Techniques of Effective Web Design for Mobile and Desktop Applications

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Abstract -- *With the invention of mobile web, World Wide Web is no longer limited to our desktops. The challenge is obviously to come up with web designs that would support web applications via mobile web browsing as well as personal computer based web browsing. In this paper we propose a model to unify the mobile and desktop web application development which will make the development easier and deliver the user with a satisfying user experience.*

I. INTRODUCTION

Less than half a century ago, no one imagined that the Internet would play such an important role in our lives as it does today. But with the development of information and communication technologies (ICT) which has gained speed during the last decade the, the Internet has become the center of attention for businesses, governments and individuals around the world. With the invention of mobile web, World Wide Web is no longer limited to our desktops. The mobile Internet is growing faster and will be bigger than the desktop Internet due to new technologies and social trends, namely 3G, social networking, video, VoIP and impressive mobile devices. The smart phones are one such category of impressive mobile devices which enable daily means of communication to the today's world.

In the modern competitive market, the mobile phone producers aim to differentiate their products mainly by price. They also provide additional utility services that include music, SMS and Internet packages. We first heard about the mobile connections a decade ago, and today mobile phones have grown up to be one of the major communication tools. 57% of teenagers consider the mobile phone as one of the main tools to maintain and develop their social network. 43% use SMS on a daily basis and place the device among top ten necessary attributes of their daily life [1]. Therefore it has become a known fact that enhancement of mobile communication contributes to the social development.

These general facts emphasize the high impact the mobile devices has made on even an average mobile user. As we have discussed already, the mobile devices are not just a communication tool anymore. It can basically provide all the necessary online services which were only available for desktop computer users few years back. This capability generated a huge demand all over the world for smart mobile phones and the service providers started to focus more on providing mobile application services. Now, an online service oriented company has two targeted devices to provide their services, the different categories of personal computers and the smart mobile devices. Then the challenge is obviously to come up with web designs that would support web applications via mobile web browsing and personal computer based web browsing. This research paper will discuss in detail about web designing techniques that would produce web oriented service products that supports mobile devices as well as the personal computers. The emphasis is given to the mobile based web designing and how the developers attempt to derive from sole desktop based web browsing to a more mobile based standard.

II. DIFFICULTIES IN MOVING FROM DESKTOP TO A MOBILE

A. Poor user experience in browsing desktop based websites through mobile devices

Although the mobile industry has developed rapidly, the website development for mobiles seems to have some flaws. When developing a website for a desktop computer and mobile device, design decisions should vary according to the device. If a website which is developed for a desktop machine is accessed by a mobile device it would not be a pleasant experience. Therefore the web site has to be changed in a way that it suits the mobile device and maximizes the use of it.

Poorly designed Web sites can lead to lost productivity and revenue for web service providers. "The question of how to improve the design of informational Web sites is important. Although most prominent Web sites are created by professional design firms, many smaller sites are built by people with little design experience or training" [2].

B. Lack of guidelines for consistent interface designing

A web site interface consists of rich text, web links, graphics, different formats, scripts, queries and various other aspects that affect overall quality of the product. Consequently, designing a web site involves a set of activities which are used to develop each of these elements in a Web site interface.

Although many researchers have produced different web design guidelines, still there is a wide gap between these guidelines and the heuristics on consistent interface designing for websites. Furthermore, guidelines are not standardized and tend to conflict at times as well. So there

exists the need for a proper set of guidelines for web designing for mobile and desktop applications.

C. *Lack of user satisfaction*

A common problem faced by the mobile users is the transferring of information across multiple devices, including web bookmarks and histories. Researches on how people used smart phones have shown that web browsing accounted for 24.1% of all mobile activity and that people browsed far less pages on mobile than on desktops [3]. This clearly emphasizes that the user satisfaction in mobile web applications are far below compared to the desktop web applications.

III. WEB PAGE AND SITE MEASURES

- *Information design* - identifies and groups the content items and develops category labels to reflect the information structure of the web site.
- *Navigation design* - develops mechanisms to facilitate interaction with the information structure
- *Graphic design*- visual presentation
- *Experience design* - encompasses all three of these categories, as well as properties that affect the overall user experience such as download time, advertisements, popup windows etc.

All of these design components require some analysis about the tasks that users are likely to carry out. The web content targeted for mobile devices is designed to suite low bandwidth of wireless networks, low storage availability of mobile devices. In order to adhere to these requirements, mobile web pages are designed to be in lower quality, have reduced page sizes and the number of images per page.

VI. A WEB DESIGNING APPROACH FOR MOBILE APPLICATIONS

So far we have discussed the common concepts entailing the mobile and desktop based web designs. Also we identified the issues the users experience in using desktop based web applications in mobile devices.

Now we move on to the techniques and technologies used in mobile based web designing. The focus will be given to the mobile applications as we try to define a set of standard formats, frameworks and a methodology that can be used as guidance for the mobile based web designers.

A. *Web formats used in mobile based web applications*

There are three of the most popular mobile web formats; Wireless Markup Language (WML), Extended Hyper-Text Markup Language Mobile Profile (XHTML-MP) and Compact Hyper-Text Markup Language C-HTML. Among those, WML is the dominant web content type even though regional differences do exist [4]. Still it is found that, WML is the format most seen among a large number of mobile devices. The reason is that, still there is a large installed base of WML content. As mentioned earlier this encounter has varied by regions.

Regarding the size of mobile Web content, the pages of XHTML-MP and C-HTML types are 50% larger on average than pages of WML type [4]. This shows that newer format types are leading to larger mobile pages. Page links are almost equal with three mobile content types. Even though the web pages had a significantly less number of links compared to HTML content, all mobile content types had a higher link density when compared against page size [4].

B. *Frameworks for mobile based Website Development*

Even while the usage is being increased, most of this content, which is written in HTML, is not convenient to use. Mobile web users face a big problem that the majority of web content is tailored for desktop computers which can have a large display area and high connection speed compared with mobile devices which have smaller display area and limited connection bandwidth. Therefore developers are searching new technologies to overcome these issues. Following are some approaches which are currently being used to address these issues.[5]

- Use a technology as Flash Lite

Flash Lite is a lightweight version of Adobe Flash Player specially designed for mobile devices. This version is intended for mobile phones and other portable electronic devices, and allows users of these devices to view multimedia content and applications, which had previously been available only on personal computers. Main drawback of this approach is the high cost because the developer has to construct the whole application from scratch.

- Extend the user interfaces of mere HTML content, normally done using JavaScript or CSS (Cascading Style Sheet).

The drawback with this technology is that, the resulting user interface resources tend to be built only for the purpose which makes it impossible to reuse the user interfaces.

As a solution, a development framework for rich user interfaces of mobile web contents is proposed. This proposed framework employs dependency injection pattern to separate content and its user interface. The objective of the proposed framework, namely extensible User Interface (XUI) is low cost development of mobile web sites with rich user interfaces. The user interface is composed of a HTML document and several user interface components called extensible User Interface Components XUICs. The efficient reuse of XUICs and HTML documents reduces the cost. Also it provides a feasible solution for above mentioned drawbacks.

This framework can be theoretically implemented as a plug-in component for open technologies like JavaScript. Thus the performance and the extendibility of the application can be enhanced. But the commonly used mobile phones are not capable of executing complex JavaScript applications smoothly. Also when implementing such framework, we have to take in to our considerations the severe resource constraints on the mobile devices. Their performance is usually much lower with smaller processor memory, smaller displays, much slower internet connectivity, low power, the form factor, bandwidth management and battery lifetime. Therefore, the runtime system of the proposed framework is implemented as an independent application.

HTML documents are easily bound with a variety of user interfaces by adding only specific attributes into existing HTML tags with the use of this XUI framework. It is further planned to develop a method to automatically bind appropriate XUIC to HTML documents. At the current state, XUIC framework also requires purpose-built software as the existing solutions. But it is planned to implement this framework as a library of JavaScript and CSS, enabling XUIC to be executed in existing mobile web browsers.

C. *Major functional aspects of mobile based web applications*

a) Data Caching and Synchronization

Data Caching means temporary storing of recently accessed data to enhance the performance via reducing the time to access same data over and over. Also this technique lets people read web content when disconnected. Synchronization helps to transfer formatted and copied web content onto another mobile device. [5]

b) Data sharing

Data sharing between desktops and mobile devices can be easily achieved by copying data from web pages that people browse. Some applications copy both mobile data types and original web contents. In data sharing techniques mobile data type is used to get the relevant information. Security management, concurrency issues are the key considerations when implementing data sharing techniques. [5]

c) Data Transfer

Mobile data types are represented by a single folder containing the original data types. Also standard synchronization tools are used to access that folder. Data transfer should be reliable and fast in order to achieve the best functionality. [5]

d) Garbage collection

Garbage Collection helps efficient management of resources and that enhances the overall quality of the product.[5]

V. OVERALL MODEL FOR BOTH MOBILE AND DESKTOP BASED WEB DESIGNING

In the previous topic we described the different techniques and technologies that can be used in mobile based designs. We further propose the web designers to reorient the architecture in a functional based manner. We identify that most designs even though are highly consistent with the user interface designs, fails with performance. Thus the proper use of technologies play a vital role in developing high performing mobile based web designs. Therefore we propose the following feature based web design model. We encourage the developers to consider these as basic requirements for their web based applications. Therefore by providing these features in their web applications, they will be able to come up with designs that will cater an enhanced user experience, thus resulting in high user interest and better service value.

Features of the Proposed Model

- Ability of creating web sites which can be accessed using both desktop and mobile devices. [6]
- Could detect the hardware and software specification of the mobile device and adjust the best suitable quality of the web site. [7]
- Design the web page using methods like image mapping, CSS sprites to minimize the number of http requests and responses to minimize the page load time.[8]
- The bandwidth required for loading a web page will be minimized using proper usage of data compression and other techniques.[9]
- Use the same platform and web hosting without any extra features or cost.
- Enhances the backward compatibility, extendibility, re-usability of the designing.
- Could be integrating with any Content Management System (CMS), any template based system or web designing framework.

VI. CONCLUSION

According the research done in the web development for mobile and desktop access it was realized that the need of a proper model to deal with web development in both the formats is high. With the proper analyzing of the needs in the development field we have proposed a model to suit the highly developing web development field.

The model we proposed is mainly targeted in saving time and resources that developers waste in developing web sites separately for desktop and mobile. With the proposed model developers will only have to develop for one format and the system will generate web sites for both mobile and desktop.

With the model it could detect the hardware and software specification of the mobile device and adjust the best suitable quality of the web site and it makes it possible to integrate with any content management system, any template based system or web designing framework.

For mobile development this model will look specifically focus on the data transfer, Data Caching and Synchronization, data sharing and Garbage collection. Furthermore it will take care of generation html code for both the platforms automatically.

Therefore we believe this model make a huge improvement in the web development for mobile and desktop platforms. Regarding the future work, we expect to develop a prototype of the proposed model and test it in normal environment.

REFERENCES

[1]Qing Li, Peter K. Smith, and Donna Cross "Research Into Cyberbullying"

[2] Melody Y. Ivory and Marti A. Hearst *University of California, Berkeley*, "ImprovingWeb Site Design"

[3]Iván E. González, Jason Hong, "GurunGo: Coupling Personal Computers and Mobile Devices through Mobile Data Types

[4] Paul J. Timmins, Sean McCormick, Emmanuel Agu, Craig E. Wills, "Characteristics of Mobile Web Content"

[5] Timmins, P.J.; McCormick, S.; Agu, E.; Wills, C.E.; , "Characteristics of Mobile Web Content," *Hot Topics in Web Systems and Technologies, 2006. HOTWEB '06. 1st IEEE Workshop on* , vol., no., pp.1-10, 13-14 Nov 2006

[6] Guirguis, S.K.; Hassan, M.A.; , "A smart framework for web content and resources adaptation in mobile devices," *Advanced Communication Technology (ICACT), 2010 The 12th International Conference on* , vol.1, no., pp.487-492, 7-10 Feb. 2010

[7] Troiano, L.; Cirillo, G.; Armenise, R.; Birtolo, C.; , "A Preliminary Experience in Optimizing the Layout of Web Pages by Genetic Algorithms to Fit Mobile Devices," *Intelligent Systems Design and Applications, 2009. ISDA '09. Ninth International Conference on* , vol., no., pp.1055-1061, Nov. 30 2009-Dec. 2 2009

[8]Tonella, P.; Ricca, F.; Pianta, E.; Girardi, C.; , "Restructuring multilingual web sites," *Software Maintenance, 2002. Proceedings. International Conference on* , vol., no., pp. 290- 299, 2002

[9]Shea, D; (March 5. 2004). "CSS Sprites: Image Slicing's Kiss of Death" , Jan 18, 2012

[10] Hopkins, A.; "Optimizing Page Load Time", Jan 18, 2012

[11]Naccache, H.; Lindquist, T.; Urban, S.; , "A framework and reusable tools for developing interactive course web sites," *Frontiers in Education Conference, 1998. FIE '98. 28th Annual* , vol.1, no., pp.85-89 vol.1, 4-7 Nov 1998

[12] Xin Fan; Jian Chen; , "A framework and methodology for development of content-based Web sites," *Technology of Object-Oriented Languages and Systems, 1999. TOOLS 31. Proceedings* , vol., no., pp.316-319, 1999