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Conference Paper · January 2012

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Lode4Android: bringing rich video-lectures into an app.

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Abstract: We present an app that allows bringing video-lectures on Android devices in either a basic or a rich format. The paper also discusses in general terms the suitability of the video-lecture paradigm in a mobile setting.

1. Introduction

The transmission over the Internet of lectures recorded in digital form pre-dates by almost a decade the YouTube era. Yet only recently the availability of recorded lectures became rather popular, also thanks to the initiatives like the MIT OpenCourseWare. Today, even though the Massachusetts Institute of Technology has by now 2000 courses on line, we are still far from a generalized, massive availability of such resources in other institutions. A showcase for video-lectures initiative is offered by the web site videolectures.net. An even more popular showcase is provided by the Apple Computers' initiative called iTunes University (in short iTunes U)[1], which started in 2007. iTunes U is a portion of Apple's virtual shopping mall called iTunes Store and dedicated to digital music, movies and software. In the academic section of the store, users can download for free learning material (mostly podcasts and educational video resources).

Video-lectures are obviously popular because they can surrogate the student's presence in class (at least in the case of frontal lectures), and hence they are useful for distance students and for all those who systematically or occasionally miss "live" lectures. Years of experimental development and deployment have however shown that also regular students use video-lectures. They use the recordings to review critical passages or check their notes. History, ideas and techniques related to the use of video-lectures have been reviewed lately (Ronchetti 2011a, 2011b). It has also been recently suggested (Ronchetti 2010a) and assessed (Ronchetti 2010b) that video-lectures can be employed to change the teaching paradigm, by using them as a pre-requirement that students have to fulfil before coming to class, and transforming the class activity from frontal to interactive.

Systems for delivering video-lectures are generally designed to be used within a web browser on a regular PC (a desktop or a laptop). However, it is thinkable that mobile device be used for virtually attending at video-lectures. An example of usage of this type would be while commuting: while sitting for half an hour or for a longer time on a train or on a bus, it is certainly possible to study. By using earphones, one can isolated her/himself from the context. The student can hence set an alarm on the mobile device (so as not to miss the right station) and concentrate on a topic. Not only laptops but also smartphones and especially pads are suited devices for this type of use.

Motivated by this consideration we ported a lecture browsing system on Android machines, following up work that was done some time ago on Symbian phones, and more recently of iPhones and iPads. It this paper we discuss the main ideas and problems and present out prototype.

2. General considerations on the video lectures

Before moving onto the mobile domain, we will here briefly overview the main characteristics of video-lectures over the Internet. In academic education, the first digital videos were employed to break space distance gaps (Heyes 1998). Later they became common also to break temporal constraints, allowing

[1] http://www.apple.com/education/itunes-u/

for asynchronous fruition. Several tools are available to produce video-lectures, and two are the basic philosophies underlying their production: an option is recording real lectures, another one to produce ad-hoc videos. The two options imply widely different efforts and investments. Recording in an ad-hoc environment – like a TV studio – allows producing well polished and controlled artefacts and requires the teacher to perform an activity finalized only to the video production. While in principle these conditions should guarantee best results, this is not necessarily the case. Such lectures, which we call "synthetic" as opposed to the "authentic" lectures recorded in a live environment, often end up being boring and uninteresting. A study by Fritze and Nordkvelle (2003) analysed the language employed, the examples used, the rhetoric figures, the presence of humour in synthetic and authentic lectures. The results show that the synthetic lectures lose many of the immediacy qualities of the authentic lectures, and the lecturers compensate for the lack of immediacy by employing a more inclusive linguistic style. In authentic lectures various techniques are used in order to reduce complexities, and supply more cues to understand the subject matter. Even though the lecture is frontal, at least some level of interaction is provided by the continuous feedback that the teacher gets from the class (even when the feedback is only mediated by the students' facial expressions).
Moreover authentic lectures do not require the teacher to do any extra activity, reducing costs.

Of course one could question the utility of having a video as opposed to the "webcasting format", i.e. audio plus slides. The difference between these alternatives has been debated in literature. According to the German instruction psychologist Glowalla (2004), learners show an even better concentration in front of a video than in a classroom, while the audio + slide version favours less the concentration, and is perceived as more boring. Data obtained by Reisslein et al. (2005) confirm that students felt that the web-carried video helped them to stay focused during the instruction. McCrohon et al. (2001) reported that a very large majority of the interviewed students preferred video to audio streaming. According to Fey (2002), video is favored by most people due to emotional reasons even though it does not increase understanding or retention.

Another issue concerns the format that is used to deliver the recorded lecture. By far, the most basic and most popular option is to record a video stream. An art director decides what to record: the teacher, the blackboard, or the projected slide. A variation of this approach is the "picture in picture" technique: the available space is filled with the main view (e.g. the projected slide) while on a corner a smaller picture shows another view (e.g. the teacher). Both these choices have both advantages and drawback. The advantage is having a polished and professionally looking video. A disadvantage of these options is the amount of dedicated labour (and hence increased costs): a devoted person has to play the role of "art director" (either in real-time or in postproduction), and (for best results) also one or more cameramen are needed. This is not the only disadvantage: cognitive focus control is stripped to the user, who has to passively adapt to the "director" choices. Sometimes users might want to spend more time (e.g.) on a slide, or focus again at it at a later stage: but the "simple video stream" option does not allow for that.

Actually, several tools for recording video-lectures, such as e.g. opencast Matterhorn [2] and LODE[3], provide lectures grounded on a double visual channel: the video recording (e.g. of the teacher) plus some other auxiliary images (e.g. the projected slide or, in an interactive demonstration, the projected teacher's monitor) are visible at the same time to the student. The student can choose at any time on which of the sources to focus (e.g. by enlarging it, or bringing it in foreground).

Also, an important role is played by the availably of additional data. Some of the MIT lectures for instance provide a transcript of the text. This is useful for searching in a set of lectures to find a particular one. Sometime, as in the NEEDLE prototype (Fogarolli et al. 2007), the transcripts are aligned with the audio, so that it becomes possible to perform searches within a lecture. More frequently, video-lectures are divided in chapters, each with a title (usually derived from an accompanying slide), so that these metadata allow semantic navigation of a lecture. Still, in the most frequent cases all that is available is a video stream and the only possibility to navigate it by using a time-bar that doesn't offer any semantic annotation. In the

[2] http://www.opencastproject.org/project/matterhorn

[3] http://latemar.science.unitn.it/LODE

following we'll refer to the format based on multiple channels plus metadata and navigation facilities as "*the rich format*" as opposed to the "*basic type*" that only offers a video stream.

3. Video lectures on mobile devices

The interest in mobile devices stems from the ubiquity of these tools (especially mobile phones). Early investigations on usage of mobile phones for supporting learning activities have concerned the use of messaging capabilities (see e.g. many papers in Attewell 2004). Other researchers used the podcast capabilities: the first paper we are aware of dates 2003 (Crawford 2003), but since then many have appeared. Some years ago we attempted to improve the podcast paradigm by selecting the audio track from video-lectures, and accompanying it with images taken from the slides (Ronchetti et al. 2008). The user could zoom into the images so as to view details while listening to the speech. The arrow keys on a Nokia phone based on Symbian OS were used to perform these operations. Also, some navigation capability was provided (i.e. navigating the lecture by slide titles). Of course all the information associated e.g. with writing on the blackboard was lost, but for PowerPoint-like based lecture the system worked reasonably well in spite of the very limited screen estate availability.

In fact, the small screen is an important drawback of the mobile phones. Maniar et al. (2007) found that on a device with a small screen (42mm diagonal) the effectiveness of an m-learning environment that relies heavily on video-based material the learning experience may be inhibited, while a slightly larger screen (58 mm diagonal) makes the experience acceptable. In the meantime, new generations of innovative devices have come into the stage: from smartphones to pads, and even small screens have today increased their resolution, so it would be interesting to repeat that investigation e.g. on the new "Retina" displays. Moreover, the advent of the pads has moved the size of mobile devices into the 6" to 10" screens, with resolutions up to 2048x1536 pixel as e.g. for the new iPad. Videos are quite popular and effective on these devices, so why not to port video-lectures on them?

This has in fact been massively done with the iTunes U initiative. iTunes U has a growing popularity with the Universities because it has a showcase effect besides being a channel for distributing educational content. Moreover it's often mentioned in the press, which adds further visibility for the institutions adopting it. Publishing on iTunes U is convenient also because, being based on a RSS mechanism, it allows students to subscribe to "channels": in such way, when a new resource gets published, it is automatically and transparently downloaded on the student's PC. It is based on a push model: the student does not need to repeatedly visit a web site to verify if anything new is available on (say) a Learning Management System and "pull" the new resources. The iTunes U paradigm is based on the download of the (audio or video) resource on the devices, so that it can later be used also in disconnected mode.

iTunes U natively supports distribution on mobile devices (iPhones and iPads), but is not only intended for mobile devices: a dedicated software, called iTunes, is freely available for Macintosh and Windows-based PC's. It manages the subscriptions, retrieving automatically all the new stuff, and allows viewing the resources on the desktop or laptop. Although Linux users are not supported by Apple, they can use an open source software called TunesViewer[4] to access the iTunes store.

However the resources come only in the "basic type" format: (audio or) video streams without support for multiple cognitive channels, or semantic metadata. As we already mention, most video lectures are generated in this form, which is far from being optimal. Those based on the "rich format" are not supported by the current iTunes U paradigm, and need to be "simplified" to bring them back to the format accepted by this distribution channel, losing much of their appeal. Multiple cognitive focuses are lost, and navigation is brought back onto the basic time bar and nothing more is offered. It is not only a problem of iTunes U, as also on platforms other than Apple mobile devices it is easy to play basic videos (e.g. mp4 files) but there is no specific support for the richer versions.

[4] http://sourceforge.net/projects/tunesviewer/

In view of this fact, we used a double approach. On the one hand, we adapted to this impoverished environment by augmenting the video-lecture production system that we developed in-house with a post-processing module that automatically merges the video and the slides, by showing the current slides for a few seconds right after it is presented to the audience (the actual value can be chosen in the system settings).

On the other hand, we really do not like this solution. When the teacher for instance comments a passage or an image on the projected image, the student has no option to viewing it if the n-seconds slots has passed. This is not a problem generated by our solution, as we find the same problem in many videos available on the Apple store and based on an "art director" choices, as it happens e.g. in the very professionally-looking ones produced by Stanford University. The problem comes from the logical architecture based on a single visual channel.

For this reason we decided in 2010 to face the problem, and to solve it by building a new, ad-hoc viewer for the iPhone that was reported elsewhere (Mattei et al, 2011). The main characteristic of the system is to give back to the user all the control that is available on a desktop platform.

4. Lode4Android

In the last two years, the Android platform for smartphones has taken the market lead, outnumbering the Apple iOS devices thanks to their lower price. As of today, these two players take a market share larger than 80% for smartphones, and larger than 90% for pads. Driven by these considerations, we built a version of the video-lecture client for Android devices.

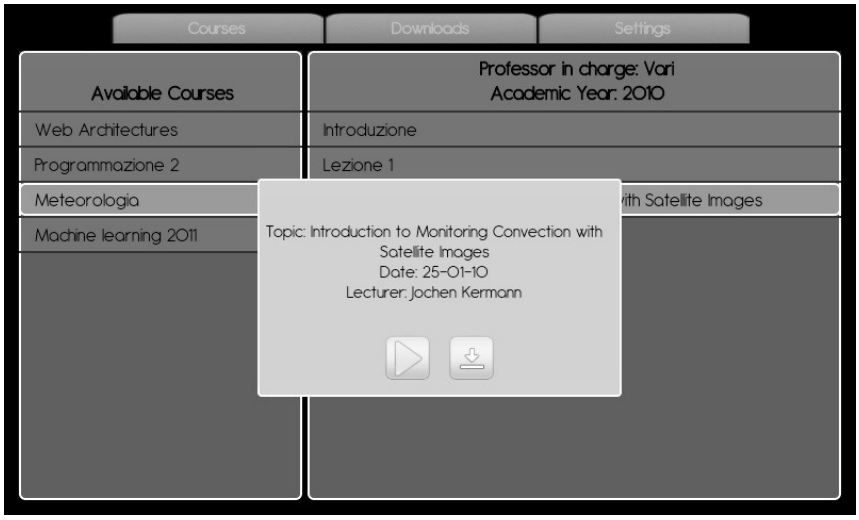
As far as the offered functionalities are concerned, the implementation follows mostly the track opened with our iPhone version, even though we introduced some modifications.
The view (in landscape format) offers a tabbed "activity" (that's how views are called in the Android world) where the user can view the list of available courses offered by a given provider, manage his/her downloads and check and modify the application settings.

A second view shows at the same time two cognitive channels (typically the video and a slide), and the user can at any time change the focus by having the two channels sharing the space, or dedicating the whole space to one of the channels. A side tab calls a menu that allows jumping to a different "chapter" in the lecture. In such case, video and slide are resynchronized on the new position. Apart from this, the user has the usual video controls to pause it, restart or stop. Temporal navigation is also allowed, either by using buttons for jumping backward/forward by a short, customizable interval (typically 10 seconds), and by using a time slider to move to arbitrary positions.

An interesting characteristic is the possibility to play the video at higher speed. Two speed options are foreseen, and by default they are set to 1.3 and 2.0 times the regular speed, but their value is adjustable by the user through the settings panel. These options are interesting for performing two different types of operation:

a) watching a lecture when the student thinks to be already familiar with the presented topics, but s/he wants to make sure this is actually the case, and hence a rapid overview of the material is useful;
b) seeking a particular place in a lecture, where a specific explanation or example is given.

These options resemble "fast reading" or skimming through a text. We are quite used to do that when we read, and in using videos they can be extremely important. Videos are time consuming exactly because the user does not usually have the set of techniques that make books so handy: direct access, indexing, the possibility to go through sections by speed reading. The optimal speed rate are subjective and depend much on external factors such as the speaking pace of the lecturer and his/her attitude to insert pauses in the speech. On the average, we think that 1.3 is a good choice for the first function (check of content on a familiar topic) while 2.0 is suited to the seeking, but even higher values can be better in certain cases. On the other hand, in rare and special cases even slowing down the speaker may be useful (and can be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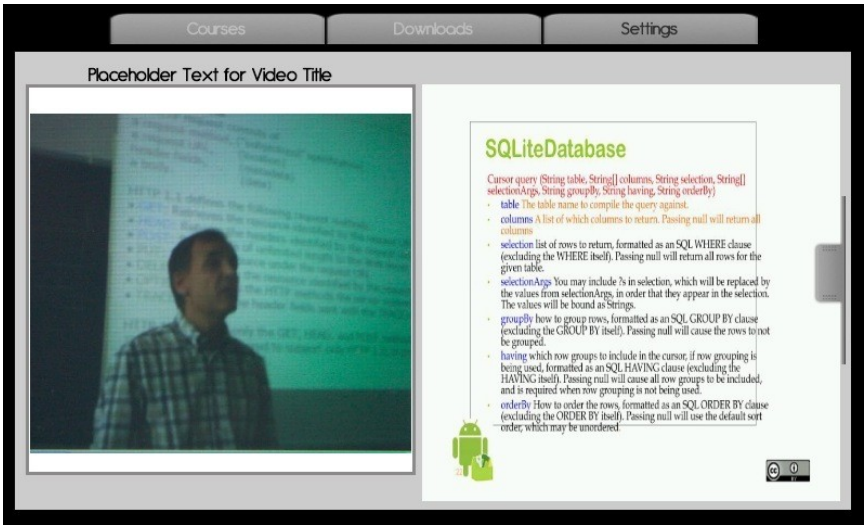
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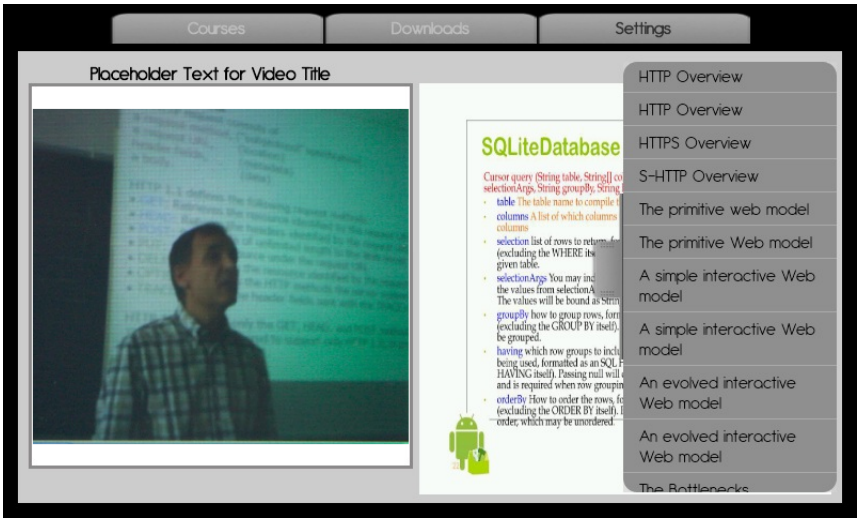
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Placeholder Text for Video Title
SQLiteDatabase
HTTP Overview
HTTP Overview
HTTPS Overview
S-HTTP Overview
The primitive web model
The primitive Web model
A simple interactive Web model
A simple interactive Web model
An evolved interactive Web model
An evolved interactive Web model

Figure 1 – Screenshots of Lode4iPhone

achieved by customizing the preferences). An important point is that the sound frequency is not changed, so the effect is not like playing a 33 rpm disk at 45 rpm, but only an acceleration in pace.

Of course the system is able to play lectures that conform to a given format. The format is open and is based on XML files containing all the needed additional information: information about the server where the course is stored, association slide – time, slide titles, course and lecture metadata, references to the files containing images and video. Also the text that is contained in the slides is extracted and included in the XML files. Suitable files are generated by our (freely available) LODE system for the recording of video-lectures. In principle it should be easy to transform files produced by other tools into the LODE format, provided that the format is well documented. We intend to explore soon such possibility.

On the other hand, to our knowledge at present all the resources in the iTunes U library are not accessible from Android devices in a simple form. We are therefore working at an interface that allows using Lode4Android to access the wide iTunes U world, and we plan to incorporate it into our system. In fact, although these resources are in the "basic format", having access to them is certainly a value, and it would increase the appeal of our app.

5. Discussion and conclusions

We presented a system that fills a gap by providing in the constantly growing Android world the possibility to use video-lectures both in the "basic format" grounded on a video stream, and in a "rich format" where the video is complemented by semantic metadata, richer browsing capabilities, multiple cognitive channels and a feature analogue of fast reading. The system is usable both on smartphones and tablets, and offers support for students on the move – e.g. those commuting – or also those studying in time fragments (like e.g. when waiting at a dentist's shop or at an airport). The system is designed to work both on smartphones and on pads.

It will be interesting to know if and how students will actually use these capabilities. A recent investigation (Defranceschi et al., 2011a, 2011b) reported that on a given iTunes U channel all the students were using only personal computers to watch the video-lectures. However, shortly after that investigation was finished, some students appeared that were using iPads. Such instruments start getting more and more popular, so we expect to see evidence that the fraction of students using such devices will grow.

It is certainly true that watching video-lectures is not the most suited activity for learning with mobile devices. Activities with a lesser cognitive impact, such as e.g. memorizing words in a foreign language, could be more suitable. Trifonova et al. (2004) suggested the activities that best fit the mobile setting are short (no more that 5-10 minutes), simple and funny, and might be domain and location specific. This is certainly not the case of video-lectures. However, as we mentioned, there are for sure scenarios in which video-lectures do make sense – like the one of students who commute for a time longer than half an hour in a relatively comfortable situation (e.g. sitting in a train).

Also, it is true that video-lectures are based on a traditional, frontal paradigm and as such they might not be the right way to innovate teaching and to make it more effective. However, as we cited in the introduction, video-lectures can be used as a propaedeutic activity that allows changing the teaching paradigm in class.

We conclude by saying that it is now proven that students do appreciate video lectures, and our work allows bringing them to the mobile scenario on the most common and successful platform that is today available: Android.

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