) features" of the software. [3]. Tutorials are offline or online, the second choice with the advantage of "the availability from any remote location at any time" [4]. In the educational field, for example, Lynda.com® is a leading online learning company that offers many tutorials to achieve personal and professional goals. Trough individual, institution or corporations subscriptions, members have access to video library tutorials and sometimes in other languages than English [5].

The interactive video defines one of the most complex material used in education in our days. It offers dynamic view by supplementing recorded video and audio with animation and graphics overlay, table of content, transcript, visual key frame map, hyperlinks, resources and external files, available straight from the interactive video player. Literature defines interactive video as:

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- I-video or hypervideo that provides methods to transmit information similar to World Wide Web [6];
- A convergence of interactive television with the Internet that brings many benefits in areas like eLearning and business [7];
- An online VCR with necessary control play, stop, pause, backward and advanced interaction features for playing, searching and navigation inside video;
- "A digitally enriched form of the original raw video sequence, allowing viewers attractive and compelling interactivity forms and navigational possibilities" [8];
- A content where students can choose the segment they want to study and repeat parts until are fully understood [9];

Interactive platforms listed in Figure 1 offer the possibility to view or to create own content. Free or commercial, simple or complex, online or local installed the platforms reflected researchers work, companies or individuals approaches.

Wiremax
Zaption Vatic Cantemo
VideoAnnEx Advene
Vertov VideoAnt
Zentrick VIAT
Youtube ELAN VCode VARS Anvil
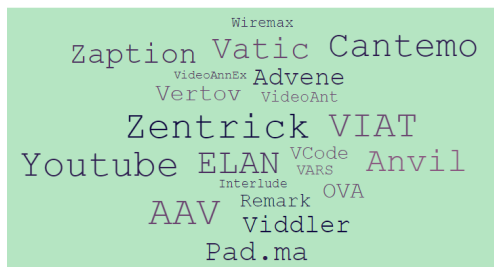Interlude OVA
Remark
AAV
Viddler
Pad.ma

Fig. 1. Video interactive platforms

According to online dictionaries [10], an animation represents a way of making a movie by using successive series drawings, computer graphics, positions of puppets or models that are slightly different from one another. The illusion of movement is created when the film is shown as a sequence, and the frames appear quickly sequentially. We can explore various types of animation: hand drawn animation, model or stop motion animation, computer generated animation (imagery) with different subcategories. The boundaries between them are, blending with great speed [11]. Hand drawn animation is also known as direct, traditional or classical animation. It is the oldest and from the historical point of view one of the most popular form of animation. Each frame is drawn by hand. Each drawing is slightly different from the one before. It takes a very long time to film from start to finish and requires many animators to complete the work. Disney uses this type of animation, animators from industry or simulated hand drawings in programs as Adobe Photoshop [11]. Model or Stop-motion animation refer to everything is shot live, frame by frame in front or under a camera. It needs a lot of time and hard work to build:

- Cut-out animation as a unique technique using flat characters, buttons, matchsticks, string, props and background cut from materials such as paper, card, stiff fabric or even photographers;

- Claymation or clay animation is the process of using clay or Plasticine figures that are moved and filmed using to create a lifelike look;

Computer generated imagery (CGI) is that kind of animation based totally on the use of computer programs. It is a little-sophisticated method of animation and includes:
- 2D animation, two-dimensional drawings;
- 3D animation is created the illusion of three-dimensional space with high accuracy [12];
- Some physical special effects, used in different movies, all the magical creatures and characters [11];
- Vector animation that defines a motion or art controlled by vectors rather than pixels. The images are displayed and resize using mathematical values, and the results allow cleaner and smoother animation.

Time-lapse represents an efficient tool for people to cognize process that "evolve too slowly to be perceived in real-time" [13]. The time-lapse video condenses time to make the invisible things visible to us and illustrate ways in which our world changes around us. Time-lapse allows us to experience the passage of time. It is a cinema photography technique whereby the frame rate that film frames are captured is much lower that which will be used to play the sequence back [14].

In Figure 2, the frames are recorded at 5 frames per second and when played back at 25 fps will be perceived as moving five times as fast, thus compressing time from one hour to twelve minutes [15].

Fig. 2. Time-lapse concept

When replayed at normal frame rate, time-lapse movies appear to be moving faster and thus lapsing. Hours, days, weeks became manageable in an amount of time. "For example, the process of a rose come into bloom takes about three days and nights. An image of this scene may be captured twice every hour, about 150 pictures will be captured in this process, and then played back at 25 frames per second; we have a 6 seconds film clip, the result would be an apparent increase of speed by 4320 times" [13]. Other examples of utilization include fields: natural science (plants growing and flowers opening, tadpoles turn into frogs, rotting fruit or vegetables); outdoor projects (clouds, sunrises, sunsets, stars) [15] or long time projects (people use public spaces, piece of art being created) [16].

Virtual tour is based on panoramic photography, a technique that use specialized equipment or software to capture images with elongated field of view (at least 160 - 175 angle degrees) and an aspect ratio of 4:1, sometimes 10:1 [17]. Panoramic images can

create a unique and fascinating visual experience for the viewer. It offers to people the opportunity to explore sites, and objects that may not be possible without the use of such technology [18]. Groups of panoramic views can create a "presentation tool of the landscape of an educational environment" [19] as a virtual tour, for example. For creating a virtual tour, it is important the photo equipment, the professionalism of content creator, the characteristics of the chosen software: supported format (e.g. flash, html5), multi-resolution, wide-range of supported panoramic formats, image file input formats and 3D projections.

III. OUR SOLUTIONS

We have in mind two categories of computer-generated videos. The first one refers to the educational part and serves as a digital support for two disciplines (3ʳᵈ and 4ᵗʰ year) in Electronics and Telecommunication Faculty, Politehnica University of Timisoara. We talk about Television System and Multimedia Developing Project. The second one brings into discussion classroom and faculty environment through 3D presentation rooms, buildings time-lapse and a virtual tour of Communication Hall department.

A. Video lectures

Tutorials were developed with Adobe Captivate® screen capture function. There are demonstrations - a how to do process - presenting some Adobe Photoshop® and DeviantArt® images operation and for television discipline the use of free Wirecast®, a tool that allow to stream live video content from your desktop to other people on the Internet/Web. We use some application particularities: highlight box, text caption, text animation, buttons, click boxes, characters, table of content, customizable player buttons, video, audio, shapes. We export them as html5 and SWF, and we distribute materials via Intranet and personal FTP address: http://mihai.cm.upt.ro/projects/atracting/tutorial
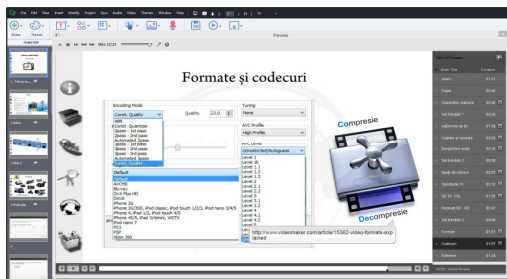

Fig. 3. Tutorial/interactive materials

For *interactive educational materials,* we follow the scenario: A presentation slides built with Microsoft PowerPoint® and the tutor speech recorded with Audacity® are completed with interactive elements from Adobe Captivate® and Zaption®:
• Overlay text with the position, action and duration settings;
• Overlay graphics and hand drawing on the video;

• Downloadable transcript;
• Self-assessment test to verify students' knowledge, what they understood;
• Highlighted areas to draw attention to specific information;
• Table of contents to access particular parts of the content;
• Customizable play buttons (replay, pause, stop, etc.);

The distribution mediums are Vimeo® and Zaption®: http://mihai.cm.upt.ro/projects/atracting/video_lectures-4/, http://zapt.io/t9aqjwny.

Another solution, not tested yet is the SCORM package. We can choose this on UPT virtual campus (https://cv.upt.ro) because it has an infrastructure based on Moodle.

We also propose a *linear video* as an exciting and dynamic educational material that brings in front of us different type of video cameras, a subject that can be watched by the public as well. Adobe Premiere® was used for editing part and for some excellent text and graphics composition Adobe After Effects®. The result was exported in a primary format and then was converted to mp4 for Vimeo sharing and distribution. https://vimeo.com/centrulmultimedia/dispozitivecaptoare.
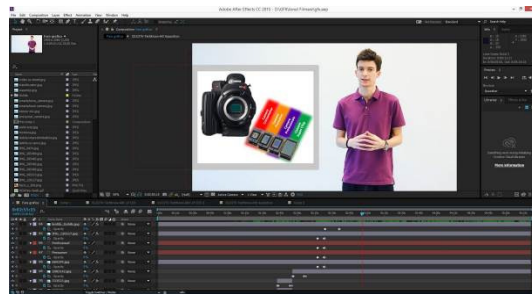

Fig. 4. Dynamic video - Adobe Premiere interface

In the video footage, we used two types of video cameras: DSLR, Canon 6D and for general view Sony HDV/DVCAM. In the editing medium, we combine two formats HD 1920x1080 and HDV 1440x1080 25 fps, progressive.

The animated instructional video was developed with Video Scribe® software. We have the PowerPoint, the transcript and the voice recorded. We transform each slide in an animation with specific elements and objects imported from an online library. We established the size, duration, type of animation, the transition time. We choose a background to project the animation and a suitable font for the proper text. We set the camera movement for seeing one object (like a zoom in zoom out action) or entire scene with objects and text interconnected. Each material can be published in different formats and resolutions and then incorporate in Vimeo® platform: https://vimeo.com/centrulmultimedia/sistemeaudio https://vimeo.com/centrulmultimedia/pdm
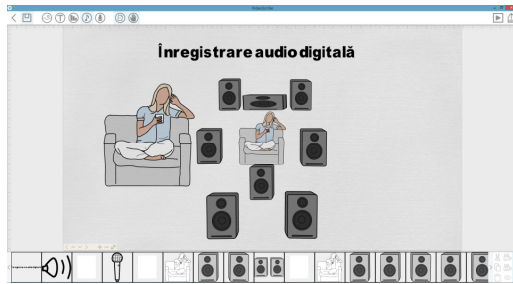
Fig. 5. Animated instructional video

B. Space presentations

We try to attract more top students to our faculty. The quality of educational materials can be doubled with dynamic and entertaining space presentations.

3D classroom videos display the insides of three laboratories from Communication Department: equipment, computers, furniture, etc. The presentation is based on 3D modeling using Autodesk Maya®.
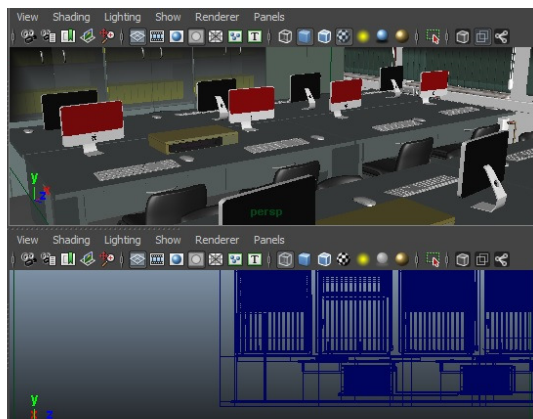

Fig. 6. Maya interface - 3D classroom presentation

Stages of creating 3D graphics elements include:
- Modeling, that uses some points in space, connected by various geometric entities lines, triangles, curved surfaces [20] to create the objects;
- Setting the stage - defines the spatial relationship between scene objects, including the position and their size;
- Rendering - assigning materials and textures, use of lights and shadow, camera animation and rendering methods [21].

Each material was published/convert into mp4 format and then incorporates via Vimeo on UPT Virtual Campus:
https://vimeo.com/centrulmultimedia/b225
https://vimeo.com/centrulmultimedia/b226
https://vimeo.com/centrulmultimedia/b227

We build *time-lapse* presentations for Timisoara City and UPT library building. For Timisoara City, we take 1600 pictures with the DSLR camera and a robust tripod to have no vibrations in the photos. We use as intervalometer a computer with a particular calculator software installed. In Adobe Lightroom®, we edit the photos. In Windows Movie Maker®, we established the frame rate (at 25 fps - 0.04 seconds), we insert background music, and we add effects and transitions between frames or sequences.

Each material was published in mp4 format and was uploaded to Vimeo.
https://vimeo.com/centrulmultimedia/timisoara
https://vimeo.com/centrulmultimedia/biblioteca

A virtual tour is an interactive view of Multimedia Centre classrooms - Communication Department as part of our faculty. To achieve panoramic photos we used a DSLR camera (Nikon D3100), Nikon AF-S 18-55mm f/3.5-5.6G VR lens, Hama tripod with 360^0 rotating head and with a 64 - 160 cm height to fix the system both in the landscape or portrait mode. We took over 793 shots, and we selected the materials needed to build panoramas. We used Arcsoft Panorama Maker® for sticking photos, Adobe Photoshop® for their manipulation and processing.
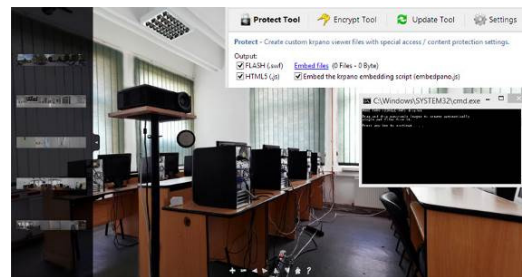

Fig. 7. Virtual tour - KRPano tool

The panoramic photos were processed with KRPano® to build the virtual tour. The results include HTML, XML and SWF pages and folders with the necessary images.
http://mihai.cm.upt.ro/projects/atracting/virtual_tour/build.html

IV. DISCUSSION

Our materials are various as themes, but they have something in common: the computer assistance - the (post)production stage. We used an Intel® Core™ Quad CPU Q6600 @ 2.40Ghz, 4,00 GB RAM, 64-Bit Windows Operating Systems. We choose various programs from Adobe package to other commercials, 30-day trial or free ones.

We have videos that need a production step and equipment like DSLR camera and proper tripod to make also photography and video recordings. Logitech® HD camera and Sennheiser Headphones with a microphone were used to record teacher face and voice.

Based on our humble experience, we make some recommendation regarding applications software:
- Autodesk Maya® for 3D modeling presentations (complex and multiple functionalities);
- Adobe Photoshop® for digital manipulation of photos and panoramas (the leader in the field);
- KRPano® for the virtual tour (cheep);
- Adobe Premiere® to edit video, include transitions, established frame rate, export to primary format;

- Adobe After Effects® for text, graphics, and other overlays dynamic object;
- Adobe Captivate® (complex) and Video Scribe (dynamic) for interactive and animation;
- Wondershare Ultimate Converter® (cheep) for encoding video in a particular format;
- Vimeo platform for storage and sharing video. We find useful the possibility of choosing: title, privacy, add credit to the authors, who can watch the video, where can video be embedded, who can comment to the video, make collections, embed code, upgrade video file, custom URL, All Creative Common License. If the institution has a virtual campus, then embed the video into it.

On the other hand:
- Students focus on more and more interactive objects, include in your presentations video: custom video player with playback controls and buttons like mute, fullscreen, annotations on/off, subtitles on/off, graphics and animations overlay, table of content, downloadable transcript, self-assessment questions;
- Create shorter videos. They are engaging. The videos must be neither too long, neither too short. In that manner, it can draw attention;
- Provide more personal feel to video lectures and more dynamic elements to space presentations;
- Use a pleasant voice for audio part;
- Identify the students need and developed the right video material. It will have a substantial impact to the message that we want to transmit;
- Identify the high school student's desires and propose the right promoting material;
- Be patient, collaborate, and make a team. The results will be better.

V. CONCLUSIONS

A university environment, in this case, represented by Faculty of Electronics and Communications, must propose itself quality and novelty. It can offer these in the educational act, by teaching staff or with modern outside-inside spaces and infrastructure.

We propose some video lectures that can improve the educational part. We develop some promoting materials for the faculty. We try to be part of a process that brings modernism, to experience a new way of teaching and building video materials.

Video lectures like a tutorial, interactive video, instructional animation video are in the top of the list in actual learning and eLearning education. They enter deeper and deeper in the head of students. They consume every day in the entertainment life; they can also consume in school life. Such materials can complete the traditional methods based on text and bring plus value in preparation and evaluation results.

The virtual tour, the 3D videos and the time-lapse enter in the category of dynamic space and buildings presentations. It can promote a faculty from the distance, it can be seen from everywhere in the country. It is exciting and serves as an attractive way, other than a simple shooting with a video camera.

Experience gained during the documentation and implementation of virtual tours, time-lapse, 3D presentations, and video lectures are particularly valuable. In this period we collaborate with students, we improve our and their knowledge. It was also a sample of teamwork benefic to the educational environment. We propose these materials to the benefit of our faculty. It is only a sample, a fraction. The teachers and the administrative part, depending on their time, interest and budget can invest effort and imagination. Can it be a new approach? The time will have the answer.

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