User Interactive Web Content Adaptation for Mobile Devices

Prakash K. Mishra  Kapil Baliyan  Deepshikha  S.P.Singh
B.Tech Final Year  B.Tech Final Year  B.Tech Final Year  Assistant Professor
prakashmmngkp@gmail.com  kapilbaliyan@gmail.com  deeps390@gmail.com  singh_sarvpal@yahoo.co.in
Department Of Computer Science & Engineering, MMMEC, Gorakhpur

ABSTRACT
The current trend is to access web contents and applications anytime, anywhere and on any device. More and more mobile users with different terminals use the various services. Unfortunately most of the current ones are designed for PCs with large color screens and broadband internet access methods. So they are not suitable for displaying and browsing on mobile phones because of a mobile phone’s limited network connectivity, processing power, storage, display and format handling capabilities.

For this reason various content adaptation techniques and browsing conventions have been proposed by different authors in the past. But every technique has its own pros and cons. These techniques either introduce new formats and mechanisms to make new Web pages adaptive to different display sizes or attempt to automatically transform existing Web pages into formats that can be browsed on mobile devices. Former requires additional effort on the web author’s part and automatic customization strategy does not include context of access (e.g. screen size of device being used, network connectivity, location, user’s preferences etc.).

In this paper authors have proposed a new user interactive adaptation technique which is based on an overview of the existing Web page. Segmentation Algorithm splits Web pages into small and logically related units of blocks and makes an overview page that fit into the screen. This overview Web page has links for the blocks of Web pages and will be served with a java script. When user will move his cursor on the link, particular requested block which the cursor is focusing will be gotten from the proxy asynchronously and zoomed in automatically for access. Proposed adaptation technique allows a user who is unsatisfied with the system’s adaptation decision to take control of the adaptation process and make changes until the content is suitably adapted for user purposes.

The adaptation system learns from the users modifications and adjusts its prediction for future access by other users.

KEYWORDS
Content adaptation, Mobile devices, Limited browsing devices, Customization, Learning

1. INTRODUCTION
A handheld device equipped with a browser and a wireless connection provides an opportunity to connect to the Internet at anytime from anywhere [4,7]. Technically, it has been possible to access the Internet on a mobile phone for several years already, but the mobile browsing experience has often been cumbersome. The conversion of standard Web pages to be used with these new devices is a challenge, as the amount of content within each of these pages is too large to be adequately displayed in these smaller display areas [4, 12]. So the user has to scroll the whole Web page for a long time to find the objective component. To provide comfortable Web browsing using cellular phones, these burdensome scroll operations have to be reduced.

Accesses of Web on the mobile devices are via low speed wireless networks. This can lead to long retrieval times, especially for lengthy content and for content that requires a lot of navigation between pages [17, 18]. User want to fast access the Web on mobile phones otherwise the cost charges can be high.

A promising solution to these problems is adaptation middleware, interposed in the network path between the client and web server, which automatically tailors content for individual mobile devices [17,19] For example, images on web pages can be served to the user at a reduced fidelity in order to conserve bandwidth and improve download times. Also, the layout and size of content objects (such as images) can be changed to better fit on a small display.

However, a key challenge in such systems is how to identify appropriate adaptations. This is a difficult problem because optimal adaptation depends on the user’s purpose as well as the user’s device and network connection. A customization that is appropriate for one user may not be appropriate for other users who utilize the content for the same purpose in dissimilar contextual conditions (e.g. same device type, network bandwidth). So the adaptation system must include user’s preferences while making adaptation of large web pages which is best suited to client.

In this paper authors have proposed a web page adaptation system, which splits the whole page in logically related blocks and make an overview page. This overview page has links for the blocks. A proxy is arranged to perform the segmentation and generation of the overview page. This proxy also creates and inserts an AJAX (Asynchronous JavaScript and XML) code [8] to reduce time consuming scroll operations. When the user move the mouse pointer to a specific link, the original block will be gotten from the proxy asynchronously and zoomed in dynamically. Our adaptation system that allows users to provide feedback when they are unsatisfied with the system’s adaptation decision, and which in turns its adaptation decisions based on user feedback.
2. BACKGROUND AND RELATED WORK

Significant effort has been expended by the research community to improve the web browsing experience on mobile devices. At a high-level, we can divide the work into two categories, techniques that do not modify the accessed content and those that do. In this section, we consider each of these in turn. Finally, we will describe fundamental open problems in content adaptation that are addressed in this paper.

Many authors presented rendering of a Web page using thumbnail view. When a Web page is displayed; it is first displayed as a thumbnail image. The image is shown divided into 9 regions. By pressing the corresponding number keys (1-9) on the phone’s keypad, the user can select the region of the page on which they would like to zoom [1, 6]. When a particular region is selected, that region of the page can be displayed in a variety of ways. For example, it can be shown as an enlarged image that can once again be zoomed into [1, 5]. This simple approach has the benefit of allowing the user to focus quickly into a particular section of the Web page by pressing a single key, no panning or scrolling is necessary. The most immediate concern for this system is the lack of intelligence employed in the segmentation. Using the divisions many regions, words, and images have been mistakenly divided. The implicit assumption that this thumbnail interaction method makes is that the user is experienced with the Web and some of its unstated conventions [1, 17]. By looking at the structure of the page, it is possible for an experienced user with knowledge of the common conventions of Websites to know which region of the page is of interest. Advantages of this approach are fast, easily understood by the end user. But this approach is extremely disruptive, it can sever words, sentences, images and regions of a Web page [1].

Some authors suggested for Web browsing a large page on a small screen requires a series of zoom interaction. Smart View [6] is presenting adapted Web page using zoom-in and zoom-out features. It is a functionality built into a document viewer that performs partitioning of Web document content into logical sections that can further be selected by the user and viewed independently from the rest of the document. The Smart View interface enforces the concept of a document by allowing the user to view both the document, a zoomed out version of the document and a document thumbnail [1, 6]. But this is a time-consuming and tiring for mobile users.

The ThunderHawk facility is an effective way of reducing the size of Web pages while retaining their complex layout, but it doesn’t allow the user to ‘zoom in’ into regions of interest. Furthermore, users might find it difficult to sustain the required effort to read a text rendered using a very narrow font.

Many authors have proposed adaptation methods to modify Web contents to meet the requirement of client capability and network bandwidth [12]. Most of the attempts to overcome the problem of document display on small devices are focused on presenting the user with information contained on the page in some other form rather than the page itself. For Web pages, the existing methods are mostly based on discarding format information. For example, in [14, 15] the authors focused on devising methods to create suitable text summaries of a single or multiple pages and present those to the user. Bitstream’s ThunderHawk facility [21] employs font technology to make Web pages accessible on small devices. It reduces the overall extent of a page, in particular its width, by using specially crafted extremely narrow screen fonts and by scaling down the size of images on the page [19]. The resulting page is then displayed on mobile phone.

There is a number of similar bandwidth saving proxy based solutions for mobile Web browsing [9]. However, none of the existing solutions combines all the important elements of Web browsing. In the following we compare our approach to the most closely related techniques. Opera Mini, which was launched summer of 2005, uses a proxy based solution. The problem with Opera Mini is that the user interface forces the page to fit to the width of the small screen of the mobile phone. Thus the user has to scroll down a lot to find a certain parts of the page.

In [11, 12], the Web page is reformatted on the basis of page annotation. However, this approach requires a practical solution to facilitate the creation of annotations for existing Web pages. The re-authoring technique proposed in [13] required Web pages to have sections and section headers, which however, are rarely used in Web page authoring today. In the work of Buyukkokten [21], an accordion representation is generated and the detail content can be folded or unfolded at client device. Since this method focuses on text summarization, it does not leverage the graphic capabilities of current devices. For efficient browsing convention there is the need of techniques for extracting the content structure of a Web page [21]. Many researchers have considered using the tag information and dividing the page based on the type of the tags.

3. OPEN PROBLEMS

While the mechanisms for doing automatic content customization have been well-studied, the challenge that remains is the design of effective adaptation policies. Content providers cannot be expected to provide constraints or rules for every data object, as this would not be very different from supplying customized content for every client type. As a result, small sets of rules are applied to broad sets of content (e.g., all JPEG images are adapted the same way independent of their purpose or value to the user). This leads to sub-optimal customizations being provided to users. At a high-level, optimal adaptation needs to take into account the usage of content, as well as the context of the user. By usage, we refer to how the user will make use of the accessed content. For instance, users may find some objects to be more relevant than others. Another challenging aspect of usage is that users might utilize the same content differently. By context, we refer to
Write your paper title here in title case

caracteristics such as the device being used by the user to browse the web, the available network connectivity, the user’s location, etc. While an object may be being used in a similar manner by multiple users, differences in context may require that the content be adapted differently. All of these factors need to be taken into account by an adaptation system in order to provide fine-grain customizations.

3. SYSTEM ARCHITECTURE

Adaptation systems consist of three components: client applications, an adaptation proxy and content servers. Client applications present adapted content to users and allow them to modify the decision made by the adaptation system. The adaptation proxy mediates all accesses to content, provides adapted content, maintains history, and serves as an aggregation point for user requests. Content servers are standard unmodified data repositories, such as web sites, databases and media servers, and no additional functionality is required for this component.

Here is the complete System Architecture.

![System Architecture Diagram]

The adaptation proxy mediates all of the client’s content requests. The proxy performs the following tasks: (1) retrieves the original content from content servers and create an overview page (2) inserts a AJAX script to the newly generated overview page (3) serves the adapted and customized content to the client, (4) responds to client requests to change the adaptation to perform on content, and (5) keeps track of user adaptation corrections (feedback).

4. KEY COMPONENTS OF THE SYSTEM

The adaptation proxy consist of four main components, an overview page generator, an AJAX code generator, an asynchronous servlet module and fidelity adaptation module which is responsible for the adaptation of images based on the users profiles.

4.1 OVERVIEW PAGE GENERATOR

In order to provide a new browsing convention of easy access of Web page on mobile phone an adaptation technique is proposed. An idea of adaptation is to provide an overview of the original Web page. The overview is a systematic review and a List of Content for the original Web page. Overview page are made by extracting the some initial text from blocks and make a title line for that block. This title works as a link in the overview Web page for the block. When users select a link then that block is open. This overview page is fit well into small screen of mobile phone. These blocks are obtained using Web page segmentation algorithm.

Here is the block diagram of the complete working of the overview page generator module.

![Overview Page Generation Diagram]

When a mobile phone browser send a request to the Web proxy segmentation server, after the parsing of the URL, Web proxy segmentation server send this request to the origin www remote server. Response of the origin server treats as an Input for this.

4.2 AJAX CODE GENERATOR

This module generates and inserts AJAX code into the newly generated web page so that when mobile user using the overview page, moves pointer to a specific link, the AJAX code that running on mobile client can get and show the original visual block from the proxy asynchronously and zoomed in dynamically for the better user experience. This issue focuses on determining the position where to display the visual block on the small screen. The screen’s size can be measured by AJAX code running on mobile client.

Pseudo code of AJAX code generator algorithm is given below:

1: invoke page block
2: construct blocks list;
3: generate AJAX code;

/***Begin: key AJAX pseudo code generated is given as follows***/
var x0, y0, x1, y1;
function mouseMove(event)
{
x0 = event.clientX;
y0 = event.clientY;
checkGetNewBlock();
}
4.3 ASYNCHRONOUS SERVLET COMPONENT

This module is responsible for communicating with the asynchronous AJAX components running on mobile clients. The servlet components receive AJAX requests, parse them, and construct responses and send the response to the client. The main work of this module is locating the web page block which the client is requiring. The pseudo code of the key servlet component which named AsynchronousProcessCenter is given as follows:

```java
public class AsynchronousProcessCenter extends HttpServlet
{
    public void doPost(HttpServletRequest request, HttpServletResponse response)
    {
        String blockid = request.getParameter("blockid");
        if (blockid == null) forward the request; //means client request a new page
        else
        { 
            string blockCode = blocksList.getBlockHtmlById(blockid);
            response.getWriter.write(blockCode);
        }
    }
}
```

4.4 FIDELITY ADAPTATION MODULE

In response to a request from the client, the proxy downloads the web content from the origin web server (which is unmodified and is not aware that content is being adapted) creates an overview page and transcodes any images into a progressive JPEG format. The proxy then serves the overview page to the client along with fidelity adapted versions of all images. We configured the proxy to generate progressive JPEG images consisting of 10 scans. Progressive JPEG images have the property that if we only have the first few scans of the image, we can see a low fidelity version of the image and as we load subsequent scans, image quality improves. The relationship between fidelity levels and scans is that fidelity level corresponds to the progressive JPEG image consisting of the first scans of the image. Users can refine the fidelity of individual images by requesting additional scans. A key function of the adaptation proxy in this system is to keep track of the history of adaptations for an object that satisfied users in the past. The proxy assumes that the highest fidelity of an image that is served to a user is the adaptation that provides satisfaction and we call this fidelity level the Fulfillment Fidelity. For each image, the adaptation module keep track of histories of fulfillment of different users. The history of successful adaptations is used by our prediction policies.

5. IMPLEMENTATION OF PROTOTYPE

The system was implemented based on the above design in the Wireless and Mobile Computing Lab (WMC) of the college. We implemented the adaptation proxy system and segmentation server entirely in Java. We used Sun Java Wireless Toolkit 2.5, Java Development Kit 1.6 and HTML Parser that is a Java library used to parse HTML for designing and implementing of Web Proxy Segmentation Server. Sun Java Wireless Toolkit 2.5 provides a device simulator, which was used to simulate handheld terminal device. Browser of the simulator was configured to route all the HTTP traffic to the segmentation server. A modified pass-through Squid proxy was used that transcodes JPEG, Bitmap and GIF images into progressive JPEG format, and can serve these at various fidelity levels.

CONCLUSION

In the proposed system we have focused on Web page customization and adaptation on mobile phones to provide a better way to enable easy navigation and browsing of a large Web page on mobile phones. This paper suggests a new adaptation approach based on overview of Web page for Web users which is completely easy and efficient to implement. The overview is a systematic review and a List of Content for the original Web page. Overview page is made by extracting the some initial text from blocks and make a title line for that block. We have also suggested that the adaptation system must include user's preferences and experience while making adaptive decisions.

FUTURE SCOPE

Future work will focus on design and implementation of rendering of Web page which contains frames and videos (multimedia contents) on mobile browser as the proposed adaptation technique is limited to static HTML pages. Future work may also include enhanced presentation and functionality provided with layered and unobtrusive elements, such as externally linked CSS and scripts.

REFERENCES


