COMPARATIVE ANALYSIS OF INSTRUMENTS USED TO MODIFY TEMPLATES IN CONTENT MANAGEMENT SYSTEMS

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Abstract
Contemporary websites become the primary, and often the only communication tool for the majority of enterprises and organizations. However, they require frequent updating of content. In such cases, content management systems (CMSes) become a dedicated solution. Due to the large offer of commercial and non-commercial CMS solutions, making the right decision is strictly connected with the costs generated by the said systems. Templates, which define the layout of a website, are a crucial element of every content management system. The following paper attempts to answer the questions whether templates can be modified by using the publicly available tools without the necessity to involve IT specialists and, consequently, incurring additional costs of making such changes.
Keywords: *Content Management System, templates, Cascading Style Sheets, websites.*

1. Introduction

Content management systems are a very frequently used tool to build contemporary websites (Figure 1). They have been functioning on the Internet technologies market since mid-nineties. They are based on the PRISM (*Presentation of Realtime Interactive Service Material*) system of the American company CNET, in which a website template with the content read dynamically directly from a relational database was used for the first time (Wieczorkowski, 2015). The dynamic development of content management systems occurred at the beginning of the 21st century.

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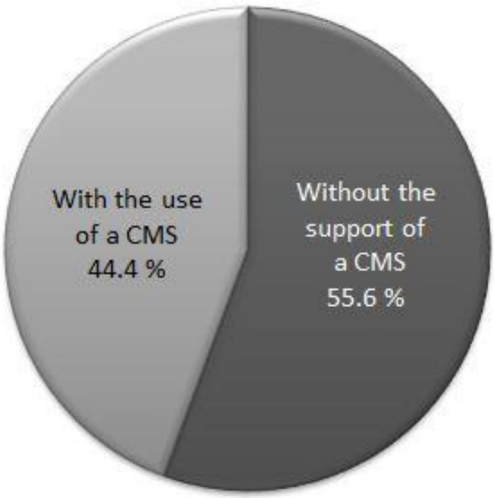

Figure 1. The use of content management systems (CMSes) to build websites
Source: Q-Success Software Quality Management Consulting on W3Techs – Web Technology Surveys websites (https://w3techs.com).

The main advantage of content management systems is the possibility to edit the content easily without having specialist knowledge of Information and Communication Technologies. It is enabled by the construction of the content management system, in which the content of a website has been separated from its layout. New information constituting the website's content entered by authorized users reaches the database. Each indication of a website address by the clients using a browser results in the CMS generating the relevant website on the basis of the content stored in the database and the template defining the website's layout. This enables a relatively quick and very flexible management of the content of the information published on the Internet. Whereas the content editing is performed with the use of simple tools included in the user interface of a content management system. Modern CMSes allow for the modification of not only the document's content but also its structure (Nalepa, Ligęza & Wójcik, 2007; Zakrzewski & Stroińska, 2009; Matysek & Tomaszczyk, 2009).

The aim of this paper is to analyze the possibility to change the graphic templates of content management systems beyond the modification frames of graphic elements provided for in the said systems. The analysis mentioned above will discuss only the methods which do not generate additional costs for the users of a content management system.

2. Content management systems (CMSes)

CMSes are most frequently built on the basis of a platform comprising a web server with an embedded PHP module and a MySQL or PostgreSQL database server, i.e. open source systems operating under the GNU General Public License (Prauzner, 2015). ASP.NET and JAVA technologies are much less frequently used in this case, while Microsoft SQL and ORACLE are not very common in the case of database servers.

The offer of content management systems is very broad and comprises several hundred systems, not including dedicated systems, i.e. developed for certain entities. A large proportion of publicly available CMSes is free. Those systems constitute at the same time a group of the most frequently used content management systems. The ones we can distinguish are WordPress, Joomla! and Drupal. The said systems constitute in total over 60% (Figure 2), and with respect to the statistics including Polish websites – over 80% (Figure 3) of the most frequently used CMSes (according to the data published by Q-Success Software Quality Management Consulting on W3Techs – Web Technology Surveys websites and the ICT BuiltWith® Pty Ltd forecasts and technology trends website).

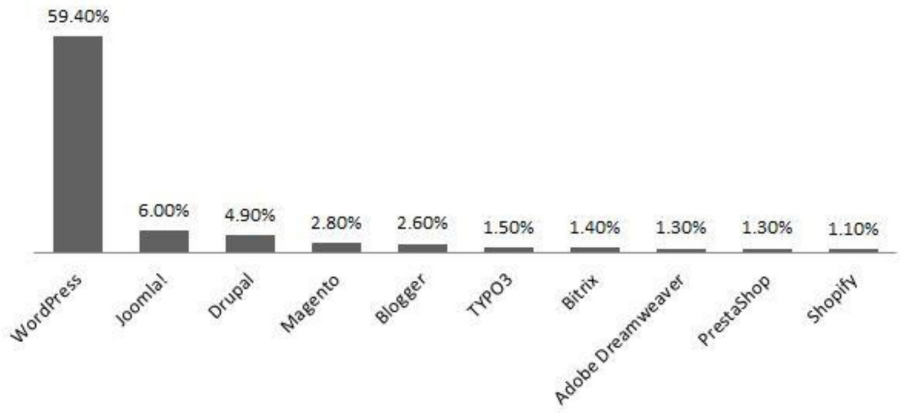

Figure 2. The statistics concerning the use of content management systems in building websites worldwide

Source: Q-Success Software Quality Management Consulting on W3Techs – Web Technology Surveys websites (https://w3techs.com).

The WordPress system operating since 2003, based on PHP and MySQL technologies and distributed under the GNU license (http://www.gnu.org) is an absolute leader in this case. It is also a very dynamically developed system.

Since 2003, several dozen versions of this systems have been created. The latest version – 4.5.2 – was released in May 2016 (https://wordpress.org).

A slightly less popular system – Joomla! – is based on the same technologies (PHP and MySQL) and, similarly to WordPress, is an open source system. Since its first launch in 2006, a dozen or so versions of this system have been created. The latest version – 3.5.1 – is the first in the 3.5.x versions series, released for the first time in March 2016 (https://www.joomla.org).

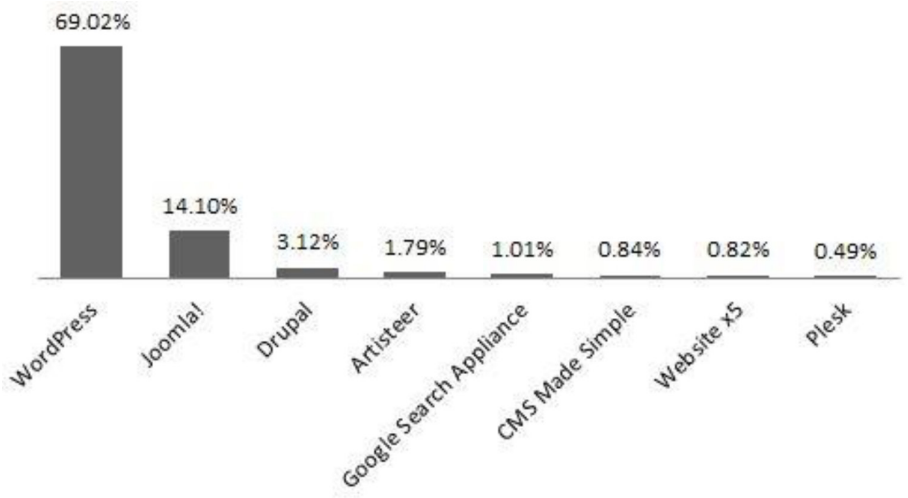

Figure 3. The statistics of the use of content management systems in building websites in Poland

Source: On the basis of the data of the ICT BuiltWith® Pty Ltd forecasts and technology trends website (http://trends.builtwith.com/cms/country/Poland).

The third most frequently used system is Drupal. Like previously mentioned systems, this one was also created in PHP. However, it can support different database servers, starting from MySQL, through PostgreSQL and SQLLittle, ending with Microsoft SQL. This system is developed as dynamically as WordPress. It appeared on the market in 2001 and since then several dozens of versions of this system have been created. Its latest version is 8.1.2, which was released on 1 June 2016 (https://www.drupal.org).

3. Graphic templates

The use of a model dynamically combining the content collected in the database with the template defining its layout enables not only a flexible exchange

of the website's content through its easy editing but also has an additional advantage of an equally easy mechanism of exchanging the website's layout through the use of a new template.

The templates, usually prepared by graphic designers specializing in building layouts for websites, are coded in the form of relevant rules of Cascading Style Sheets (CSS). They define the properties of individual elements forming a website's template.

Modern templates define not only the properties related to the appearance of individual markers but also the correlations between them and their allocations in the area of presentation of the website's content. A large number of elements forming the template, cascading correlation between individual definitions similar to the inheritance mechanism used in object-oriented programming and division in which individual elements are distributed, make the simple definitions of CSS's properties create an often complex structure, very difficult to interpret without specialized tools.

Therefore, the change of a website's layout requires an appropriately prepared template. The user of a content management system may use for this purpose ready-made templates shared by the authors of individual CMSes. Websites sharing free and commercial templates for individual content management systems are also available. Examples of such websites are among others: www.subrion.org, www.freecmstemplates.com, www.template.net, and themes.cmsmadesimple.org.

It is also possible to commission the creation of a dedicated template for the built website. Such a solution guarantees that the template will meet our expectations and will not require further modifications. This, however, entails some costs we have to bear.

All options mentioned above lead to the use of a ready-made template. If we focus on the lowest costs of obtaining a template and use one of the free distributions, we have to take into account the fact that it may be difficult to find a template that meets all of our expectations. We also have to be aware that the pool of free templates is publicly available, which means that the layout of our website will not be unique and, consequently, it may not be easy to achieve one of the marketing objectives, i.e. to distinguish oneself from the competition (Wit, 2009).

So how to obtain a template that is unique and adjusted to all our needs while keeping the costs to a minimum? A good solution would be to modify a free template so that it meets our needs. Yet any interference with the code of CSS files that store the properties of individual website elements without specialized tools may not be easy and frequently entails the necessity to involve a qualified specialist to make such a modification, which results in the increase of the related costs.

It also turns out that modern browsers have an embedded tool that significantly facilitates the modification of a template and allows for making potential changes with a minimum knowledge of the CSS technology.

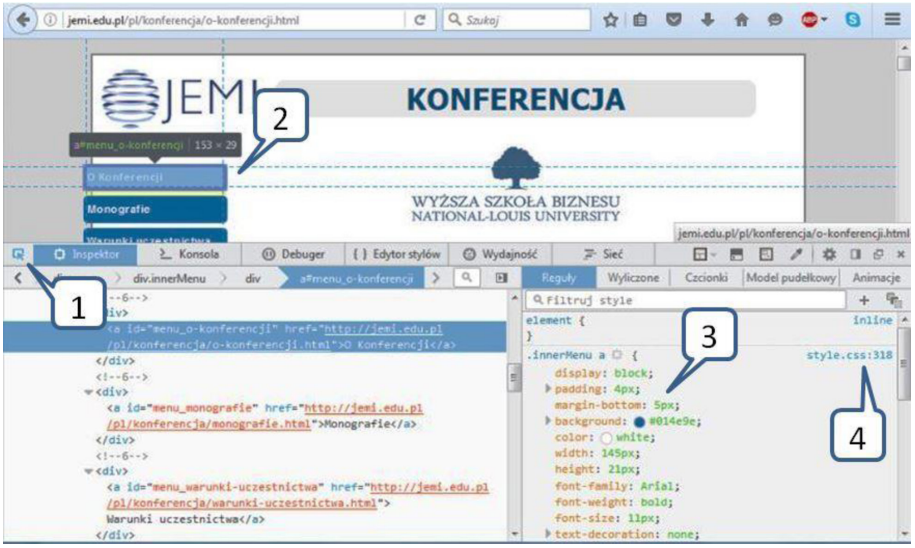

Figure 4. The work area of Firefox browser with enabled Developer Tools. 1) starting the elements indication mode, 2) the indicated element, 3) CSS definitions describing the properties of the indicated element, 4) location of the properties in CSS files

Below we will analyze the procedures for changing a website's layout through the modification of the template, with a particular focus on the maximum reduction of costs, i.e. with the use of publicly available and free tools.

4. Modification of templates in Joomla!

Although this system is not the leading content management system in terms of frequency of use, it has the most user-friendly interface which can be used in order to modify graphic templates.

In the default installation of the latest 3.5.1 version of Joomla!, we get four templates. The system administrator interface enables a simple modification of several parameters of each of the templates installed by default. The changes include the possibility to add a logo of an institution or a company to the template, select one of the several available color schemes, and a very

simple modification of the font of the text the website will use. These minor modifications allow for a slight diversification of the available templates. However, they cannot be considered sufficient, in particular in terms of distinguishing the website from the competition.

As an administrator, we can simultaneously edit all files, including CSS format files that store complete information about the layout of the template installed in the system. We can move to the editing mode by selecting the chosen template. It shows among others a list of all files comprising the template. In the case of templates prepared for Joomla!, CSS files are located in a catalog of the same name, which facilitates their location. When we open it, we get the possibility to edit each of them in a very convenient editor which highlights the syntax.

Unfortunately, in most cases, CSS files constitute a very complex set of definitions of the properties of individual elements. Their modification in the editor without adequate qualifications or an appropriate tool facilitating such modification is very difficult.

Aid is provided by modern browsers, and more specifically the embedded programming tools called Developer Tools. They are used by all of the most common browsers, both Microsoft's Internet Explorer (from version 11) and the new Edge browser, Mozilla's browser – Firefox (from version 11), Google's browser – Chrome, and Safari browser dedicated to devices with Apple's IOS system. In the latter one, this tool is called Web Inspector. It is available from versions iOS 6.1, and its activation requires an additional selection of the appropriate option in the menu. The Web Inspector is activated through the menu or shortcut key Ctr+Alt+I. Unlike in the case of other browsers, where Developer Tools are enabled by selecting the F12 function key.

In the case of website templates, this tool is perfect for locating the relevant definition in complex CSS files through the indication of the selected element of the website with the mouse cursor. In response, we get the definition of cascading style sheets for a given element with the precise location of the definition (name of the file and number of the line). Having this information, we are easily able to make individual changes in the relevant file that define the properties of a given element.

The template modification procedure with the use of Developer Tools is therefore performed according to the following diagram (Figure 5).

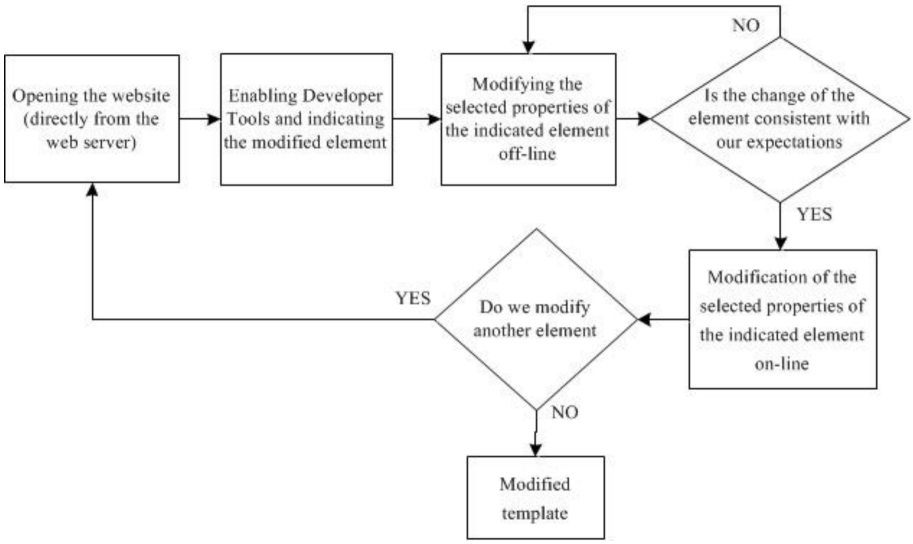

Figure 5. The template modification diagram with the use of Developer Tools embedded in the browser

In the first step, we open our website with the use of a chosen browser by indicating the domain name specifying the location of our website. As a result of such an inquiry, the content management system operating on the server generates a website created from the combination of the content located on the database server and the template specifying the layout of our website. In the next step, we enable the Developer Tools embedded in our browser by using the appropriate function key or by selecting them in the browser's menu.

Selecting the option of the Developer Tools' selector allows for indicating the element of the website we want to modify. The indication of the selected element while switching from Developer Tools tabs to CSS files editing results in the indication of the rules specifying the properties of the given element. In the opened editor window of CSS files, we can change a given value and therefore change the layout of the given element. In almost every browser the embedded programming tools will also show the possible values of a given property, which significantly facilitates the modification for users who do not have good knowledge of the CSS cascading style sheets technology (Figure 4).

However, it is necessary to bear in mind that the modifications made in this manner are modifications in the off-line mode, i.e. they function only on the website loaded locally to the browser. A permanent change of the selected properties requires saving the changes on the server in the appropriate place

in the relevant CSS file. This is also facilitated by Developer Tools, in which we obtain precise information on the location of the changes, consisting in the indication of the name of the CSS file and the number of the line in which the change is to be made.

Making a permanent change directly in the files located on the server is possible in the case of Joomla! by editing the file indicated in Developer Tools from the system administrator level. By moving to the option of template management and indicating its name, we get the possibility to edit each of the files forming the template, including the CSS file indicated by the browser's programming tool. We modify the file directly on the web server by saving the changes made in the editor.

An alternative for editing the file from the system administrator level of a content management system is the possibility to establish a connection through the File Transfer Protocol client, download the modified CSS file to local resources, and modify it with the use of any editor in accordance with the indications from Developer Tools. We overwrite the locally modified file version on the server using the established FTP session.

Considering the fact that all the data necessary to make the changes are provided by Developer Tools, the modification of the properties of individual elements of the template should not cause problems for an average user of a content management system; especially assuming that we only make a reconstruction of the installed template.

In this case, particular attention should be paid to the copyright of the template's authors, and especially the clauses allowing for the modification of the downloaded templates.

5. Modification of templates in WordPress

In WordPress content management system, at the start the user gets only two graphic templates. The scope of modification of the templates from the administrator's level in the default installation is significantly broader than in Joomla! content management system. The user gets the possibility to select one out of four color schemes for all template elements, and also the possibility of an individual change of the colors of selected template elements. He can also easily add a logo or a website background. Although the administrator's interface of the WordPress system allows for a slightly broader modification of the template, it does not guarantee the development of a unique layout of the website. The mentioned changes are limited only to some template elements.

As in the case of Joomla!, here the possibilities of template modification can also be significantly extended by supporting the process of changes with the browser's Developer Tools. Here the pattern is very similar to the changes

made in the templates of the Joomla! system. (Figure 5). Also, the modification of CSS files alone is possible directly from the administrator's interface with the use of the available editor. However, in this case, we encounter a less user-friendly editor environment. The syntax is not highlighted, and the lines of the edited file are not numbered. This greatly hinders the modification of the properties of the selected elements. Despite precise information about the location of the definition of the selected element's property we get from Developer Tools, we are not able to find the right definition as quickly and precisely as in Joomla!. In the case of WordPress, the stage of updating the CSS files located on the server may be performed with the use of the FTP client. The default location for cascading style sheets of the templates in WordPress is the wp-content/themes/ catalog. We can edit the file downloaded through the FTP in the editor which highlights the syntax and, more importantly, numbers the subsequent lines of the edited text. This can be done with the use of the very popular and free editor Notepad++. We place the modified file on a server, saving its original location.

We can eliminate the inconvenience resulting from the relatively limited editor embedded in the administrator's interface of the WordPress system by installing an add-on that facilitates file editing. Examples of such add-ons are "WP Live CSS Editor" and "Simple Custom CSS". They enable a preview of the changes on the website during the modification of the properties of individual elements saved in CSS files. However, it must be remembered that the installation of every add-on requires a verification of its compatibility with the installed version and often the issue of additional commands, which may cause problems, especially for inexperienced users.

6. Modification of templates in Drupal

The default installation of Drupal offers only two templates. As in the majority of content management systems, after we move to the system administrator's panel, we get the possibility of simple modification of templates, consisting mainly in the selection of color schemes prepared for a given template. However, this option has a very convenient interface of modification of colors of the main elements of a template through a very intuitive and easy to use mechanism. The manual selection of color results in the generation of its RGB code, which is at the same time assigned to the selected element. After saving the above settings, we can see the direct effect on the website generated by Drupal.

This is, however, the only mechanism that distinguishes Drupal in terms of template modification. In the default installation, this system does not have a file editor that allows for editing and modifying their content directly from

the CMS interface. Therefore, we should save all changes we make with the use of the FTP client. As in the case of the default installation of WordPress, the files downloaded through the FTP are modified locally on the basis of the set parameters of the element indicated by Developer Tools. It, therefore, uses a similar pattern (Figure 5), whereas on-line modification is done mainly with the use of the FTP protocol.

As in the case of WordPress, Drupal also allows for installing additional modules enabling to edit CSS files directly from the system level. Popular plug-ins such as CSS Editor, Lice Theme and Live CSS often require additional configuration and verification of compatibility with the version of the plug-in with the version of the installed content management system. Also, it is important to remember about certain limitations resulting from the configuration of accounts on the servers on which our website is located. The installation of dedicated plug-ins should, therefore, be treated as an additional option without which we cannot modify the styles specifying the template using only a locally installed editor, the free FTP client, and Developer Tools embedded in the browser.

7. Conclusions

Content management systems are a technology increasingly used to build websites. By definition, they are the tools for the flexible formation of website content. The layout of a website built with the use of a CMS is imposed by a ready-made template. The administrator interface of the content management system enables only a minor modification of the template. However, the conducted comparative analysis shows that the combination of two independent tools, i.e. a content management system with Developer Tools embedded in modern browsers enables a significantly greater interference in the template's structure, allowing at the same time for a relatively easy and almost unlimited modification of the template. Also, the analyzed methods of modification of a graphic template do not generate any additional costs, which satisfies the assumptions mentioned at the beginning of the paper.

References

Matysek, A., & Tomaszczyk, J. (2009). Systemy zarządzania treścią. *PTINT Praktyka i Teoria Informacji Naukowej i Technicznej, 17*(1-2), 35-44.

Nalepa, G.J., Ligęza, A., & Wojnicki, I. (2007). From content to knowledge: a perspective on CMS. *Automatyka, 11*(1-2), 217-226.

Prauzner, M. (2015). Nowoczesny system CMS w kształtowaniu treści i sposobu ich prezentacji on-line. *Edukacja – Technika – Informatyka, 6*(3), 290-295.

Wieczorkowski, K. (2015). Metodologia projektowania systemów zarządzania dokumentami CMS. *Zeszyty Naukowe Wyższej Szkoły Informatyki*, *141*(1), 60-81.
Wit, B. (2009). *Electronic commerce – Budowanie konkurencyjności przedsiębiorstwa w Internecie*. Lublin: Wydawnictwo Politechniki Lubelskiej.
Zakrzewski, L., & Stroińska, E. (2009). Rola internetowych systemów zarządzania treścią (CMS) w rozwoju społeczeństwa informacyjnego. *Zeszyty Naukowe. Studia Informatica/Uniwersytet Szczeciński, 23,* 205-214.

Websites

WordPress – official website, http://www.wordpress.org
Joomla! – official website, https://www.joomla.org
Drupal – official website, https://www.drupal.org
CSS – World Wide Web Consortium (W3C), https://www.w3.org/Style/CSS/
GNU/GPL License, http://www.gnu.org/licenses/licenses.html#GPL
Mozilla Firefox, http://www.mozilla.org/firefox/
Google Chrome, https://www.google.com/chrome/
Apple Safari, www.apple.com/safari/
W3Techs – Web Technology Surveys, https://w3techs.com/technologies/
BuiltWith® Pty Ltd, http://trends.builtwith.com/cms/country/Poland

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