

**The Design and Implementation of a Web-Accessible Library  
Database (WALDB) Containing Materials for the  
Rural Transit Assistance Program (RTAP)**

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# Abstract

The objectives of the library of a Rural Transit Assistance Program are to promote the effective operation of public transit systems while efficiently utilizing public and private resources and to continually improve the quality and availability of resources and technical assistance to rural transit systems. To fulfill these requirements the Small Urban and Rural Transit Center (SURTC) at North Dakota State University (NDSU) designed and implemented a Web-accessible library database (WALDB) containing materials for the Rural Transit Assistance Program (RTAP). This document describes the software design and development procedures for this RTAP library database.

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## Scope

This document contains a complete description of the design of a SURTC WALDB. The basic architecture is a Web server from a client server paradigm. The basic pages will be in ASP.NET. The designated or authorized member in charge of the WALDB will have full access to make changes. The changes could include, but are not limited to, changing the content of the catalogs and processing requests from clients for lending resources.

## Architecture Design

The three-tier architectural design system has been used to develop the RTAP library website. In general, the three-tier architecture is used when distributed client/server design is needed to provide increased performance, flexibility, maintainability, reusability, and scalability, while hiding the complexity of distributed processing from the user. A three-tier distributed client/server architecture includes a user-system-interface top tier where user services (such as session, text input, dialog, and display management) reside. The middle tier provides process-management services (such as process development, process enactment, process monitoring) that are shared by multiple applications. The third tier provides database management functionality and is dedicated to data and file services. It should be noted that connectivity between tiers can be dynamically changed depending upon the user's request for data and services.

## Development Tool Selection

Leading development tools for information systems were reviewed to insure that the system would be up-to-date. Two types of tools were used: back-end tools and front-end tools.

### **Back-End Tools**

The back-end application is where the data reside. It also is known as the server. The server processes provide background services for the client process. The application for this project is intended for use through a website. One of the leading enterprise database tools, Microsoft SQL Server was chosen for this job.

### **Front-End Tools**

The end-user usually interacts with the client process. The client is any computer process that requests services from the server. The client is also known as the front-end application. Modern software products for the development of the front-end are commonly referred to as "visual development tools." Microsoft Visual Studio .NET was used for development of the front-ends for this project.

## Types of Users

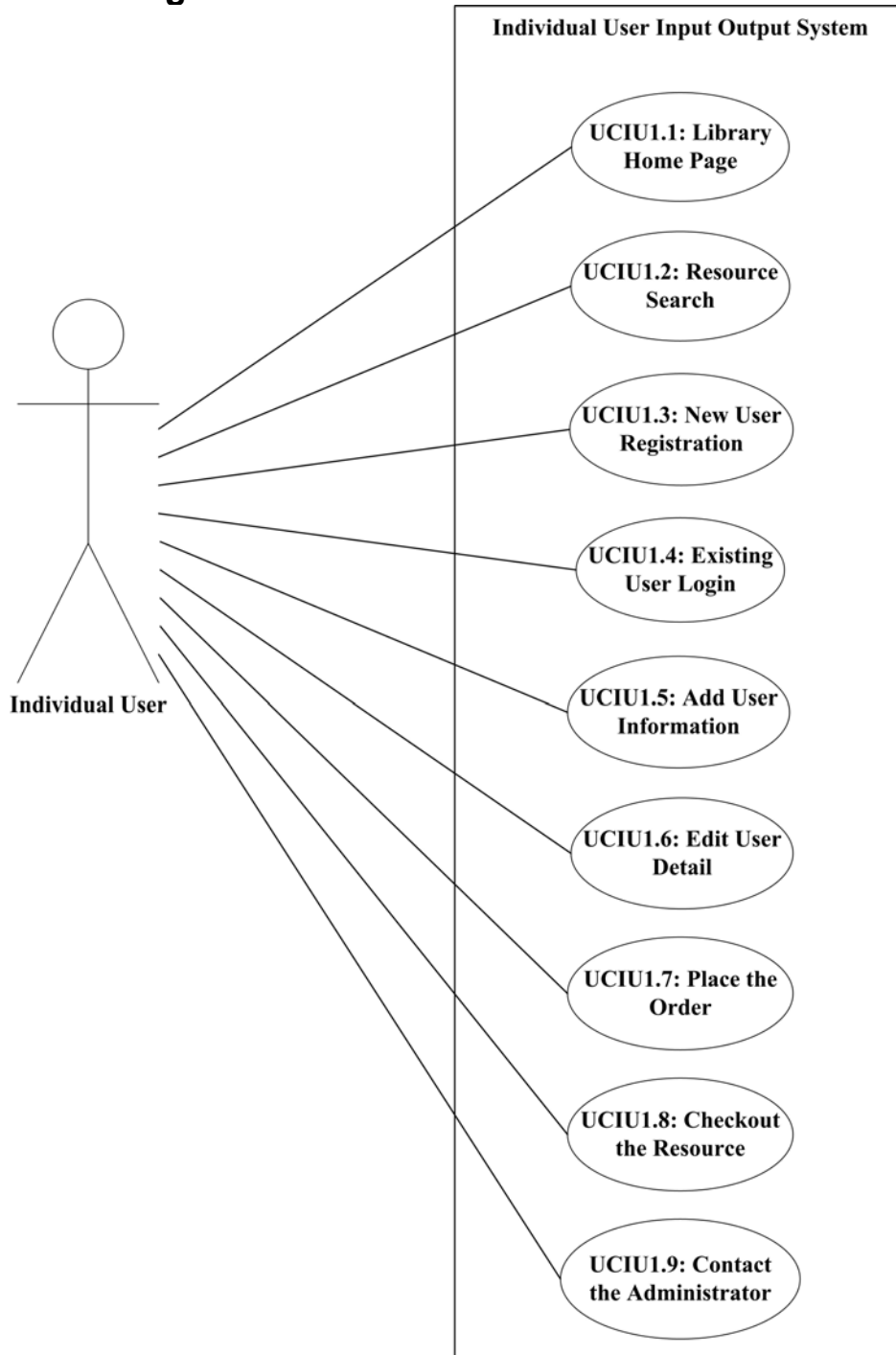
There are two types of users. Client-type users ask to lend the resources. The other types of users are administrative users. The administrative privilege allows for the resource list to be updated or edited and for orders to be processed.

## Conclusion

This Web application for the SURTC RTAP is the first step to keeping the list of library resources in a database and to supporting the rural transit activities by training, technical assistance, and research. In the future, developers may add more functionality according to user requirements.

# Appendix A

## Use Cases: Diagrams and Scenarios



<b>Use Case Name:</b> Library Home Page Browser	Use Case ID: UCIU1.1
Primary Actor: Individual user	
<b>Stakeholders and Interests:</b> Individual user – the user who wants to look for RTAP resources.	
<b>Brief Description:</b> This scenario describes an individual user browsing the RTAP library database through a Web browser.	
Trigger: None.	
Relationships: None	
Normal Flow of Events: Individual user indicates that they would like to browse the RTAP library website.	
<b>Exceptional Flows:</b> The Web page could be down for administrative maintenance.	Error message
<b>Precondition:</b> Individual user has navigated to this application website and searched the list of resources.	
Post condition: None.	

Use Case Name: Resource Search	Use Case ID: UCIU1.2
Primary Actor: Individual user	
<b>Stakeholders and Interests:</b> Individual user – the user who wants to look for RTAP resources.	
<b>Brief Description:</b> This scenario describes an individual user looking for the resources of the RTAP library database through a Web browser.	
Trigger: None.	
Relationships: None	
Normal Flow of Events: Individual user indicates that they would like to look for the RTAP resources.	
<b>Exceptional Flows:</b> The Web page could be down for administrative maintenance.	Error message
<b>Precondition:</b> Individual user has navigated to this application website and searched the list of resources.	
Post condition: None.	



<b>Use Case Name:</b> New User Registration	Use Case ID: UCIU1.3
Primary Actor: Individual user	
<b>Stakeholders and Interests:</b> Individual user – the user who wants to look for RTAP resources.	
<b>Brief Description:</b> This scenario describes an individual user looking for the resources of the RTAP library database through a Web browser and wants to register. This registration is only for the new user.	
Trigger: None.	
Relationships: None	
Normal Flow of Events: Individual user indicates that they would like to register without checking out any resources. Individual user indicates that they would like to register during check out of any resources.	
<b>Exceptional Flows:</b> The Web page could be down for administrative maintenance.	Error message
Precondition: None	
Post condition: None.	

<b>Use Case Name:</b> Existing User Login	Use Case ID: UCIU1.4
Primary Actor: Individual user	
<b>Stakeholders and Interests:</b> Individual user – the user who wants to look for RTAP resources.	
<b>Brief Description:</b> This scenario describes an individual user looking for the resources of the RTAP library database through a Web browser who wants to log in during the check out.	
Trigger: None.	
Relationships: None	
Normal Flow of Events: Individual user indicates that the existing user can log in during the check out of the resource.	
<b>Exceptional Flows:</b> The user id and password should be matched during log in.	Error message
Precondition: None	
Post condition: None.	

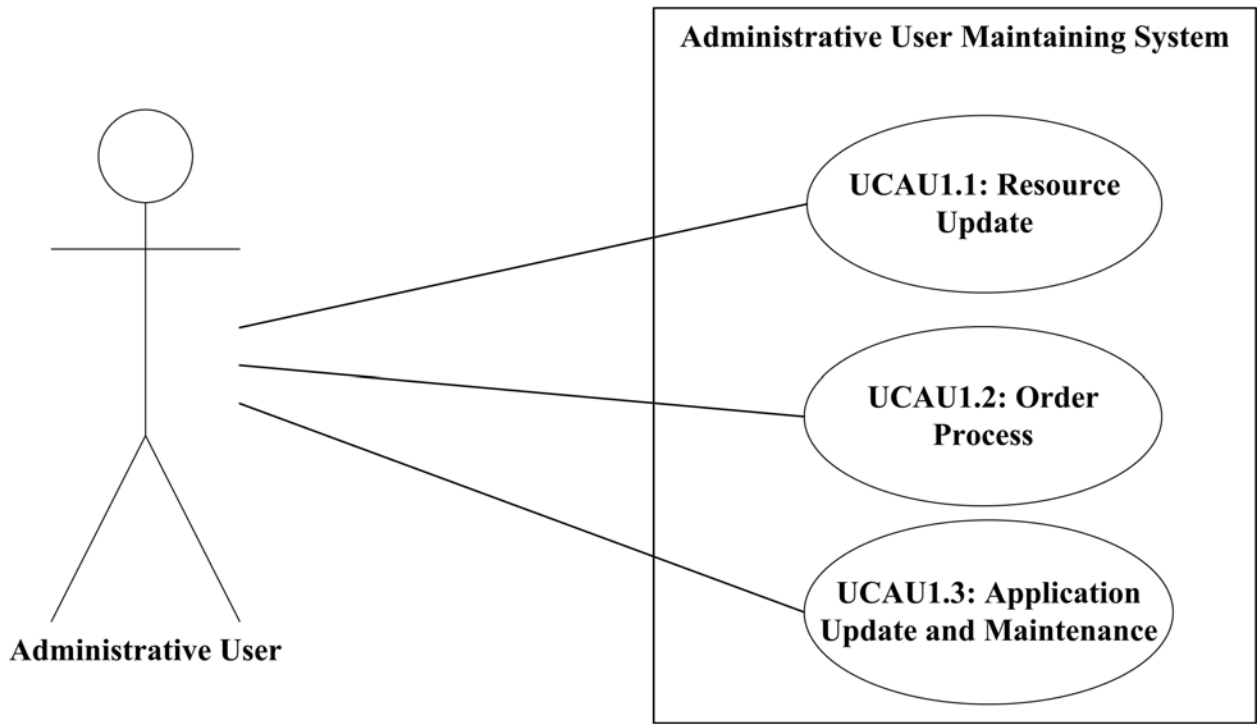
<b>Use Case Name:</b> Add User Information	Use Case ID: UCIU1.5
Primary Actor: Individual user	
<b>Stakeholders and Interests:</b> Individual user – the user who wants to look for RTAP resources.	
<b>Brief Description:</b> This scenario describes how an individual user can add the personal information needed to ship the resources.	
Trigger: None.	
Relationships: UCIU1.3: New User Registration UCIU1.4: Existing User Login	
Normal Flow of Events: Individual User indicates that the user can add information such as name, address, and phone number.	
Exceptional Flows: None	
<b>Precondition:</b> The user should be logged in.	
Post condition: None	

<b>Use Case Name:</b> Edit user detail	Use Case ID: UCIU1.6
Primary Actor: Individual user	
<b>Stakeholders and Interests:</b> Individual user – the user who wants to look for RTAP resources.	
<b>Brief Description:</b> This scenario describes how an individual user can edit their personal detail.	
Trigger: None.	
Relationships: UCIU1.3: New User Registration UCIU1.4: Existing User Login UCIU1.5: Add User Information	
Normal Flow of Events: Individual User indicates that the user can edit information such as name, address, and phone number.	
Exceptional Flows: None	
<b>Precondition:</b> The user should be logged in and the information should be available.	
Post condition: None	

<b>Use Case Name:</b> Edit user detail	Use Case ID: UCIU1.7
Primary Actor: Individual user	
<b>Stakeholders and Interests:</b> Individual user – the user who wants to look for the RTAP resources.	
<b>Brief Description:</b> This scenario describes how an individual user can edit their personal detail.	
Trigger: None.	
Relationships: UCIU1.3: New User Registration UCIU1.4: Existing User Login UCIU1.5: Add User Information	
Normal Flow of Events: Individual User indicates that the user can edit information such as name, address, and phone number.	
Exceptional Flows: None	
<b>Precondition:</b> The user should be logged in and the information should be available.	
Post condition: None	

<b>Use Case Name:</b> Checkout the Resource	Use Case ID: UCIU1.8
Primary Actor: Individual user	
<b>Stakeholders and Interests:</b> Individual user – the user who wants to look for RTAP resources.	
<b>Brief Description:</b> This scenario describes how an individual user can checkout the resources.	
Trigger: None.	
Relationships: UCIU1.7: Place the Order	
Normal Flow of Events: Individual User indicates that the user can checkout the selected resources.	
Exceptional Flows: None	
Precondition: None	
Post condition: None	

<b>Use Case Name:</b> Contact the Administrator	Use Case ID: UCIU1.9
Primary Actor: Individual user	
<b>Stakeholders and Interests:</b> Individual user – the user who wants to look for RTAP resources.	
<b>Brief Description:</b> This scenario describes how an individual user can contact the administrator.	
Trigger: None.	
Relationships: None	
Normal Flow of Events: Individual User indicates that the user can contact the administrator by email, or phone or mail.	
Exceptional Flows: None	
<b>Precondition:</b> The contact information should be available in the Contact Us page.	
Post condition: None	





<b>Use Case Name:</b> Resource Update	<b>Use Case ID:</b> UCAU1.1
<b>Primary Actor:</b> Administrative user	
<b>Stakeholders and Interests:</b> Administrative user – The users who will be authorized to update the catalog/resource list.	
<b>Brief Description:</b> This scenario describes an administrative user updating the catalog.	
<b>Trigger:</b> Based on the catalog type, the subject type and the resources should be updated.	
<b>Relationships:</b> None	
<b>Normal Flow of Events:</b>	
<ul style="list-style-type: none"> <li>Administrative user indicates that the users will update the catalog, subject and resource list.</li> </ul>	
<b>Exceptional Flows:</b> None	
<b>Precondition:</b> The administrative user should go to the “Contact Us” page and click on the “catalog page” link. The resource should be selected based on the catalog type and subject type.	
<b>Post condition:</b> The resource should have a specific catalog and subject type.	

<b>Use Case Name:</b> Order Process	<b>Use Case ID:</b> UCAU1.2
<b>Primary Actor:</b> Administrative user	
<b>Stakeholders and Interests:</b> Administrative user – The users who will be authorized to process the client’s order.	
<b>Brief Description:</b> This scenario describes an administrative user processing the individual user’s orders.	
<b>Trigger:</b>	
<b>Relationships:</b> None	
<b>Normal Flow of Events:</b>	
<ul style="list-style-type: none"> <li>• Administrative user indicates that the users will process the order.</li> </ul>	
<b>Exceptional Flows:</b> None	
<b>Precondition:</b> Administrator should go to the “Contact Us” page and click on the “orders page” link. There should be a new and complete order to process.	
<b>Post condition:</b> The order should be processed.	

<b>Use Case Name:</b> Application Update and Maintenance	<b>Use Case ID:</b> UCAU1.3
<b>Primary Actor:</b> Administrative user	
<b>Stakeholders and Interests:</b> Administrative user – The users who will be authorized to update, modify, and maintain the application.	
<b>Brief Description:</b> This scenario describes an administrative user updating and maintaining the system.	
<b>Trigger:</b>	
<b>Relationships:</b> None	
<b>Normal Flow of Events:</b>	
<ul style="list-style-type: none"> <li>• Administrative user indicates that the users will update, modify, and maintain the application.</li> </ul>	
<b>Exceptional Flows:</b> None	
<b>Precondition:</b> Administrative user knows how the database and Web-based system works in a server machine.	
<b>Post condition:</b> The system should work perfectly after updating or modifying.	

# Appendix B

## Details of the Individual Pages

### **SURTC RTAP Library Home Page**

Title of the page: SURTC RTAP Library home page

Name of the page: default.aspx

Description: This is the default page presented to the user upon connection with the library Web page and database server. Each page including this one has five sections. The top one is the Header, the left side is the LeftSide (this section is also divided into two sections LeftSideTop, and LeftSideBottom), the right side is the RightSide, the bottom is the Footer, and the middle sections. There is a navigation bar in the header, which contains several buttons, including “Home,” “About Us,” “Category Search,” “Registration,” “Policy,” and “Contact Us.”

### **Category Search**

Title: SURTC RTAP Library Resources search page

Name: inventorysearch.aspx

Description: This form is a combination of dropdown lists and one of the blank dropdown lists will be completed upon the selection of one of them. When the user clicks the catalog dropdown list, it will show the available catalog options (i.e. book, video, publication, etc.), from which the user will select one of the options. This selection is mandatory. After selecting the catalog options, the list of subjects related to the selected catalog will show up in the subject selection dropdown list (i.e. transit: etc.). The selection of the subject is mandatory for searching. There are two other dropdown lists for the "from year" and "to year" selection. These two are optional. After selecting the different criterion, the user will submit the "Search" button. The search result will come up in the search criterion area. Each result will contain the name of the resources, a short description of the resources, publication year, volume and volume number, availability, etc. Each individual item will contain a button, called “Add this item.” The user can pick the item by submitting the “Add this item” button. At the end of the search result area, there will be a button, called “View Cart” which will take the user to a new page named shop.aspx.

### **View the selected items in a cart**

Title: Selected items in the Cart

Name: shop.aspx

Description: This page will contain the items selected by the user. In this page there is a data grid in which the user can see the selected item name and description. There will be a “Remove” button with each selected item. The user will be able to take any item out of

their cart. A button called “Checkout” will take the user to a page called UserLogin.aspx page.

### **User Login**

Title: User Login Page

Name: UserLogin.aspx

Description: There are two sections in this page under the main area. The first section is for the existing users. Existing users can checkout after a successful login. For this purpose, the email address and password must be entered during registration. The user will check his/her email and password and click “submit.” The library server will check the password against the password stored in the user’s record in the library database. There is a button called “Login” after submitting the correct information, the user will click the button. After a successful verification of the submitted login information, the users will move to the next page, called “Checkout.aspx”. If the passwords do not match, the library server will return a message to contact the authorized member in charge of the library database to receive a password. The password is encrypted with a hash function. The user will be able to receive a new password. If the user is new, then they have to go to the second section. In this section, the users can register themselves. After clicking the “Register” button the new user will be redirect to a new page called “UserNew.aspx”.

### **New User Registration Page**

Title: User Registration Page

Name: UserNew.aspx

Description: This page is used to register new users. After entering the user name, email address, password (enter the same password twice), and a phone number; a new user needs to submit the “Confirm” button to register. After a successful registration, the user will move to the “Checkout.aspx” page to checkout the items.

### **Checkout Page for the New User**

Title: Checkout Page

Name: Checkout.aspx

Description: This page will contain the item selected by the user and the “Change the User Details” and “Add Address” buttons. The “Change the User Detail” button will allow the user (new or existing) to change their existing personal detail by opening a new page, called “UserEdit.aspx”. The “Add Address” button will take the new user to a new page called “UserAddress.aspx”, where the new user can add their address. This is the address the library authorities will use to ship the materials. A third button called “Place the Order” will be available for registered users who have their addresses in the database. New users, after entering their shipping address, will be able to see that button.

### **Edit User Details Page**

Title: User Edit Page

Name: UserEdit.aspx

Description: In this page the registered user can change their user name, email address, password, and phone number. After submitting the confirm button the user will be redirected to the checkout page.

### **Add User Address Page**

Title: User Address Page

Name: UserAddress.aspx

Description: In this page the new user can add and the registered user can change their address, city, state and zip code. After submitting the confirm button the user will be redirected to the checkout page.

### **Place the Order Page**

Title: Order Done Page

Name: OrderDone.aspx

Description: This page will come up after the user has successfully placed an order. There will be a “Log Out” button to sign out from the library Web page for security purposes. Clicking the “Log Out” button will take the user to the default page. Or the user can go back to the catalog search page, by picking the “Back to Search” link.

## **The Administrator or the Authorized User Pages**

In these pages the authorized personnel can edit, update, and delete the records of the category database. To edit the database, the authorized personnel will have to go to the “Contact Us” page. There are two links: “Catalog Page” or the “Orders Page.” The authorized user may update or edit the catalog page by using the “Catalog Page” link, or may process the orders by using the “Orders Page” link. But at the very first, “Catalog Page” and “Orders Page” link will take the authorized person to the “login.aspx” page, where they can enter login ID and password to enter the desired page.

### **Admin page to update the catalog**

Title: Update the Catalog Page

Name: admin.aspx

Type: Web Form

Description: From the very first screen, which contains the list of catalogs, the admin/auth person can edit the catalog list by “Edit” button, can edit the subject related to the catalog by using the “Edit Catalogs” button, or can delete the “Catalog” by using the “Delete” button.

## **Orders admin page**

Title: View the Orders

Name: ordersAdmin.aspx

Type: Web Form

Description: From this page authorized personnel can see the order placed by the user by submitting the different queries. From the result page, the admin can get the latest order request and process the order.

# Appendix C

## Page Outlets

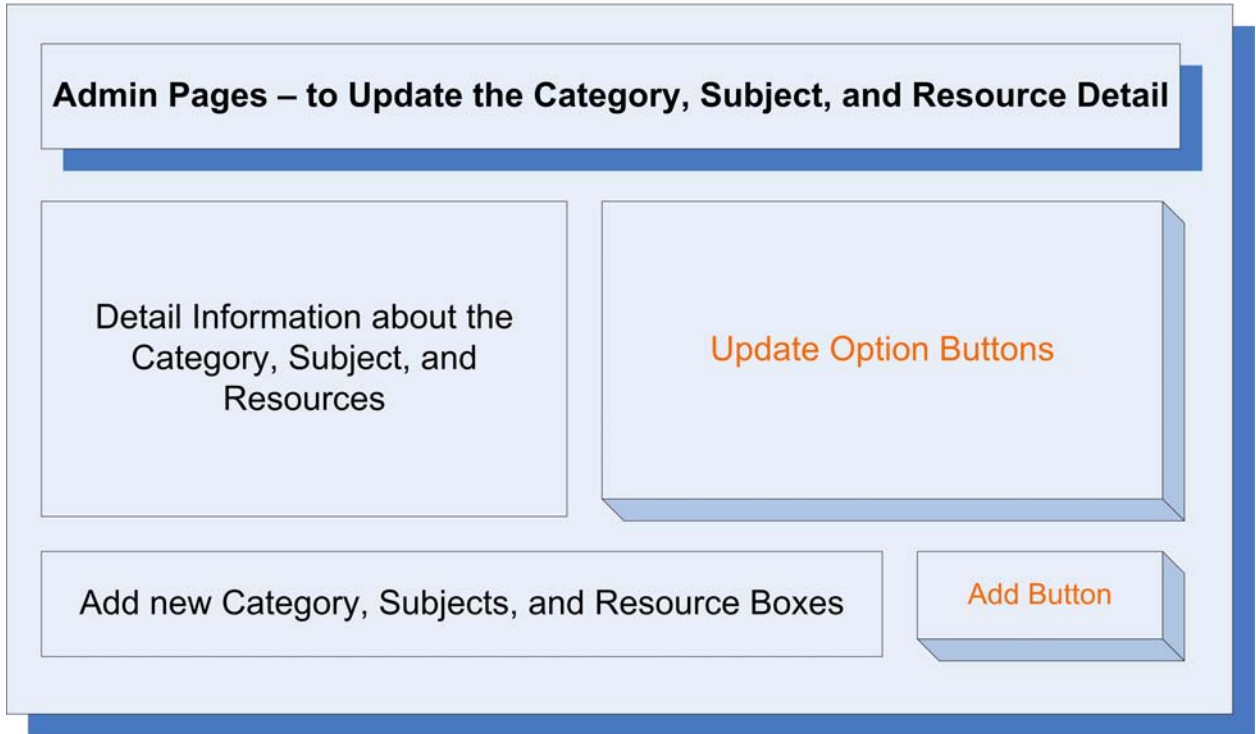
**Admin Pages – to Update the Category, Subject, and Resource Detail**

Detail Information about the Category, Subject, and Resources

Update Option Buttons

Add new Category, Subjects, and Resource Boxes

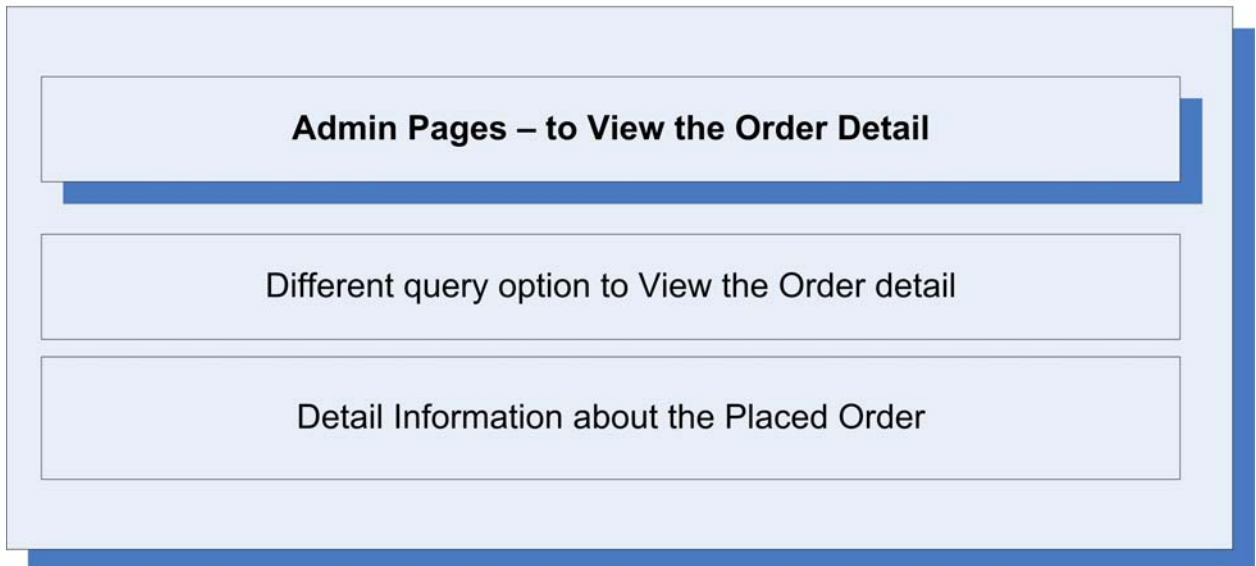
Add Button



**Admin Pages – to View the Order Detail**

Different query option to View the Order detail

Detail Information about the Placed Order





### User Login Page

For the returning User

Email Address

Password

Submit Button

### New User Option

Register Button

### Registration page

User Name

Password

Retype Password

Email Address

Phone Number

Submit Button

### User Address Entry Page

User First Name

User Last Name

Address 1

Address 2

City

State

Zipcode

Type of User

Submit Button

## Inventory Search Page

Inventory Search Option

Category Selection List

From Year

To Year

Subject Selection List

Search Button

## Inventory Search Result Extension

The query page, after submitting the Submit button

Resource ID

Resource Name/Title

Author

Publication year

Volume and Volume Number

Description

Availability

Add to Cart Button

View Cart Button

**SURTC Logo  
Navigation Bar**

**Template Area  
(Header)**

**NDSU Logo**

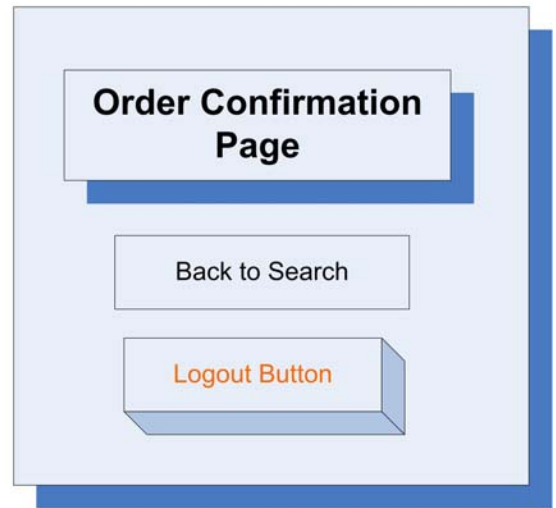
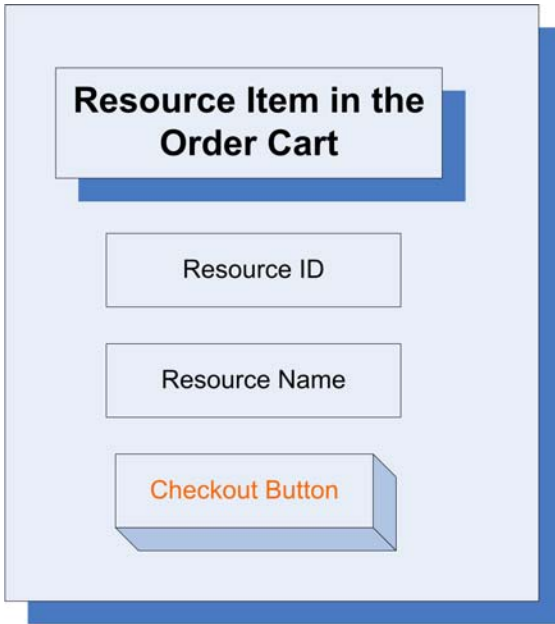
**Template Area (LeftSideTop)  
NRTAP Logo**

**Main Section:  
Query Area,  
Search Result Area,  
Message board**

**Template Area (RightSide)  
SURTC Pyramid image: Program Breakdown Structure**

**Template Area  
(LeftSideBottom)**

**Template Area (Footer)**



## References

[IEEE] The applicable IEEE standards are published in “IEEE Standards Collection,” 2001 edition.