Intelligent Device Independent UI Adaption for Heterogeneous Ubiquitous Environments

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Summary
Most of the available User Interfaces and web contents are designed for the desktop PC's having large displays. It is tiresome to surf these large web pages on mobile devices with small screens. In this paper, we proposed and developed a novel server side XHTML, CSS based code which can be downloaded and attached to any of the existing web page. By applying this code, the original webpage makes itself to be adaptable to the heterogeneous mobile devices. It fit the webpage to the small screen of mobile devices having low resolution. Our designed code will improve the outlook and formation of an existing web page and split it into small and reasonably interrelated units. It will provide reasonable browsing experience to user's of mobile devices in heterogeneous ubiquitous environments.

Key words:
Interface, mobile devices, resolution, heterogeneous, ubiquitous

1. Introduction

Recent growth of mobile devices and advancement of their associated technologies as by the internet usage and mobile devices become more widespread in our daily life. According to the statistics in the year 2010 there was 18.5% increase in the sale of mobile devices as compared to 2009 [1]**.** Services and software's for mobile devices are more likely to work on a wider variety of platforms. The Processing power of mobile devices has been increased a lot. New hardware and software changes are fragmented into these tiny devices to facilitate the end-user. Also, the computer is becoming fragmented to a lot of the smaller devices and which are expected to deliver the services in a mobile fashion as desired by the users of the technology with enhanced functionality and performance [2], [3]. Mobile devices are as capable as their dedicated desktop counterparts.

It's important to have a mobile friendly website. With the increase in fame of smart phones and tablet PCs, growing number of users are accessing the Internet via a mobile device.

Users in mobility means away from home and offices are accessing websites exclusively from mobile devices so mobile internet usage is no longer referred to checking email only. The usage is now comprised of online shopping, information gathering and be well aware via getting information services. The internet users are growing rapidly as compared to the desktop users [4] Fig. 1.

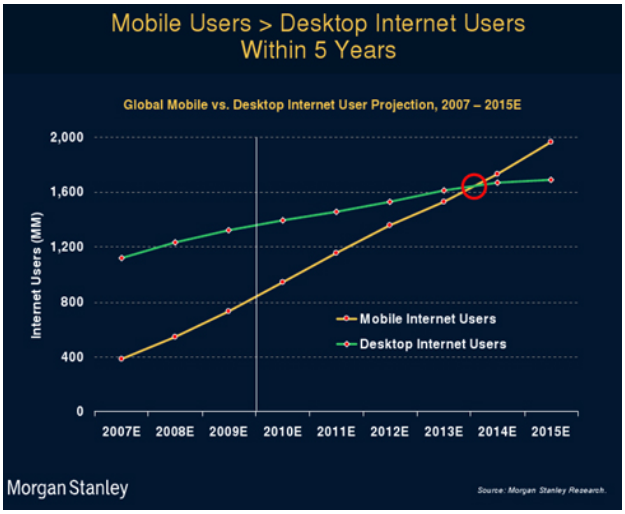

Fig. 1 Comparison of Mobile and Desktop Users of Internet.

1.1 E-Commerce

Online selling and services the main part of E-Commerce is now more attractive by the common use of mobile devices. It is another important aspect for the developers to make websites display friendly not only the common browsers of desktop PCs but also the heterogeneous mobile displays using default and installable browsers available for mobiles and handhelds [3].

1.2 Mobility

Many users have to travel all the time, such as business people and tourists, may find themselves using mobile internet services exclusively. While they may visit a website frequently on their home PC and they like to visit the same sites of their interests on their mobiles as well, so the respective sites must be mobile friendly with its interface. The usage of internet on mobile devices for the year 2011 is shown in fig. 2. Having a mobile-friendly website, we allow our user and visitors to continue having a great experience, regardless of where they are.

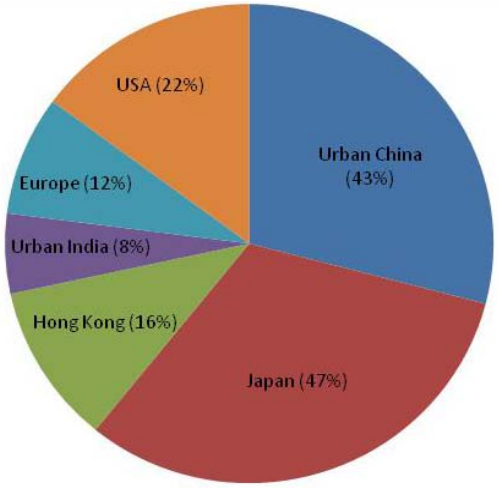

Fig. 2 Users accessing internet on mobile devices in 2011.

Content adaptation refers to the transformation of contents to be adapted to the device capabilities, user's choice and resource limitations [5]. Mobile devices face many challenges in content adaptation. To overcome these challenges efficient techniques must be followed for making an optimal content adaptation version [6], [7].

In *ubiquitous computing* the applications are designed in such a way that they are embedded in the objects found the functionality every where. Ubiquitous computing having great impact on the recent development of mobile web applications and gadgets [12].

2. Problem Statement

Intelligent device independent UI adaption refers to the availability of an application which is totally heterogeneous in nature and adapts itself to the target device without any dependencies on underlying hardware and operating system (OS) [8]. Making one user interface that can be highly optimized for each mobile device, without compromising interface quality and content availability [9].

Mobile phones, handheld personal digital assistants (PDA's), i-phones and laptops have limited processing and bandwidth capacity. Porting applications between heterogeneous devices require significant software development work.

Subsequent approaches are mainly followed:

- Dissimilar content sets based UI across terminals
- CSS support handy for some of the devices
- Unchangeable media support
- Non-uniform support for structural elements (tables, lists)
- XHTML based device specific markup
- dissimilar steering on various devices

Additionally screen resolution, storage, bandwidth, memory, battery and computational limitations are major constraints towards UI adaptation for heterogeneous environments [8].

3. Design Process

Making web contents friendly for mobile devices is a typical practice and mostly followed now-a-days. We initiate the standards-based HTML and CSS through the help of XHTML markup which will display cleanly, and accessible on all sort of mobile devices. With the use of CSS the breakup of contents from appearance point of view means that it will be accessible to ordinary mobile devices. The semantic markup is vital when we think about the diversity found in mobile devices. A number of devices recognize the floats, tables, scripts, and dynamic menus, but many of the devices are not capable for this. Some of the mobile devices render websites with XHTML and CSS. However, a few recognize HTML 3.2, but others identify with XHTML [14]. Our approach works with HTML and XHML with working in CSS based external file which attached itself with the target page. This file has the code snippets which use the % approach for HTML tables TDs and TRs and in DIVs based structured sites rather than using fixed pixels for the layout width as well as heights. HTML and XHTML by means of semantic markup to divide web content from Web User Interfaces with CSS. Webpage format analysis and modules for heterogeneous interfaces is shown in Fig. 3 and Fig. 4.

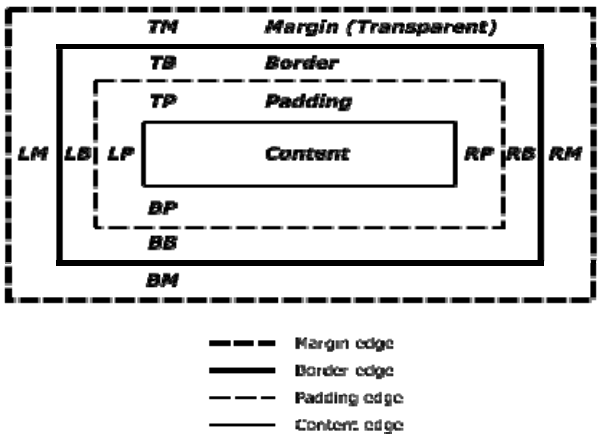

Fig. 3 Web page format analysis.

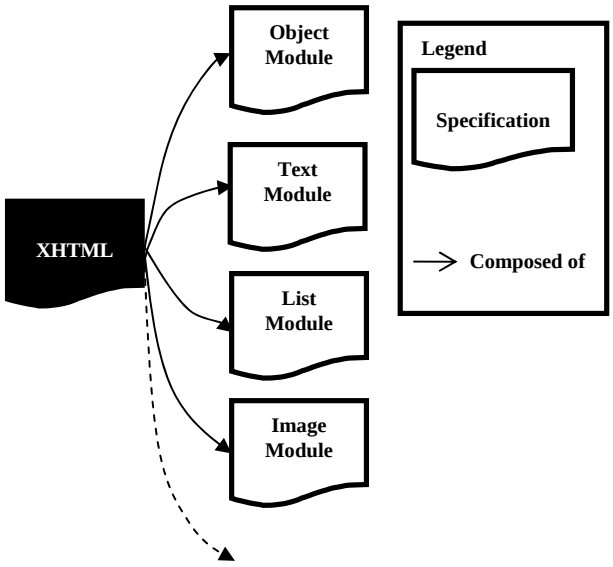

Fig. 4 Modules for Heterogeneous Interfaces

4. Testing Process

The testing process on real time mobile devices is far better than the testing on simulators either free or fee based. Generally the Opera browser web developer bar contains a button named as “Display”. For general view Opera browser web developer bar has a button called Display which permits to switch on or off the CSS for the presentation of a webpage on smaller screen view [14].

As mentioned in Fig. 5(a) a scroll bar and the missing content can easily viewed while on the other hand in Fig. 5(b) using intelligent device independent friendly interface file attached to the website and the display is clear with no scroll and the content is adapted to the screen [11].

Fig. 5(a) & 5(b): Webpage adaptation on mobile screen

XHTML belongs to the family of XML markup languages that are being used to extend the versions of HTML. XHTML is an application of XML, a subset of SGML. XHTML documents need to be well-formed, can be parsed using standard XML parsers—unlike HTML, which requires a lenient HTML-specific parser [15].

CSS is a language to make style sheets which are used for the definition of semantics arrangement (how it appears to be) of a file in black and white in a markup language. The webpages are being coded in HTML and XHTML, CSS can apply on all sort of webpages including XML, SVG and XUL.

The separation of manuscript content (written in HTML or at any sort of similar markup language) from document appearance, including elements such as the layout, fonts, and colors is being done by CSS. To boost content flexibility, availability and control in the narration of appearance distinctiveness separation is useful and it becomes licensed for multiple pages to contribute to formatting.

Intelligent device independent interfaces using stylesheet for making the webpage intelligent and device independent for heterogeneous mobile devices in ubiquitous environments [11]. There are mainly two conventions to rearrange the div content sizes and div sidebar and to eliminate the float. The coding mode of style sheet is:

```
#content {
        float: none;
        width: 95%;
}
#sidebar {
        width: 90%;
        margin-left: 5%;
}
```

Behind the media, the link of the stylesheet combined to the document head, to be at the end of the cascade by a link element. The mobile devices used to recognize CSS; for getting in styles the handling of a link is much more responsible than use of "@import".

To retain any of the existing styles in a handheld display, there is one more step, change the link element for intelligent device independent interfaces existing stylesheet to comprise this media element: media = "handheld,all".

5. Architecture

Intelligent Device Independent User Interface adaption for heterogeneous ubiquitous environments offers a formal model that can be extended, shared, and reused for the existing web contents and UI to be displayed on heterogeneous mobile devices.

As depicted from our design methodology the web pages requests for the mobile version. Our architectural design supporting adaptation of web-based content and UI elements enriched with attributes such as links, menus, radio buttons, check boxes etc. The structural webpage elements such as templates, headers, footers, containers, etc. The fundamental abstract interaction dialogues in multiple alternative styles such as navigation, file up-loaders, paging styles, text inputs [10].

The existing web pages request together with XHTML layer, CSS application layer returns back to the mobile device for adaptable view by considering the mobile device profile (e.g. device H/W diversity, underlying O/S, screen sizes, screen resolution, fonts etc.) Fig. 6. Our system operates on the web pages that are in HTML format.

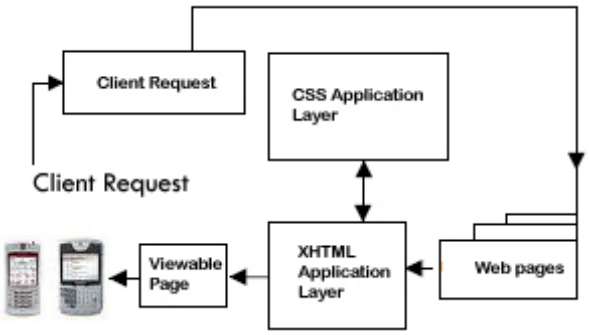

Fig. 6 Intelligent Device Independent Interface Architecture

6. Conclusion and Future Work

We have designed and built Intelligent Device Independent system that allow the adaptation of the user interface to heterogeneous mobile devices in ubiquitous environments.

Intelligent device independent web commerce commences web content adaption of on hand web resources to range of web users with improved experiences. Web content and all sorts of elements are reorganized to the globally accepted context parameters and transformed in quite effective formation. A prototype demonstrates the modeling, adaptation, abstraction and rendering realities.

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