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User Interface Design Framework for Digital Libraries

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Abstract: The proliferation of Information and Communication Technologies (ICT) has provided a well sophisticated environment for the development of digital libraries. The usability of a digital library primarily depends upon its user interface (UI) system. Designing effective user interface system for digital libraries is a complex task. User Interface Framework is helpful to design effective interface system, as it identifies and focuses on the various factors and limitations that influence the design of the system. Hence, this paper presents a novel user interface design framework for digital libraries based on user-centered design methodology and digital library user interface design principles, for its effective implementation.

***Keywords*:** User Interfaces, User Interface Framework, Digital Libraries

I. INTRODUCTION

A digital library is a large-scale, organized collection of complex and dynamic multimedia information and knowledge, and tools and methods to enable search, manipulation and presentation of this information and knowledge via Internet. Since the digital libraries are running on the Internet and the users are from different psychological, educational and social backgrounds, the usage of digital libraries is varying from user to user which entail the need of best user interface (UI) [1]. User interface design is a highly creative process [2] requiring intuition and an artistic sense from the designer, and also some past design experience or mimicking from other systems' design [3] which should be understood as part of the design process. Developing user interface framework for digital libraries would help to design the usable digital library user interface system with improved interactive information seeking process. Hence, this paper presents a novel user interface framework for digital libraries based on the user centered design methodology and digital library user interface design principles. The paper is organized as follows Section 2 presents Research areas in user interfaces for digital libraries Section 3 presents Major Phases of UI system development in digital libraries Section 4 presents a novel UI design framework for digital libraries and conclusion follows.

II. USER INTERFACE RESEARCH AREAS IN DIGITAL LIBRARIES

Designing an interface for digital libraries is a complex process that is oriented towards demonstration of the system's potential capabilities [4]. Various research projects are working towards designing the effective user interface system for digital libraries [1] [5] [6] [7] in various directions. The following are the major research areas of digital library UI system and shown in the Figure1.

A. User interface architecture
B. Pattern of interaction language
C. Human factors

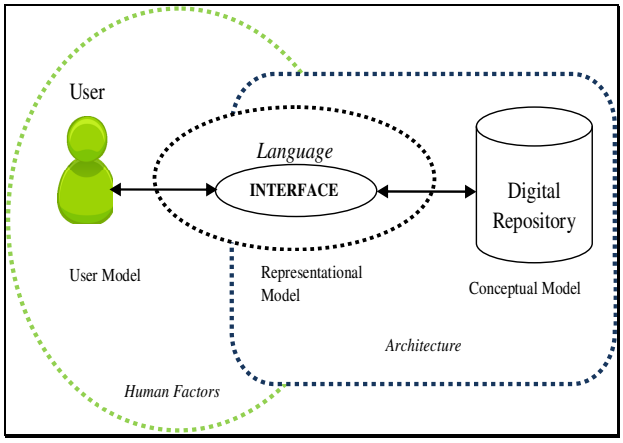

Figure 1: User Interface Research Areas in Digital Libraries

III. MAJOR PHASES OF USER INTERFACE DEVELOPMENT FOR DIGITAL LIBRARIES

User interface development for digital libraries consists of the following three major phases.

A. Discover and Requirements Phase.
B. Concept Development Phase.
C. Specifications Phase.

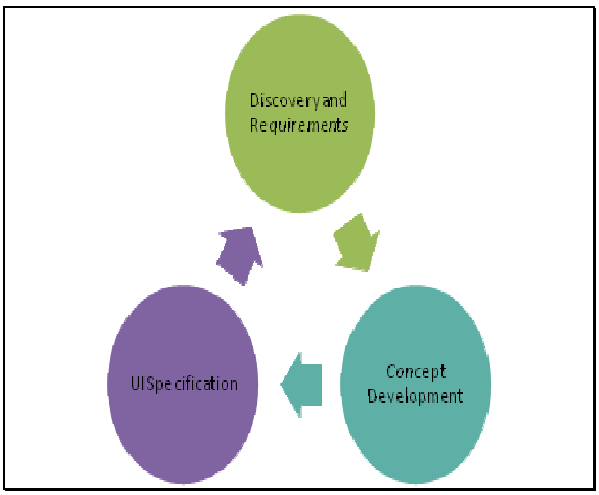

Figure 2: Major Phases in Digital Library UI development

Phase 1: Discovery and Requirements

[a] Project startup session with Stakeholders-Explore the project plan.

[b] Conduct user surveys and interviews with the stakeholders to identify the needs, goals, expectations, vision.

[c] Conduct user research and contextual inquiry with a sample target users.

[d] Document and present research results.

[e] Device the high level UI requirements based on Common Industry Specifications for Usability Requirements of NIST, NISTIR 7432.

[f] Document and present the devised high level UI requirements.

[g] Conduct a review and prioritization on requirements.

Phase 2: Concept Development

[a] Identify the important scenarios based on requirements review and user research.

[b] Devise Information Architecture for the Portal and document screen flows.

[c] Develop interactive simulations for these scenarios.

[d] Develop three initial visual concepts consisting of three screens each that will be refined.

[e] Carry out the usability study of the simulations and visual designs based on Common Industry Format for Usability Test Reports, ANSI NCITS 345-200.

[f] Perform the Section 508 review.

[g] Change simulation/visual design as per feedback, if necessary.

Phase 3: Specifications

[a] Document UI specifications

[b] Create a visual style guide for the digital library portal

[c] Testing the pre-release application

Proper integration of these three important phases iteratively in building of digital libraries from the master plan level would be helpful in building of effective user interface system for digital library with improved user experience.

IV. NEED OF USER INTERFACE DESIGN FRAMEWORK FOR DIGITAL LIBRARIES

From last two decades, several information scientists have paid attention to Human Computer Interaction (HCI) and the user interface design for information retrieval systems as well as a digital libraries[8] [9] [10] [11]. Various theories, models and principles from the domain of HCI can be applied for developing effective UI systems. However, research has shown that user centered approach [12] with proper integration of digital library user interface design principles [1] and contemporary user experiences [6] is suitable for designing the effective UI systems. Proper UI design framework simplifies this complex process and efficiently guides the designers to develop effective UI for digital libraries.

V. USER INTERFACE DESIGN FRAMEWORK FOR DIGITAL LIBRARIES

The following User interface design framework for digital libraries specifies the way that user interface design is handled by using well known design patterns with a clear identification of the discrete areas of focus for designing the UI system for digital library.

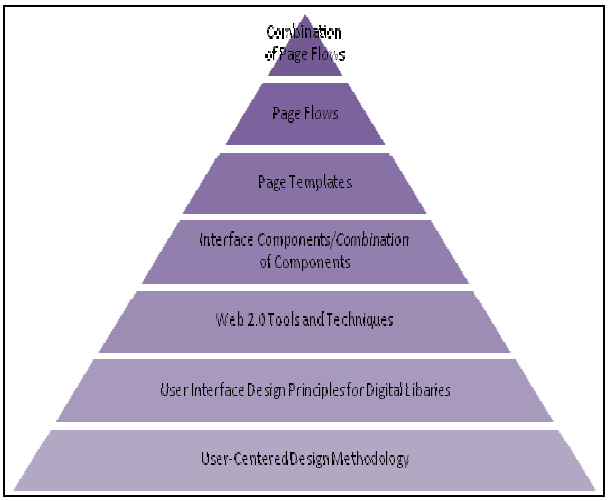

Figure 3: User Interface Design Framework

This UI design framework employs the principles of user-centered design (UCD) methodology with Web 2.0 techniques [13] [14] in order to promote the usability with rich interactions. This framework focuses on standards of interaction, navigation, page layout and visual design and other aspects with user-centered approach. This framework represents blocks of guidelines, each top layer builds upon the previous layers as one moves from the bottom to top. The bottom layer of the framework is user-centered design methodology followed by user interface design principles for digital libraries, web 2.0 tools and techniques, interface components/combination of components, page templates, page flows and combination of page flows.

The bottom layer of the framework is dedicated to identify and analyze the user interface needs, requirements and challenges by using UCD techniques. The next two layers guide to formulate the user interface design principles to address the identified interface needs, requirements and challenges in the context of Web 2.0.

The next layer guides to design the simple and complex interface components eg. Buttons, widgets, tab navigation structures, tree components etc... The next layer is Page Templates, Page templates are comprised a combination of Components on a page. For example, a Search Page shows the UI components for situation when images, audio, video or other formats need to be search in the digital library.

Within each Page Template guideline there may be multiple Component choices and layout options, each slightly different but all satisfying the same overall goal of consistency. The multiple options help satisfy the requirements for the broad range of users supported. Page Flows are the fourth level in this framework, and consist of combinations of Page. This level outlines a combination of Page Templates with contents that form a common task flow. These are similar to notion of UI patterns. Example, Page Flows include: Search and View results, Browse and Find, Update Preferences, Export/Import, Customization of views, Navigation. The next layer concentrates on Interaction Models and Patterns, which is a combination of Page Flows to support various types of user communities, such as students, researchers, professors or anonymous users etc. All of these user interface models are consisting of a combination of common page flows and page templates along with customizable features.

In this framework all interaction models and patterns are based on the web 2.0 paradigm.

VI. CONCLUSION

Based on the above framework the prototype interface has been successfully developed using JSF technologies. The initial test results of the prototype interface are encouraging. In the next paper we will present the interface architecture along with the usability test reports.

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