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Location based Learning Content Authoring and Content Access in the docendo platform

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Abstract— Learning does not only take place in a conventional classroom setting but also during everyday activities such as field trips. Such context sensitive learning is not new and can be observed in many different areas. The increasing availability of mobile devices and network access opens up new possibilities for providing context aware support for such learning scenarios. Related work focuses mainly on supporting the learner by delivering context aware learning content and by appropriately adapting the learning media to the limited viewing capabilities of their mobile devices. The learning content provided is dependent on the context of the learner e.g. the learner's current location. In this paper, we argue the need for providing context aware support for authors of learning content. We present an extension of docendo, an open learning content authoring and management platform, to support teachers while creating location based learning material for field trips. An important new feature is the automatic mapping of the location of the author to the learning resources collected by the author.

Mobile Learning, Location Based Services, Authoring, Metadata

I. Introduction

Learning in an everyday context is of high educational value and has been practised by teachers over a long period of time. Examples of such learning scenarios are field trips or simulation games. Mobile devices such as mobile phones are well suited to such scenarios because they are readily available in these different everyday life situations and contexts. Relevant learning information can be drawn from these contexts to enrich the learning activity and overall learning experience [1]. Providing technical support for field trip scenarios, applying pervasive technologies and linking these new technologies to existing e-learning platforms are the objectives of numerous projects. The museum and tourism sectors have been especially active in developing advanced learning material for such scenarios. These scenarios require a high effort to realize and specialised devices are needed for example in a museum environment. However, with the ever increasing availability of mobile devices and high bandwidth, it is now possible to realize such learning scenarios with less effort as well as utilising the mobile phones of the learners instead of using specialised devices as in the past.

Existing related work focuses on supporting the learner by detecting his context, especially his location, and thereby delivering learning content that fits to the location of the learner. We extend this approach by supporting the teacher in his/her role as the author of learning material, especially during the process of content authoring for a field trip scenario.

This paper is organized as follows. Section 2 emphasizes the complexity of creating location based learning scenarios and highlights the benefits of technological support with the help of an example. Section 3 summarizes different state of the art approaches for pervasive learning in general and for location based learning in particular. In section 4, we present an overview of the main functionality and concepts of our open learning content authoring and management platform docendo. The different challenges faced when realizing support for location based content authoring and access are explained in the beginning of section 5. How we meet these challenges, our extensions to the docendo use cases and how we implement these new features are explained further on in section 5. The paper ends with a summary and outlook.

II. Location based Content Authoring and access in a Learning Scenario

To illustrate the benefits and the need for location based learning, we first present a scenario from a biology class. The aim of the course is to teach learners about various species of trees and the different characteristics needed to identify them. The mediation shall be illustrative and will not be held in the classroom but rather outside the classroom, in order to increase the motivation of the learners. In addition, each learner shall make his or her own individual experiences and deepen his or her knowledge him- or herself by interacting with the learning material for example by answering and reflecting on test questions. Therefore, the learner has to determine in what order and at what pace he or she wishes to learn.

The first task for the teacher is to determine specific learning stations, in our example, trees of different species to be visited by the learners. These stations are then documented on paper. The teacher also has to collect relevant information about the stations which will be presented to the learners at the various stations. The teacher therefore walks through the park and searches for different trees. He or she documents the position of the trees, for example by highlighting them on a map. He or she takes photographs of the characteristic parts of the trees which are needed to identify that particular type of tree, e.g. the leaves, the bark or fruit of the tree. If necessary, he or she makes notes of additional information like the size of the leaves of the tree. The teacher also writes down instructions or questions for the learner, for example, what is the difference between a golden beech and a copper beech?

In the second step, back in the classroom, the teacher has to prepare the information collected so that he or she can provide the learning material to the learners. He or she has to retrieve the resources he or she collected, such as the pictures he or she took on his or her camera or instructions he or she wrote down and assign these to the respective stations. Figure 1 shows the information the teacher collects for authoring a course and the relations between the concepts in an informal structure. The various stations will also need to be recorded electronically on a map for the learners to access easily.

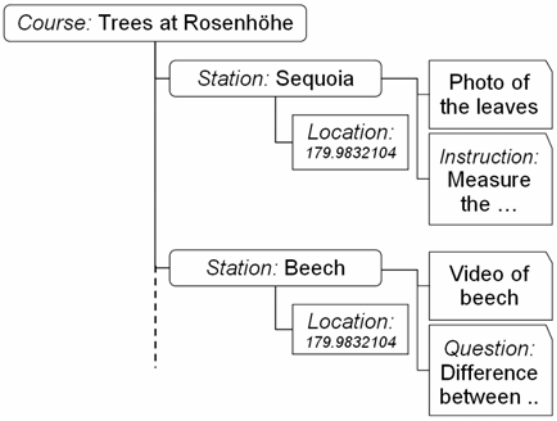

Figure 1: Informal structure of information collected by teacher

The learners use the map created by the teacher to visit the stations, in our example the trees. If the learner stands in front of a tree he or she selects the additional resources provided by the teacher by using an identifier like a number or title, which is associated to the tree.

As shown in this scenario, the preparation of the resources for each station in a course without technical support is very time-consuming and tedious. The teacher has to associate every resource to a station and has to document the location of the station manually. We therefore want to support this scenario in the following manner:

(1) The teacher creates resources using his mobile device by making photos and noting down questions using a mobile authoring application. He or she can do this initially in form of a draft, and reedit it at a later stage in the authoring system. When a resource is created, the location is automatically determined and assigned to the resource. The allocation of resources to a station is done by matching the location information of the resource to the location of the station. The resources collected are automatically transferred and stored in a repository. These resources can thus be easily retrieved later by the authoring system when the teacher does the final authoring of the course back in the classroom.

(2) The learners access the learning resources using their mobile devices. All existing situations are shown in a map on the mobile device in addition to the current position of the learner. In this way, the learners are guided to the different stations, trees in this example. By selecting the resources of a nearby

station, the resources related to this station are presented to the learner. He or she gets more information about the station, or has to answer questions relating to the tree.

III. Related Work – Mobile Learning

Related work on mobile learning and supporting field trips has to be differentiated between the support of the mobility of the learner, which is the case in most existing work, and the support of the mobility of the author or the teacher when preparing the learning material.

There are many examples of scenarios of museum visits and field trips which address the mobility of the learner. MyArtSpace [2] supports mobile learning during school trips to museums and art galleries. Students can collect information during these visits by taking pictures, making voice recordings and taking notes on a multimedia phone. The collected material is sent to a personal weblog via GPRS and can be worked on later in the classroom. The goal of this project is to provide a seamless learning experience between learning in and outside the classroom. Other examples are described in Ambient Wood [3] and MOBIlearn [4].

Math4Mobile [5] offers mobile applications to support learning mathematics. Real life scenarios, such as a person walking, are captured with the video camera and sent to other students via MMS. The mobile applications Sketch2Go and Graph2Go help students create sketches and graphs representing the observed phenomena, which can then be exchanged between students via SMS. The project intends to examine how socio-cultural and situated learning aspects are reflected in learning experiences.

Mugwanya and Marsden give an overview of mobile learning content authoring tools in [6]. These tools are used to generate learning content that can be consumed on mobile devices which enables anywhere, anytime learning. These tools support amongst other goals, content re-use, authoring of tests as well as content authoring and integration in Learning Management Systems.

EDUCA [7] is an example of an authoring tool which enables a community of authors and learners to create, share and access adaptive learning content in a Web 2.0 collaborative and mobile learning environment. A recommender system is used for filtering related material and a web mining system for searching for learning resources.

However, to the best of our knowledge, none of these tools actually support the mobility of the author during the creation of learning material for situated learning. Preparing and authoring learning content for situated learning scenarios requires a location based authoring environment, where the author can plan and physically pre-create the learning context whilst authoring the mobile learning content. In order to meet these needs of the author, we extended our existing learning content authoring and management platform docendo, which will be presented in the next section.

IV. The Open Learning Content Authoring and Management Platform docendo

docendo[1] is a web-based platform for the authoring, management and exchange of content respective resources for web-based trainings (WBT). It is composed of different editors (the Course Structure Editor, the Section Editor, the Testitem Editor, and the Metadata Editor). The main characteristics of docendo, which are described in [8], are:

- The provision of resources in a repository. Resources can have different aggregate levels, from assets to entire courses.
- The support of modular reuse and authoring by aggregation [8], which means that all existing resources from assets to sections can be modified by any author and can be integrated in a new training course.
- The integration of metadata editing in the authoring process in a transparent fashion and thus providing a high level of user friendliness.
- The support of collaborative authoring in groups.
- The strict separation of content from layout, thereby enabling instructors without specialized knowledge of HTML editors and multimedia tools to create self-study material by themselves.
- The adoption of data format standards such as Sharable Content Object Reference Model (SCORM) and Leaning Object Metadata (LOM) for content and metadata respectively to support

[1] docendo is available as open source software at http://www.docendo.org

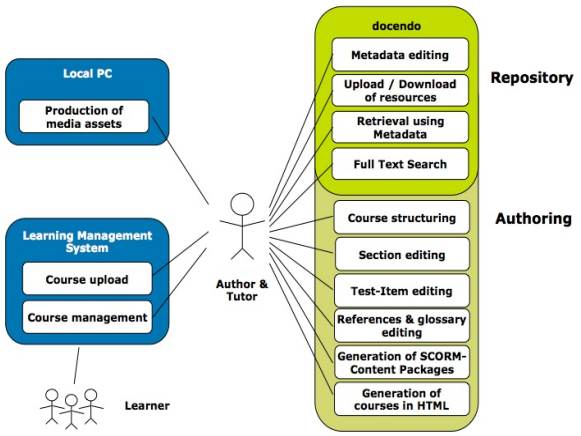

Figure 2: docendo Use Cases

the exchange of learning content across different platforms.

A. docendo Use Cases

The individual functions of docendo are shown in Figure 2. Only the creation of assets, like images, videos or animations, takes place outside the docendo platform using external tools. The resource repository offers search, upload and download functionalities. Complete courses are offered to the learner generally by using a separate learning management system.

B. Authoring and description of learning resources using docendo

The authoring of courses is done using various web-based editors, including the Course Structure Editor and the Section Editor. If an asset gets integrated in a section, it is stored in the repository and described with metadata. Here, the description is made using the LOM metadata set [9]. Specialized editors are provided in docendo for the authoring of specialized content such as test items, glossary terms or references.

C. Access to Learning Resources via a Learning Management System

Usually, a complete course is exported using an XSL-transformation to generate a SCORM-compliant content package [10] or an HTML-course. The author can save the course and import it to any SCORM-compliant Learning Management System (LMS). In an LMS, learners can subscribe for courses or a course is assigned to learners by a teacher. Access to the different sections of a course takes place according to the navigation in the course, sequentially in many cases.

V. Realization of Location Based Learning Content Authoring and Access in docendo

A. Challenges

Different challenges have to be solved in order to realize the scenario of location based learning presented in section 2. First, there are the challenges associated with the authoring process:

- The author should be able to create resources such as assets, including images or videos, and descriptive texts, work orders or questions for test-items using his mobile device.
- To describe the created resources with information about the location, the current location should be determined during resource acquisition. Location detection should be supported indoors as well as outdoors.
- The repository needs to be extended to support uploading resources and the metadata describing them, especially the location information, from mobile devices.

Furthermore, there are the challenges associated with accessing the learning resources by the learner:

- The learner should be able to search for courses which are related to his current location.
- If the learner processes a course with sections assigned to different locations, he or she should be routed to the appropriate places.

B. Extended docendo Use Cases

In order to solve the challenges we have shown, we implemented an application for a mobile device for the creation of resources and location detection. We also extended the functionality of a learning management system to deliver courses and sections based on the current location of the learner.

For learning we do not need a new mobile application. The existing browser on the mobile device is used to access courses and sections. Figure 3 shows the extended use cases. In addition we implemented a new XSL-transformation to better adapt the learning content to the constraints of mobile devices.

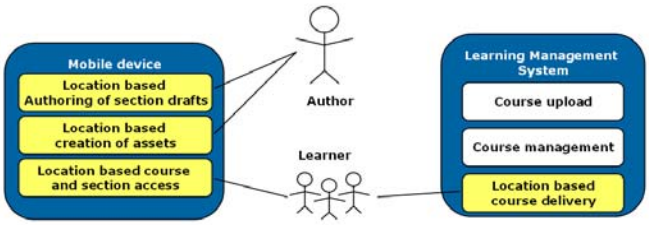

Figure 3: Extended docendo Use Cases

C. Application for mobile Authoring and Location Detection

We developed our mobile application for authoring on the Android operating system, serving as an editor for docendo. Therefore we have to map what we call stations in our scenario described in section 2 to sections in the docendo data model, as shown in Figure 4. Our mobile application consists of a simplified Section Editor, which allows the author to capture drafts of the learning units primarily in the form of text, see Figure 5. The teacher can assign one or more resources, which he or she created with his mobile device, particular photos or videos, to the section. All sections and the resources also are described by the location.

To detect the location we usually use the GPS coordinates. If these are not available, we use the coordinates of a query with HTML 5.0. Since this can be inaccurate, it is possible to adjust the position in docendo later. The location information is stored in the LOM metadata set using the field General/Coverage. All the resources together with the metadata are uploaded from the mobile device into the repository of docendo automatically. Using the docendo editors, the author can revise it at a later date. For this we have implemented a location based search filter in docendo. When searching for relevant resources, the author can specify a location and radius to find all resources whose location information meets these criteria i.e. all resources that fall in the specified region. This location based search filter is depicted in the highlighted circle in Figure 6.

D. Location based Learning Content Access

To provide a new course to the learners, it is first exported from docendo. For access via mobile devices, a special content transformation is used that

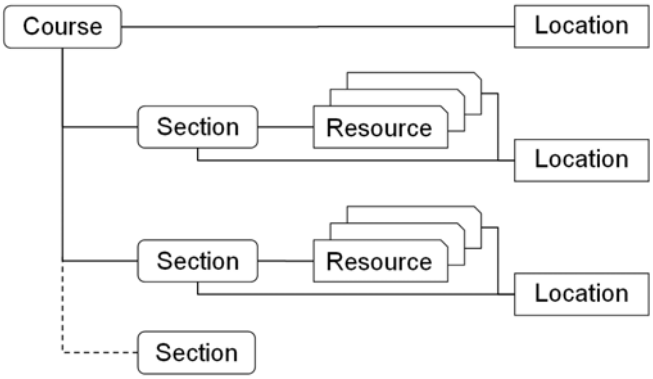

Figure 4: Mapping of stations to the docendo data model

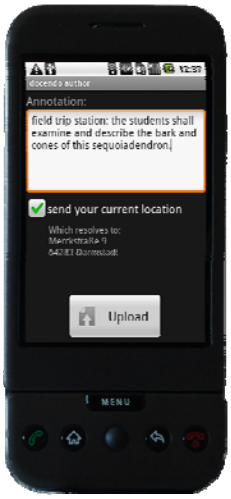

Figure 5: Section Editor on the Android Phone

reduces the padding and margin of content elements. That mobile version of the course is then uploaded to the learning platform. We have added two new interfaces for location based access to the learning platform, Moodle in our prototype. The first is a list view, in which the courses and sections are sorted by the distance from the current location of the user. The second view presents the sections in a map, based on Google maps. The current position of the user and all sections are displayed, as shown in Figure 7 (where the current position of the user is panned out of view and the shortest route to the selected learning object is highlighted in blue). The sections in either view can directly be opened by the learner with a single click.

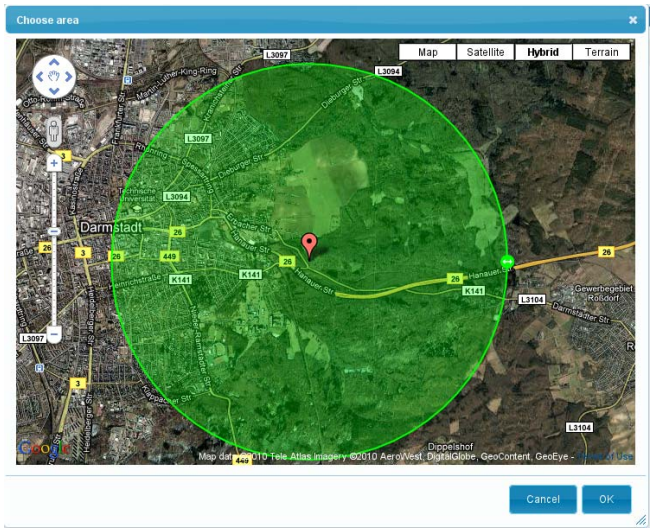

Figure 6: Location based search filter

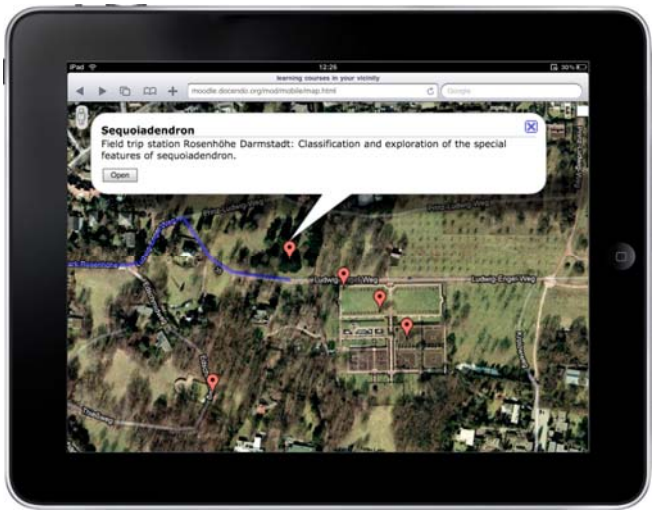

Figure 7: Map View on the iPad

To improve the learning experience when viewing sections on a mobile device, we had to modify the Moodle SCORM player since it reserved too much screen space for irrelevant information. We replaced all navigation elements with simple forward/backward image buttons and disposed of the large header area containing information about the course.

VI. Summary and Outlook

In this paper, we have presented docendo, an open learning content authoring and management platform, with extended functionalities to support the mobile authoring of location based learning content. An important new feature is the automatic mapping of the location of the author to the relevant learning resources collected at this learning station. In this way, the process of creating location based learning content for mobile learning scenarios, especially for field trips, is made much easier for the teacher. These extended features are currently being integrated into five installations of docendo used at universities in Germany and Switzerland. docendo is also available as open source software.

Although a comprehensive evaluation has yet to be made, individual feedback received from teachers using docendo has been positive thus far. A survey of the first users of docendo is planned in the coming months. In the future, we plan to investigate the collection and utilization of additional sensor information. For example, according to different users, the viewing direction would be useful context information.

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