Content Adaptation for Gradual Web Rendering

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Abstract. We previously proposed a gradual Web rendering system. This system rendered Web content incrementally according to the context of the user and the environment, enabling casual Web browsing. Unfortunately, it had low levels of readability and enjoyment. In this paper, we describe the problems with it and introduce content adaptation mechanisms to solve these problems.

1 Introduction

We can now browse Web pages at any time and from anywhere, by using portable computers or mobile phones, thanks to advances in downsized computer hardware, improved performance, and the popularity of wireless networks. Also, ubiquitous computing and wearable computers are now becoming a reality. Thus, the Web is no longer confined to offices or studies but is instead being widely applied to various scenarios in our daily lives.

Expanding the use of the Web in everyday life could also increase the provision of services based on coordination between Web content and external factors, such as the status of the user and the environment. Context-aware information services are an example of possible developments. Existing approaches, however, which assume active utilization on the user’s part, are unsuitable for many daily uses.

Therefore, by extending the concept of time-based representation of content, we developed a gradual Web rendering system based on abstract parameters, which could be connected to inputs indicating various status values (e.g., temperature, time, illumination, and energy consumption). This approach enables casual browsing.

In gradual Web rendering, the system first acquires the target Web page from the WWW (World Wide Web). Next, it divides the page into several parts and serializes them. It also monitors status values from sensors or input devices and adds them to the content of the page. Finally, it renders the different parts of the Web page. People can change their reading (browsing, rendering) speed by using certain parameters.

In addition, we previously implemented the EnergyBrowser [2] and Ambient-Browser [3] systems. EnergyBrowser was designed to encourage the user and makes
exercising more enjoyable and interesting. *AmbientBrowser* was designed to provide a huge variety of peripheral information via ubiquitous displays in kitchens, bathrooms, bedrooms, studies, and streets. People can thus acquire knowledge by viewing information from ubiquitous displays, with only minimal interaction.

We found that the gradual Web rendering system could increase legibility, because it directed the user’s viewpoint so that he or she could read more easily. We therefore concluded that the gradual Web rendering/browsing mechanism would be suitable for everyday use. Unfortunately, we also found problems with the system, as the following summary of user comments reveals.

- It was frustrating for users to have to read/browse unnecessary parts of pages, such as menus, links, and advertisements on news sites.
- It was difficult for the elderly to read/browse Web pages that were designed with small fonts.
- Most users became bored with reading/browsing very long texts.
- Just browsing through image content was not sufficiently interesting because nothing was left to the imagination.

The users’ comments emphasized the importance of adapting Web pages to the gradual Web rendering system. In addition, we concluded that the system should remove unnecessary parts for readers in order to increase readability. The presentation of Web pages is also important. Large fonts and appropriate typefaces are required for legibility. We found that some Web pages that could typographically adjust the pace and volume of speech were very popular with users, because the incremental rendering made it appear as though the speech was actually being spoken. Adapting these content presentation styles to a Web page consisting of long passages of text would increase users’ enjoyment. On the other hand, we should also introduce gradual image rendering mechanisms, because some users indicated that just browsing through image content was not interesting.

In this paper, based on these considerations, we introduce a content adaptation mechanism that removes unnecessary parts of Web pages and increases readability by changing the sizes of fonts, images, and tables. In addition, we introduce a simple presentation mechanism that uses the context of text and gradual image rendering to increase users’ enjoyment of content.

## 2 Content Adaptation

### 2.1 Removing Non-essential Parts

To remove the non-essential parts of a Web page accurately, we normally would have to first analyze the structure of the page and calculate which parts are essential. In a gradual Web browsing system, however, accuracy is less important, because it is not used for searching. The system thus uses prepared patterns and pattern matching to remove non-essential parts.

It first loads rules specifying essential and non-essential parts. The rules consist of flags for essential or non-essential content, the names of the rules, the parts of the