A LOCATION BASED E-LEARNING SYSTEM

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Abstract: Much information is inherently coupled with a certain place. Accessing this information at the given place is often the key to understand it or at least it helps understanding the information much better than accessing it elsewhere. e-Learning systems free the learners from the chains of time and place. However they are normally used with PCs or laptop computers either at home or at certain premises. Especially in a city like Trier, which is full of history, it is easy to verify that learning about the Romans and seeing a picture of a historic site is different to the real world experience of this site. This reflection leads us to the idea to extend the capabilities of a conventional E-learning system in a way that information can be accessed where it can be understood more easily, i.e. on its place. Therefore we have extended the system MOVII (Moving Images and Interfaces), which is a flexible and visually appealing E-learning Platform with a possibility to geocode information entities and to access them appropriately.

1 INTRODUCTION

Trier is the oldest city of Germany. Therefore it is not astonishing, that it is a place, where everybody can observe many tourists walking through the city, contemplating roman ruins and other historic sites from the different centuries. One could ask the question, why people are doing this instead of sitting at home and reading a book about the city or watching a report on a DVD. However the answer would be relatively easy to give: To walk through the historic sites allows the tourists to gain a much deeper insight. In the case of Trier this means that e.g. walking through a gigantic roman city gate is obviously a different experience than looking at a picture of the same building. You can see the site from different angels, you can touch the stone, and you can experience the site with all your senses. The emotions that arise from this visit are completely different to the emotions that come from reading a book or watching a movie. It is easy to verify from personal insights that we remember facts about places we have visited much better than about places we have only read about.

What are the consequences of this observation? Much information seems to be inherently coupled with a certain place and accessing this information at this place helps to acquire knowledge or to learn about this place more efficiently.

The last sentence already implies what the core of a tourist visit of a city really is: It is learning about the city, about certain periods, about architecture, etc..

This again leads to another question. How do we learn today? Watching at schools and universities, etc. one can see that in the last years a trend towards computer supported learning becomes more and more common. Today many e-Learning platforms are available, like Ilias (Kunkel 2004), WebCT (Gurrie 2006), MOVII (Kluge et al. 2004) and many more. These platforms are well suited to make (pedagogically carefully elaborated) learning materials available wherever the user has network connection and a suitable access device however there is no concept to make the information available where it is meaningful to deliver this information.

This paper will describe a generic concept and a prototypic realization for an extension on the example of the e-Learning platform MOVII, which will be able to attach location information to the learning content.

The paper will start with the discussion of the different concepts of e-Learning platforms and location based guides. Afterwards, we will present the concept how to attach location information to e-Learning content. Finally we will present the realization of the system. The paper will close with some concluding remarks.

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2 LOCATION BASED GUIDES VERSUS E-LEARNING SYSTEMS

Several projects already deal with the issue of location based services.

The Moses project (Schneider and Greving 2005) for example used infrared beacons for position tracking, a commercially available PDA and a proprietary content management system for multimedia content.

In the area of mobile tourist and museum guides, different hardware settings are used for tasks like tracking, the delivery of information or the network connection. The focus however lies mainly on the accurate delivery of additional content to the exhibits or points of interest (e.g. Rocchi et. al. 2004, Cheverst et. al. 2000, Malaka and Zipf 2000 or commercial systems like the "Mobile Travel Guide" (Moltomedia 2006) or the BUGAButler (Blis 2006), only to mention some of them). One drawback of these systems is that they do not have an explicit pedagogic background or a special learning focus for the information that they deliver, whereas presentations for e-Learning systems have exactly this focus. In the museum scenarios the user is guided by the concept of the museum director who installed the exhibits in the real world. In the case of the tourist guides the user is often guided by the incidental regional proximity of Points of Interest. Another disadvantage is that the information is usually stored in proprietary formats and is therefore hardly reusable.

On the other hand there are mobile extensions to e-Learning systems. Trends for mobile learning (Kuszpa 2005a) rather deal with the idea to access learning materials with arbitrary devices over different networks. "Pocket University" from the Distance Learning University Hagen (Kuszpa 2005b) tries to reinforce learning using a mobile phone or a PDA to access material, which has been already worked on. The contribution from the University of Klagenfurt, Austria, to the Mobilearn project (Hitz and Plattner 2004) describes an innovative idea to augment paper based learning resources using a PDA but does not regard further the geographical location of the learning content. The commercial products "Mobile Learning Platform" and "Mobile Learning Engine" (Elibera 2006) also focus more on the idea of testing and reinforcing already accessed material. The University of Birmingham (Lonsdale et. al. 2005) has implemented a system for museum visits, which targets to support learning activities, which take into consideration the location of the user. However the system rather behaves like a conventional location based system. It supports the learning activities of a learner by delivering additional information to an exhibit but it does not guide the learner through the museum in order to achieve a certain learning outcome. Furthermore the system also uses an XML-based but not standardized format.

The conclusion of this discussion is that a location-based learning system should take into account the following points:

- Focus on Learning
  The system shall provide the possibility to design courses focussing on special subjects and learning outcomes. Furthermore there should be a relation between conventional learning situations and materials and the geocoded equivalents in a way that a learner can prepare or reinforce the mobile learning experience. Ideally she can use the same learning path in the mobile and in the conventional e-Learning setting.

- Reusability of content
  It is crucial to choose extending an e-Learning system towards location based capabilities. This procedure guarantees that already available content can be reused in mobile scenarios. Furthermore it stimulates the generation of content for special purposes, which can vice versa be used also in a non mobile setting. Additionally, if the e-Learning system respects already existing standards (e.g. Scorm 2006) the exchange of learning material with other e-Learning systems is also guaranteed.

- Geocoding of Content
  There must be a possibility to attach location information to learning resources where it is vital. Learning resources that have no spatial context (e.g. basic or background knowledge) do not have to be geocoded.

These remarks also motivate to choose a loose coupling of the systems in order to be as flexible as possible.

3 INTEGRATION CONCEPT

In the following section, we will describe the MOVII system, our integration concept and the basic architecture.

3.1 The e-Learning System MOVII

As discussed in the preceding section, it is not meaningful to write a new system from scratch, but to integrate a mobile extension for a location based service in an already existing e-Learning system. In our case this is done on the example of the e-Learning system MOVII (Kluge et al. 2004). In this paper, we will only give a short introduction into the ideas of MOVII, further information can be found at the project website (www.movii.de).

The system hierarchically structures the learning content into the following concepts: Module, Act, Scene, Core and Entity.

The core is an atomic structure, which refers to a certain learning content. A core can play different roles. It can be the core content to learn, as the word already implies. A core can also be an exercise; it can be more detailed information to this topic or a link to a completely different topic area. Furthermore the same core can play different roles in different learning scenarios. Whereas it can be an exercise in one scenario, it might be the relation to a different topic field in another setting. These different potential roles are called the entities of the core.

Related cores are grouped into scenes. Scenes belong to acts, which again belong to a module. A module covers a coherent topic field. In order to create a certain learning path a sequencing tool is used, where the teacher can arrange cores using a graphical user interface.

3.2 Mapping Learning Objects to the Real World

The task of the mobile extension is to find a way to attach positions in the real world to learning objects. In many scenarios it is sufficient to know the coordinates (longitude and latitude) of a point. For a museum context however one can quickly verify that more information is needed. Here, different cores can be on the same coordinate but in different stories of a building (altitude). They can also be very close together and the orientation of the user is vital information. In a museum it is crucial to know if a user looks in the direction of an exhibit or if the exhibit in her back. Both situations correspond to the same coordinate likewise.

The mobile extension basically structures its content into Points of Interest (POIs). For the reasons mentioned above we differentiate POIs and "inner" POIs. POIs can be specified using longitude and latitude (and can be identified e.g. using a GPS receiver). Inner POIs must be specified using other means, e.g. IDs (from Infrared beacons or RFID tags).

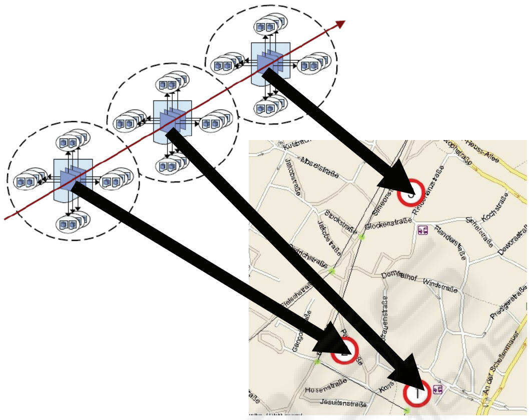

Figure 1: Mapping cores from a learning path to coordinates in the real world.

Figure 1 illustrates the idea of geocoding MOVII cores. The cores are already assembled to a learning path, whereas the cores in the middle specify the basic learning content and the cores grouped around in a shamrock like manner are exercises, examples, and links to other topic areas or in-depth information.

4 ARCHITECTURE

The architecture of the mobile extension to MOVII is based on a loose coupling between the systems. The mobile extension retrieves the information from MOVII and caches it in a local database via a web service interface, i.e. cores, learning paths, etc.. This allows an efficient interaction between the two systems since only an API is needed to interact with the e-Learning system. Interaction with other e-Learning systems will be also relatively easy to create because the system has not to be altered. Additionally it is not necessary to copy the whole database in one cycle, which would require a long pre-processing time. The local cache will be filled over time. Furthermore this procedure will speed up the response times since the already retrieved content can be serviced locally.

The relation between cores and positions is done using a specialised authoring tool, the "Route Designer". Right now we only support GPS coordinates. Cores can simply be dragged and dropped on a certain position on the map. A local database finally stores the information between cores and coordinates.

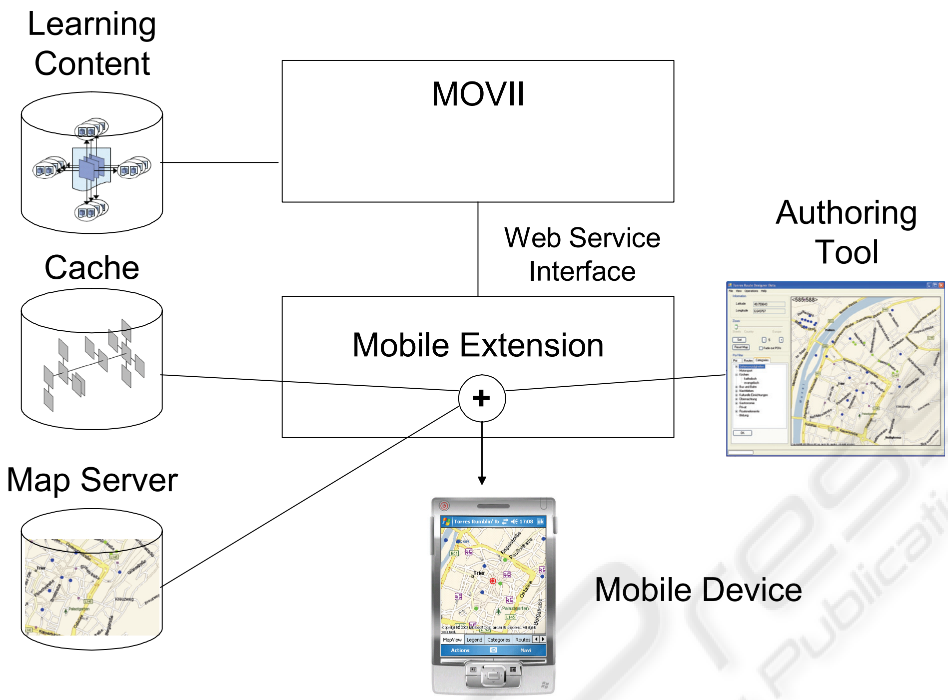

Figure 2: System Architecture.

In order to give the user an orientation on his mobile device, a map server is included, which visualizes the current position, of the user. Additionally the learning path can be visualized on the map. Routing information how to get to the next Point of Interest can also be displayed.

Finally a mobile device with a GPS receiver can access the content of the system via a wireless network (e.g. UMTS or WLAN). The GPS receiver tracks the user's position. If she approaches a referenced location, the system can activate a core and display the belonging information on the mobile device.

5 IMPLEMENTATION

The system is mostly written in C# and uses a web service interface in order to retrieve the information from the MOVII e-Learning system. Afterwards the data is stored in the local cache of the mobile extension, which is a MySQL Database. The system uses the Apache Torque extension (see Torque 2006) as object relational mapping tool.

The authoring tool, which creates the relation between cores and coordinates with the use of a graphical user interface, communicates with the system via a web service interface over an Apache web server. This authoring tool, the so called Route Designer is also a C# application.

As a map server we are using Microsoft MapPoint 2006, which runs as a web service under IIS. It also offers possibilities to scale the maps and to display routing information.

The PDA is a Fujitsu Siemens Pocket LOOX N560. The device has a 624 MHz Processor, based on Intel XScale architecture. The PDA uses an integrated GPS receiver, which supports the NMEA 0183 standard. It has a VGA display with a resolution of 480* 640 pixels. The device has WLAN, Bluetooth and Infrared connection.

6 CONCLUSIONS AND FUTURE WORK

Integrating location information into e-Learning systems is a very promising way to for tourist information systems. The system can reasonably guide visitors through cities along nicely elaborated learning path. They do not have to switch from one topic to another, only because POIs are next to each other. Furthermore the information is reusable and does not “belong” to a specialised, proprietary system. We strongly believe that his fact also motivates authors to create high quality content.

The realization has proved that the mobile extension does not have to be closely integrated into the e-Learning system. We have made good experiences with our loose coupling approach and we hope to be able to support also other e-Learning applications as well.

In the future we will address several extensions. Currently we are working on a much more sophisticated concept where cores can belong to more than one location, etc.. Furthermore we can only support GPS coordinates for our objects right now. In the future we want to implement a position abstraction layer, which can equally support other tracking technologies, for example Infrared or RFID.

Another challenge is the relation between the mobile and the PC based version of the learning path. A deeper integration of both versions in a way, that the mobile extension is much more aware of the learning advances in the PC based version and vice versa is desirable.

Additionally the integration of community service, where users can interact with each other and communicate about learning objects and POIs would be a further improvement of the system.

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