ABSTRACT
Recently, mobile browsing on the World Wide Web is growing rapidly. The growth has created a surge in the number of Web pages designed for mobile devices. To increase the usability of mobile browsing, the Mobile Web Best Practices have been proposed to guide the development of mobile-friendly Web pages. In this paper, the mobileOK checker, a free service provided by W3C, is used to automatically inspect the conformance of 46 popular mobile Web sites to the Mobile Web Best Practices. We analyze the evaluation results and provide suggestions for improving the design of mobile Web sites. In mobile browsing, different mobile devices have different screen sizes, layout structures, and styles to represent Web contents. Furthermore, mobile devices are developing fast. The diversity and fast development of mobile devices cause the mobile design guidelines changing over time. However, the mobileOK checker is not flexible to include new guidelines or customize a best practice rule to fit a specific mobile browsing scenario. To solve this problem, this paper presents a generic approach to represent the mobile design guidelines through an XML schema. Using the XML schema provides the flexibly to support evolving guidelines in an open format. To evaluate our approach, a prototype, WPChecker, has been developed.

Keywords: Mobile Browsing, Mobile Devices, Mobile Human-Computer Interaction (HCI), Mobile Web Best Practices, Usability Evaluation

1. INTRODUCTION
The fast growth of WWW provides a convenient and promising approach to accessing information. Meanwhile, wireless network and mobile devices make it possible to access information from anywhere at anytime. Nowadays mobile devices such as advanced smart phones are getting a larger multi-touch display, and stronger processing capability. The global increase in mobile device ownership creates great opportunities to distribute and access multimedia content through personalized mobile devices.

To support efficient mobile browsing, some markup languages (e.g., WML and XHTML Mobile Profile) have been developed to specifically facilitate delivering information on mobile devices. Furthermore, researchers and designers have documented successful Web-design experiences as guidelines that were used...
to develop mobile-friendly Web sites. Those mobile-friendly design guidelines improve the user experience of mobile browsing. For example, the Mobile Web Best Practices (W3C, mobile web best practices 1.0, 2008), developed by W3C, summarizes the best practices for delivering Web contents to mobile users.

Evaluating the conformance of a user interface to guidelines is one of the vital tasks for the overall user-interface design. It is time consuming and error-prone to manually evaluate the Web interfaces against the guidelines. Therefore, it is desirable to automatically evaluate an interface. As a useful complement to usability testing and expert review, automation of usability evaluation has various advantages, such as a reduction in cost, less time, an increase in the consistency of the errors uncovered, an increase in coverage of the evaluated features, etc. (Ivory & Hearst, 2001). The automatic evaluation can take place during any stage of the user-interface development process. Especially, it is cost effective to conduct automatic evaluation during the early stage of the development process.

This paper conducted an automatic and extensive evaluation on the 46 popular mobile Web sites according to the Mobile Web Best Practices using the mobileOK checker (W3C, MobileOK checker), a free service provided by W3C that helps to analyze the mobile-friendliness of a Web site. A set of best practices of mobile Web design are automatically evaluated by the mobileOK checker. When all the tests are passed, the Web page is said to be mobileOK. The automatic evaluation aims to provide insights for designers to improve the overall design of mobile Webs. Especially, summarized statistic evaluation results identify the common mistakes mobile Web developers have made. The analysis results also promote the awareness of best practices among the Web developers, which can improve a user’s Web-browsing experiences.

In a pervasive environment, different mobile devices have different screen sizes, layout structures, and styles to represent Web contents. Furthermore, mobile devices are developing fast. The diversity and fast development of mobile devices cause the mobile design guidelines evolving over time. The mobileOK checker (W3C, MobileOK checker), however, does not provide an open format to incorporate new mobile design rules. To solve the problem, we proposed a novel approach that uses XML, i.e., an open standard, to represent the mobile design guidelines. The use of XML gives the extensibility to incorporate new guidelines. Furthermore, it provides the flexibility to modify a rule to fit different mobile devices. To evaluate our approach, we developed an automatic mobile Web page evaluation tool, called WPChecker, to perform the automatic analysis of mobile Web pages. Based on a set of guidelines specified in the form of XML, WPChecker accepts the URL of a Web page, and evaluates whether the evaluated Web site conforms to those guidelines or not.

The rest of the paper is organized as follows. Section 2 discusses the evaluation results of the guidelines on the 46 most popular mobile Web sites using the W3C mobileOK Checker. Section 3 describes the semantics of XML rule schema, which is used to describe best practice rules of mobile page design. Section 4 presents WPChecker based on the XML rule schema. Section 5 discusses related work. Section 6 concludes this paper and presents our future work.

2. EVALUATING MOBILE WEB SITES THROUGH THE MOBILEOK CHECKER

We use the mobileOK checker to evaluate the mobile-friendliness of mobile Web sites (Top MOblines Websites for 2008). The evaluation explores the state of the art of current mobile Web designs, and helps designers/developers identify existing issues. We have evaluated the home pages of 46 popular mobile Web sites. The results provide a deeper understanding of mobile Web development and point out a few guidelines that have been violated frequently.
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