Mobile Lessons: concept and applications for "on-the-field" georeferenced lessons.

Antonio Pintus, Davide Carboni, Gavino Paddeu, Andrea Piras, Stefano Sanna
CRS4, Center for Advanced Studies, Research and Development in Sardinia
Edificio 1, Loc. Piscinamanna, Polaris
09010, Pula (CA), Italy
{pintux, dcarboni, gavino, piras, gerda}@crs4.it

Abstract

We have coined the term "Mobile Lesson" to express the concept of lessons carried directly on-the-field. Mobile is the keyword to be emphasised because all actors (teachers, students, tutors) of a Mobile Lesson are free to move in sites of educational relevance and, by means of mobile devices (TabletPC, PDA, smart-phone, equipped with GPS) and geo-referenced applications, are able to perform educational activities directly on the spot. Suitable disciplines for Mobile Lessons are history and biology and ideal scenarios are archaeological sites and natural parks. Each relevant point for the lesson is expressed in latitude-longitude coordinates and is called hotspot.

The Mobile Lessons technical infrastructure consists of a Web browser augmented with GPS capabilities and a Web Service able to generate dynamic content according to the actual position of the end user.

We have chosen a Web-based architecture because Web browsers are commonly available for a large number of platforms such as PCs, PDAs, and smart-phones.

The browser has been extended with a custom add-on able to read the current position from GPS hardware and adds a "User-Location" header to each HTTP request. The Web applications can return on-the-fly created Web pages tailored for the end user position.

Keywords: Mobile Lesson, GPS, Web

1. Introduction

We coined the term "Mobile Lessons" for lessons held outside the classroom. During a Mobile Lesson, all actors are mobile and have to move to perform the required tasks. Topics and disciplines that may be benefited from Mobile Lessons are geophysics and mineralogy in geography, monuments in history, trees and ecosystems in biology, distance measuring in physics and geometry, and dialects in linguistics.

Mobile Lessons are not a new teaching technology or methodology (Du Boulay et al., 2001), but they are a way to render lessons more efficient and more attractive using new communication technologies and mobile devices. Students can improve their knowledge directly on the field, looking for information, observing the real environment, and feeling more involved having the feasibility to behave autonomously (Rogovon, 1998). To integrate mobile devices in our "on the field" approach, we designed and implemented software that helps teachers to create and edit lessons that will be later delivered to students and accessed through mobile devices. Finally, it allows teachers to monitor students' activities while they are on the field (Giroux et al., 2002).

2. Organization of a Mobile Lesson

A Mobile Lessons introduces four main steps of realization. These steps are a sort of "guideline" toward the realization of a complete Mobile Lesson.

The first step concerns with the lesson design: teachers and/or tutors choose the scenario (e.g., an archaeological site or a natural park), go to the site, choose particular points of interests (called hotspots), and mark them with their GPS coordinates. Then, either in the hotspot or later in the school, they prepare the pedagogical material such as: historical information, hotspot descriptions, observation instructions, help, tips

and curiosities. They can, also prepare quizzes and tests both about the whole scenario and for particular hotspots. This entire step is performed by means of the Mobile Lessons authoring tool.

The second step is a "traditional" lesson in the classroom to impart to the students the background knowledge required to fully appreciate the contents of the on-the-fields experience. The lesson should also explain the technical equipment they are going to use.

The third step is the on-the-field experience. Students and teachers are free to move around the scenario with their mobile devices. Students have to discover the hotspots previously chosen by teachers and software provide them with every geo-referenced information produces by the teachers in the first step. The mobile lessons can be as a "treasure hunt", where students receive a score for every hotspot found and for every answered quiz.

The fourth and last step is performed "back in the classroom". Teachers conclude the lesson assessing the results of the experience and focusing their attention on pedagogical corrective actions for those students that have showed poor results.

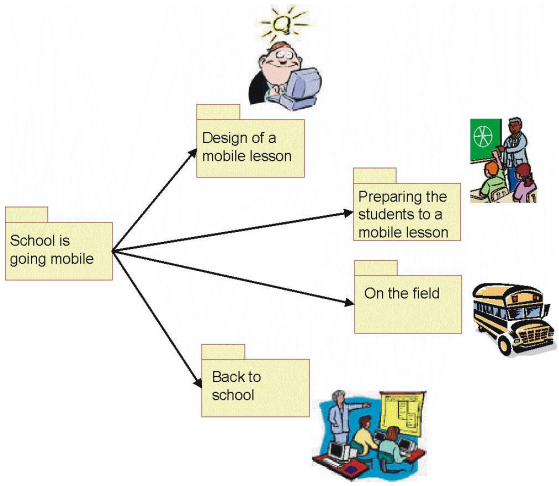

Figure 1.The four main steps of the Mobile Lessons concept.

3. Design goals

The three main design goals for the Mobile Lessons system are:

- devices must be online and communicate with a central server containing all relevant data. We deprecate the use of off-line devices with preloaded data because maintaining every device up-to-date is a tedious task;
- we do not want to write from scratch a brand-new multimedia interactive application in the device. We want to reuse as much as possible from existing software;
- we do not want to define and implement a new client-server protocol but instead we prefer to use a reliable implementation of the HTTP protocol which is well tolerated by firewall/router security policies.

4. The prototype

The design goals stated above leads to an architecture composed by a Web browser augmented with a GPS interface and a Web service able to generate dynamic content according to the actual position of the end user.

The "augmented browser" is part of the GPSWeb Project (Carboni et al., 2004). We have chosen a Web browser for three reasons:

- it is commonly used by a large number of users;
- it is included in a wide set of devices, such as PCs, PDAs, and smart-phones. Although each browser provides its own User Interface (UI) (sometimes customized with original solutions, such as tab panes or third-party toolbars), common basic functionalities are easily found and accessed by users;

The GPSWeb module is available for Mozilla Firefox and Microsoft Internet Explorer. The module reads the current position from the available GPS hardware and adds the "User-Location" HTTP header to each browser request. The Web applications returns on-the-fly created Web pages specific for the position in the header.

The clients are notebooks and Tablet-PCs with GPSWeb-enabled browsers connected through serial or Bluetooth ports to GPS devices and able to access to Internet via GPRS connections (although it can be used on small areas with wireless LAN coverage the application does not rely on a specific network infrastructure).

The Web application is developed in Java and PHP and a MySQL database is used to store any Mobile Lesson relevant information.

5. The experiment

The archaeological site of Nora, in the south of Sardinia, has been selected as scenario for our first Mobile Lessons experience. The site has thirteen hotspots such as the Esculapio's temple, the main roman street, the theatre, the thermal baths and so forth.

For each hotspot, the teachers specified the name, a brief description, quizzes, pedagogical material, and the radius of the area of interest (AOI) centered on the hotspot. When the students were on the site with their GPSWeb-enabled clients, they requested to start the quiz. If their position was inside the AOI for that hotspot the quiz was presented to students. Otherwise, no quiz was showed and the student score was decreased. All answers and requests were stored in the Mobile Lessons database.

The experiment has brought several positive considerations and indications about the concept and applications of Mobile Lessons. Teachers and students involved were very excited about the on-the-field experience marking the effective pedagogical validity of the whole project. Students find more interesting to have a direct contact with what they are studying and the competition among classmates is an exciting incentive. The teachers find software tools useful to author lessons, to prepare quizzes, and to make analysis on student answers.

6. Conclusions

Connected mobile devices provide valid support for instant information access and GPS-enabled browser improves data processing on server side. At the same time, on-the-field lessons are very exciting experience for both teachers and students. We have presented the Mobile Lessons experience, based on Web technologies such as the GPSWeb tools. By means of a standard Web browser, teachers can define and modify the lesson whenever they want (ever during the on-the-field lesson, if needed), while only information or quizzes related to a specific area are presented to students. Tests carried in the archaeological site of Nora have shown the practicability of this new mobile learning experience. Since wireless technologies are rapidly evolving, Mobile Lessons will have several benefits and we can imagine performing in the future the same experience with UMTS phones or Wi-Fi PDA.

7. References

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