Collaborative Curriculum Development in Webmapping

Antal Guszlev (a.guszlev@gmail.com)
University of West Hungary, Szekesfehervar, Hungary
Ferenc Speiser (speiserf@mail.aut.vein.hu)
Pannon University, Veszprem, Hungary

SUMMARY

Webmapping has become a mainstream internet technology in recent years. The evolution of the *Web 2.0* phenomenon has accelerated this process. The most important developments like wikis, blogs, RSS feeds, AJAX, mashups, audio/video on demand, backpack and tagging have an enourmous potential in GI education also. This new generation of social networking paves the way for effective online collaborative work.

There is a need for a solid educational grounding in order to exploit the new possibilities. This paper focuses on the use of available online teaching tools and resources in the field of webmapping. Case studies and practical hands-on exercises are developed which are all based on freely available open APIs and open source solutions. After introducing visualisation methods and conceptual design issues, the underlying technological frameworks are described.

WEB 2.0 AND EDUCATION

User requirement analysis has shown that traditional ways of education are suffering to find appropriate and up-to-date teaching materials. Having access to some service installations is just the first step. Building up and providing exercises require a huge amount of additional time. You have to find data and load the different service repositories, you have to configure clients and import your data into catalogues. Often, you even have to deal with legal restrictions. Further on, if you want to show interoperability, you should have at least more than one installation involved, but synchronous, multiple set up is very labour intensive (Simonis, 2006).

Not all, but many of the above addressed problems can be solved by applying novel Web 2.0 education frameworks. The biggest advantage is that students become part of the constant updating process by developing their own solutions. Instead of solely concentrating on content development, the role of tutors should be to guide and evaluate the students.

The number of web tools available to learners across the planet increases every day, and teachers as well as students can be confused by the options. Which web 2.0 tool is appropriate for which educational tasks? The web 2.0 is totally *decentralized*: there are no set standards, no boundaries, no restrictions confining us to conform thoughts to any given set of rules and regulations (Benzinger, 2006).

Blogging has quickly become one of the most effective learning tools in education today. It introduces students with new methods of communicating and helps motivating them. We might say it even makes learning fun. Many students become so attached to their blogs that they make it a responsibility to keep consistent and up-to-date. Educators generally blog about school news, philosophies, and class activities. On the other hand, students tend to write about current events, personal beliefs, and topics related to their education.

Social *tagging* is having a great impact on existing small learning communities. In many cases, teachers in small learning communities share ideas and materials as part of their current practice. Online file sharing with social tagging can function as an extension to current teaching practice and introduce an easy way to recall relevant information. Tags add vitality and a personal touch to online

bookmarking. While discounted by some as a temporary and somewhat less precise method of categorization and search, interest in social tagging is growing. With the potential to personalize the Web to "my Web," social tagging technology will soon find its way into classrooms also.

GIS data capture and maintenance can be revolutionized by active participation. Just as millions of bloggers daily create and edit web pages to maintain their weblogs and thus revolutionise online journalism, so anyone with a location-aware device could potentially create their personal map. *Collaborative mapping* is an initiative to collectively produce models of real-world locations online that people can then access and use to virtually annotate locations in space (Mac Gillavry, 2004).

Mashups are reusing and combining available online resources to produce new, derived applications. Most typical cases of these web application hybrids are based on open map server APIs (e.g. Google Maps, Yahoo! Maps and Virtual Earth). They offer a wide range of possibilities and spatial operations starting from adding custom markers to accessing statistical databases via XML.

PUBLISHING MAPS ON THE WEB

Our proposed webmapping curriculum will cover the following fields:
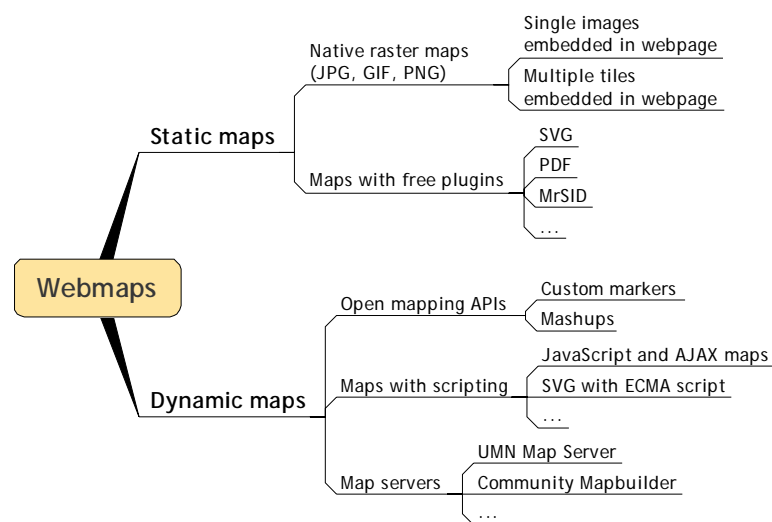
Figure 1: An overview of publishing methods.

Based on the above mentioned methods we try to give some examples for using open source GIS tools in education. There are two systems we will introduce. They are continuously under development. Both of them give a useful tool for the students to understand spatial relations through thematic maps, diagrams and tables. These systems give information of social statistics and environmental parameters for sociologist and environmental engineer students of Hungarian universities trough on-line web-portals. Both system gives a user interface to the students, they can customize the information wanted to analyze or visualize over a map.

CASE STUDY 1 – POLITICAL AND SOCIAL GEODATABASE

Since 1991 there has been a database on geoinformatics being built at the Budapest University of Technology and Economics (Department of Sociology and Communication). Primarily it stores data

of the Hungarian elections concerning various descriptive data about social and settlement statistics of voter citizen groups integrated to a certain extent into a single database system.

From the beginning to 2005 the system has been running on the same application platform (Oracle RDBMS, Arc/Info GIS), while the hardware and OS-platform has changed several times (Sun-Unix, Silicon-Unix, Sun-Solaris, Intel P4-WinXP).

The components of the system have been placed on free software basis from 2005 on (Linux, PostgreSQL, PHP). The whole database has been transformed into a portal over the Internet on the score of a unique integrated data model. With the system the opportunity presents itself to visualize data in form of maps with the assistance of open-source on-line geoinformatic software (UMN MapServer + Chameleon).

Modeling and visualization

What do we think about our world? A thematic mapping system can widely influence our way to seeing things or just support our hypotheses and the assumptions of data that we can only suspect by the facts concealed behind the prepared maps. It depends on us, how we use it…

However, the most important and interesting question is what kind of data we can draw on a map. To interpret the answer we have to know, how these maps can be produced. The essential property of the management (production) of digital maps, is that we always need two types of digital data. On the one hand, we need the data we want to represent in connection with its spatial attributes - generally these are numerical data enumerated in simple database tables. On the other hand, we need digital map-files. Its objects (districts, countries, towns) can be related to the current record of the represented database table.

Unfortunately, one condition of this dual requirement of the availability of digital maps is often not fulfilled. However, more and more (and even better) digital maps have been available in Hungary nowadays, although we still do not have as much digital data as needed (and we have not concerned the difficulties of the access to the existing maps). Certainly our statement above is only exact if we say that only a few satisfactorily detailed and accurate digital maps are available. An important property of digital maps is the resolution and the accuracy of the production that can naturally define how detailed data can be represented on them. For the spatial presentation of data it is necessary to correctly handle the polygon borders corresponding to its aggregation and/or collection level - namely it should be represented on the current map.

Of course, for the sake of fair visualization of the data over maps but even more for the interpretation it is not enough to harmonize the data aggregation level and the districts of the digital maps, it is also desired and important to collect and aggregate data on as low level as possible. The bigger the area of the aggregated data is, the less valuable it is.

Goals

From the beginning we have aspired to the data and databases being at our disposal be loaded into a unified and consistent system. This – continuously strong – intent to integrate (and the conversion and data cleaning work completed during the years) resulted in the system, which contains data from various sources stored and represented in uniform spatial- and time-coordinate system.

On this base, by giving the appropriate parameters, it was possible to achieve immediately newly generated maps without time consuming work. For this of course, we need to fit it to this uniform and integrated database a spatial software system (map server), that can draw the maps constructed from the database and the stored information in the files of digital maps.

Further development

In focus of our present development stands that we publish our database through the Internet, the way next to the bare data, we can attain the map representation of it also.

The aim is that everybody can make a map suitable for all their needs, based on its theme and the topics that is desired. Should somebody feel like making their own maps, type the http://mokk.bme.hu/atlasz URL into the address line of a browser and give it a try.
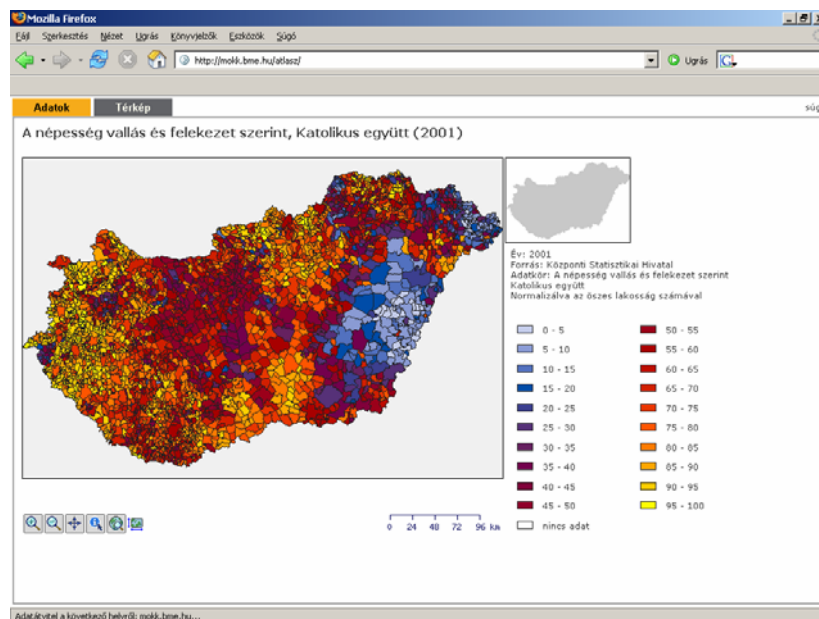

Figure 2: 2001 Census, Distribution of Roman Catholic religion.

CASE STUDY 2 – ENVIRONMENTAL MONITORING

Within the Faculty of Engineering of Pannon University a unique economic unit was established called "Sustainable Development Environmental an Informatics Cooperative Research Centre". This centre started an R+D project on the main topic of environmental protection and its technologies. This work is about the environmental informatics sub-program, which targets to work out the measurement methodologies of environmental pollution data, then measuring (monitoring) these. The main goal of the project is to make it possible to build and deploy an information system based on the collected data that can publish environmental data trough the internet as a web service.

In connection with the information system above, the local government/authority can elaborate an attractive, informative, up-to-date information service that provides data of the state of their environment for the inhabitant's purpose.

The database resulted by the measurements is a kind of data source possessed by the local authority, that can be efficiently used for preparing the yearly environmental report, as well as for supporting decisions where displaying of spatial information on maps has great relevance.

Goal

Resulted by the measurements performed as services, Pannon University can acquire that kind of measurement experiences, data which can make it possible to occupy a leading position among the similar faculties in Hungary and the universities and educational institutes of neighbouring countries also.

The goal is to develop an information system that is suitable for integrating, processing (average, statistics, limit), and then publishing environmental parameters (air, noise, water, soil and weather attributes) represented by database tables, diagrams, graphs and maps in the same way and that is accessible through the web. The system provides other related environmental data like environmental infrastructure (eg. treatment of waste), and can offer various environmental events as well.

Novelty of the system

During the preliminary consumer research and surveying the existing monitoring systems and services it was apparent that the air pollution-monitoring is the most important in the city-environment. Therefore the processing and representation of measured data is limited only to these parameters. However the planned system gives the possibility to manage series of environmental parameters and - after loading - publish them immediately.

The managed data is stored in a scalable, fast geodatabase by the system, which means it is easy to search and browse, so we get an easy to use device to achive data for modelling, spatial statistics, queries and surveys.

Since we use the same database for storing all type of environmental data, we don't run into the diversity of formats used by different measurement systems – what can make the data collection slower and harder – but only one query through only one user interface we can obtain the proper dataset according to our needs. The application differs from the other services in the mobility of measurements also. The measurements performed by a monitoring-car equipped by the proper measurement tools and devices. It is possible to make a daily or monthly repeated round-measurement by this car during an optional time period, so we can make conclusions, maps regarding the tendencies of the examined area.
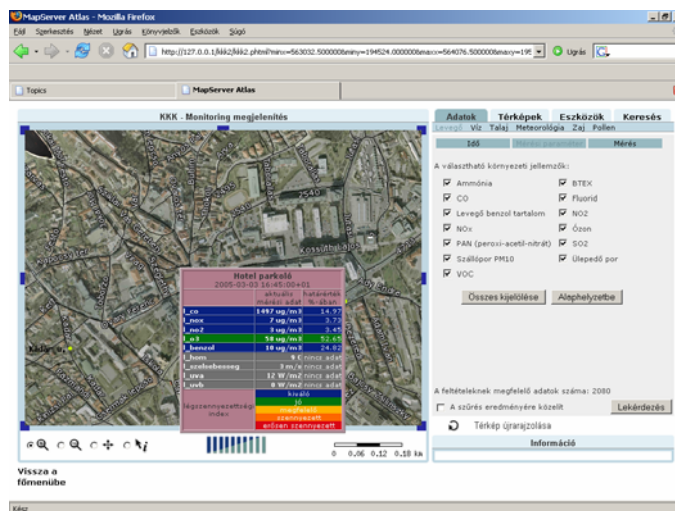

Figure 3: The user interface of the system.

The components of the system are working on a Windows 2003 Server operating system. These are open source (http://www.opensource.org) software. The developer-team decided to use the following tools:

- MapServer (http://mapserver.gis.umn.edu/)

- MS4W package (http://www.maptools.org/ms4w/)

- PHP/MapScript (http://mapserver.gis.umn.edu/doc44/php-mapscript-class-guide.html)

- Apache (http://www.apache.org/)

- PostgreSQL (http://www.postgresql.org)

- PostGIS (http://postgis.refractions.net)

If we pair appropriate logic to the components, we can form a data model to connect the environmental information system with an outside link even to the local government information system.

Use in education

One purpose of the development was the opportunity of utilization in the education. Since we talk about service which running on the server of the Pannon University, the students can insert their measurements that they prepared in a field-work. They can make their experiences, reports queries, hypothesis based on the spatial changes of parameters through the web-application and they can display it on a map of the related area.

During the measurements in the field they gain perfection in the use of devices correspondent to the present technology, and they can get to know the opportunities of the internet and the new technologies. Hereby their experience makes it possible to compare the old and new measurement procedures. The collected data by the students make an information basis that is perfectly appropriate for modelling environmental parameters at the observed area, and also for other analysis that requires much data.
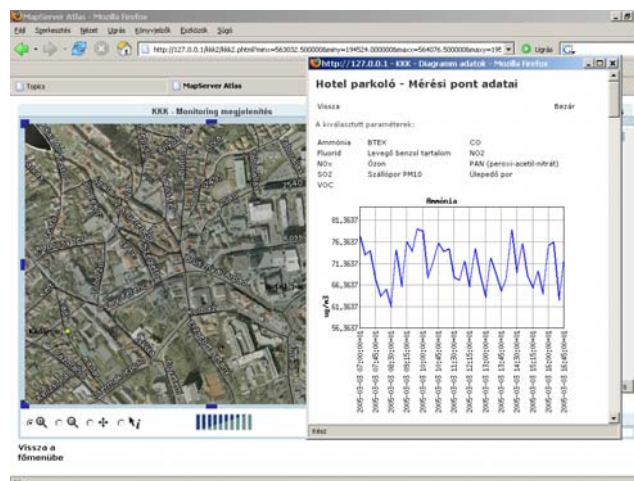

***Figure 4**: Diagrams of measurement data.*

BIBLIOGRAPHY

Benzinger, B: Back to School with the Class of Web 2.0 http://www.solutionwatch.com/519/back-to-school-with-the-class-of-web-20-part-3/

Mac Gillavry, E.: Collaborative mapping: by the people, for the people. SoC Bulletin. 2004 37 (2), pp. 43-45.

Mészáros J. – Szakadát I. – Speiser F.: "Tér-kép(elem)zés" In: Mészáros József, Szakadát István. 2005. Magyarország Politikai Atlasza 2004 Gondolat Kiadó, Hungary, Budapest ISBN: 963 9510 01 1 p.11-16.

Simonis, I. – Brox, C.: Teaching SDI and OGC, GSDI 9, Chile 2006

Speiser F. – Magyar I. – Jamniczky R. – Dr. Rédey Á.: Városi környezetmonitoring rendszer és eredményei, Országos Térinformatikai Konferencia (CD-ROM), Szolnok, 2006.

Storey, M.-A. - Phillips, B. – Maczewski, M. – Wang, M: Evaluating the usability of Web-based learning tools, Educational Technology & Society 5 (3) 2002 ISSN 1436-4522

Wachowicz, M. – Brox, C. – Reinhardt, W. (2005): Challenges on Advancing GI Education in Europe. GEOinformatics. 6(8): 10-13