Design of Web Contents Transcoding Middleware for Mobile Devices

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Abstract: - Mobile devices have the limited environment such as low process performance, small screen size, low network speed and restricted user interface. This situation prevented the use of diverse and rich desktop-based information and services because the user could use limited services in mobile telecommunication environment. Also, this demands that service providers should develop a separate web contents for mobile telecommunication. Therefore, in this paper, we proposed web contents transcoding middleware that could provide automatic web contents reauthoring for mobile devices.

Key-Words: - Mobile web, Transcoding, Middleware, Adaptation, Personalization

1 Introduction
Recently, the demand for the use of web at the variety of mobile devices including mobile phones is growing. This is based on new worth discovery for the realization of a variety of wire-wireless integrated service in ubiquitous environment. Ultimately, this has been started from a natural demand that web environments in the wire-wireless should be integrated into one. Through this, we expect to create many new business opportunities[1].

Mobile web contents market was dominated by general cellular phone in the past, so service providers could provide only native applications, but now the web content development and distribution is activated by development environment with open platform and open source and expansion of the smartphone market such as iPhone and Android. Therefore, this situation is very attractive factor from the web content provider's side because the mobile market which is possible to compete through the technology is better than the desktop market which is holding by major companies.

However, there are some problems to service the web content, which is optimized at desktop, to the mobile device which has limitations such as screen size, performance, network speed and support software. Currently, Most of web contents providers have been working to rebuild desktop web contents to mobile based.

There are two different methods to rebuild web contents for the mobile device. These are manual method and automated method[2, 3].

Manual authoring method that the web content provider prepares a variety of web contents version for various device profiles and provides is currently most frequently. This approach is possible to provide high quality web contents, but the web author have to manage web contents directly and have to expect what contents are accessed by user. Also, it is very waste of time and costs, because they prepare same web contents for various versions of mobile devices.

Automatic authoring method using transcoding technique is an approach that could provide transformed web contents for the user device when the user requested. It is an attractive technique because it could be transform automatically in any device environment. But, transformed web contents which apply this method have lower quality than manual authoring method. Furthermore, most of transcoding techniques are based on method that can simply assign web contents to fit the size of the mobile device through parsing HTML codes and searching regular patterns.

Therefore, in this paper, we proposed item based on content block extraction method, which is not dependent on only HTML codes, for solving problem of Automatic authoring method and designed transcoding middleware which can provide automatic web contents reauthoring for mobile devices.

2 Related Works

2.1 Mobile Browsing
It is mobile browsing to view web contents based on existing desktop using mobile devices. In mobile browsing, there are four methods as follows in order to view web contents.
2.1.1 Full Browsing

Full browsing is a method which shows the screen of a desktop as it is to on a mobile device without enlarging or downsizing[4]. This method may have a problem of contents-aware in low-resolution mobile devices because there happen left/right and top/bottom scroll extremely. Recently, there is a try to embed a zoom in/out function into mobile devices or support high-resolution in order to be able to see a full screen at a glance, however, it is a crystal clear for a mobile device with 3-inch-screen to grab a full screen web site.

2.1.2 Mini-map

Mini-map method shows a mini-map downsized of full-screen, so the current location will be displayed if a user scrolls it. For the user, it is possible to move a bit more easily directly, but the space for display will be shorten because it takes some room of mobile display[5].

2.1.3 Thumbnail

Thumbnail is a method that shortens a whole page to a screen size and links a part to the enlarged page as clicked[2, 6]. It has been advanced of previous thing that is very effective method about moving sub-page from complexity main-page. Users can watch contents through moving a sub-page. But, it is able to lose half of efficient in case of moving page which is consisted of complexity page by moving.

2.1.4 Vertical-align

Vertical-align is a method which optimizes to vertical side in screen[7, 8]. It is superior to others because that is not occurred left/right scroll by fitting horizontal-size although vertical-scroll can be lengthen, but It has a problem of scroll which can be lengthen in case of portal-page which have many contents. Google has a function that provide to automatic page division. But it will occur to problem that is frequently page-moving in case of finding particular contents by users because it is decided by size for page-division.

2.2 Web Contents Adaptation System

Through considering in heterogeneous mobile device of each user, the system which can provide by automatically adapting in user environment for web contents based on desktop are developed and proposed.

2.2.1 Mobile Gate

MobileGate proposed a method to service by transforming from web contents to image that protect to occur for impossible contents into mobile-device in content of web-contents. It is imagification for whole web-page that is divided by carat about user's preference area and using method to service by transforming image suitable format in mobile[9].

2.2.2 Xadaptor

Jiang He proposed a Xadaptor adapting system using a rule-based approach for flexibility and scalability[10]. It explains to adapting technique about various architecture and basic type such as text, image, streaming media, etc. Especially, it provides to adapting technique such as table and frame.

3 Design of Web Contents Transcoding Middleware

Web content is Generally made on the basis of the desktop environment thus it has difficulties of use at the mobile device which has limited resources such as low process performance, small screen size, low network speed and restricted user interface.

Recently, some parts of limitations of existing mobile devices is supplemented by the appearance of the smartphone which competes with desktop performance through development of the mobile technology, but the mobile device still have problems, such as readability of web contents and scrolling for showing whole page, due to its special features. Especially, there is a serious problem that the developer has to rebuild web contents for mobile device owing to differences of each mobile platform.

These problems can be resolved through the middleware which can reconstruct web contents by extracting item based on content block and using the user preference for the priority location of items. Figure 1 shows structure of web contents transcoding middleware proposed in this paper.

![Fig. 1. Structure of Web Contents Transcoding Middleware](image)

3.1 Extraction Method of Web Content Item Blocks
Web content transcoding technique is an adaptation method that can automatically transform web contents for various user devices and can provide web contents suitable for their devices and platforms. Most adaptation methods, based on heuristic methods which find regular patterns in accordance with HTML code analysis, split web content into blocks and summarize it for the size of the mobile, and hence link it to the interface with block. However, this method causes a problem that cannot extract items, which are content units for user recognition, because it is dependent on only code or size of web content.

Web content based on desktop does not consist of one subject but detailed items such as menu, login, logo, search, news, etc. Users are able to search and read interesting items, and click hyperlink linked to the items. If an item is divided into different blocks, or a number of items are grounded into one block, it will cause difficulties for users to understand the content of each item. Therefore, most of transcoding methods are less effective at the structurally complex web page such as portal sites. Hence, we proposed item block extraction method based contents using document object model in this paper.

DOM(Document Object Model) is a structure which is made as object tree by parsing HTML document. It can be possible to analyze the content or the structure of web contents according to searching DOM tree, modifying or deleting particular nodes and tags. And, through this, generated web content is optimized for mobile browsing service environment. Figure 2 shows an example of DOM tree for the web content.

Generated web content should mitigate inconvenience of the interface using preference of users in the mobile browsing environment.

Which items will be preferred by users among items of web content? It will be the item which users prefer and frequently use. Interface manipulation is the most troublesome in mobile browsing. Personalizing service which searches items preferred by users on desktop web applications uses a service tool which reduces awkward interfaces as well as difficulty of search for interesting items for users.

Item block extraction method of personalizing web content proposed in this paper does not extract the size or code on web content but item based blocks, the unit to consist the content. To create extracted blocks on personalizing web content by preference of users, it makes that web content is rebuilt by calculating the preference of each item block using user preference profile. This also includes user interest information.

The user preference can be measured by collaborative filtering and profiling. Through attaching user preference weight to the web content item, we can suitably assign web contents using prioritization at the mobile display screen. Figure 3 shows concept of Web Content Location Assign using User Profile.

![Fig. 2. DOM Tree of Web Contents](image)

**3.2 Location Assign Module with User preference**

**3.3 Styling Module**

HTML tag and style sheet language are widely used for item design on most of desktop based web content. However, there is a difficulty about applying web content to mobile devices, because style sheet is designated for the desktop environment. Hence, the middleware should convert original web content to suit the mobile environment for representing content items to users. The module which is in charge of analyzing and adjusting about style sheet is needed, because the style sheet which need to accept and the style sheet which need to reconfigure are mixed.
4 Conclusion

Due to development of the mobile technology, now users can use various desktop based web contents at the mobile devices, so the mobile browsing environment that users can access web contents over any device at anytime at anywhere is possible. However, there are several problems to browsing web contents at the mobile owing to the limitation, such as screen size, support software, etc., of mobile devices compared with desktop-pc. Hence, service providers should develop a separate web contents for the mobile device environment.

Therefore, in this paper, we proposed the automatic reauthoring middleware which can reconstruct web contents by extracting item based on content block and using the user preference for the prioritization of items. Also, for this purpose, we proposed item block extraction method based on content using document object model, and propose a web content reconstruction methodology which can reassign items according to user preference profile for interface manipulation that users have felt the most uncomfortable using mobile browsing.

In the future, we would develop and test proposed middleware applying item extraction method and reconstruction methodology, and the process of evaluation verification of proposed middleware would be proceeded.

References: