Analysis of the Important Mobile Devices Features to Improve Mobile Web Applications

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***Abstract*—The mobile devices related industries are subject to rapid change, driven by technological advances and dynamic consumer behaviour. Hence, the understanding of the mobile devices markets is an important step in the analysis phase of mobile applications development. In this paper, a brief description of the different markets is introduced followed by an analysis of the main features of the markets leaders' devices which are important in the development process of mobile web applications. Finally, approaches are proposed to deal with the mobile devices diversity.**

***Index Terms*—mobile devices market, mobile web, mobile applications development, m-learning.**

I. INTRODUCTION

The aim of analyzing the mobile devices market is to realize the major manufacturers in order to study the capabilities of their state of the art products. This is performed by creating a database of and analyzing the specifications of these products. The understanding of these capabilities is important to reach an optimized design of the implemented applications which is supposed to make use of the advanced abilities of such devices. Finally, different approaches are proposed in order to detect these abilities.

II. THE MOBILE DEVICES MARKETS ANALYSIS

The mobile devices market is divided into three main market segments; mobile phones, Smartphones, and PDAs. By observing the behaviour of the three market segments in the last 30 months (figures 1-3) [1], it is realized that the Smartphones market has been growing rapidly and continuously gaining a serious part of the PDAs market share. On the other hand, the mobile phones market has been growing in a stable rate unaffected by the emerging Smartphones market. To realize the relative sizes of the three markets, figure 4 shows a pie chart of the mobile devices markets performance in 2006.

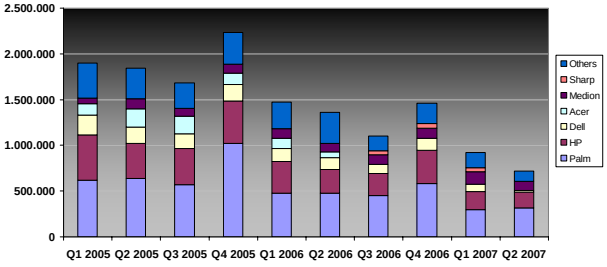

Figure 1. A graphical realization of the number of the worldwide shipped PDAs (Q1, 2005 – Q2, 2007)

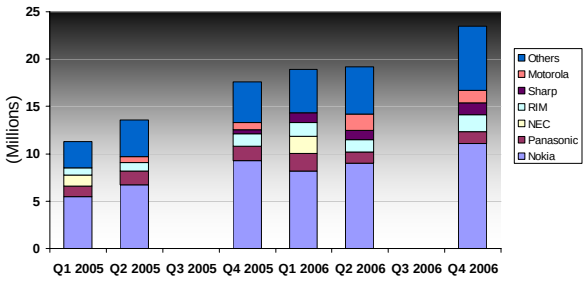

Figure 2. A graphical realization of the number of the worldwide shipped Smartphones

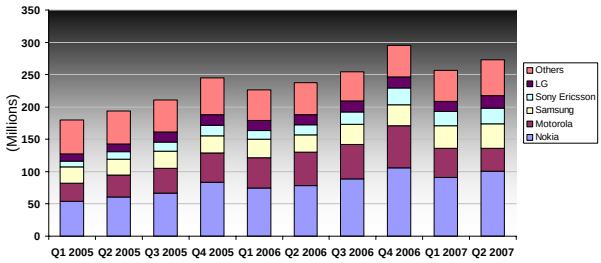

Figure 3. A graphical realization of the number of the worldwide shipped mobile phones (Q1, 2005 – Q2, 2007)

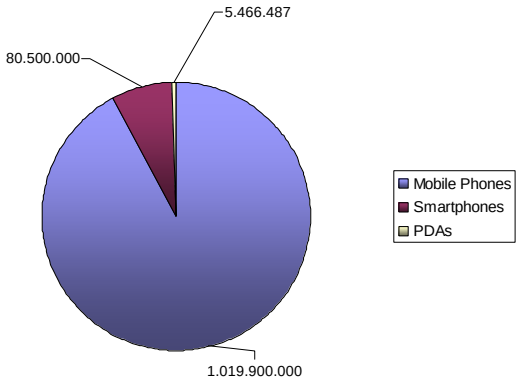

Figure 4. A pie chart realization of the worldwide shipped mobile devices in 2006

III. MOBILE DEVICES DATABASE

Relying on the results of the previous analysis, a group of the main products of the market leaders in the different market segments was selected. Then, the information about their capabilities, which are important for mobile web applications, was collected from their specification sheets.

The main conclusion of this devices database analysis is that the dividing line between mobile devices has become less distinct, and different types of mobile devices currently have very close levels of capabilities and offer similar services. As a result, it is not a proper method anymore to use the general classifications (PDA, Smartphone or mobile phone) for predicting the capabilities of a certain device.

New classification criteria should be introduced, depending on a group of factors which are important for the implemented application.

In a typical mobile web application, the important factors to be studied and used are:

- The visual capabilities, such as information about the display size, resolution and number of colors.
- The Internet access capabilities, such as the used technology and the connection speed it is able to offer.
- The Internet browser (or microbrowser) capabilities.

In the following paragraphs, the conclusions related to each one of them are discussed.

It was realized from the devices database that they offer a wide range of visual capabilities. One factor, which is of most interest for our project, is the display resolution (the screen size (width x height) in pixels). There are 16 different values of resolution found in this list of 50+ devices distributed as shown in figure 5.

This means that the visual capabilities of the devices are an important issue to be taken into account in the design phase. It is important for the application to make use of the advanced visual capabilities of some devices and to be able, at the same time, to deliver proper content to other devices with limited capabilities.

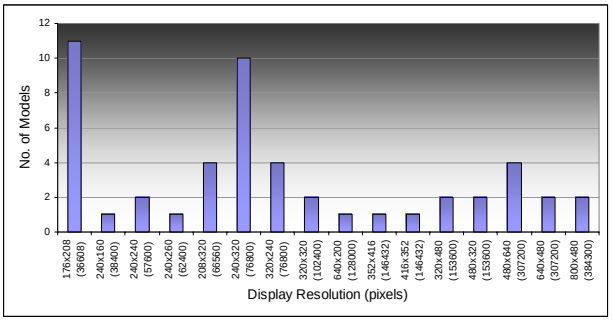

Figure 5. The number of models against display resolution

The other issue, which is realized while reviewing the Internet access capabilities of the devices, is that most of them offer this service via one of the following two technologies:

- Wireless Local Area Network (WLAN), or IEEE 802.11b and g, via WiFi card. This means that the devices are able to access the Internet through a conventional network similar to the way a normal PC on the same network accesses the Internet.
- General Packet Radio Service (GPRS) via a mobile communications service provider. Many of the devices offer more advanced technologies (i.e. UMTS and EGPRS) in addition which also provide Internet access via mobile communications service providers.

Different methods of payments are usually applied when using the two groups of technologies. While the amount of transmitted information is an important factor for the user who is accessing the Internet via the second technology, relying on the first technology could mean that the connection time is the important factor (when using a modem) or neither one of them (when the user has a flat rate connection).

Finally, it is also evident that the majority of the microbrowsers on these devices fully support XHTML Mobile Profile (XHTML MP) at least. This is understood implicitly when it is stated that the microbrowser supports any of the following:

- The WAP 2.0 standard, as XHTML MP is a part of this standard.
- The XHTML markup language, as XHTML MP is a subset of XHTML [2].
- The HTML markup language, as XHTML MP is also a subset of HTML [2].

As a result, the XHTML MP is highly recommended to be used as a platform for mobile web applications as it is the least common denominator for most of the current versions of microbrowser.

IV. THE IMPORTANT PARAMETERS FOR APPLICATION DEVELOPMENT

A. *The Visual Parameters*

Currently, there is a huge variance in the visual capabilities of the available mobile devices in the world wide market. While there are a lot of visual limitations on an application which is running on a mobile phone with a small screen and limited number of colors, other more visual oriented mobile devices provide means for applications with advanced visual capabilities. Here comes the importance of enabling the same application to use the maximum visual abilities of the used device. The main factors that were found to vary from one device to another are: the display size, the screen resolution, the screen size in characters, the number of colors and the orientation of the device (portrait or landscape).

B. *The Connectivity-related Parameters*

These are the connection speed, the Internet browser (or microbrowser) and the Internet access method, which specifies whether the device is connected to the Internet via a Wireless LAN or a mobile network service provider.

C. *The Media-related Parameters*

The available mobile devices were found also to have a wide range of media presentation capabilities (i.e. acceptable MIME media types). Media types are text, images, audio and video. While one mobile device may be able to present a media type with a certain file format, another may not be able to present the same media type or may have the ability to present it but needs another file format.

Other factors that may vary from one device to another are: the supported languages, the memory size, the operating system and its version.

V. DETECTION OF THE CLASSIFICATION PARAMETERS

The following are the main approaches which are mostly used by mobile web developers to detect the values of the necessary parameters:

A. *HTTP Request Headers*

Using HTTP request headers such as the user-agent header and the accept headers is the easiest approach to be implemented and the fastest from the performance point of view, but it has some drawbacks. One problem is that it provides a very limited set of information about the user's browser like the accepted MIME types, preferred character set and accepted language set. Another problem is that browsers may not provide full or correct information. However, this approach can be effectively used to distinguish microbrowsers from normal ones, in other words, mobile devices from desktop devices (PCs and laptops).

B. *CC/PP framework, UAProf*

The CC/PP (Composite Capabilities/Preferences Profile) framework is recommended by the W3C [3] as a standard for delivering information about the used mobile device. That standard defines the structure of the device profile based on the RDF (Resource Description Framework) [4], but it does neither provide any recommendation about the content of such profiles nor the way they are delivered and by whom. For this purpose, the UAProf (User Agent Profile) [5] standard is used which is defined by the OMA and followed by most of mobile device manufacturers. That approach provides clearer, more precise and more variant information about the user's mobile device. But it provides information on connection capabilities of the device. which is insufficient for providing information on the connection bandwidth and the method of payment; whether the user is concerned about the connection time or the amount of delivered data.

In some cases, a simple software code could be applied in order to have a more precise value for some of these factors such as the connection speed. But, for some of the factors there is currently no other solution than asking the user to provide the factor, such as the Internet access method.

VI. AN EXAMPLE FLOWCHART OF DEVICE CAPABILITIES DETECTION

A combination of the previous mentioned methods is to be used. The flowchart in figure 6 is used in our implemented iSign mobile web module. It models the whole process of device capabilities detection. First, it is detected whether the user is connecting to the system via a mobile device or a desktop device by analysing the user-agent header. Then, the visual factors are detected using the UAProf XML file which is downloaded from the manufacturer's server. The last step depends on the Internet access method which has to be delivered by the user.

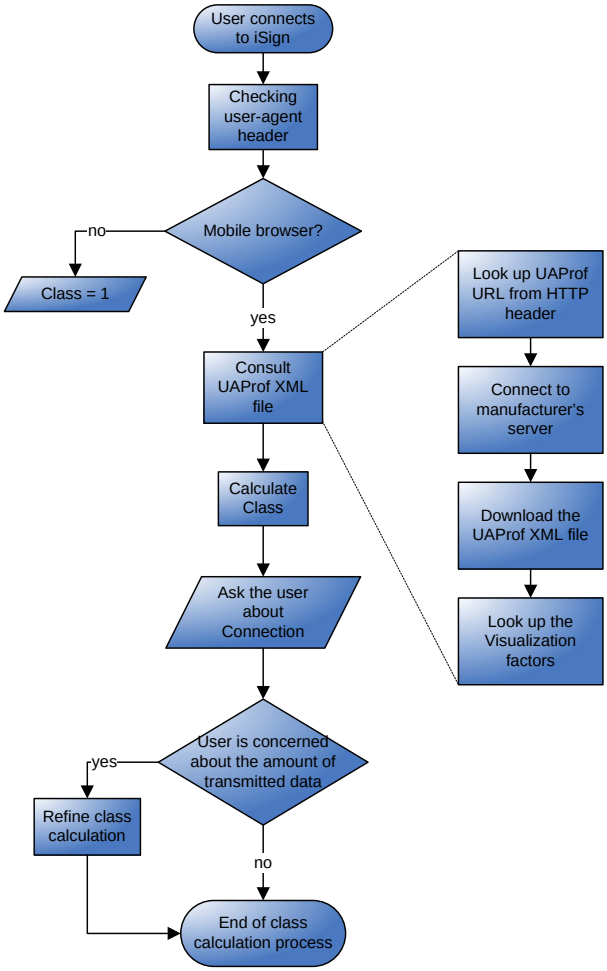

Figure 6. Parameters detection flowchart

Finally, the requested content is collected and arranged in a page which is presentable on the connected device and makes use of its maximum abilities as shown in figure 7.

Figure 7. The same page as displayed on three different classes of Devices

REFERENCES

[1] IDC, IDC's field studies on the mobile devices world-wide markets, http://www.idc.com, 15th Sep. 2007.

[2] Open Mobile Alliance, "XHTML Mobile Profile," http://www.openmobilealliance.org/release_program/docs/Browsing/V2_3-20050614-C/OMA-TS-XHTMLMP-V1_2-20050118-C.pdf, 18th Jan. 2005.

[3] World-Wide Web Consortium, "Composite Capability/Preference Profiles (CC/PP): Structure and Vocabularies 1.0," from: http://www.w3.org/TR/CCPP-struct-vocab/, 15th Jan. 2004.

[4] World-Wide Web Consortium, "RDF Primer," http://www.w3.org/TR/rdf-primer, 10th Feb. 2004.

[5] Open Mobile Alliance, "White Paper on UAProf Best Practices Guide," http://www.openmobilealliance.org/docs/OMA-WP-UAProf_Best_Practices_Guide-20060718-A.pdf, 18th Jul. 2006.

[6] Omari, R., "A SW Module for Mobile Device Content Delivery," Master Thesis, University of Applied Sciences Offenburg, 30th Nov. 2006.

[7] Feisst, M.; Omari, R.; Oliver, K.; Christ, A., "Authoring design patterns for user & device dependant adaptive data presentation," Proceedings of mLearn2006, Banff, Canada, Oct. 2006.

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