Towards Adapting Sakai for e-Learning Provider

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Abstract: Massive Open Online Course (MOOC) is an emerging method in online education. Sakai is a popular open source platform widely used by e-learning providers to offer MOOC. Sakai provides a set of collaborative tools for teachers, learners and researchers to support teaching, learning and research. For using Sakai, the e-learning provider needs to customize and adapt the interface of Sakai, like, banner, logo, background color etc. to suit their requirement. This paper presents the development of a tool named SkinChanger that facilitates customizing of Sakai interface, based on need of the e-learning provider. SkinChanger customizes the appearance of Sakai body, header and footer. It facilitates skin changing by providing a user friendly interface. SkinChanger is component-based tool and can be plug-in. This paper illustrates the use of tool to customize the Sakai interface for University of Delhi.

1 INTRODUCTION

e-Learning is impacted through the development of technology. Massive Open Online Course (MOOC) is an emerging method in online education that came into existence in 2008. It promotes formal and informal education via open enrolment, unlimited participation and allows access via the web (Wikipedia, 2014). There are several MOOC providers that support e-learning, like, Coursera, Udacity and edX.

The e-learning providers can set up their own new MOOC platform or adapt an existing one. Generally, an open-source platform is customized by the e-learning provider to suit their needs. Some of the available open-source MOOC platforms are Open edX by edX, CourseSites by Blackboard, Versal, CourseBuilder by Google and Sakai. The Open edX requires investing in setup and maintenance; CourseSites limits the number of courses up to five; Versal lacks discussion forum, a key feature of MOOC (Swope, 2014). Sakai is a popular platform having a community of developers from all over the world supporting it.

Sakai is an open-source educational software platform used by e-learning providers to offer MOOC. It provides Collaborative and Learning Environment (CLE) and it is aimed to develop a set of collaborative tools for teachers, students and researchers that supports teaching, learning and research (Alves et al., 2012, p. 50). Sakai is used by more than 350 world's great colleges, universities and organizations of diverse profiles list; over 4 million learners worldwide (Sakaiproject.org, 2014) which shows it's acceptance in education industry.

The Sakai Project[1] follows Model View Controller (MVC) architecture for programming. It provides a modular architecture in which various tools, services and resources are combined within a single, access-controlled framework (Fraser, 2005 cited in (Rimpiläinen and Carmichael, 2006, p.2)). Thus, a new feature can be easily incorporated in it.

Sakai interface comes with a default look and feel. Any e-learning provider having interest in adopting Sakai, need to customize its appearance, like, logo and banner of their organization. The provider hosting Sakai needs to configure Sakai's skin for making these changes.

In Sakai, there are three popular ways of customizing the skin - (1) choose from pre-installed skins in Sakai package, (2) manually setup up a new skin, and (3) use a tool for customization of skin. When using the first two options for skin changing, there is a need to understands the Sakai file structure and skin installation process. SkinManager (Knoop

[1] http://www.sakaiproject.org.

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and Groen, 2007) is an existing tool developed by Edia Educatie Technologies to automate the process of skin customization in Sakai. Although the SkinManager allows provider to choose from the listed archived skins, but, to define a new skin, the provider need to have prior knowledge of style sheets, Sakai file structure, storage directories and graphics. The using of existing ways to customize the skin of Sakai does not provide flexibility and is a tedious task.

In this paper, we focus on development of tool that facilitates the Sakai adapters to customize its appearance. The tool promotes flexibility by allowing the user to customize the Sakai skin as per their requirement, via an interactive interface. In the rest of the paper, we use the term user for the organization or the provider using Sakai for e-learning. Using our tool, the user can change skin by selecting desired options in contrast to writing fresh code for the same. Our tool focuses on customization of existing text properties like, color and font style; rather than text editing and reordering of elements (menu, table calendar, button).

Here, we present SkinChanger, a tool for customization of skin of Sakai for e-learning providers. It is composed of three main components- (1) Body-Skin, (2) Header-Skin and (3) Footer-Skin. Body-Skin component allows style changes in body of the displayed gateway screen. Likewise, changes in top portion of the screen are done using the Header-Skin and changes required, like, copyright styles that are located in the bottom portion are performed by Footer-Skin component. Each component is further divided into sub-components where their corresponding properties to revise the skin are defined.

The tool is developed as a pluggable component. It needs to be installed before runnning the instance of Sakai. Using the tool does not require any particular specialization or expertise.

The SkinChanger tool is implemented in Java and developed using Sakai Wicket maven Archetype packages based on Apache Wicket. The package allows generation of a sample Sakai app. The app is based on Apache Wicket which integrates nicely with Sakai (Swinsburg, 2014). Using the Wicket does away with the need of XML configuration files. The versions used in the development of tool are JDK 1.7, Sakai 2.9.x, Apache Tomcat 7.0.52, and Maven 3.1.1.

In this paper, section 2 is a survey of related work. Section 3 presents the interface of Sakai. Section 4 explains the SkinChanger and its features. Section 5, 6 and 7 discuss the main components of the tools - body, header and footer, respectively. Section 8 enumerates use and implementation details of SkinChanger. Section 9 states the conclusion.

2 RELATED WORK

Several researches exist in area of customization of interfaces. Some are specific for software like, Word Perfect (Page, Albert and Allen, 1996), Microsoft Word (McGrenere, Baecker and Booth, 2007), and DISCIPLE (Dorohonceanu, Sletterink and Marsic, 2000). Others focus on customizing interfaces for a specific purpose like, simulation (Nichols and Stanton, 1990), multi-user interface (Rodham and Olsen, 1994), GIS (Lopes de Oliveira, Mederiso and Cilia, 1997), online travel planning (Jurca, 2000) and supporting group collaboration (Dorohonceanu, Sletterink and Marsic, 2000). The customization is also targeted for a special class of users, for example, blind (Winberg, and Hellstrom, 2003) and different skill level (MacLean et al., 1990) users. Cognitive characterstics and phycological behaviour of the user is also used to adjust look and feel of the interface for individual or group of users (Benyon, 1993; Benyon and Murray, 1993).

Adaptive systems are used for providing the customized services to the user that supports automatic customization of the user interfaces (Cockburn, Gutwin and Greenberg, 2007; Findlater et al., 2009; Gajos et al., 2006; Greenberg and Witten, 1985). But adaptive approach mainly changes presentation of content rather than interface elements. Advance options for customization are also provided in (Stuerzlinger et al., 2006; C. Zeidler, Lutteroth and Weber, 2013). Eigo Okada et al. (2008) propose a framework for customization of menu structure and accessibility of functions using hyperlinks.

The *manual process* of customization of Sakai provides best results as by programming a fresh code almost any element of interface can be customized. But, it can be done only by an expert having knowledge of programming Sakai.

Generally, use of tool reduces need of domain knowledge and programming skills. The already existing *SkinManager* (Knoop and Groen, 2007) tool allows to change appearance of Sakai by choosing from archived skin or defining a new skin. Both options have their own limitations.

When selecting a pre-defined skin, it has predefined logo, banner etc. which might not be useful for organisation adapting Sakai. For defining a new skin there is a need to have the knowledge of CSS programming and expertise in Sakai.

Table 1: Evaluation of customization methods of Sakai.

Features	Manual	Existing Tool–SkinManager	Proposed Tool–SkinChanger
Process	*Locate files* that needs to be changed *Program* CSS code for change *Configure file* to load changed skin	Select a skin from archive or Upload a new skin	Select component and corresponding properties
Process Automation	–	Only for manual process's configure file step	For all steps of manual process
Technical Expertise	CSS programming, Sakai file structure, storage directory	CSS, Sakai file structure, and storage directory knowledge – to define new skin	Not required
Scope	Customization flexibility up to full extent, need extra efforts and expertise	*Select a skin* - provide skins with predefined parameters that might not be in useful for another organization *Defining new skin* need expertise	Allows customization based on user's selection from the listed component, subcomponent and properties
Partial customization	Possible – write specific new code	Not possible	Possible – Select specific component and its parameters

Table 1 summarises evaluation of customization method for Sakai.

To best of our knowledge, we could not find any work that provides skin customization of Sakai based on the user's selection. *SkinChanger*, our tool, does not require any prior knowledge for changing.

3 SAKAI INTERFACE

The Sakai provides a user-friendly interface for learners and educational providers. It provides easier navigation via menus. The logo, banner, tagline of organization, information about the course etc. are displayed in the header of page. The available sites, enrolled students for each site, type of role assigned for a site to student, available resources etc. are displayed in the form of table. The events and schedules are highlighted in calendar. To get details regarding a particular course site, the information is displayed in a tabular form. The footer of the page displays the quick links and copyright information.

Figure 1 shows the interface of Sakai with its default skin. It includes banner, header color, menu, links, and copyright information. In figure, some sections and properties that need to be customized by the adapters of Sakai are highlighted. For example, logo, banner, header color, calendar style, table style, copyright information, quick links, font color and background color. The e-learning providers adopting Sakai need to customize the look and feel of the skin of Sakai.

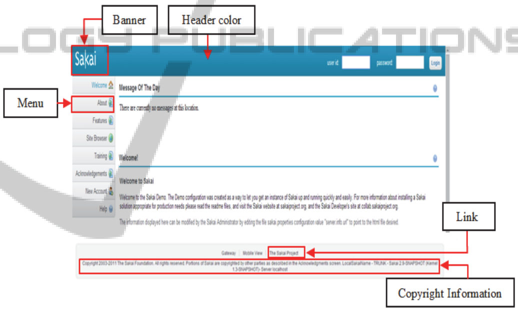


Figure 1: Default Sakai 2.9.x interface with highlighted banner, header color, menu, link and copyright.

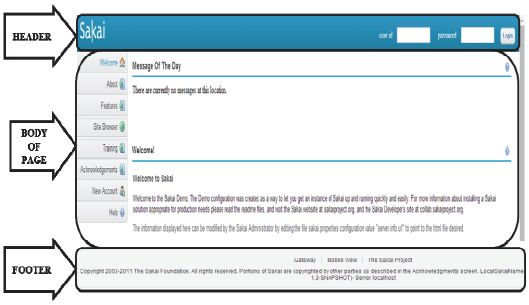


Figure 2: Sakai page layout division in header, body of page and footer.

4 SKINCHANGER: A TOOL

SkinChanger is a tool developed to provide an interface for changing the look and feel of Sakai according to requirement of e-learning provider. Page layout of Sakai is divided into sections as shown in Figure 2. Components are designed for each section based on their role of customizing a specific portion of page. SkinChanger has three components as follows-

1) Body-Skin
2) Header-Skin
3) Footer-Skin

The Body-Skin component is responsible for formatting the body of page, like, menu, table, calendar and style of content. Customization of site navigation area and contents in top portion of page is done using the header-skin component. Footer-skin component allows making changes in the footer portion of page, like, copyright information.

The key features of SkinChanger tool are explained as follows:

Change Appearance of skin when an organisation needs a different look and feel for their Sakai portal, for example, logo, banner, background color etc. Using this interface they can change layout of body, header and footer of the page according to their needs.

Conditional Formatting is a feature that facilitates formatting of the skin based on selection of the component and its properties. The organisation may need to change only a portion of skin. SkinChanger enables customization based on requirement selection for the organisation.

Selection helps to make SkinChanger interface user friendly. By selecting a section or sub-part, the user will get the list of styles available for the selected component. For defining a new skin for Sakai, user only needs to select the component and its available style.

Independency - The SkinChanger is developed as a different component, so its inclusion does affect any already existing tool or service of Sakai.

Plugin is a feature of SkinChanger that treats tool as an independent component that can be plugged-in whenever required.

The following sections discuss components of the SkinChanger tool.

5 THE BODY COMPONENT

The Body-Skin component is used to customize the main portion of the page. The component consists of four sub-components- a) Body_Menu, b) Table, c) Calendar and d) Body_Style. Table 2 summarizes the components of Body-Skin with their properties.

Body_Menu sub-component customizes the menu of page. It is divided into *Menu_style, Menu_Selected_Style* and *Menu_MouseOver_style*. Style of menu is customized using *Menu_style*. *Menu_Selected_style* is used to change menu style when a user selects it. *Menu_MouseOver_style* is responsible for changing menu styles whenever mouse pointer scrolled over it. Each of these styles provides list of style properties based on the selected style. A user can select some, all or no properties. Figure 3(i) illustrates customized menu with color change and mouse over option.

Table sub-component defines formatting style for activities listed in the table. It consists of *Table_Header_Design* and *Table_Content_Design*. To customize the header of table along with its properties, like, width of table border, font weight etc., *Table_Header_Design* is used. *Table_Content_Design* is assigned the task of making changes in properties for content of the table, like, text vertical alignment, border color of top & bottom, bottom size of top & bottom, and highlight added item style of table header. Figure 3(ii) shows customized table reflecting changes in header color.

Calendar sub-component customizes the listed events belonging to a site or user. Calendar is divided into *Cal_Header_Style* and *Cal_Day_Style. Cal_Header_Style* helps to modify header information of the calendar. For example, changing background color of calendar header and define parameters of border. Customization of the date displayed in calendar is under *Cal_Day_Style.* Based on different types of day styles it is further classified into *Cal_Today*, *Cal_Activity*, and *Cal_NoActivity,* to customize the current date, associated date with an event and date not associated with any event, respectively. Each of these day styles have properties like, border width, text alignment. Figure 3(iii) shows customized calendar of changed background color of date associated with an activity.

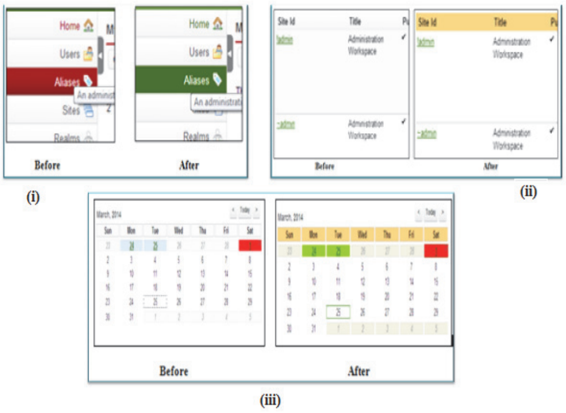


Figure 3: Screenshots of customized Body skin (i) Body_Menu, (ii) Table, and (iii) Calendar.

Table 2: Body-Skin.

Sub-components	Classification		Properties
Body_Menu	Menu_Style		Text (Color, Alignment) Background color, , Border style
	Menu_Selected_Style		Text color, Background color
	Menu_MouseOver_Style		Text (Color, Decoration), Background color
Table	Table_Header_Design		Border (Width, Style), Font weight, Background Color
	Table_Content_Design		Vertical alignment, Border Color(Top, Bottom), Border Size (Top, Bottom)
Calendar	Cal_Header_Style		Background color, Border (Width, Style)
	Cal_Day_ Style	Cal_Today	Border (width, color)
		Cal_Activity	Background color, Text alignment
		Cal_NoActivity	Background color, Text alignment
Body_Style	Link_Style		Text color, Link_Text decoration, Link_MouseOver (Text color, Decoration)
	Horizontal Rule		Color, Width, Border style
	Text Heading		Color

Table 3: Header-Skin.

Sub-components	Classification	Properties
Header_Style	Configuration	Background color, Logo image file, Image (Width, Height)
	Before_Login	Height, Banner image, Banner image(Width, Height)
	After_Login	Height, Banner image, Banner image(Width, Height)
Header_Menu	Style	Background color, Font weight
	MouseOver_Style	Background color, Border
	Selected_Style	Background color, Selected border

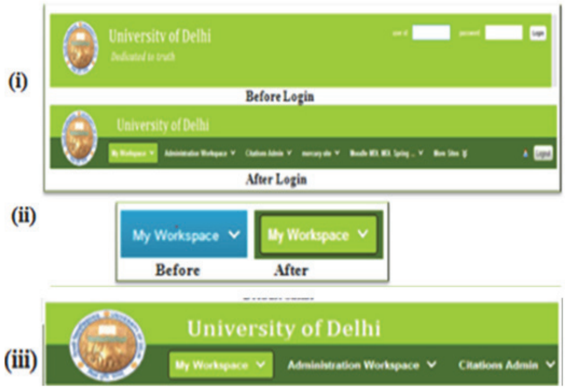


Figure 4: Screenshot of customized header (i) before & after login, (ii) menu, and (iii) header.

Body_style sub-component handles styling of the page body. The task of customization of the body of page is done using *Link_Style*, *Horizontal rule*, and *Text heading*. Page has different types of links, like, visited, non-visited, and active that helps to navigate to some other page. *Horizontal rule* is assigned to change color, width and border style of these lines. *Text Heading* allows changing color of the text.

6 THE HEADER COMPONENT

Customization of top portion of the page is done using *Header-Skin* component. The functionality provided by the header is divided into two sub-components *Header_Style* and *Header_Menu*. Table 3 presents header components and their properties.

Header_Style sub-component customizes content in the header of page, like, logo, banner and label. The task of formatting the *Header_style* is further classified into *Configuration*, *Before_Login* and *After_Login*. The properties like, logo image file, image parameters are modified by *Configuration.* Header style is different when user login and it changes when a user logs out. *Before_Login* and *After_Login* are assigned to customize the header before and after log in, respectively. The properties like, logo image file, image parameters are modified by *Configuration.* Both before and after login style provides option to customize height, banner image, and banner image parameters (width, height) of header. Customized header of the gateway before and after login is shown in Figure 4(i).

Header_Menu allows customization of information, like, my workspace, course and project names. It is further divided into *Style*, *MouseOver_style* and *Selected_Style*. *Style* is responsible for formatting of the menu, for example, change background color and font weight of menu. *MouseOver_Style* customizes menu when mouse pointer scrolls over it. Customization of selected menu is done using *Selected_Style*. It facilitates the user to change properties, like, background color, border of menu. Figure 4(ii) shows changed background color of header menu. Customized header after changing its header style and its menu is shown in Figure 4(iii).

7 THE FOOTER COMPONENT

The information like copyright, quick links, server information, and version information is customized using *Footer_Style* sub-component. It is categorized into *Link_Style* and *Copyright_Style*. Table 4 lists the footer component with their properties.

Link_Style customizes the links available in the footer for navigation. The formatting of copyright information is under *Copyright_Style.* Each provides the option to change their properties. Figure 5 shows the customized copyright information and quick link in the footer.

8 USING THE TOOL AND ITS IMPLEMENTATION

Whenever an organisation needs to change appearance of Sakai portal, the tool only needs to be plugged in. It makes the tool available in the list of available menus as shown in Figure 6(i). User can change a portion of page by selecting a section, subsection and properties. Figure 6(ii) depicts selected header component from the list and their subcomponents are shown in Figure 6(iii). Main components and their properties are as in Figure 7.

Here we illustrate use of SkinChanger for customizing the default gateway screen of Sakai 2.9.x. We have used it to customize the appearance for University of Delhi. Figure 8(i) shows default Sakai home page and customized home page with Delhi university logo, banner, color changes etc. is shown in Figure 8(ii).

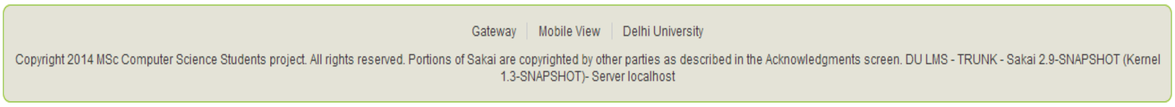
Apache wicket and Eclipse have been used to develop SkinChanger that implements it as Eclipse plug-in. SkinChanger is then plugged into the Sakai portal. The component based model of Sakai supports inclusion of new tools or services.

Sakai follows Model View Controller (MVC) architecture for programming. Therefore, designing and implementation of the tool is done in three layers as depicted in Figure 9. Model provides data objects for resource accessing mechanisms. Data Access layer at physical layer use the DAO (Data Access Object) APIs and DAO Implementation to access and save data corresponding to skin. Controller uses logic APIs and its implementation for business logic layer. It retrieves the data from Model and provides it to presentation layer.

The presentation layer of the tool is designed in Java Server Faces (JSF) and it separates presentation from tool logic. The classes used for SkinChanger are separated according to the layered architecture of Sakai as shown in Figure 10. This tool focuses on presentation layer implemented in web pages using JSF and HTML. Web pages are in WebApps of the Sakai where separate HTML files are used for each section and subsection. Logic interacts with the Model using the APIs for accessing the resources.

Table 4: Footer-Skin.

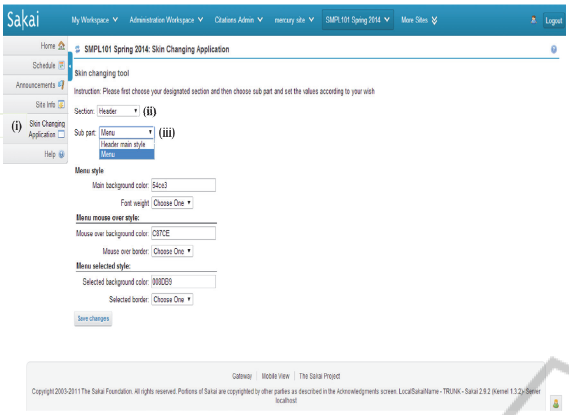
Sub-components	Classification	Properties
Footer_Style	Link_Style	Text (Color, Decoration), Element space (Top, Bottom)
	Copyright_Style	Text color, Background color



Gateway | Mobile View | Delhi University

Copyright 2014 MSc Computer Science Students project. All rights reserved. Portions of Sakai are copyrighted by other parties as described in the Acknowledgments screen. DU LMS - TRUNK - Sakai 2.9-SNAPSHOT (Kernel 1.3-SNAPSHOT)- Server localhost

Figure 5: Screenshot of cutomized footer with customized link and copyright information.



SMPL101 Spring 2014: Skin Changing Application

Skin changing tool

Instruction: Please first choose your designated section and then choose sub part and set the values according to your wish

Section: Header

Sub part: Menu (Header main style, Menu)

Menu style

Main background color: 54ce3

Font weight: Choose One

Menu mouse over style:

Mouse over background color: C87CE

Mouse over border: Choose One

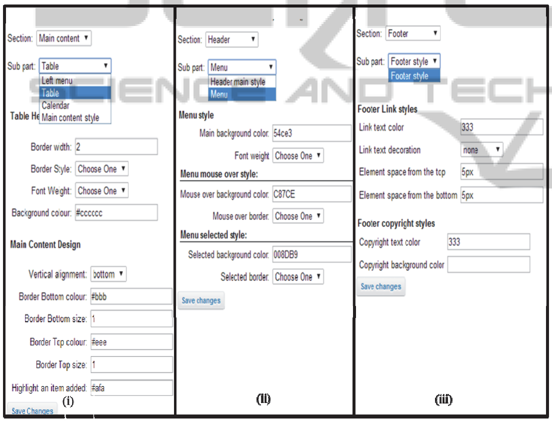
Menu selected style:

Selected background color: 008DB9

Selected border: Choose One

Copyright 2003-2011 The Sakai Foundation. All rights reserved. Portions of Sakai are copyrighted by other parties as described in the Acknowledgments screen. LocalSakaiName - TRUNK - Sakai 2.9.2 (Kernel 1.3.2)- Server localhost

Figure 6: Screenshot of SkinChanger Tool - (i) illustrating plugged in tool as skin changing application, (ii) showing selected Header section, and iii)showing list of sub-components for header with selected Menu sub-component ,with list of available options for Header.



Section: Main content

Sub part: Table

Border width: 2

Border Style: Choose One

Font Weight: Choose One

Background colour: #cccccc

Main Content Design

Vertical alignment: bottom

Border Bottom colour: #bbb

Border Bottom size: 1

Border Top colour: #eee

Border Top size: 1

Highlight an item added: #afa

Section: Header

Sub part: Menu

Menu style

Main background color: 54ce3

Font weight: Choose One

Menu mouse over style:

Mouse over background color: C87CE

Mouse over border: Choose One

Menu selected style:

Selected background color: 008DB9

Selected border: Choose One

Section: Footer

Sub part: Footer style

Footer Link styles

Link text color: 333

Link text decoration: none

Element space from the top: 5px

Element space from the bottom: 5px

Footer copyright styles

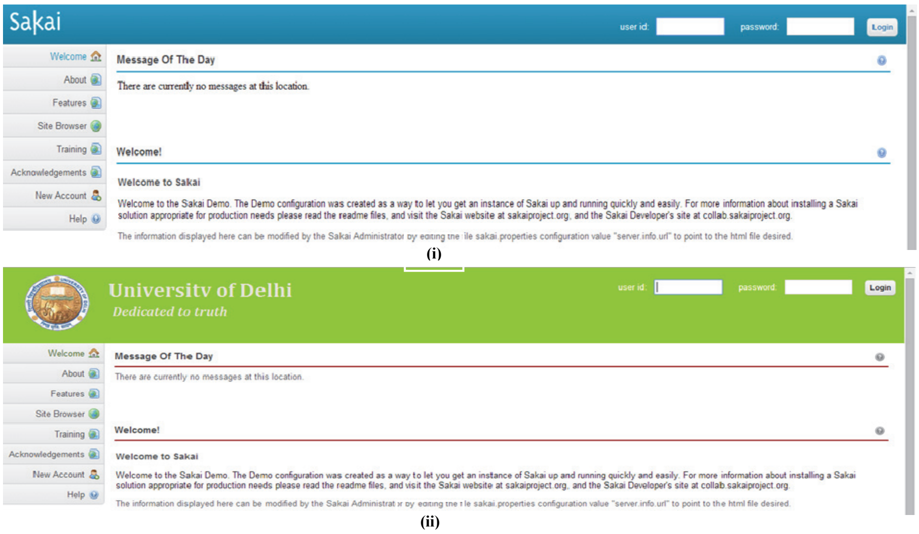
Copyright text color: 333

Copyright background color:

Figure 7: Screenshot of SkinChanger main components (i) Body-Skin, (ii) Header-Skin, and (iii) Footer-Skin.

The four main classes used by SkinChanger are `BasePage`, `ColorPickerTextField`, `DataBase` and `FileHanding`. The selected section and corresponding subsection provided by the interface are managed by `DataBase` class. `FileHanding` class is created for accessing files of the skin and exception handling, like, creating a file if it is not found or handle a generated exception. The `BasePage` class of Sakai extends by adding `HomePage` class of SkinChanger tool. `HomePage` class uses `Database` class and instantiates `FileHandling` public class. All the classes created for sections and subsections use the extended class `ColorPickerTextField` for rendering of color. Figure 11 shows UML diagram of Java classes used for the tool. In accordance with the wicket programming style, java files are created corresponding to each HTML file. SkinChanger uses the following classes-

- **Main page** - HomePage.html, HomePage.java
- **Panel associated with each style** HeaderMainPanel.html, HeaderMainPanel.java, HeaderMenuPanel.html, HeaderMenuPanel.java, MainContentPanel.html, MainContentPanel.java, MainToolMenuPanel.html, MainToolMenuPanel.java, MainTablePanel.html, TablePanel.java, CalendarPanel.html, MainCalendarPanel.java, FooterLinkPanel.html, and FooterLinkPanel.java
- **Color chooser TextField component** – ColorPickerTextField.java
- **POJO(Model) classes** – Section.java, SubSection.java
- **File reading and writing** – FileHandling.java



Message Of The Day

There are currently no messages at this location.

Welcome!

Welcome to Sakai

Welcome to the Sakai Demo. The Demo configuration was created as a way to let you get an instance of Sakai up and running quickly and easily. For more information about installing a Sakai solution appropriate for production needs please read the readme files, and visit the Sakai website at sakaiproject.org, and the Sakai Developer's site at collab.sakaiproject.org.

The information displayed here can be modified by the Sakai Administrator by editing the file sakai.properties configuration value "server.info.url" to point to the html file desired.

Message Of The Day

There are currently no messages at this location.

Welcome!

Welcome to Sakai

Welcome to the Sakai Demo. The Demo configuration was created as a way to let you get an instance of Sakai up and running quickly and easily. For more information about installing a Sakai solution appropriate for production needs please read the readme files, and visit the Sakai website at sakaiproject.org, and the Sakai Developer's site at collab.sakaiproject.org.

The information displayed here can be modified by the Sakai Administrator by editing the file sakai.properties configuration value "server.info.url" to point to the html file desired.

Figure 8: Screenshot of the Sakai home page (i) Before customization, and (ii) After customization.

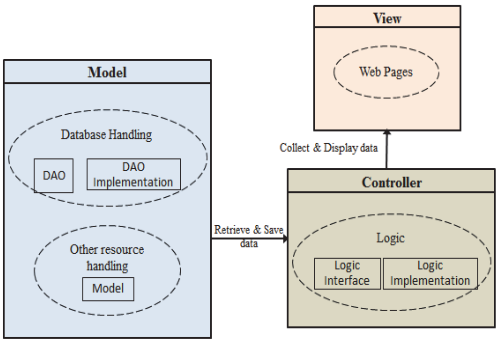


Figure 9: Skin Changer Tool MVC Structure.

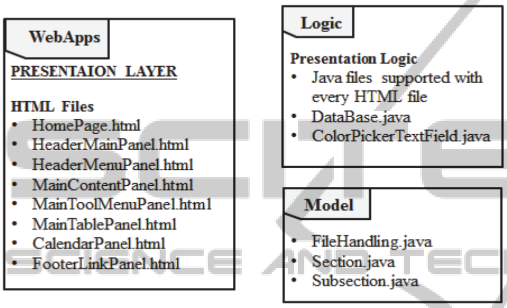


Figure 10: Layered structure of Classes used.

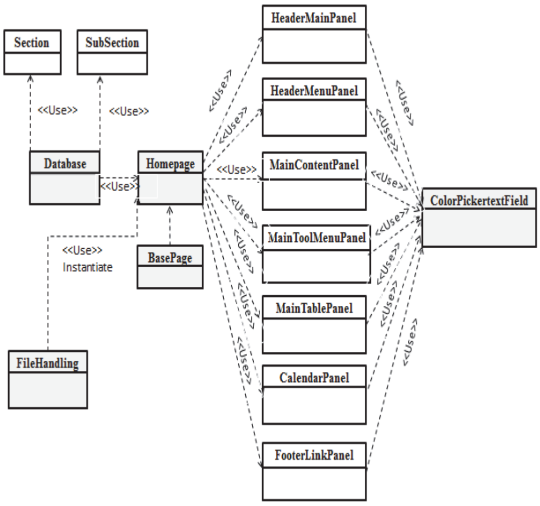


Figure 11: UML Class Diagram.

9 CONCLUSIONS

In this paper, we present the adaptation of Sakai skin for e-learning providers. We present the development of a tool, SkinChanger that changes the appearance of Sakai CLE. The SkinChanger tool provides an interactive interface to educational providers for customizing look and feel of the Sakai. The interface provides a menu based system in order to provide a user friendly environment. Furthermore, a user does not have to learn any sort of programming skills and expertise in Sakai file structure, to change the look and feel of Sakai. The user can just use the tool to select the element and their properties that have customization need to fit in the requirement of the organisation. For using the tool, it only requires to be plugged in before running the instance of Sakai environment. The non-requirement of any specific skill and degree of extent of customization makes it different from all the earlier work.

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