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A Simple Website Optimization Framework for Web developers in Kurdistan Region of Iraq

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Abstract

In this paper we investigate the current state of developed websites in terms of speed (page load time) in Kurdistan Region of Iraq and propose a simple optimisation framework to reduce webpage load time. Recently the Kurdistan region of Iraq (KRI) has seen progress in many areas of life, due to this progress there are many companies that compete to deliver services. One way these companies try to get their messages across to consumers, not surprisingly, is through the internet which is realised by creating dedicated websites for their companies. There are a number of companies that claim to have the ability to develop professional websites in Kurdistan region but the current level of customer satisfaction indicates otherwise.For the purpose of data collection we investigate a number of current websites developed by local companies for their load time speed using a number of available tools. As a result we propose a simple optimisation framework for developers in these companies that can aid in reducing webpage load time. The results show that the framework is simple and effective and can benefit developers elsewhere. This paper contributes toward improving website developments in KRI in terms of load time speed.

Keywords: *Website, Speed, HTML, JavaScript, Images, CSS, Optimisation framework*

1. Introduction

Recently the Kurdistan Region of Iraq (KRI) has experienced an explosion in exposure to new technologies in different sectors especially in media and telecommunication. Developing web sites to deliver news and other information is a relatively new phenomenon in Kurdistan; this means that the web developing companies may have not paid full attention to all aspects of website performance. Quality of Service (QoS) is the term most used for assessing website performance which mainly includes availability and response time. In this paper we investigate the latter and focus on load time speed of the websites developed by Kurdistan based web development companies. We propose a simple optimization framework to help the companies optimize websites in terms of load time speed before they are published online for use.

People have a busy life style which means time is precious and they don't feel happy if they wait for few more seconds longer for a webpage to load. According to [1] if the load time is more than 8 seconds on average most users leave the site altogether. Google found that the traffic of a typical webpage drops by 20% if the page load time is increased by 5 seconds. Authors of [2] found that users expect to get a response for simple information retrieval in 2 seconds and the longest time users can wait before losing interest is 15 second. This means that websites should be monitored and optimized to reduce the load time as much as possible in order to increase user satisfaction otherwise websites loose users [3].

To many businesses a reduction in website traffic means a loss in revenue and step backward in being competitive. [4] Claims that if a website is slower by more than 250 milliseconds compared to a competitor the site will have fewer visitors. Authors in [5] found that 2/3 of users encounter slow responding websites every week and of those 49% switch to a competitor. To make the matter worse [6] claims that half of those users that abandon a website because of long webpage load time will go on to tell others about their negative experience. To avoid this, every measure should be taken to attract more users and a way to do so is to improve website load time.

Now a days the demand for rich web pages are in the rise and web pages are getting bigger than ever, [7] states that a web page contains at least 80 resources such as images, JavaScripts, Cascade Style Sheet (CSS), HTML files, etc., that all influence the size of website contents. [7] Also states that 80% of the time required to load a webpage is consumed by loading resources such as CSS and images which means only 20% of the time is required to load a typical webpage. It is a fact that no matter how

attractive a website is or how brilliant is the processing mathematics behind it if it cannot respond to uses request and load within an 'acceptable time' it loses visitors. it is essential that web developers pay great attention to load time of sites, to stress this importance [8] claims that a one second delay in load time decreases customer satisfaction by 16%. Any reduction in the size of a webpage content result in the reduction of web page load time [9] hence the need for webpage optimization framework.

For the purpose of this study we have chosen three reputable web development companies based in KRI namely Avesta Group[10], RAS Group[11] and Ava Group[12]. For each company we have selected three websites developed for different purposes to be investigated for their load time speed. In our investigation we use load time testing tools such as webpagetest[13], gtmetrix[14], and pingdom[15]. We also use the Google developer website to identified weaknesses in the chosen websites. The result indicates that the websites have not been optimised fully before they are published online for use and there is room to increase their load time speed. To help the companies optimise the websites they develop in terms of load time speed we propose a simple optimisation framework. This paper contributes toward improving website development and use in KRI which in turn help the development of the region.

The rest of this paper is organised as the following, in section 2 we provide background, literature review and research steps. In section 3 we outline our proposed optimisation framework, in section 4 we discuss the implication and limitation of the proposed framework and finally we conclude in section 5.

2. Background

In section 2.1 we provide a brief background about the companies we have chosen to investigate, in section 2.2 we explain the concept of optimisation, in section 3.3 we provide some literature review relating to website optimisation and finally we explain the steps of our research in section 3.4.

2.1 Company introduction

Avesta Group[10] offer services in many fields of information technology including web development, IT consultancy, software development and training courses, the company was established in 2006 and its headquarter is located in Sulaimany, Kurdistan, Iraq. RAS Group [11] was established in 2014 and their main focus is on web development, windows application development and social media marketing. The company's headquarter is located in Erbil, Kurdistan, Iraq. AvaGroup[12] was established in 2007, the group consists of four sister companies which are, avamedia, avaelectronics, avatechnology and ava travel. The company's headquarter is located in Sulaimany, Iraq Kurdistan. They offer services in different fields, such as media and advertisement, application and web development, electronics and travel services. Table 1 presents the websites developed by each company that we have chosen for the purpose of this study.

Table 1: Selected companies and websites

Company name	Website URL
Avesta Group	www.awene.com
	www.xendan.org
	www.bareazgroup.com
RAS Group	http://sarbaxo.com
	http://physic4kurd.net
	http://shakibacompany.com
Ava Group	http://aweza.co
	http://www.dasy2.com
	http://www.kurdsoft.net

2.2 Website optimization

A website consists of many pages put together and served through a single domain, which are developed for different purposes such as education, ecommerce and socializing. Websites have become an essential face of today's businesses and organizations; in most cases the success of a company mirrors the success of their websites especially in ecommerce businesses. One of the most widely known issues of a website is the loading time which is influenced mainly by its size.

There are many tools available for monitoring and evaluating webpage load time such as Y Salw [16], and Metrix [14]. The size of a website is directly proportional to its loading speed i.e. the smaller the size the lesser the loading time. Components that contribute towards the total size of a website are HTML, CSS, JavaScripts, images, multimedia, etc.[3]. To reduce load time it is important that web pages are optimized and to achieve this, there are optimisation techniques such as JavaScript, CSS, HTML compression and image optimisation. Results show that these optimization techniques can reduce webpage load time by 20%-80% [17]. [6] States that critical load time of a webpage is 3 seconds and web developers have to use performance optimasation techniques to achieve this. Gzip is developed by the GNU project and it is one of the most effective and poplar methods for webpage compression, and it is supported by nearly 90% of all browsers in use today. To show the effect of reduced load time Google reduced the homepage size of Google Map from 100KB to 70-80 KB and monitored the page traffic as the result they noticed traffic went up by 10% in the first week and later by 25% in the following weeks [18]

One other factor that can speed up webpage response time is using techniques to reduce the number of requests required to render a webpage fully. According to [19] CSS Sprite is one those techniques preferred for reducing the number of Image requests.

2.3 Literature review

Studying the performance characteristics of websites are widely researched with the aim to identify weakness that can be addressed. A number of performance metrics that measures website quality are proposed by [20], [21] and [21] load time is one of those metrics that is seen as important. The authors of [22] studied performance characteristics such as transferring sizes in URL, [23] studies website locality richness, [24] researched the relationship between webpage load time and design attributes and [25] investigates performance related features of websites. The authors in [26] researched the effect of webpage images on download time and they found that having large number of images reduces the performance of websites. To deal with is they suggest that developers should use images efficiently and pay great attention to their format and size. There are other factors that can affect web page load time such as the distance between the client and the web server and to tackle this [27]and [28] state the need for the use of content delivery network (CDN). CDN is a collection of web servers that are located in different geographical areas, they work together to deliver website content more efficiently. To reduce page load time there are some other studies that focus on transmission time of data across the internet and they suggest the use of caching technique [29][30]. To address the speed of loading a webpage there isn't a perfect framework available instead different framework is available to address a problem they focus on. [31] States that a primary cause of poor website design which influences load time is the difference in understanding between developers and users regarding the structure of a website. Since there isn't one generic optimisation framework for web developers to use we propose a simple framework in section 3.3 that can help developers in KRI to increase the load time speed of the websites they develop. The literature review shows that very few researchers studied the affect of content size on webpage load time and the majority focus on technological, mechanical and implementation aspect of websites to reduce load time. This paper is a contribution towards filling in this gap, having said that we recognize that our study is limited in scope since our proposal is for web developing companies operating in KRI. However it doesn't mean that our proposal is not beneficial to web developers in general.

2.4 Research method

To achieve the aim of this research we take the following steps which are illustrated in figure 1:

1- Choose three reputable web development companies in KRI to be investigated
2- For each company select three random websites developed by the company
3- Test the loading time of each of the selected websites using three available and reliable speed testing tools
4- Take an average of the results produced by each tool for each of the selected websites
5- If the average result of the speed test shows that the speed of the website is not within acceptable range use " Google Developer tool" to identify the technical
6- Identify the main reasons behind the performance of each site and put together an overall good practice framework to be observed by the web development companies in KRI

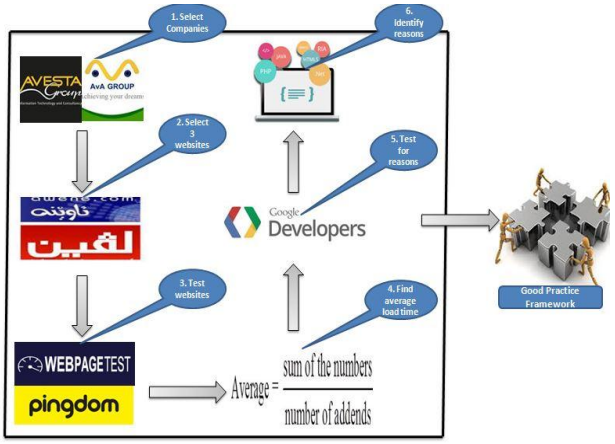

Fig.1 Research Steps

3. Optimization framework development

In this section we present the result of the investigation we carried out to reveal the state of load time speed of the websites developed by companies in KRI. In section 3.1 we analyse the current state of load time, in section 3.2 we summaries the weakness that can be addressed to improve load time speed, in section 3.3 we out line our proposed optimization framework and finally in section 3.4 we present some results supporting the effectiveness of the framework .

3.1 Current Load time speed

Website performance is affected by several factors including page content, browser, bandwidth etc. We have tried many speed testing tools collected by [32], as a result we have chosen 3 best ones for the purpose of this study which are Webpagetest, gtmetrix, and pingdom where the aim of these tests are to determine the average load time of each of the websites presented in table 1. The way webpage load time test works is by submitting continues request to the website and measure the average response time between replies sent by the website. By doing so the load tester emulates users which are known as virtual user [6]. To make sure the result is reliable we have tested each of the websites three times using the tools mentioned above and calculated the average of the results as shown in table 2.

Table 2 Average speed for a single website

Company	Website Name	Used Tool	Page Load Time/Seconds
AvestaGroup	www.bareazgroup.com	gtmetrix	11.64
AvestaGroup	www.bareazgroup.com	webpagetest	9.90
AvestaGroup	www.bareazgroup.com	pingdom	11.30

Table 3: Average load time speed per websites and companies

Company name	Website URL	Average load time / Second For each website	Average load time / Second for each Company
Avesta Group	www.awene.com	6.23	7.46
	www.xendan.org	5.22	
	www.bareazgroup.com	10.94	
RAS Group	http://sarbaxo.com/	7.18	7.57
	http://physic4kurd.net/	5.53	
	http://shakibacompany.com	9.99	
Ava Group	http://aweza.co	9.51	7.38
	http://www.dasy2.com	7.02	
	http://www.kurdsoft.net/	5.59	

Table 4 Load time delay factor

Website name	Should Fix	Consider Fixing
www.awene.com/	Images	CSS, JavaScript, HTML
www.xendan.org	Images, Leverage browser caching	CSS, JavaScript, HTML
www.bareazgroup.com	Images, Leverage browser caching, Reduce server response time, CSS	JavaScript, HTML
http://sarbaxo.com/	JavaScript and CSS, Images	Server response time, Leverage browser caching HTML
http://physic4kurd.net/	Server response time	JavaScript and CSS Images, browser caching, HTML,
http://shakibacompany.com/	JavaScript and CSS	Images, server response time, browser caching
http://aweza.co/shop/index.php	Browser caching, server response time, images	JavaScript and CSS, HTML
http://www.dasy2.com/	Browser caching, images, JavaScript and CSS,	HTML, visible content JavaScript, CSS
http://www.kurdsoft.net/	JavaScript and CSS	Images, JavaScript

$$Average = \frac{\sum loadtime}{numberoftests} = \frac{11.64+9.90+11.30}{3} = \mathbf{10.94}$$

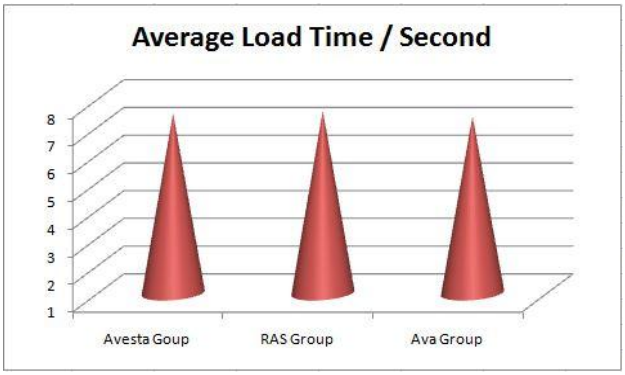

Fig. 2 Average load time speed per company

The above process is repeated for all the 9 selected websites and the result is as table 3 and illustrated in figure 2. The result shows that the load time speed is missing the critical 3 second identified by [33]. In the next section we analyse the websites using Google Developer tool to identify areas that can be improved.

3.2 Analysis results

To analyse the websites for load time delay causes we have used the Google developer online tool [34]. Figure 3 shows some 2 example of the tests we carried out to collect the result summarised in table 4.

As the result in table 4 clearly show that the delay are caused by a number of factors and the most common ones are:

1- JavaScript
2- Images
3- CSS
4- HTML

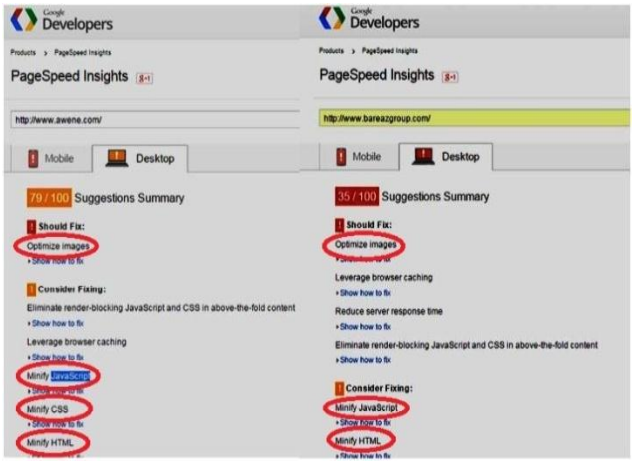

Fig. 3 Google Developer test results

3.3 Simple Optimization framework

In this section we propose the best practices for website speed optimization and we have benefited from the optimization suggestions made by Google Developer [34] and Yahoo YSlow[16] in considering our framework. We rely on the following two techniques in our optimization framework:

1- Minify JavaScript,CSS and HTML : Compressing and minifying HTML, CSS and JavaScript files using techniques such as Gzip allows content to be transferred more efficiently and in result reduce the load time significantly. Reducing the size of a JavaScript file can be done for example by removing white spaces and comments, CSS files can be reduced for example by removing unused codes. JSCompress [35], JSMini [36] and YUI Compressor [37] are some of the freely available tools for JavaScript minification
2- Compressing Images: when an image is created there are additional information imbedded in it, removing theses extra information reduces the size of the file. To elaborate more if we take a JPEG file it normally includes the name of the program wrote it, this information increases the size of the image file. Also large, high resolution images can take 10x as long to load as normal images this can drastically slow down page rendering

More precisely the proposed good practice framework guide the flow of website optimisation process in the following 5 steps as illustrated in figure 4:

Table 5: Awene optimization result using the framework

Test type	Tool used	Source File	Pre-optimisation file size/seconds	Pre-optimisation file size/KB	% reduction in file size
Minify JavaScript	refresh-sf	/sites/all/modules/nice_menus/superfish/js/superfish.js?N	3.71	2.52 KB	32
Minify CSS	refresh-sf	sites/all/themes/awene/css/awene.css?N	148.63	128.66 KB	13
Optimise Image	Dynamicdrive	http://www.awene.com/sites/www.awene.com/files/imagecache/profile_picture_large/pictures/picture-2429.jpg	(jpg) 10.7	(jpg) 3.92	63
Total			163.04	135.1	17

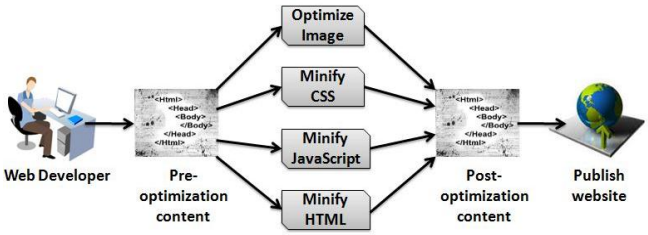

Fig.4 Proposed simple optimisation framework

1- Web developer access the code of developed components of the web site.
2- Filter out images, CSS, JavaScript, and HTML code.
3- Minify CSS, JavaScript, and HTML code and optimise images using available tools and techniques.
4- Reintegrate the compressed code and test the workability of the website.
5- Published the optimised website online for use.

3.4 Results of applying the framework

In this section we have applied our framework to optimise three of the websites we have been investigating as listed below, tables 5, 6, and 7 are the result of the optimisation. Table 8 is the summary result for all the three sites and the result is illustrated in figure 5.

Table 6 Shakibacompany optimisation result using the framework

Test type	Tool used	Source File	Pre-optimisation file size/seco--nds	Pre-optimisation file size/KB	% reduction in file size
Minify JavaScript	refresh-sf	cache/template/theme-8c18a303.js	85.86 KB	73.64 KB	14
Minify CSS	refresh-sf	cache/template/bootstrap-c4399660.css	148.63 KB	128.66 KB	13
Optimize Image	Dynamic drive	"apple-touch-icon-precomposed" href="/templates/yoo_everest/apple_touch_icon.png"	(png) 12.1	(png) 6.87	43
Total			246.59	209.17	15

Table 7 dasy2 optimisation result using the framework

Test type	Tool used	Source File	Pre-optimisa-tion file size/seconds	Pre-optimisa -tion file size/KB	% reduction-n in file size
Minify JavaScript	refresh-sf	LoadMoreJs/jquery.loadrmore-1.0.0.js	3.90	1.52	61
Minify CSS	refresh-sf	menujs/wf-menu-dark.css" /><link href="Icon.css" rel="stylesheet"	20.73	13.50	35
Optimise Image	Dynamicdrive	ReklamImages/thumb_1d81ee91-c232-48e4-b503-dd9925480c35.png	(png) 546.	(png) 12.0	97
Total			570.63	27.02	95

Table 8 overall reduction % in size of web files

website	Pre-optimisation file size/KB	Pre-optimisati-on file size/KB	% reducti-on in file size
www.awene.com	163.04	135.1	17
Shakibacom-pany.com	246.59	209.17	15
www.dasy2.com	570.63	27.02	95

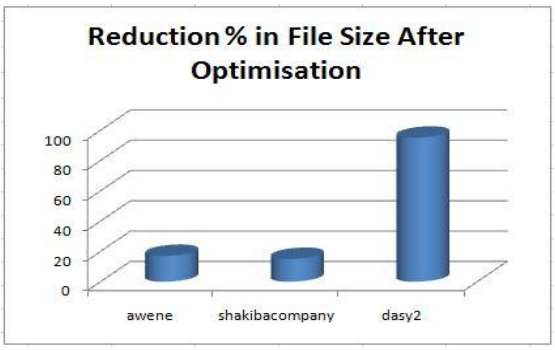

Fig.5 overall reduction % in size of web files after

1- www.awene.com, as shown in table 5
2- www.shakibacompany.com, as shown in table 6
3- www.dasty2.com, as shown in table 7

4. Discussion

Now a days the demand for rich web pages are in the rise and web pages are getting bigger than ever, studies show that on average a webpage contains at least 80 resources. Loading up all these resources take time which visitors would like to be kept as low as possible, otherwise they lose interest and won't come back.

To many businesses losing visitors of their website means losing revenue, this means web developers need to use techniques to keep webpage load time as low as possible. In this paper we have presented a simple good practice framework for web developers in Kurdistan Region of Iraq with the aim to reduce webpage load time. The framework is based on some credible analysis we carried out for a number of websites developed by web development companies in the region. The result of the analysis in section 3.2 shows that there are a number of factors affecting the load time speed of the websites. In general we found four common factors which are related to the size of the website contents namely HTML, JavaScript, CSS and image. We have used the framework to optimise a number of selected websites and the results show that using the framework can reduce the size of webpage contents by more than 40% on average as

presented in table 8. Although we have suggested some tools that can be used in implementing the framework but developers are free to use the tools they prefer.

It is worth mentioning that there are several factors affecting the speed of a website which are not considered in this study for example, the speed of the internet, the type of device used, the technology the site have been developed in etc.. There are some studies that focus on these aspects of website performance for instance [18] studies the performance difference between websites developed using PHP and ASP.NET web programming languages. We don't also advocate that the techniques used in the proposed framework are the only way to optimise websites. In fact, there are other simple ways to reduce webpage load time for instance flushing the buffer early, removing duplicate scripts, make Ajax cacheable and post load components tag. However the advantage of our framework is the availability of free tools that can do the work for developers with minimum effort. Our proposal is targeting web developers in KIR in specific, but it may also be used by other developers elsewhere.

Conclusion

Kurdistan Region of Iraq is a newly recognized region of Iraq, after the fall of the Iraqi regime in 2003 the region was opened up to a wave of new developments. The introduction of new electronic technologies such as the internet encouraged the development of new businesses in the field of web and software development in the region. Designing and developing a professional website is a complex process that requires systematic analysis and design, and to keep websites efficient in terms of load time speed optimization techniques have to be used before a website is published online for use. Based on our study we can conclude that the web developing companies operating in Kurdistan are not matured enough to deliver efficient websites yet (at least in terms of speed). To address this we have proposed a simple optimization framework that can help web developers in KRI to increase the efficiency of the websites they develop. The results show that the framework is simple and effective. The framework can also be used by developers elsewhere to make sure that the webpage load time is kept as low as possible.

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