ONDIGITA: A PLATFORM FOR THE MANAGEMENT AND DELIVERY OF DIGITAL DOCUMENTS

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ABSTRACT

This paper presents Ondigita, a platform developed at the University of Applied Sciences of Southern Switzerland for the management and delivery of digital documents to students enrolled in bachelor's courses in various curricula within the field of engineering. Ondigita allows our organization to have a cloud-based repository of educational materials (documents, books, audio and video) and allows our students to store and access these resources from their computers, tablets, or mobile phones. A specific Android mobile app automatically synchronizes the student's device with the learning resources provided by the teacher and stored in Ondigita, and automatically fetches all documents for the courses the student is enrolled in. Ondigita is built with the purpose of creating an infrastructure that will allow students to annotate their PDF educational materials, to take notes in a personal notepad, and to share annotations with teachers and peers.

KEYWORDS

Digital materials, document management system, document annotations, learning management systems

1. INTRODUCTION

In recent years we have witnessed a revolution in the production and delivery of instructional materials in schools, universities and educational organizations in general. The internet phenomena has revolutionized the approach of students to access learning resources. Teachers and schools have started producing digital learning resources and they use Internet-based repositories to provide materials to their learners (Hylen, 2006). Nowadays, students consider Google to be the easiest place to start research (Griffiths & Brophy, 2005), use social networks to keep in contacts and exchange materials with peers, and use popular wikis (such as Wikipedia) as the main reference for their study (Dawley, 2009). Universities and schools, on the other hand, have introduced Learning Management Systems (LMS) (such as Moodle and Blackboard) as the primary tool to assemble and deliver learning content rapidly, to collaborate and to promote activities and assessments for their students (Sclater, 2008).

Tablet computers (such as Apple iPad and similar) are revolutionizing the way students approach learning (Jones & Strudler, 2012). If two or three years ago university students used to bring their laptop in classes, nowadays several of them have replaced their laptops with tablets. Students prefer tablets to laptops for their lightness and versatility. Universities and schools are now considering tablets as interesting tools for learning and teaching. Several schools have started small and large projects for the introduction of iPad in schools, and the initial results are very interesting (Hu, 2011, Preciado-Babb, 2012). It's now becoming more and more common to see instructors using tablets for presentations. Moreover, due to the increasing demand of cost reduction and efficiency, these organizations are trying to replace any printed educational resources (handouts, presentation manuals, books, ...) with digital resources. Nowadays, teaching institutions are faced with the problem of managing a large amount of digital resources that often changes through the years. Instructors need an infrastructure for storing and delivering digital materials to their students. Students, on the other side, may take advantage of tablet computers to annotate documents, take personal notes, and share these notes with instructors and peers.

2. ONDIGITA INFRASTRUCTURE

Ondigita is an infrastructure that allows training and educational organization (schools, universities, training departments) to create a digital collection of their educational materials, and allows their students to store and access these resources in their computers, tablets, or mobile phones. Ondigita offers the possibility to easily store all the digital learning materials (books, handouts, presentations, audio, video) in a single course space that is automatically synchronized into the student's mobile device. Materials are always updated and can be synchronized across multiple devices. This way, students always have the most up-to-date version of the digital course archive in their tablet. The mobile device becomes the physical support of all educational materials provided by course instructors.

Thanks to the capabilities offered by the latest tablets, the Ondigita app offers students the possibility to annotate their PDF educational materials. Students will be able to mark up lecture slides, highlight or underline important text passages and add textual notes. An important aspect is the possibility to share annotations: Ondigita enables students and teachers to attach personal multimedia notes that can be shared with others and are synchronized across devices. For instance, a student can attach to a document a voice recording of the instructor explaining a concept, or a link to a website for a more in deep study of a topic. The student can decide whether the multimedia note has to be private or can be shared with peers.

2.1 Integration with External Repositories and Learning Management Systems

Instructors nowadays use different and heterogeneous tools to provide digital materials to their students. Some instructors prefer to use cloud-based infrastructures (Drobox, skydisk, iCloud, …), other use Learning Management Systems (LMS) (if provided by the school), and others simply prefer to send materials via email. Ondigita's approach is to leave the instructor free to use the delivery modality he/she prefers. For this reason, Ondigita has been designed to allow specific adapters to integrate Ondigita with external repositories, such as: LSM (Moodle), Google Drive, Dropbox, email drop, ... This integration will allow teachers to use their preferred modality to deliver materials to their students. Once the teacher uploads a document into a Moodle course or in one of the supported on-line storage service such as Google drive or Dropbox, it will be automatically imported into the specific Ondigita course and converted into the basic format (documents are converted into PDF, video into H.264 standard format, audio into AAC format).

Ondigita is able to synchronize content with Learning Management Systems (LMS) (in particular, Moodle). Learning Managements Systems are very popular and widely employed in schools and universities. Nowadays almost any educational institution uses an LMS to complement and support the activities in the classroom: it is organized like a virtual university in which you can view the course materials, see who is attending the course, provide interactive tools such as quizzes, chat, discussions etc. We implemented a specific adapter for the Moodle LMS. Ondigita is able to automatically fetch the content from a Moodle course and convert it into a basic format. In Moodle, the adapter is implemented as a side block for Moodle courses. The course instructor receives a special pairing key from the Ondigita administrator. Thanks to this key inserted in the block, the instructor creates a connection between a Moodle course and an Ondigita course. In this manner text documents inserted by an instructor in the Moodle course are automatically replicated in the Ondigita course.

The infrastructure (see Figure 1) is structured in the following components:

- A **course materials repository** where all course materials are stored.

- An **application server** provides the basic services to our applications. The application server takes care of converting documents into basic formats, suitable for different devices.

- A **web application** allows institutions to structure their users and courses. Instructors can access the course with their personal account and can use the web interface to upload the learning resources to be delivered to their students. Student can access the web application to manage their account and to access their documents.

- A number of **adapters for external repositories** will be implemented. Thanks to these adapters, teachers can store their resources in other file hosting services (dropbox, google Docs, …) or institutional LMS (Moodle, Blackboard,...) and automatically integrate them into Ondigita infrastructure.

• A **mobile application**, currently available only for Android OS. This app automatically synchronizes the learning resources stored in the repository, and automatically fetches all documents for the courses where the student is enrolled in. It will allow also annotating PDF materials, and taking handwritten notes in personal notepads.
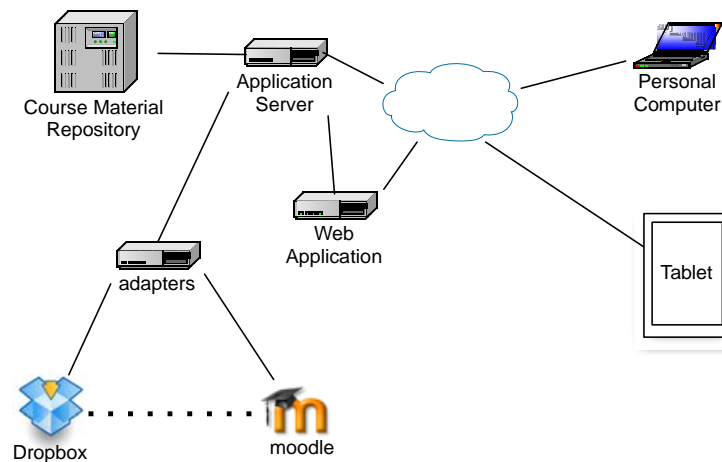

Figure 1. Ondigita infrastructure

3. MOBILE APPLICATION

We implemented a specific app for Android V.4 devices. Currently, this app is not available in the Android marketplace (Google play), since our purpose is to provide the service only to our students. Students have to install the app on the tablet provided by the school and create an Ondigita account through the Ondigita Web application. The android application has a tab-based user interface (see Figure 2) where the students can enroll to courses from a catalog, and browse the courses they are enrolled in. Course content (fetched from a Moodle LMS or from another external repository, or uploaded directly into an Ondigita course by the teacher through a Web interface) is represented by a plain list of PDF files ready to be accessed, studied, and annotated by students.

Course documents in PDF are visualized directly into the mobile app, thanks to the integration of MuPDF, a free software library for rendering high quality anti-aliased graphics. We decided to include this viewer in our application in order to provide the intended document annotation functionalities, namely the possibility to draw lines, to insert drawing object such as rectangles, ovals etc. and insert sticky notes directly into the document. As illustrated in Figure 3, the PDF viewer is integrated with a toolbar that provides such functionalities. Students can tap on one of the icons of the tool to draw the geometric element or to add a sticky note directly on the document. Differently from other PDF annotating tools, such as Adobe acrobat or iAnnotate, Ondigita doesn't insert the note directly into the file, but notes are represented as overlay graphical objects over the PDF document. This technical solution has been adopted for two reasons: first, there is no need to create a new annotated version of the PDF file; secondly, notes are processed as objects that are independent by the PDF document. This solution makes it possible to share annotations across devices and even between peers, and it opens new possibilities of exploitation of the digital device for new advanced functionalities.
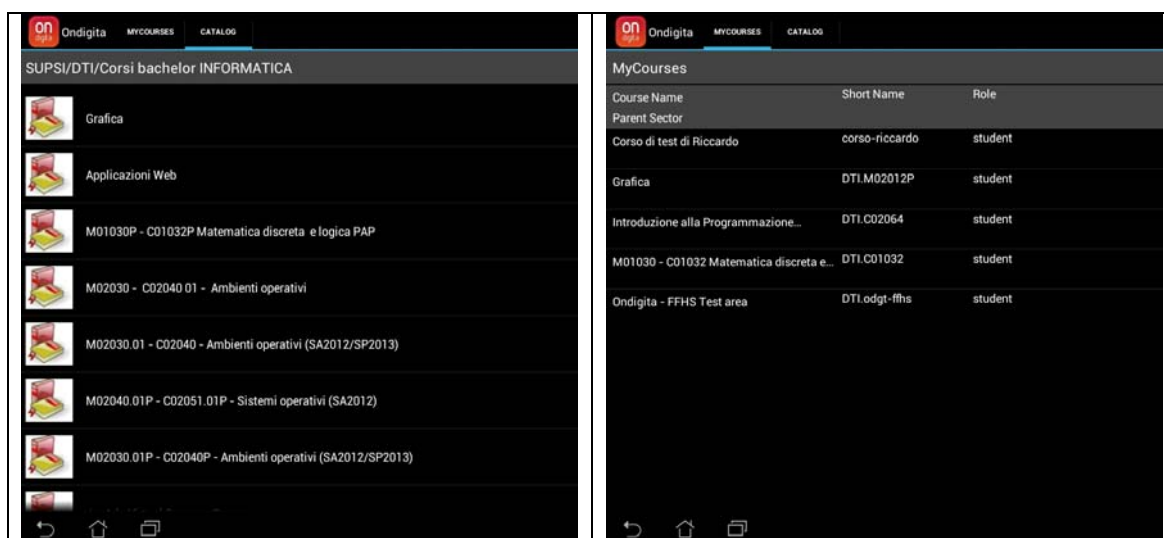
Figure 2. Ondigita mobile app user interfaces for courses. On the left the catalog of courses of the bachelor in computer science, on the right the list of courses the student is enrolled in.

In fact, one of the reasons that have driven us to create Ondigita was to take advantage of the networked device for adding new functionalities that can help students in their learning activities. The possibility to annotate documents and share textual annotations with instructor and peers is considered to be a source of added value by students and instructors alike. The current version of the Ondigita app doesn't allow the sharing of annotations, but we are working towards a new version of the app that allows that functionality and allows the user to define whether a textual annotation has to be kept private or public/shared. In that case, the students, when browsing the document, will see icons denoting textual comments of others. By tapping on the icon, the text of a comment inserted by a peer appears and can be shared if needed. This functionality will be provided in next releases of Ondigita app.

4. FIRST EXPERIENCE OF USAGE

At the beginning of the winter semester in September 2012, all first year students of the bachelor degree in Computer Science have been provided with an ASUS TFT 300 Tablet. In total, about 150 students started using Ondigita to access digital documents that instructors made available through the Moodle platform. About 80 Ondigita courses have been created, and each of them has a corresponding Moodle course. The Ondigita mobile version used by student is a first alpha version of the tool: student cannot share annotations and these are not synchronized with the server, but are saved only on the mobile device.

After about a month of usage, we started collecting first informal feedback by representative of students. We invited two students for each class in a focus group, with the aim of understanding the usage of Ondigita, reporting problems, and collecting needs and ideas for further development. We learned that most students experienced technical difficulties with the device and with the Ondigita app in form of crashes of the application or even of the Android operating system. Document annotation is not very much used for two reasons: (1) due to frequent system crashes, the application is perceived as unreliable; (2) in-class document annotation is not very convenient because of the lack of a keyboard and the impossibility to use a stylus pen to take textual annotations. Students still prefer to take notes on paper, or in some cases even to print out the document and take notes directly on the printed version. However, students expressed a positive opinion on the tool: annotation sharing is a functionality that they want to have, and the note-taking feature has to be easier and close to their needs. Using display keyboard to take notes is inconvenient, complex, and takes too much time. Moreover, very often students want to take notes in a schematic form. A touch keyboard on display is not the ideal tool for that.
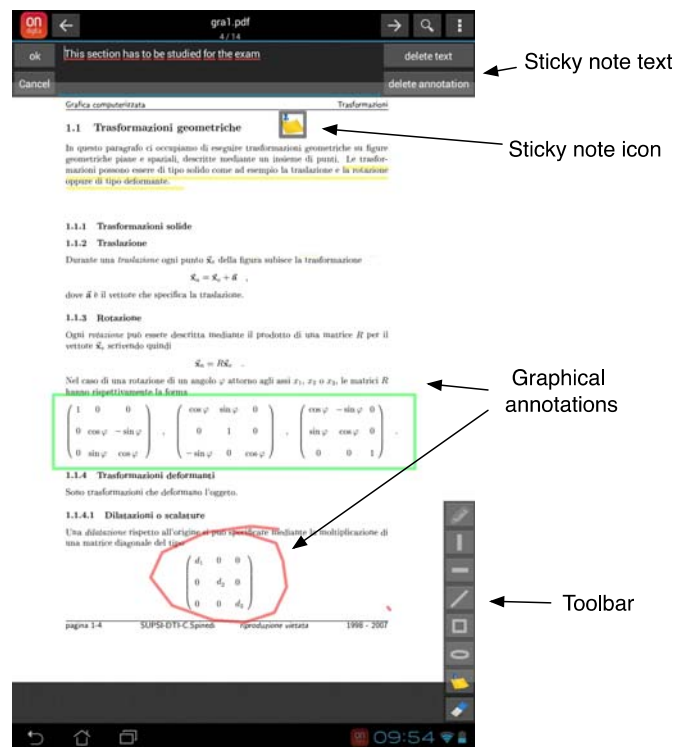
Figure 3. Rendering of a PDF file in Ondigita Mobile Application. Toolbars and digital annotations are visible.

5. CONCLUSION AND FUTURE WORK

We provided our first year student with an Android tablet and an infrastructure that extracts documents from Moodle courses, pushed these documents into students' tablets, and made them available for reading with no need for constant network connectivity. The Ondigita app allows students to annotate PDF documents with drawings, and textual annotations in the form of sticky notes on the document. After a first informal evaluation with some representatives of students after a month of usage, we discovered that tool reliability is a strong prerequisite for being accepted, and students need a flexible tool for note taking that is not limited to a display keyboard. For these reasons, we are working on a new version of the Ondigita application for mobile devices. The new app will allow students to take handwritten notes in a notebook, take multimedia annotations (pictures, audio recording, etc.), and share these notes with peers and instructors.

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