Mobile Lessons and GPSWeb: Mobile Classrooms with georeferenced information

Davide Carboni, Antonio Pintus, Andrea Piras, Stefano Sanna & Gavino Paddeu
CRS4 – Center for Advanced Studies, Research and Development in Sardinia, Italy

Abstract

A complementary approach to the classic classroom lessons is represented by "outdoor–taken" on-the-field lessons. This approach is a way to get lessons more interesting and more attractive for the students. In fact, they can improve their knowledge directly on the field and feel more involved having the opportunity to behave autonomously while teachers have the opportunity to verify the student's knowledge without traditional paper-based tests and exams. The use of new communication technologies and mobile devices lets teachers and students to move on a site realizing a true mobile lesson. Based on such considerations and using the GPSWeb concepts and technology, we have developed one prototype able to support mobile and on-the-field lessons called Mobile Lessons.

Keywords: Mobile Lessons, mobile devices, Web, GPS, geographical coordinates.

1 Introduction

An alternative approach to the classic classroom lessons is represented by "outdoor–taken" on-the-field lessons. This approach is a way to get lessons more efficient and more attractive for the students. They can improve their knowledge directly on the field and feel more involved having the opportunity to behave autonomously [1], at the same time teachers have the opportunity to verify the student's knowledge without traditional paper-based tests and exams.
The adoption of new communication technologies and mobile devices lets teachers and students move on the site realizing a true mobile lesson. For each lesson there is a pathway containing a set of points of interest called hotspots and

expressed in latitude-longitude coordinates. Suitable disciplines for Mobile Lessons are history and biology and suitable scenarios are archaeological sites and natural parks. Activity related to Mobile Lessons has to be considered as complementary to classic indoor lesson [2]: it can substitute multimedia presentations or documentaries, offering pupils the concrete opportunity to experience what they have studied on books.

2 Technologies

To integrate mobile devices in our "on the field" approach, we designed and implemented a software that supports teachers in editing lessons to be delivered to students by means of mobile devices. Moreover, the software platform allows teachers to monitor students' activities while they are on the field.

The core of our software platform is called GPSWeb [3]. It consists of a Web browser augmented with a GPS interface and Web applications able to dynamically deliver content according to the actual position of the end user. A standard Web browser becomes a GPSWeb-compliant browser installing an extension module. To date, modules for Mozilla Firefox [4] and Microsoft Internet Explorer have been implemented.

The GPSWeb extension reads the current position from the GPS hardware and adds the custom "User-Location" HTTP header to each browser request. In this way, the GPSWeb based applications receive also the geo-referenced information and can adapt the content to deliver to user. The user is not required to manually insert his position: this task is automatically performed by the system.

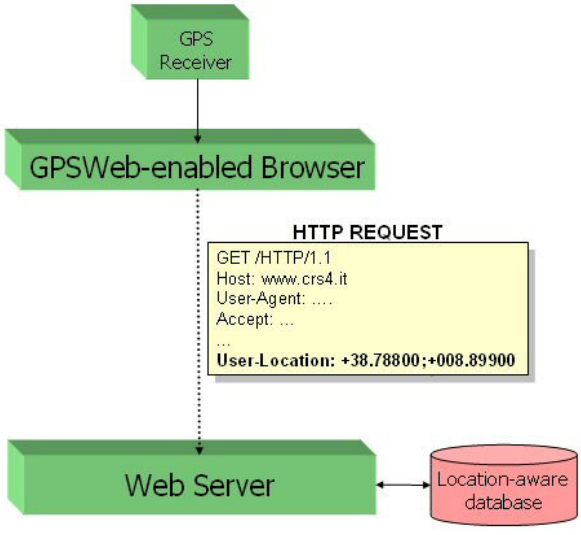

Figure 1. The GPSWeb architecture.

We have chosen to use Web browser and not develop an ad-hoc application for three reasons:

- it is commonly used by a large number of users;
- it is included in a wide set of devices, ranging from PCs and PDAs, to smart-phones;
- it allows developing applications using common scripting languages (JSP, PHP, ASP, and so on) and the existing ones can be adapted with few changes.

3 The experimentation

The hardware supporting the on-the-field tests are notebooks and Tablet-PCs with GPSWeb-enabled Firefox 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 any specific network infrastructure). The Web application is developed in Java [5] and PHP [6], data storage relies on a MySQL database [7].

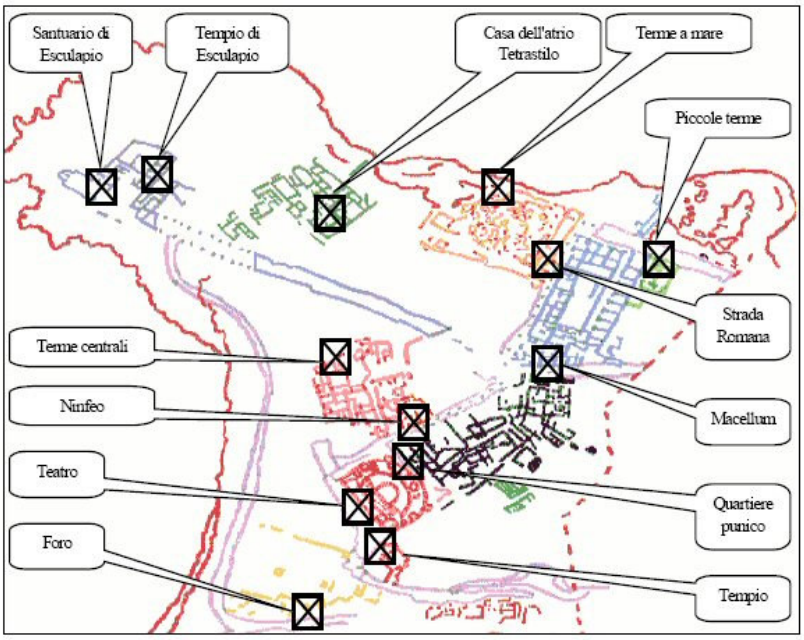

Figure 2. The site of Nora and the selected spots.

In order to test Mobile Lessons on a real world application, we have selected the site is Nora: the most wide phoenix-roman archaeological site in the south of Sardinia [8]. We have identified thirteen hotspots such as the temple, the main roman street, the theatre, the thermal baths, the forum, and so forth. For each hotspot, the teachers specified the name, included a brief description, wrote true-false/multiple choice quizzes, and provided other relevant material.
During the lesson, the students were conducted on the site with their GPSWeb-enabled devices. When their position was inside the area of interest associated to a hotspot they can read and answer the question relevant to that spot. The question is not showed if the students are out of the area related to the hotspot.
Tests carried in the archaeological site of Nora have shown the practicability of this new mobile learning experience.

4 Preparing and analyzing a mobile lesson.

A mobile lesson is not an isolate lesson but an element of a pedagogical sequence. It is based on previous lessons and its outcomes have to be reused in successive ones and to address students' lacks.
Before to apply a mobile lesson, teachers have to prepare and design it. The first tasks are to select a zone considering the course topics and individuate important places using software running on a mobile computer (laptop, PDA, or mobile phone) equipped with a GPS system and connected to Internet. The information gathered on the site can be completed with documentation and a set of tests and quizzes are defined.
During the classic in-door lessons preceding the mobile lesson, the teachers prepare the students exposing the theoretic argument. For example, before a mobile lesson in Nora site, teachers present the phoenix-roman age included between the sixth century BC and the third century AD. Furthermore, they show the map of the site, present the tasks to do, show also how to manipulate the devices and software, and build students' groups.
After the mobile lesson, teachers have the chance to analyze the results of the experience and, in case of poor results, focus next lessons on pedagogical corrective actions for those students that have showed.

5 Conclusions

On the field excursions are a complementary activity for classic indoor lessons, because they provide a unique opportunity to compare real world with knowledge acquired on the books. The Mobile Lesson approach involves student and teacher, making the learning experience more attractive, exciting and effective [9]. The three main design goals driving us for the definition of 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.

These design goals make possible to supply the lacks of the first draft of the Mobile Lessons architecture [10] that was a stand-alone application with the pre-loaded lessons and not able to establish wireless Internet connections.

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, mobile devices and GPS technologies. 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.

Since wireless technologies are rapidly evolving, we can imagine performing in the future Mobile Lessons experiences with UMTS phones or Wi-Fi PDA.

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