An Approach to Dynamic Division of Web Pages for Displaying on Small Screen Devices

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Abstract: - In this paper, we would like to describe a design of web page slit system on hand held devices. The purpose of this study is to display a web page with rich contents on small screen devices. Nowadays, many web sites have rich contents. It is too inconvinient to read because the screen size of a hand held device is much smaller than the layout size of a web page. To solve this problem, we divided a web page to several parts. Each part is a web page which is suitable for a small screen. Our division algorithm is designed by considering small screen size. We do not re-generate or convert contents. We are not concerned with transmission speed and processing power in terminal. Transmission speed has been risen recently and processing ability also has been improved in terminal. We assume that those features are enough powerful to process a web browser system.

Key-Words: - web page, division, small screen, document object model, screen size

1 Introduction

Transmission speed has been risen recently, and processing ability also has been improved very much in a terminal. Those features are enough powerful to process a web browser system. It is possible to see animation in a cellular phone. Therefore, it is able to browse a text and an image-based web page in hand held devices as generalized cellular phones and PDAs, etc. Nonetheless what these hand held devices were not able to overcome is screen size. To solve this problem, we proposed a way to divide and display a web page suitable for a screen without re-construction and conversion of contents.

This paper configuration is as follows. We explained background of the web-page division technique in this section. In the next section, We will look into related technologies. In the third section, We will describe main algorithm in detail. In the forth section, We will show an example divided using the algorithm in this paper. We will make a conclusion in the fifth section.

2 Previous Work

We would like to describe previous works to display existing web pages on small screen device in this section. We have categorized techniques into three approaches: device-specific markup language design and re-authoring web pages, transformation or filtering in a proxy and screen scrolling.

2.1 Device-specific markup language and re-authoring web pages

Because existing HTML (Hyper Text Markup Language) [1] pages are not suitable for small screen devices, some vendors designed new markup language for their hand held devices. For examples, there are WML (Wireless Markup Language)[2], cHTML(Compact HTML), mHTML(Mobile HTML), and so on.

WML was proposed by WAP (Wireless Application Protocol) forum. WML is a markup language based on XML(extensible Markup Language)[3] and is intended for use in specifying content and user interface for narrowband devices,

including cellular phones and pagers[2]. WML is designed with the constraints of small narrowband devices in mind [2].

cHTML proposed defines a subset of HTML for small information appliances such as smart phones, smart communicators, mobile PDAs, and etc. Such a certain level of HTML is strongly required as a guideline from the manufacturers of small information devices, service providers, carriers, and software developers. It is used by i-mode service of NTT Docomo.

Besides, mHTML is a markup language used by Microsoft ME(Mobile Explorer) and sHTML is a markup language used by samsung phone. Those are a subset of HTML and use HTTP protocol.

Service providers must provide web pages written with these specific markup languages to support in each terminal. These technologies cannot support to display the existing web page in a hand held device as it is. There is the burden that service providers must newly establish a website.

2.2 Transformation or filtering

There is another way that converts the existing web page into a form suitable for a terminal and transmits it in a gateway [4, 5, 6]. At this time, as for the method to convert a web page, it is general to convert into markup language to support in a browser of a terminal. A way to filter a part of HTML is known. These two ways have a merit that they provide the existing web page as it is and they can generate a form of the web page that is suitable for a terminal. However, a lot of disadvantages appear. We must bear the costs that establish a gateway system, because we must always provide contents through a gateway. Also, anyone can read contents in a gateway, and a blind spot comes into being in security.

2.3 Screen scrolling

There are several ways to display existing web pages on hand held devices without transformation or re-authoring in a gateway. There are two examples. One is a way to read a total page by scrolling the page using scroll bar on the web page display. Two is a way to read a total page by enlarging or reducing the page.

The First way is too inconvenient to use as if a blind touches a leg of elephant.

In case of the second way, there is a merit to be able to read a page at first sight. However, if there are a lot of contents, there is a disadvantage that we are not able to read characters of a page well.

3 Dynamic Web Page Divisions

In this section, we will explain our proposed way to display the existing web pages on small screen devices in detail. This section includes the process and system configuration, the division algorithm, the data structure and so on. Divided pages are suitable for small screen size. A divided page is a unit to display on a screen.

3.1 System overview

Fig.1 shows a diagram of the process and system configuration to divide for displaying web pages on small screen devices.
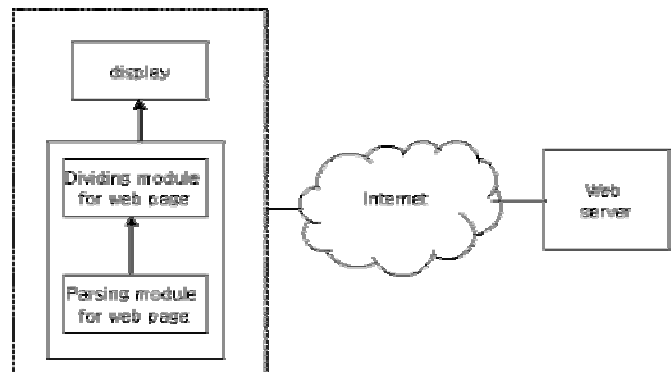

Fig.1 A process and system configuration

There are hand held devices, connected to web server via Internet. A web browser on hand held device retrieves data from a web server without altering. The web browser consists of parsing module, division module and display.

The parsing module for web pages parses a document from web server and generates a document object

model. At this time a document object model is structured data of a tree form to contain elements, attributes and text of the original document. The document object model consists of nodes. Each node has node type by document type definition.

The division module transforms structure of the document object model generated. We can calculate the layout size of each node. If the calculated size is very larger than the screen size, it makes a division of document object model for one page on screen.

3.2 Division Algorithm

Fig.2 shows a flow chart to divide document object model generated by web page division algorithm of this paper. The key point of our study is to divide a page based on the screen size. We will explain web page division algorithm in detail.
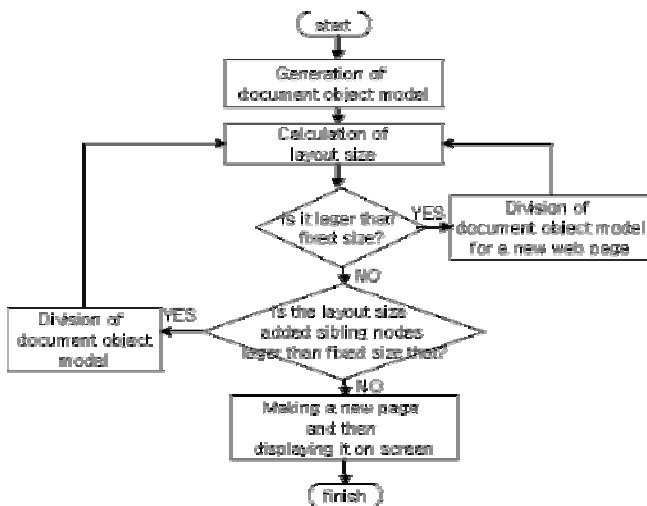

Fig.2 flow chart of division algorithm

The parser parses a document and generates a document object model. This document object model is a page being rendered on the screen. The divider searches the tree and calculates a layout size of a node. If the size is larger than the screen size, the node is a page. That is, a node presents a page. If the size is smaller than the screen size, divider adds sibling nodes. Whenever the calculated layout size is larger than the screen size, nodes are divided to fit a page. Even if screen separation was not over, top of the

pages generated is displayed on the screen. A divided page replace with new node with hyperlink and the root node in the page contains new page identification, flag and so on.

Usually, a page may contain several nodes However, a node may be divided several pages. For example, if the layout size of text of a node is larger than the screen size, the text is also divided into several pages.

We would like to use hyperlinks to connect a new page into an original page. The value of title or name attributes will be used as a hypertext. If any of them does not exist, we use some strings as [following page] or [next page].

3.3 Document Object Model

A document object model is a structured data to contain elements, attributes and text of the original document. Document object model generated by a parser is a form of a tree. Fig.3 shows original document object model generated by a parser.

Each node can be an element, string data or a image. And an element node can have children that may be elements, strings, or images. The image and the text node with some strings are always a leaf node. We can calculate the width and the height that each node would be displayed on the screen.
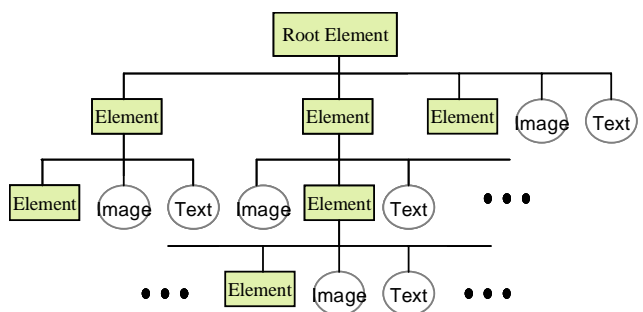

Fig.3 original document object model of a web page

The document object model for a web page divided by division algorithm proposed in this paper.

The root element of an each page will be generated for identifying. Each page has a unique

page number and a flag to present a new page generated.

We will explain examples seeing Fig.4. In the case of the new page number 1, we divided a node into a page, because the layout size of an image which the node contains is larger than the screen size. An application for rendering can search for the new page by using the unique page number that is one. So if you would click the hypertext of the previous page, you can see the image on the screen.
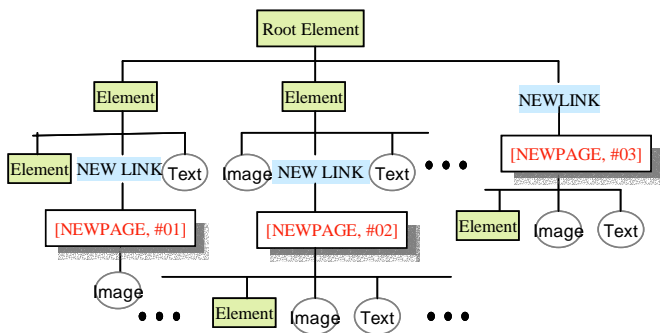

Fig.4 divided document object model

If there are a lot of pages divided, we can find a web page for displaying using a hash table. It depends on the development of an application.

4 Demonstrations

We demonstrate an example that is applied with the division algorithm proposed in this paper as shown in Fig.5.
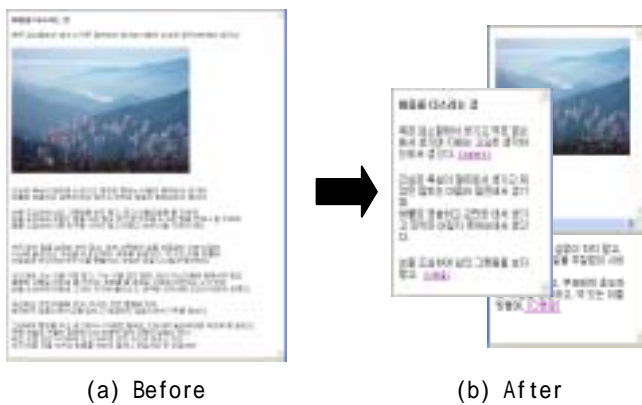

(a) Before   (b) After

Fig.5 web page division on screen

The (a) of Fig.5 shows an existing page from a web server displayed on the screen. The (b) of Fig.5 shows several pages that are divided by algorithm in this paper.

5   Conclusion

In this paper, we proposed a web page division algorithm for displaying the existing web page on the screen of hand held devices. This is a way to display a web page on small screen devices by dividing into several pages, if the layout size of an original page is larger than the screen size. In order to serve existing web pages in hand held devices appropriately we do not need to newly establish web pages. Without altering the content of web pages in a gateway, we can display a web page suitable for small screen devices. So, we do not require costs to establish a gateway system. Also, there is the merit that can use the existing infrastructure as it is.

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