

THE POSSIBILITIES OF USING CHOSEN JQUERY JAVASCRIPT COMPONENTS IN CREATING INTERACTIVE MAPS

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Summary

The availability, functionality and usability of interactive maps and digital representations of environment in Internet are on the rise. Their popularity results mainly from the technological progress and development of programming tools available as open source, and from the growing demands of users who are looking for specialist geoinformation services in Internet. The goal of this study is to analyse the possibilities of using chosen programming techniques and tools such as jQuery JavaScript components to creating interactive maps. JQuery was chosen because it is one of the most popular technology of making web applications.

The analysis was possible thanks to tests of three web applications created on the basis of chosen scripts, available under open source licence. The research showed that jQuery library can be used to creating web map applications but in a limited scope.

Keywords

map applications • web maps • digital representation

1. Introduction

The computer techniques developed since 1950s are finding many new applications mainly in creation of maps and carrying out spatial analyses [Miś et al. 2001]. These tools more and more often take a form of web application, giving their users access to data by means of a web browser.

Data available in Internet have different forms, from basic informational messages, through vertical portals (vortals) up to specialized systems of databases [Dziubiński 2012]. In turn, web applications by which these data are available, can be graphically sophisticated, functional and useful and thus attractive to users.

The number and availability of programming techniques are growing fast. The new technologies of making web applications, developed by communities of users, continue to emerge. The diversity of computer techniques means that they can be implemented in representations of digital data, including image geoinformation and geographic and cartographic data. Dąbrowski and Sawicki [2010] as well as Prus and Budz [2014]

suggest that the modern developments in information technology made digital forms of environment representation universally accessible. Longley et al. [2006] recognised advantages of this situation: relatively low cost of implementation, fast data transfer and simplicity of information retrieval. Barteleme [2005] and Gotlib et al. [2007] noticed that professional map services, gathering spatial data and enabling data analysis, are giving users the access to specialist geoinformation services.

Warcup [2004] and Kowalski [2012] observe the increasing popularity of Internet services, including localization and navigation ones, that take the form of tourist, road or city maps. Diverse geoinformation portals, including those run by the administration and local government, make more and more geodesic and cartographic data collections publicly available, and they can replace in the future printed sheets of topographic and reference maps.

Various navigation interfaces and services displaying maps are constantly improved. In the initial phase of computer technology development, data were presented as static raster images. Then they were replaced by applications with many functions. But still few services offer the raster images that can be comfortably and interactively used [Wężyk et al. 2004].

The goal of the study is to analyse the possibilities of using chosen programming techniques and tools to creating interactive maps with a primary function of zooming in maps that have the form of raster files.

2. Materials and methods

The above-mentioned goal could be achieved thanks to three prototypic maps that are part of websites and are prepared on the basis of chosen open source scripts. The maps were created with the help of raster studies of local developments plans [Król and Salata 2013] and a tourist map and environmental protection forms [Pietroń 2012] of the Tomice commune (Małopolskie voivodeship, Wadowice district).

Internet applications can be prepared by means of programming languages (PHP, Ajax, JavaScript, Java), libraries (OpenLayers, jQuery) or complex open source components (GeoServer, PostgreSQL, PostGIS) [Delipetrev et al. 2014].

The assumption was made that the fundamental function of the proposed applications would be the presentation of spatial phenomena and its basic functionality – the possibility of magnifying its fragments. The application jQuery JavaScript was chosen, version 1.4x and 1.7x (jquery-1.7.js), issued on the 3rd of October 2011, which was embedded in hypertext as standard XHTML document.

The first edition of jQuery was made available in 2006. The library has quickly gained recognition and became one of the most popular technologies used to creating web applications. Among its advantages are relatively simple implementation in the standard XHTML document structure, flexibility (it can be easily transformed and modified) and numerous possibilities of adding functionalities to it [Verens 2012, Bennet et al. 2014]. David [2011], McFarland [2012] and Li and Li [2013] believe that by using jQuery JavaScript library one can improve the process of creating websites

and increase their attractiveness by enhancing their interactivity and dynamic form of content presentation.

The jQuery library is available under Open Source GNU General Public Licence and MIT (Licence X11), which give unlimited rights to use, copy, modify and distribute (including sale) the original or modified programme. Usage of complete scripts in a form of programming base is possible if the licence conditions are respected and requires only providing the information about its author.

The programming base of used scripts was modified and given a graphic interface by means of cascading style sheets (CSS) that allow to define the presentation (display) form of a hypertext document.

The basis for presented information were vector maps transformed into raster files. The presentation was than divided into rectangular (usually square) primary fields. The raster structure is a natural data structure of digital image. Individual raster cells are called pixels, which form a mosaic "representation". This in turn can be interpreted by the user.

The rasters in the project were saved with "*.jpg" or "*.png" extension. JPG (Joint Photographic Experts Groups) is one of the method of saving images. It is characterized by high degree of compression, smooth colour change and lack or small number of sharp edges and details. PNG (Portable Network Graphics) is a raster graphic file format that supports lossless data compression. Files with extension "*.png" have distinctly better quality than those with "*.jpg" extension and are only slightly larger in size.

Raster graphics used in the projects of applications is a result graphics, free and passive. It is called the "result graphics", because it is the result of merging thematic layers and transformation to a raster file; it is free because there is no direct link of a created raster with GIS software; and it is passive because of its character. Moreover the raster graphics as a base for interactivity is not accompanied by additional information and any databases.

The applications that are prepared this way were located on the server (Table 1) and tested as to their validity and usability.

Table 1. Internet addresses of applications developed with jQuery library

Use	jQuery tool used	Internet address
Zooming map of local development plan of the Tomice commune, fragment	Cloud Zoom	http://www.homeproject.pl/ZoomBox2
Zooming map of local development plan of the Tomice commune, fragment	Image Lens	http://www.homeproject.pl/ZoomLens
Tourist map and forms of environmental protection of the Tomice commune	Gzoom	http://www.homeproject.pl/ZoomBox3

Source: authors' study

Validation in exact and computer sciences determines what action should be taken to ensure that the procedures, techniques and tools lead to predicted results. In the case

of web projects development it means verification of the syntax correctness of the web code by means of independent application or web browser plug-ins.

The validation of the created applications was carried out with the use of a cross method. It consists in checking the syntax correctness of the code by at least two mutually independent tools [Król and Salata 2013]. The software of W3C (The W3C Markup Validation Service), the organisation setting the worldwide standards of creating websites was used, and the software HTML Validator, which is an extension of Mozilla Firefox web browser.

The functionality of applications was added by means of such tools as jQuery Cloud Zoom, Image Lens and Gzoom. They enable to programme interactive zooming of the map view in the window of hypertext document browsers. The tools differ in programming structures and the way the functions are made.

jQuery Cloud Zoom and jQuery Image Lens are components that can magnify the detailed images. The tools can be used to presentation of raster graphic maps of large sizes, for example 4000 x 3000 px, in a small workspace window. The components display map miniature, which can be explored by means of an interactive lens. The fragment of a map under the lens is displayed as magnified in an additional window. In the case of jQuery Image Lens the interactive lens is at the same time the display window of the enlarged map. The magnifying lens is round and its attributes are definable. It is the diameter and framing, among other things, that can be configured.

The component jQuery Cloud Zoom in a basic version (the programming base) was developed and made available by R. Cecco [2015]. The jQuery Image Lens plugin was developed and presented by M. Soni [2015] as part of MIT License.

jQuery Gzoom is a plugin that allows to zoom in and out the map view in a window of defined size. The characteristic feature of the script is a navigation menu as a horizontal slide and navigation icons. Moreover the magnifying effect can be achieved by a computer mouse cursor.

The basic version of the JQuery Gzoom plugin (the programming base) was developed and made available by G.B. Lenoci [2015] and is dual licensed under the MIT and GPL licences.

The use of jQuery components presented in the study is free of license charge (also in commercial projects) and their source code can be freely modified.

3. The examples of application

Application of jQuery Cloud Zoom and Image Lens scripts is presented on the example of maps of land plots intended use in a local spatial development programme (MPZP) of the Tomice commune [Salata and Król 2012, Prus and Salata 2013].

jQuery Cloud Zoom allows to zoom in and explore a given raster file in a web browser window. The script can be used in maps services with frames that do not fill the whole space of a web browser window, which means that they take up only its fragment, e.g. 1000 px of a screen's width. The component allows to develop a cartographic compilation of large size. The interactivity of jQuery Cloud Zoom is based on a rectangular zooming tool by

which a user can move through the map's miniature. The area of user's interest – being within the scope of a lens – is presented in a real time in a window next to it (Figure 1). The application is created according to XHTML 1.0 Strict specifications with Cloud Zoom v1.0.2 scripts and jQuery JavaScript Library v1.7 (Table 2).



Source: authors' study based on the part of the local spatial development programme of the Tomice commune [Król and Salata 2013]

Fig. 1. The example of jQuery Cloud Zoom usage in a local spatial development plan of the Tomice commune

Table 2. Web standards used in making the applications

Application	Programming techniques and web standards used
Zooming map of local development plan of the Tomice commune, fragment	Cloud Zoom v1.0.2 jQuery JavaScript Library v1.7 XHTML 1.0 Strict Valid CSS 3.0
Zooming map of local development plan of the Tomice commune, fragment	jQuery Image Lens jQuery JavaScript Library v1.4.2 XHTML 1.0 Transitional Valid CSS 3.0
Tourist map and forms of environmental protection of the Tomice commune	jQuery Gzoom jQuery UI CSS Framework XHTML 1.0 Strict

Source: authors' study

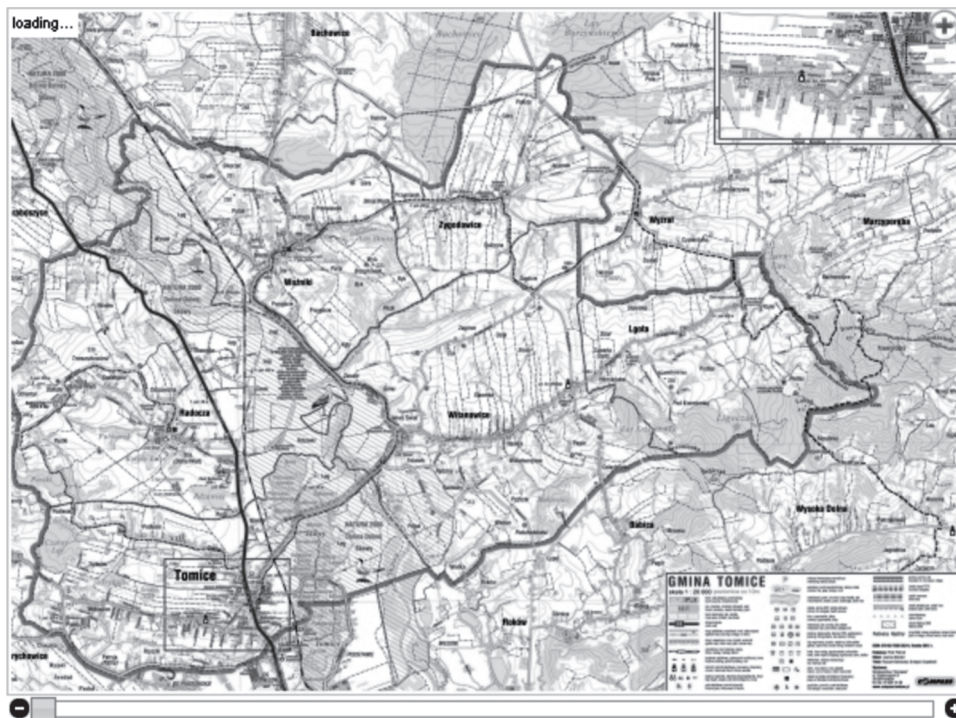
Another application was created with jQuery Image Lens. The script allows for programming the image magnifying effect by interactive lens. The raster development is magnified directly in its window which plays the role of magnifying glass (Figure 2). JQuery Image Lens can be used in presenting raster developments of relatively large dimensions in small workspace window. The option of rounding up the lens can be used only in recent versions of web browsers. The application is created according to XHTML 1.0 Transitional with jQuery Image Lens and jQuery JavaScript Library v1.4.2.



Source: authors' study

Fig. 2. JQuery Image Lens, map zooming in by round lens

In another application jQuery Gzoom component was used. The way the script works is shown on the example of tourist map and forms of environmental protection of the Tomice commune (Figure 3). The application was created according to XHTML 1.0 Strict specifications with jQuery Gzoom and jQuery UI CSS Framework (Table 2).



Source: authors' study based on Turystyczno-przyrodnicza mapa gminy Tomice [Pietroni 2012, Tomice 2015]

Fig. 3. Graphic form of navigation jQuery Gzoom

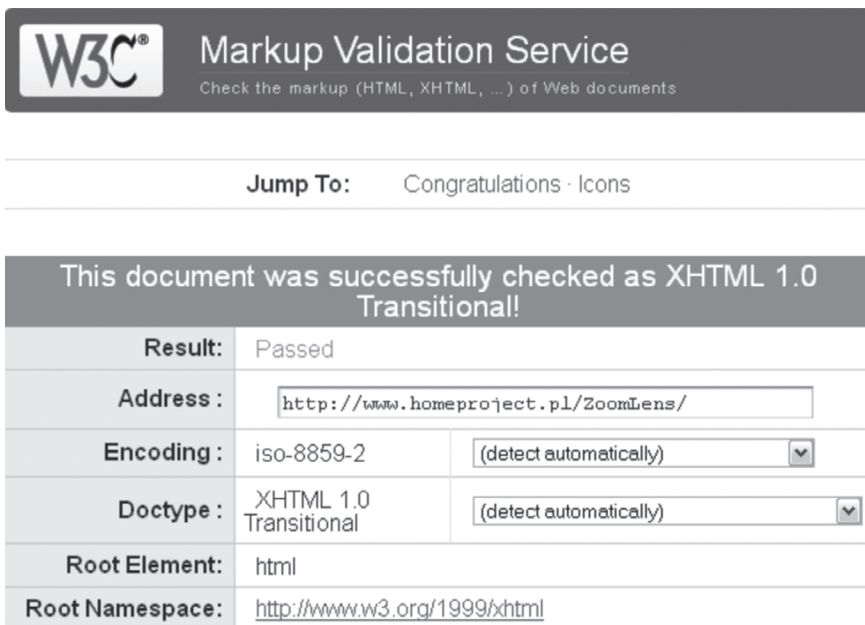
4. Results and conclusions

Cross validation tests showed no syntax error in the structure layer (HTML) and presentation (CSS) of created web applications.

Usability tests of created applications (user's evaluation) allowed to characterise the proposed programming techniques and tools. The following advantages of the presented jQuery scripts can be singled out:

- the simplicity of applications structure and of transformation of the complete programming base, simplicity of script implementation in the structure of hypertext document,
- the possibility of displaying relatively large raster graphic images in a limited workspace window; the ergonomics of applications can be effectively designed and their usefulness increased,
- to add dynamics to static raster developments,
- universal applicability expressed by the possibility of launching the application in any web browser (provided it is updated), also when it is offline, on any data storage device,

- the ease of modification and development of applications,
- no limits in implementation; the presented scripts can be embedded in any hyper-text document,
- non-invasive character of jQuery code, which can be entirely saved in an external JavaScript file; code separation is good for creation of universal scripts which can be used again in other applications,
- reliability and maintenance-free character; applications created on the basis of presented elements do not require maintenance or servicing,
- relatively low technical requirements and ability of processing data and their size; applications can be launched only if the user has updated web browser.



W3C Markup Validation Service
Check the markup (HTML, XHTML, ...) of Web documents

Jump To: [Congratulations](#) · [Icons](#)

This document was successfully checked as XHTML 1.0 Transitional!

Result:	Passed	
Address :	<input type="text" value="http://www.homeproject.pl/ZoomLens/"/>	
Encoding :	iso-8859-2	<input type="text" value="(detect automatically)"/>
Doctype :	XHTML 1.0 Transitional	<input type="text" value="(detect automatically)"/>
Root Element:	html	
Root Namespace:	http://www.w3.org/1999/xhtml	

Source: authors' study

Fig. 4. The result of a syntax validation of a jQuery Image Lens code

The disadvantages of the presented jQuery scripts used to creating map developments:

- limited functionality, which boils down to only magnifying raster maps view; it requires other techniques to increase interactivity and usefulness,
- possible divergence when displaying chosen navigation elements in different web browsers, or impossibility of their display; it largely results from the fact that web browsers are not adjusted to changing web standards,

- technical limitations resulting from using raster files of a size more than a few megabytes, which significantly limits the usefulness of the application or makes it useless on computers with slow Internet connection,
- the code becomes quickly out of date; some implementations are quickly replaced with the new and better ones due to the advance of programming techniques.

5. Recapitulation

The conclusion of this study is based on analysis of structure and functioning of map components developed with chosen computer techniques and tools. In the article a few examples have been given of applications equipped with primary functionality that consists in interactive magnifying the map created as a raster file.

The scripts jQuery presented in this study can be successfully used to browsing rather small maps, based on a raster file. Simplicity of their structures and implementation sets the limit of their functionality. The tests carried out and the characteristics of the presented applications prove that they are mostly effective when they are components or fragments of a larger, more advanced map service. They can be also used as an image information extension of a text, but the dynamics and interactivity of the information can be limited.

The limited functionality of scripts are compensated by numerous advantages. The most important of them are accessibility, non-invasive character and simplicity of implementation and modification. They are called plugins, because at any time they can be plugged out of the base document and replaced by a newer, more functional and more useful version. That is why jQuery library is constantly developed and its new implementations and functions are continually created.

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