Adaptive Contents Management Framework and Cloud Authoring Server Based on Dynamic User-Context

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Abstract. IT Technology makes it easy to consume contents with various sorts of devices in a variety of service environment. There needs to be a more effective way of providing high-quality service to the user. In other words, considering personal environment as well as physical environment is important for providing better service. This paper presents a framework generating adaptive user interface which is comprised of many basic unit Resources. Several Resources are selected according to the user's context, and final user interface is generated by gathering and adapting those Resources. And the framework is also designed to provide restructuring UI using end-device information in real-time, because these days most customers access the same UI on smartphones, tablets, or desktop computers and expect the user experience to be optimized for them right now, on whatever platform they're currently using. In order that, this framework requires unit Resource registration module, connection function between Resources and specific contexts, independent UI libraries, and UI Package module. This framework, service directors might make the intelligent UI easily considering user contexts despite their lack of expertise, and it will provide users with high quality user experience.

Keywords: Context-Awareness, User Interface, Contents Management Server, Adaptive UI

1   Introduction

Advances in IT technology have created an environment in which people can use whichever service and content they wish. In these latter days most devices that have different characteristics such as screen sizes and resolution support various contents without any restriction such as network condition and service space. As mobile devices

have also continued to evolve and spread, so we need to have the process of designing and developing service contents that work across a diverse range of devices. One of the biggest issues in web developer field is accessibility of websites on various devices other than the standard desktop screen [1], [2]. RWD (Responsive web design) is the typical approach that suggests that user interface should respond to the user's environment based on resolution and device's orientation [3]. However, RWD isn't going to be a cure-all solution. Not only does client-side adaptation like RWD requires a careful approach, but it can also be difficult to optimize source order, contents, application design and other user contexts within only RWD technology. And an aspect of functional and efficient factors was most important at first, but aspect of emotional and subjective factors about UX becomes more and more important.[4] For this reason, many service providers are beginning to start a personalized service considering contexts of individual users [5][6]. As mentioned above, technology for providing adaptive user interface, including contents management system and responsive web design, have continued to evolve. Strong focus on the end-users and high demand for improved user experiences have made context-awareness and personalized service that considers individual contexts and environment. Nevertheless, this approach like RWD is mainly intended for not smart context-awareness services but general web sites which have almost fixed contents and user interfaces. Although this existing CMS (Contents Management System) can be helpful in common web sites targeted at general services, but it won't be the solution that each specialized services need.

In this paper, we report a prototype framework, Framework for Responsive Remote User Interface (RRUI), providing an adaptive user interface for multiple devices that have different characteristics which adapts to user's various contexts such as time, user pattern and profile. This framework collects unit Resources matching specific condition according to the user's contexts and makes adaptive user interface using them considering device features in real-time. This paper also presents authoring tool connected to this framework which helps service directors who don't know details of authoring technology for UI. Adaptive UI related to many contexts might be simply generated by authoring tool. This proposed framework also needs to have studies of generating general libraries for multi-view and technique of Resource package so that UI from it fits any device.

2   RRUI Framework Overview

2.1   Framework Architecture

RRUI, a framework which automatically generates user interfaces tailored to an individual′s contexts, aims to achieve high-quality user experience for complex services. The first requirement for the user experience is to meet the exact needs of the customer.

And UI can be generated from not general programming language but connections between contexts and unit Resources in order that service provider without knowing high-level techniques of IT can easily generate UI. It is defined that Page is a whole UI representing service itself and consist of one or more Resources and contexts related to Resources, and Resource is the smallest unit of Page. Each Resource can have some significant information such as design, function and contents. This proposed framework is concerned with the understanding of context such as service environment, user's basic profile and pattern. Context is any information that can be used to characterize the situation relevant to the user and service environment. Adaptive user interface from this framework comprises one or more unit Resources which are connected to the specific context value. Significant Resources can be filtered and selected according to the circumstances. Unit Resource might be defined the smallest unit so that those can be reused and make various UI. Figure 1 shows RRUI System that is divided into two framework: RPF(RRUI Providing Framework), ROF(RRUI Organizing Framework). ROF contains Page authoring tool. RPF handles all of the process for service request and understanding user contexts, and ROF figures out the message from RPF and generates proper user interface page.
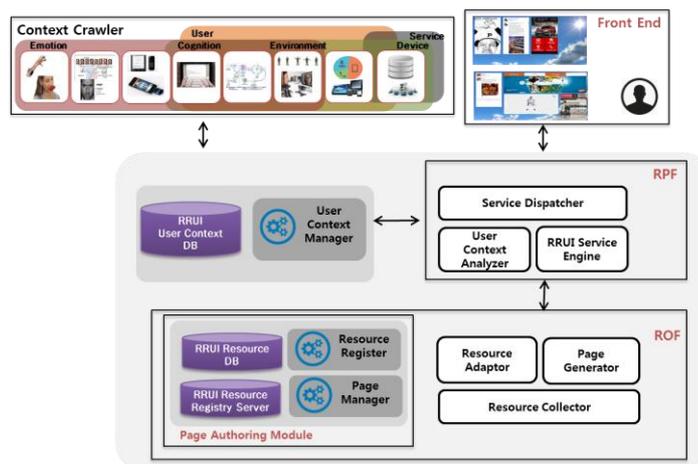

Fig.1. Responsive Remote User Interface System Architecture

2.1 ROF (RRUI Organizing Framework)

ROF (RRUI Organizing Framework), the core framework generating and transferring UI, interprets requests from RPF. ROF have roughly two functions, one is making a UI Page-Set

with authoring tool which can connects Resource and each value of context, and the other is selecting significant Resources according to contexts of user and the UI Page-Set and generating the adaptive real-time UI. The first module with authoring tool can be used to organize the UI Page-Set. To set UI Page-Set with context value and Resources must take precedence in order to generate final UI from it. Resource have information about basic information such as name, contents and description of it, format type information (CSS, html, xml, JavaScript, webpage-Link, video, audio and image), the mental load related to interpreting Resource itself by general user, provider information and so on. We predefined that adaptive UI can be comprised of four UI factors, design factor, mark-up factor, functional factor or media factor. And in this paper each Resource must have the only one factor of them to minimize unit Resource. As previously mentioned in this paper, Resource is the smallest unit representing element of UI page so that it can be reused flexibly according to contexts.

2.2   RPF (RRUI Providing Framework)

RPF (RRUI Providing Framework) is a framework for responding service request from user, interpreting user's contexts and forwarding significant information to ROF. User can access through service dispatcher to use RRUI service and to get responsive UI from RPF, RRUI Service Engine of RPF can transfer and get information related to an adaptive UI from ROF. Fig. 2. shows the flow of RRUI service.
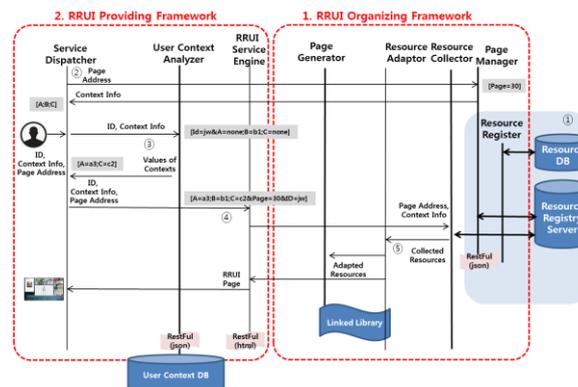

Fig. 2. Responsive Remote User Interface Service Flow

3   Implementation

We made a UI Page-Set with proposed authoring tool to evaluate proposed framework, and generated adaptive user interface with using it as an input of proposed framework

according to user′s contexts. Fig. 3. shows flow of simulation for this framework including registering Resources with Resource Register, generating UI Page-Set with Page Manager of authoring tool, choosing individual value of contexts and simulating final adaptive user interface with Service Simulator. Contents providers can independently register their own content as a Resource on proposed cloud authoring system. Resource can be CSS influencing design of UI, JavaScript controlling UI function and IOT device, webpage-Link presenting independent web contents and fragment of HTML.
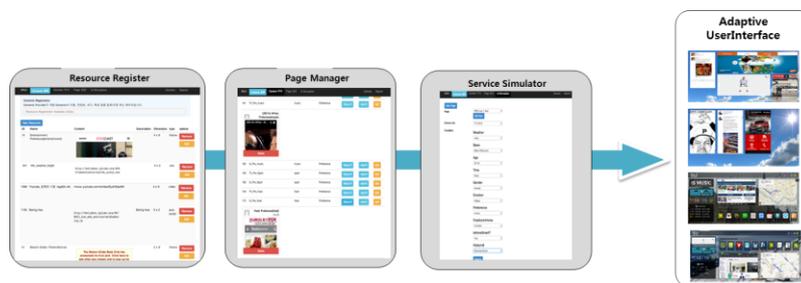

Fig. 3. Flow of simulation for proposed framework with authoring tool

4   Conclusions and Future Work

This paper introduced a framework for generating adaptive UI automatically according to contexts. This framework interprets user contexts and selects proper Resources to generate adaptive UI. For that we designed two main frameworks named ROF and RPF, and defined architecture of Resource as the smallest unit for UI.   To evaluate proposed architecture, we developed the prototype framework and authoring tool, and generated several user interfaces for various devices and users who have different user contexts. Proposed framework provides adaptive UI easily to customers considering service strategy, contents properties and user's preference by service director without high-quality authoring technology. And UI generated from framework will let customer feel a high level of satisfaction.

Further work is needed to generalize our framework in the field, where user interface is more complex and there are many more demands on the user's contexts. In addition, we have plan to design and develop a novel system which provides not only graphic user interfaces but also other complex types of user interface such as control UI for home appliance in the Home-Network environment and interactive

References

1. Slatin, J. M., Rush, S.: Maximum accessibility: making your web site more usable for everyone. Addison-Wesley Longman Publishing Co., Inc (2002)
2. Bryant, J., Jones, M.:   Responsive web design. In Pro HTML5 Performance . Apress (2012)
3. Frain, B.: Responsive web design with HTML5 and CSS3. Packt Publishing Ltd (2012)
4. Garrett, J. J.: Elements of User Experience, The: User-Centered Design for the Web and Beyond. Pearson Education (2010)
5. Magoulas, G. D., Papanikolaou, Y., Grigoriadou, M.: Adaptive web-based learning: accommodating individual differences through system's adaptation. British journal of educational technology, 34(4), 511--527 (2003)
6. Ho, S. Y., Kwok, S. H.: The attraction of personalized service for users in mobile commerce: an empirical study. ACM SIGecom Exchanges.3(4), 10--18 (2002)