

**Writing Consultant Online Scheduler
(WCOS)**

By

Charles W. Corder

A Proposal Submitted to the
Faculty of the Information Engineering Technology Program
in Partial Fulfillment of the Requirements for
the Degree of Bachelor of Science
in Information Engineering Technology

University of Cincinnati
College of Applied Science

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Abstract

The *Writing Consultant Online Scheduler* (WCOS) is an independent, general purpose, interactive Web-based scheduler allowing any organization to set appointments between its representatives and customers. In particular, the application was developed and will be used by the Writing Labs of the Humanities Department at College of Applied Science (CAS) to allow students to schedule appointments with the writing consultants. However, the application can be used in any similar environment. The WCOS application uses the latest technologies, ASP.NET and SQL.Server, to facilitate online a twenty-four-hour-day, seven-day-week scheduling service for students with consultants free of charge. There are three roles (Students, Consultants and Administrator) that operate within the scheduler system. An email is sent to all parties once an appointment is scheduled or changed. The authentication is done using the existing Active Directory system that students use to login to the computers in the lab. Business rules are actively set during deployment and/or dynamically through the administrator role. The Web pages use Microsoft Outlook standard colors and functionality for navigating, viewing and setting appointments. The WCOS maintains database scheduling activities that forecast when consultants are needed, their availability and any changes in appointments that might occur after the initial appointment is created. In addition, the scheduler produces a simplified and effective system for gathering a large amount of data about customers' and representatives' interaction. It is recommended that a data mining and reporting module be added to the application to allow the ultimate utilization of this data.

Writing Consultant Online Scheduler **(WCOS)**

1. Statement of the Problem

The Writing Consultant Lab is located in the OCAS Administration Building Room 502. With the present method for scheduling appointments, there are two main problems. First is missed appointments due to the inability to effectively make changes to the paper scheduler. Second is the difficulty in making appointments with consultants. Both of these situations result from not being able to locate and update the paper schedule. The paper schedule can only be changed during lab hours with the present system. The schedule paper passes through so many hands that the person using the paper scheduler has no guarantee the schedule is accurate and up-to-date. (See Appendix A, 11.1)

2. Description of the Solution

The Writing Consultant Online Scheduler (WCOS) is designed to replace the present out-dated paper method used by the writing consultant lab administrator to set up appointments between students and consultants at College of Applied Science (CAS). Currently, the student needs to locate the correct appointment sheet or consultant administrator to coordinate a time with a consultant. The current system is not flexible enough to handle all of the scenarios involved in scheduling.

When problems and questions occur, the present method oftentimes fails to effectively communicate between the student and consultant, and appointments are missed or not made. The WCOS is designed to improve communication between the students and consultants. It is a full featured program that simplifies the gathering of

information. More importantly, it manages and tracks all aspects needed to successfully complete the scheduling process.

The consultants can more accurately manage their own schedules without the aid of the consultant administrator. When a student makes an appointment, they expect the consultant schedule to be up to date.

The WCOS is a complete Web-based appointment system for the students and consultants. Combining an HTML and ASP user interface with a sophisticated relational Microsoft SQL 2000 database, the WCOS system gives the user 24-hour access from any computer with an UC Intranet connection.

The heart of the WCOS is the ASP Pages. I have chosen to use ASP Pages for the following reasons:

- Active Server Pages are browser independent. The browser only sees pure HTML pages; no vendor proprietary programs or extensions are needed.
- ASP hides the code from the user.
- ASP gives an efficient link to the many databases that comply with the Open Database Connection (ODBC) standards.
- ASP provides an efficient means to View, Add, Delete, Edit and Search Databases.

2.1 User Profiles

The intended users for the WCOS System represent three levels of IT literacy: Students, Consultants, and Administrator.

2.1.1 Student

The Student must be able to use a standard computer Web browser, be able to navigate the Web pages and make/keep appointments. The Student also must have

knowledge and agreement of commonly used practices and guidelines of the CAS Student/Consultant agreement. (see appendix A.)

Having knowledge of Microsoft Outlook 2003 will help Students navigate the Web application to set and change their appointments.

2.1.2 Consultant

The Consultant must have the student level of computer Web browser skills as well as an understanding of WCOS consultant schedule management. The Consultant also must have knowledge and agreement of commonly used practices and guidelines of CAS Student/Consultant agreement.

Having knowledge of Microsoft Outlook 2003 will help the Consultant navigate the Web application to set and change the Consultant Scheduler.

2.1.3 Administrator

Along with the Student and Consultant competencies, the Administrator needs additional knowledge of the overall Web based scheduler software and hardware system. At the present it requires an associate's degree in Information Technology and experience in maintaining Web/database software application. The Administrator needs to be able to guide and train the users to effectively use the WCOS. The Administrator typically reports to a project leader or manager.

2.2 Design Protocols

I plan to work with all four computing areas within the Information Engineering Technology program to complete this project. The main focus will be on database and programming. Multimedia and networking will be used to support the other areas.

2.2.1 Microsoft SQL 2000 Database

The transactional database will be created with relational tables for simultaneous multi-users. The database will be accessed by an Intranet, which will also address security issues.

2.2.2 Networking

Networking will play a key role in the success of this project. I am going to set up a Web server using Windows 2000. As I move through my Networking II and III classes I will become more knowledgeable on how to use Microsoft Internet Information Server and Active Directory. I will also need to secure the Web server as well as give access to users.

2.2.3 Multimedia

The multimedia section of the project will be addressed by the layout of the Web page and how the user interacts with the database. Simple and fast loading pages are the key to success. The main purpose for the user is to operate the scheduler in a fast and efficient manner. The site does not need to be flashy and high tech.

2.2.4 Programming

The program will be written to programming standards so it can be readable and maintainable. I will use standard protocols to communicate with the database and client Web browser. I have decided to use ASP Pages, which will work the best with my design in the Microsoft Network environment. A good portion of HTML code will be used to create the user interface.

3. Deliverables

1. A Web Based Consultant Scheduler that manages and tracks Student appointments.
2. The user interface is written in HTML, which allows simple user navigation.
3. The WCOS uses ASP Pages to communicate between the client and database.
4. Users of the WCOS will have a secure login that is authenticated by the network Active Directory Server.
5. The users of the WCOS will be able to complete the following tasks:

3.1 Student Role Users

1. Initial ADSI Authentication will store the user contact information in the DB.
2. User profile is mandatory to be updated on the first login and once each quarter.
3. Misuse of WCOS will result in a Student locked out for the duration of the quarter. (Business Rules Apply)
4. All Student add/cancel appointments generate a notification (email) to the Student, Consultant and optionally to the Administrator.
5. Navigate within the quarter calendar to do the following:
 - a. View current Student appointments
 - b. Cancel current Student appointment (Business Rules Apply)
 - c. View selected Consultant schedule
 - d. Add appointment to selected Consultant schedule (Business Rules Apply)
 - e. View Consultant schedule and see possible schedule conflict with an option to cancel appointment (Business Rules Apply)
 - f. View Consultant profile (Read Only)

3.2 Consultant Users

1. Manage their own Consultant schedule. (Business Rules Apply)
(Example: can not modify Consultant schedule that is in the past)

2. Consultant schedule can be prepared a quarter in advance.
3. User profile is mandatory to be updated on the first login.
4. Cancel a Student appointment individually or by calendar selection. (Business Rules Apply)
5. All Consultant cancel appointments generate a notification (email) to the Student, Consultant and optionally to the Administrator.
6. Add Consultant note to Student appointment. (Business Rules Apply)
7. Consultant will be asked to do a follow-up on pass appointments to mark the appointments as show or no show.
8. Read and write Consultant message board.

3.3 Administrator User

Manage writing consultant lab hours

1. By the quarter.
2. Once the quarter is active or Consultant is ready, the schedule engine time slice can not be modified.
3. Once the schedule engine time slice is loaded, the lab hours maybe adjusted by the lab open/close time slice control.
4. Dash-Board view of activity.
5. Appointments activity.
6. No Show Appointments.

Manage user

1. Manually add a user to the WCOS Database (Must be authenticated user) in order to promote the user to a Consultant role.
2. Set or reset Consultant roles.
3. Lock or Unlock any user.
4. Reset student no-show counter.

5. Request all Students to update their profiles.
6. Cancel Consultant appointments. (Business rules over ridden)
7. Individually.
8. By the day.
9. By the week.
10. By the quarter.

Student appointments (Business rules over ridden)

1. Add appointment.
2. Cancel appointment.
3. Individually.
4. Entire quarter.
5. Reports (Display, print, and build MS Excel ready file).
6. Facility Activity.
7. Consultant Activity.
8. Student Activity.

Archive (As a complete unit by quarter) the WCOS Transaction Database Schedule.

Engine Data will be dropped once the data transfer to Analytically Database has been confirmed. The User information will remain on the WCOS Transaction Database. The following will be moved to an Analytical Database

1. Facility Activity.
2. Consultant Activity.
3. Student Activity

4. Design and Development

The Web pages are divided between the three user roles of the (WCOS) application. The Students (student role) use the system to view and set appointments with a Consultant. The Consultants manage and view their schedule and appointments. The Administrator manages the scheduler and monitors Web site health.

4.1. Student Screen Design (View Student Appointments)

The user network authentication is accomplished by the Microsoft Network Active Directory maintained by OCAS Network Administrator. Any network user is considered to be a WCOS Student by default unless promoted to a Consultant or Administrator role. The first time the Student enters WCOS within the UC Quarter the Student profile and user agreement confirmation page will be presented. The user will be expected to maintain contact information and check the user agreement check box each quarter. The Student must supply the following information:

- Last 4 digits of the social security number
- Contact telephone number
- Contact address

Once the profile page is completed, the Student Appointment becomes the main page that contains the calendar navigator and Student appointment view. The Students can navigate through their appointments day by day within the boundaries of the current quarter. The Student also can navigate Consultant schedules and view, set and cancel their appointments with the selected Consultant.

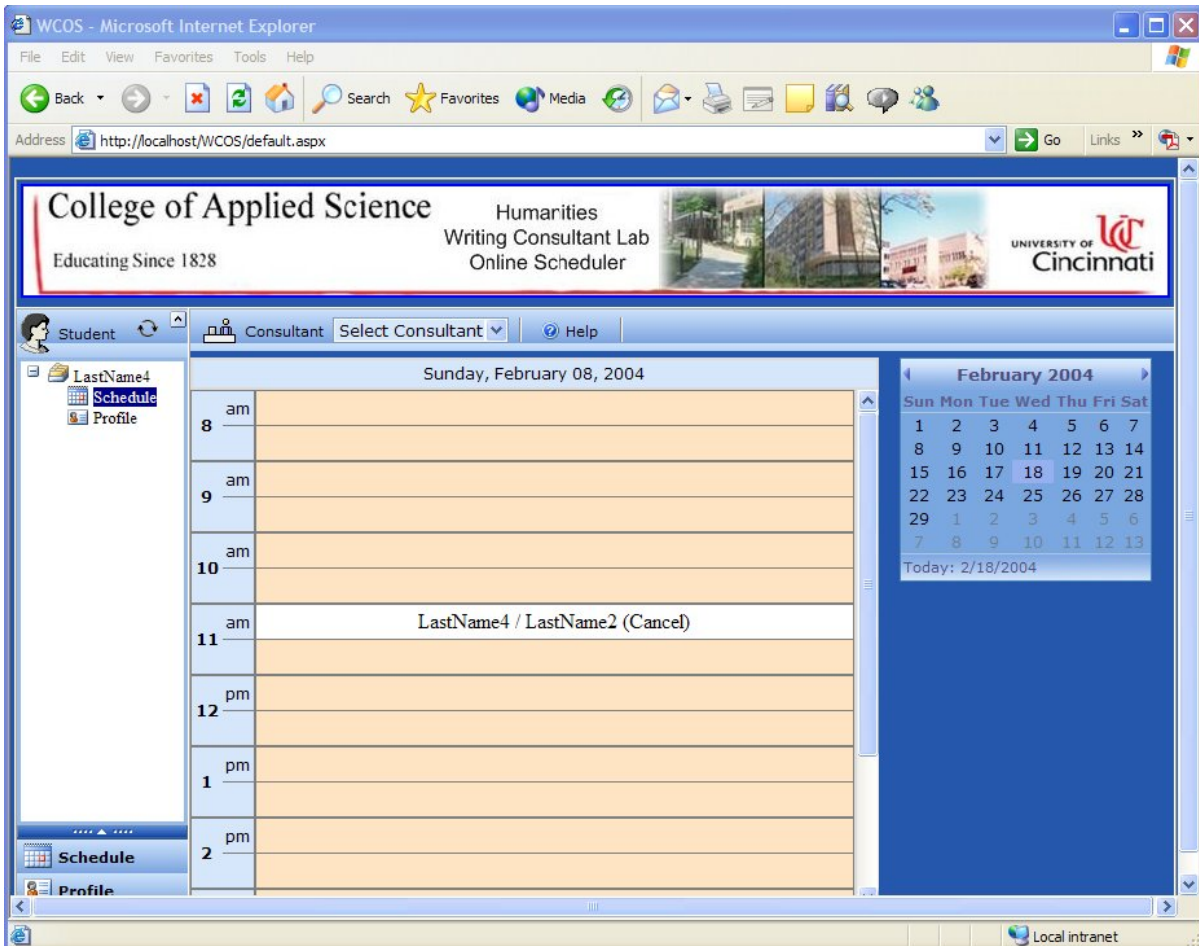


Figure 1. Sample of Student Appointment Page

4.2. Consultant Screen (View Consultant Schedule)

The user network authentication for the Consultant is the same as for the Student. However, the WCOS Administrator has promoted the user to a Consultant Role Member. The first time the Consultant enters WCOS within the UC Quarter, the Consultant profile and user agreement confirmation page will be presented. The user will be expected to maintain contact information and check the user agreement check box each quarter. The Consultant must supply the following information:

- Last 4 digits of the social security number
- Contact telephone number
- Contact email address

Once the profile page is completed the Consultant Schedule becomes the main page that contains the calendar navigator and schedule view. The Consultants can navigate through their appointments day by day within the boundaries of the current quarter. The Consultant also can manage the schedules, appointments and participate on the Consultant/Administrator message board.

The screenshot displays the 'John Smith Appointments' page for a consultant. The header includes the College of Applied Science logo, 'Humanities Writing Consultant Lab Online Scheduler', and the University of Cincinnati logo. The page title is 'John Smith Appointments' with a 'Help' link. The main content area shows a calendar for 'Mon, Jan 19' with a time slot grid from 8am to 4pm. Appointments are listed as follows:

Time Slot	Appointment
8am - 9am	
9am - 10am	Charles Corder
10am - 11am	
11am - 12am	Larry Adams
12am - 1pm	Larry Adams
1pm - 2pm	(Cancelled) Charles Corder /John Smith
2pm - 3pm	
3pm - 4pm	

On the right side, there is a calendar navigator for 'January 2004' showing the current date 'Today: 1/19/2004'. A vertical navigation pane on the left contains icons for 'Schedule', 'Manager', 'Message Board', and 'Profile'.

Figure 2. Sample of Consultant Schedule Page

4.3 Administrator Screen (View Lab Schedule)

The Administrator, like the Students and Consultants, are authenticated the same way. The WCOS determines the Administrator by Administrator Role membership. The Administrator pages are separated into four areas of responsibility.

- Consultant lab schedule manager
- User manager
- Consultant scheduler
- Error event log manager

4.1.1 WCOS Development

The flow of WCOS scheduling information is a three (3) step process that is detailed in the following drawings.

1. The Administrator sets when the lab is available in the scheduler.
2. The Consultants select from the lab availability when they will be available for student appointments.
3. The Students schedule an appointment from the Consultant's available time list.

The time is now set as unavailable to other Students.

4.1.2 Use Case Diagram

The use case diagram shows how the top level user roles information flow through the WCOS Appointment Scheduler

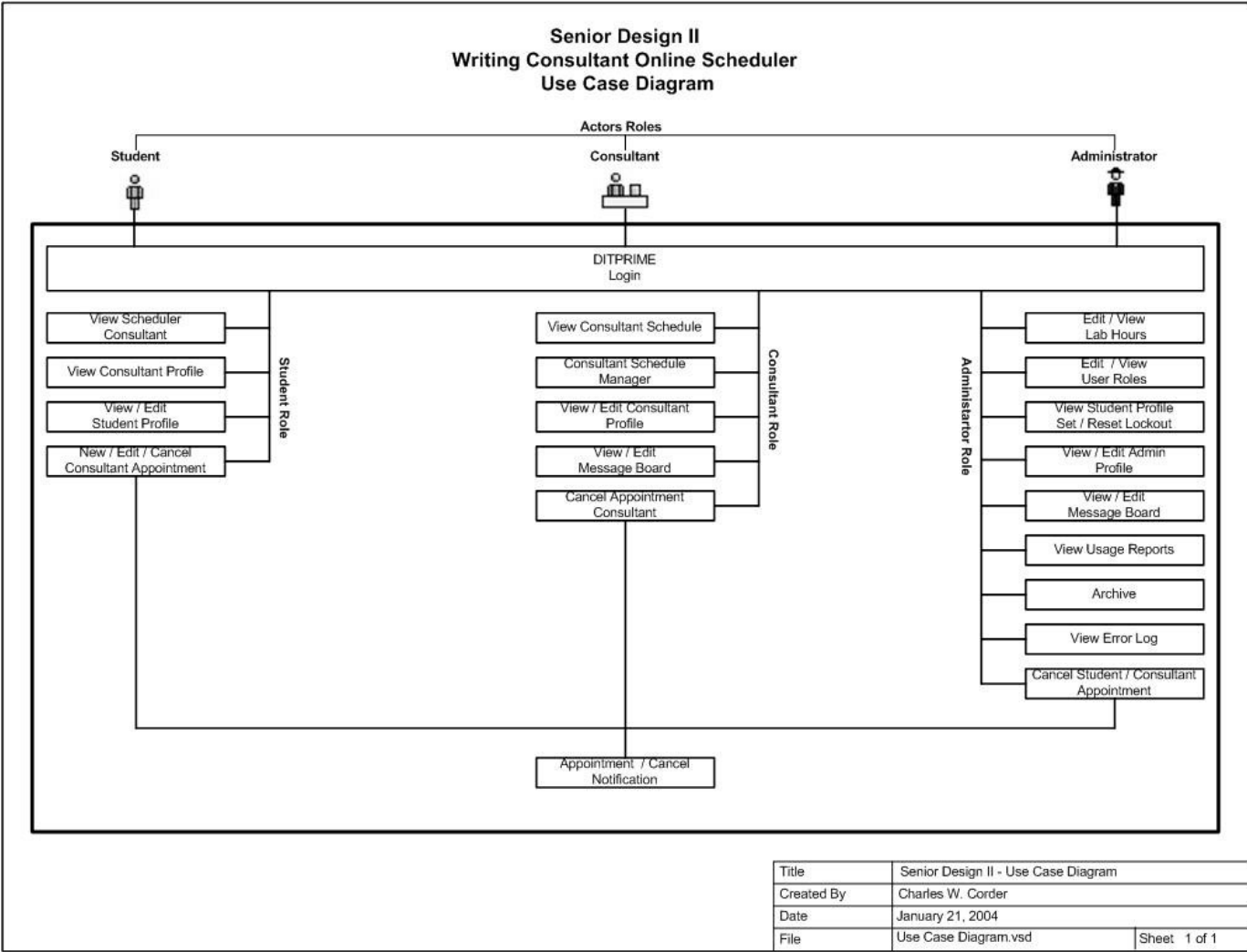


Figure 3. Use Case Diagram

4.1.3 User Interface

The user interface details the schedule information flow for the three user roles.

- Student
- Consultant
- Administrator

4.1.3.1 Student Role

The Students can view their appointments, view Consultant schedules, view contact information, and set up a scheduled appointment with a Consultant.

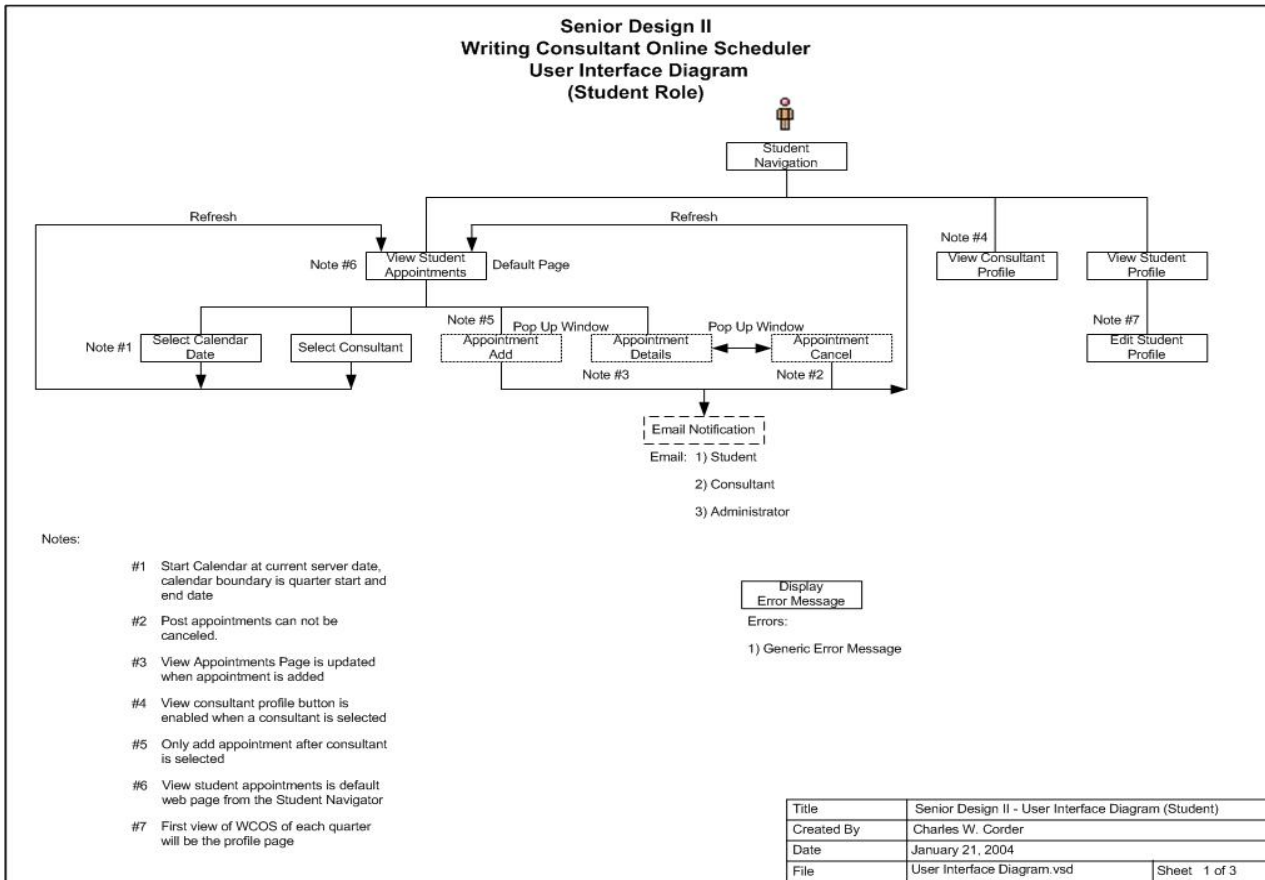


Figure 4. Student User Interface Diagram

4.1.3.2 Consultant Role

The Consultant can set and view their schedule manager, view scheduled appointments, and cancel appointments.

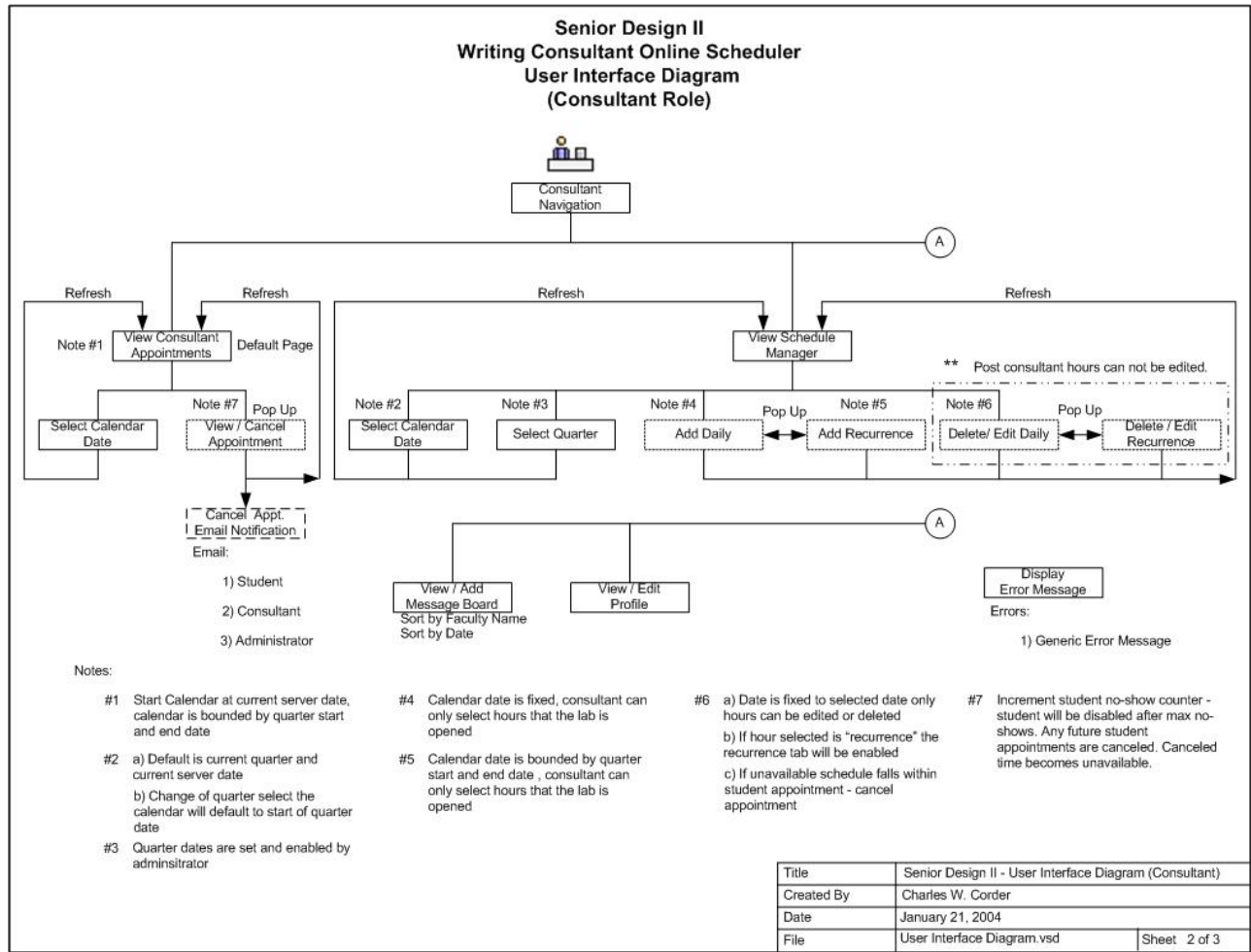


Figure 5. Consultant User Interface Diagram

4.1.3.3 Administrator Role

The Administrator sets the facility schedule manager, view scheduled appointments, cancels appointments and generates resource usage reports.

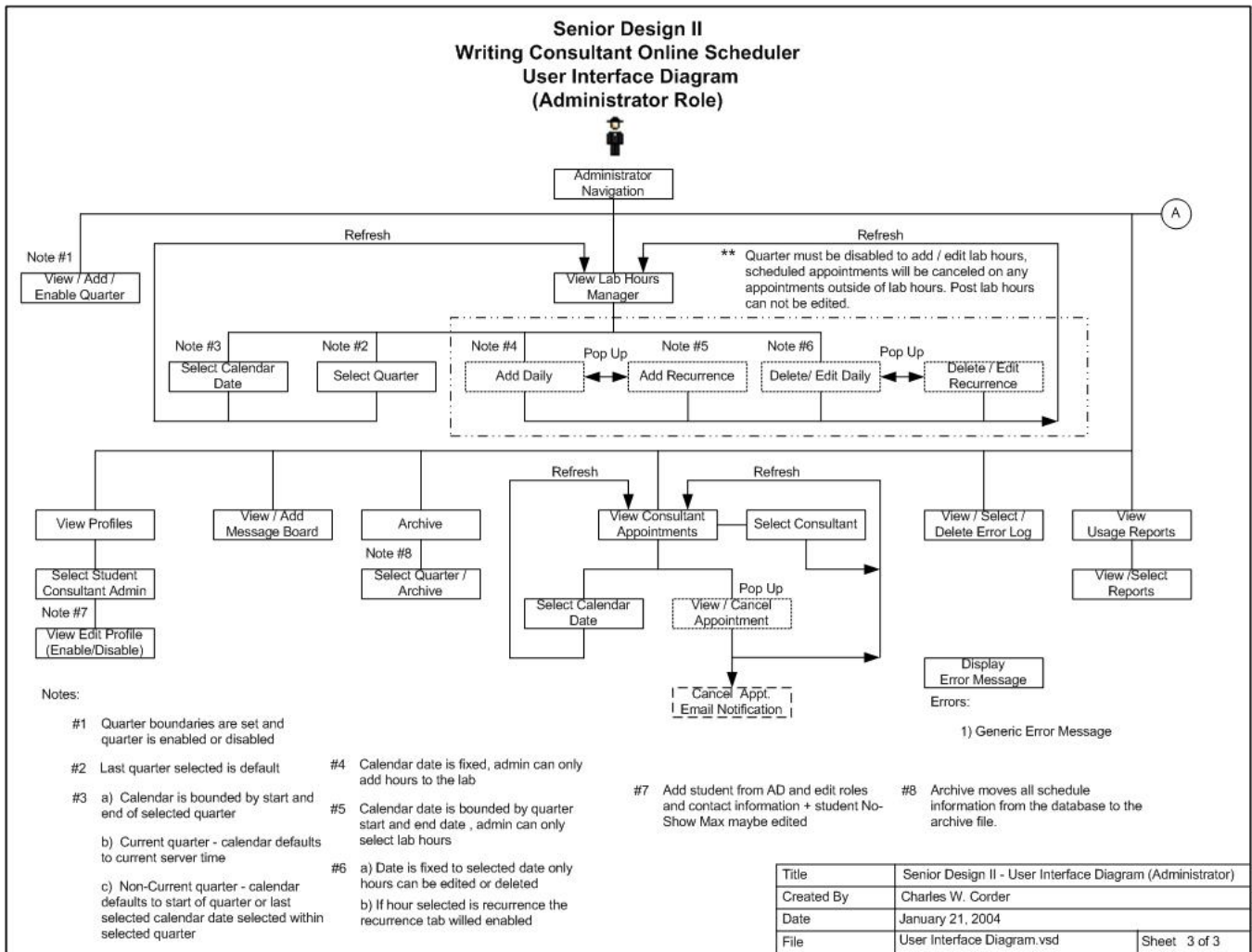


Figure 6. Administrator User Interface Diagram

4.1.4 Programming Coding Standards

The WCOS Project is written to a set of coding standards which makes the project more readable and maintainable.

4.1.4.1 Programming C# Coding Standards

1. Comment, comment, comment. It is difficult to have too many comments in a program.
2. Do not abbreviate any variable.
3. Use compound names for variables, functions and sub-routines, when applicable. Use proper case (i.e. capitalize the first letter of each word). For example: lngOrderTotals.
4. All variable names must be meaningful/descriptive.
5. Do not use global variables.
6. Use indentation to show scope. Indent 3 or 4 spaces. Indent inside functions, sub-routines, loops, if a case statement.
7. Be consistent.

Data Type	Prefix	Example
Arrays	a	alngOrders
Boolean/Bit	bln	blnResult
Character	chr	chrMiddleInitial
Integer	int	intIndex
Long	lng	lngOrderSize
Short	sht	shtIndex
Single Float	sng	sngAverage
Double Float	dbl	dblAverage
String	str	strFirstName
Forms	frm	frmStudents
Modules	mod	modConstants
Class Modules	cls	clsStudent
HTML Template Web Items	tpl	tplLogin
Web Class	wc	wcLogin
Label	lbl	lblLogin
Text	txt	txtLogin
List Box	lst	lstOrderList
Command	cmd	cmdLogin
Option Box	opt	optShipping
Check Box	chk	chkPaymentType

Figure 7. C# Naming Conventions

4.1.4.2 Programming SQL Coding Standards

1. Capitalize reserved words in any SQL command or query.
2. Do not abbreviate any variable, column, table, view, stored procedure or constraint name.
3. Use proper-case (Capitalize the first letter of each word) with compound names. For example strFirstName.
4. All variable, table, view, stored procedure and constraint names must be meaningful/descriptive.
5. All table and view names are plural.
6. All columns must be NOT NULL. (NULLS are evil)
7. Be consistent.
8. Use indentation to show scope.

Examples:

```
CREATE TABLE TStudents
```

```
(
    intStudentID      INTEGER      NOT NULL,
    strFirstName      VARCHAR(50)   NOT NULL,
    strLastName       VARCHAR(50)   NOT NULL,
    CONSTRAINT TStudents_PK PRIMARY KEY (intStudentID)
)
```

```
INSERT INTO TStudents (intStudentID, strFirstName, strLastName)
VALUES(1, 'John', 'Doe')
```

```
SELECT
    intStudentID,
    strFirtsName,
    strLastName
FROM
    TStudents
WHERE
    strFirstName = 'John'
AND strLastName = 'Doe'
```

Data Type	Prefix	Example
Table	T	TStudents
View	V	VStudentsOrders
Stored Procedure	sp_	sp_AddRecord
Boolean/Bit	bln	blnResult
Currency	cur	curItemPrice
Date/Time	dtm	dtmOrder
Decimal	dec	decPrice
Double Float	dbl	dblPrice
Error	err	errMessage
Integer	int	intIndex
Long	lng	lngQuantity
Single Float	sng	sngPrice
String/Varchar	str	strFirstName

Constraint	Suffix	Example
Primary Key	_PK	TStudents_PK
Foreign Key	_FK	TStudents_TOrders_FK <Child>_<Parent>_FK
Clustered Index	_CI	TStudents_CI
Non-clustered Index	_NI	TStudents_CI
Unique	_UN	TStudents_lngID_UN

Figure 8. SQL Naming Conventions

4.1.5 Application Architecture

The WCOS application is an ASP.NET Web application that uses a logical, 3-tier architecture.

4.1.5.1 Three Tier Architecture

Data access, business logic, and user interface logic is separated into different classes.

Three-tier architectures have many advantages, including:

- There is a distinct separation between the user interface, business logic, and data access layers. This isolation promotes code re-use and makes maintaining and enhancing the code easier. Development is also easier because there is a clear decomposition of functionality allowing developers or teams of developers to focus on different parts of the application during implementation.

- Business rules are centralized into one component that is easy to re-use and provides a high-level language (like C# or Visual Basic .NET) in which to develop business rules.
- Data access code is centralized in one place making development and maintenance easier.

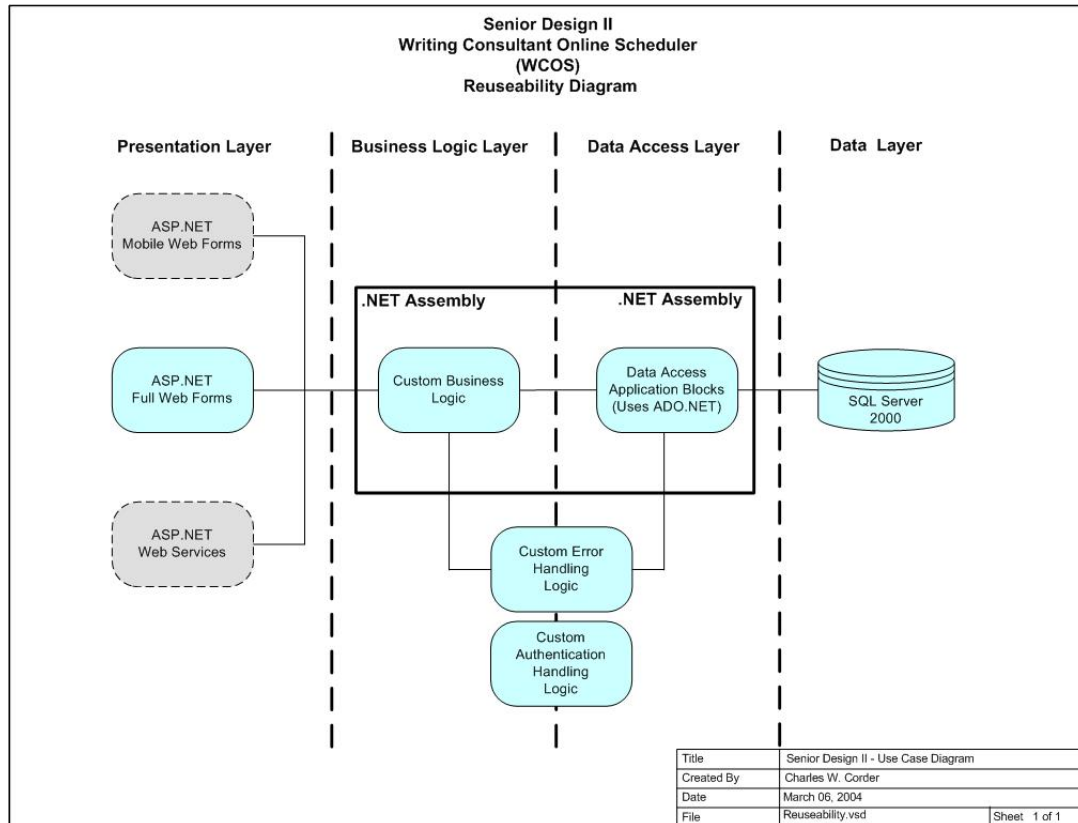


Figure 9. Three Tier Architecture

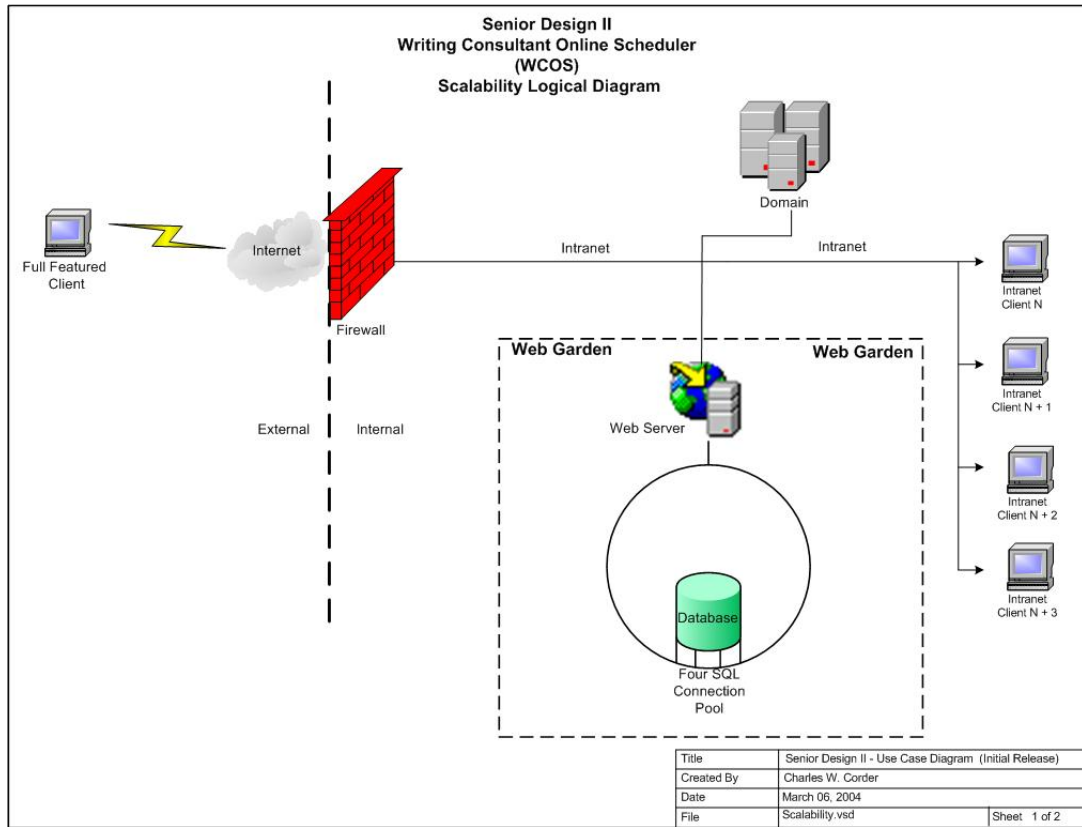


Figure 10. Scalability - Initial Release

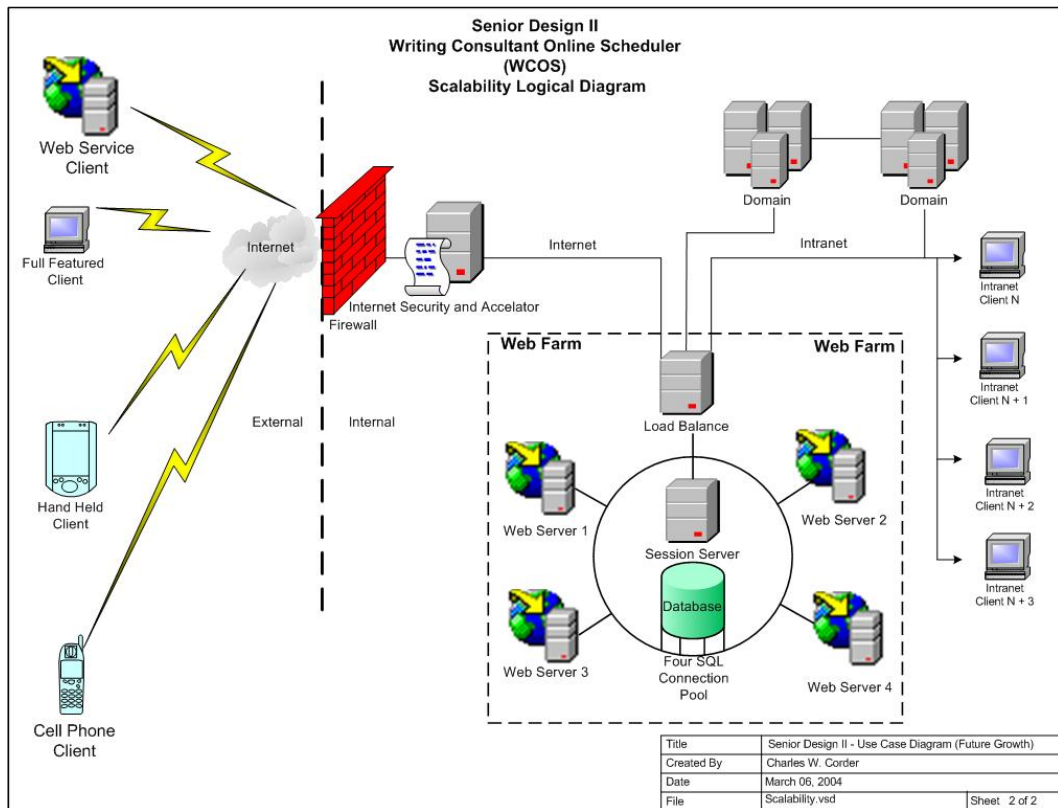


Figure 11. Scalability - Future Growth

4.1.6 Data Layer

The ASP.NET WCOS application uses a Microsoft SQL Server 2000 database. (MSDE 2000 is also supported) The physical database schema was created after careful analysis of the WCOS requirements and user cases. Examples of these requirements are:

- A Student user enters time for a Consultant appointment.
-
- A user has a role that specifies the features they are authorized to use in the application.
- Only Students who are authenticated members of a WCOS application can schedule appointments.
- The WCOS Administrator assigns users roles.

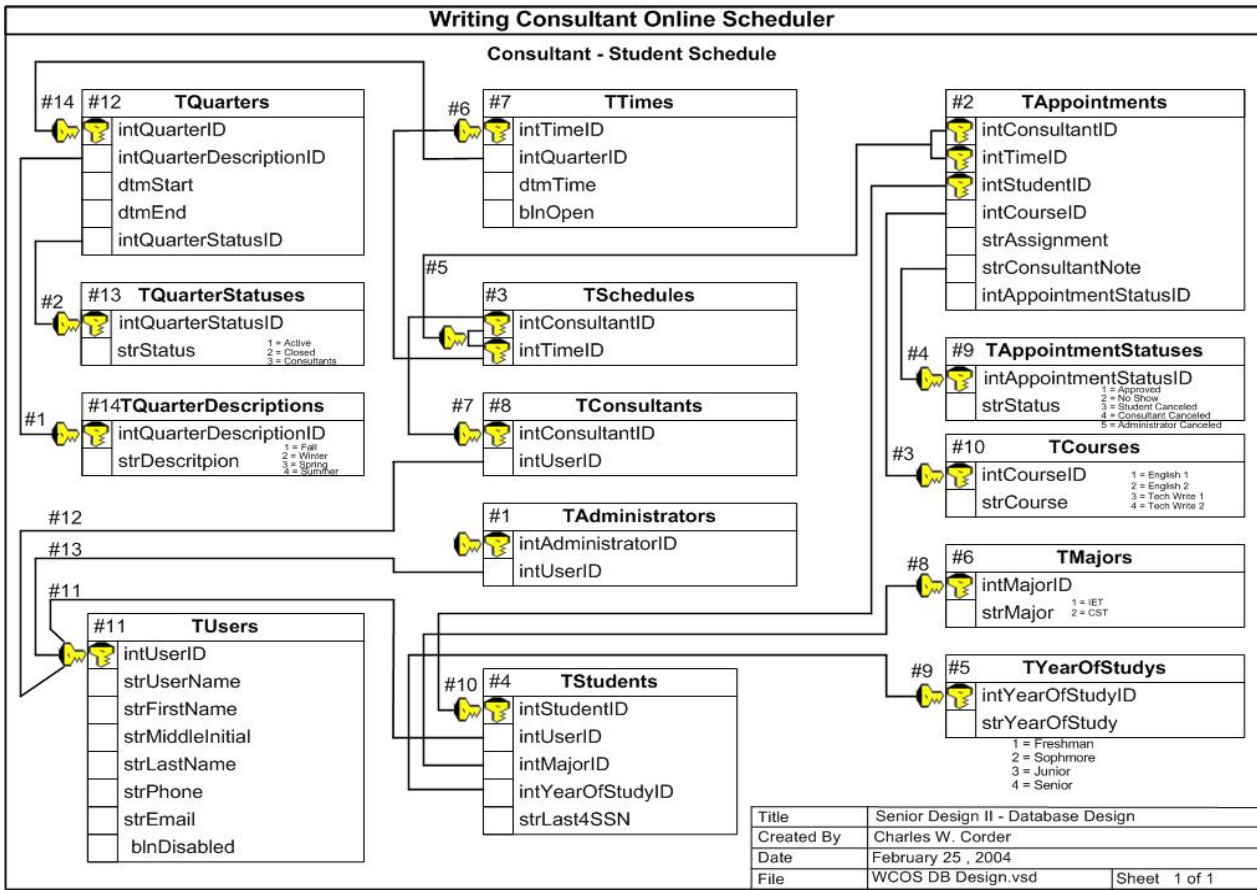


Figure 12. Database Schema

4.1.6.1 Stored Procedures

The WCOS application uses stored procedures to encapsulate all of the database queries. The use of stored procedures provides a clean separation between the database and the data access layer. There are performance benefits when using stored procedures. They are optimized the first time they are run and then are retained in memory for subsequent calls. Strongly-typed parameters and the ability to set permissions on each stored procedure result in improved security. Furthermore, the user accessing the stored procedures only needs rights to the stored procedures and not the underlying tables.

Depending upon the type of changes made to tables in the database, stored procedures can be modified without requiring changes to the data layer. Changes to stored procedure signatures, however, usually ripple up to the data layer, business logic layer, and presentation layer.

The following stored procedures represent a subset of what is required to implement the WCOS application.

Name	Parameters	Description	Result
sp_GetDayConsultantSchedule	@dtmDay @intConsultantID	Retrieves the time slices for one day and consultant availability	SQL result set consisting of rows and all columns from schedule engine tables
sp_GetConsultantProfiles	@intDisabled	Retrieves consultant profile	SQL result set consisting of rows and columns from user information table
sp_AddStudentAppointment	@intConsultantID @intTimeID @intStudentID @intCourseID @strAssignment	Inserts appointment entry into the schedule engine tables	SQL returns a success or failure of the posted schedule appointment transaction

Figure 13. Appointment Schedule Engine Stored Procedures

```

CREATE PROCEDURE sp_AddStudentAppointment
(
    @intConsultantID    INTEGER,
    @intTimeID          INTEGER,
    @intStudentID       INTEGER,
    @intCourseID        INTEGER,
    @strAssignment       VARCHAR(50)
)
AS

SET NOCOUNT ON

BEGIN TRANSACTION AddStudentAppointment

DECLARE @intAppointmentCount INTEGER,
        @intReturn           INTEGER

SET @intAppointmentCount = -1
SET @intReturn           = 0

-- Check if appointment is available
SELECT @intAppointmentCount = COUNT(*)
FROM TAppointments
WHERE intConsultantID = @intConsultantID AND intTimeID = @intTimeID AND
      intAppointmentStatusID = 1

IF @intAppointmentCount <> 0
BEGIN
    GOTO ERROR
END

--Add Student Appointment
INSERT INTO TAppointments( intConsultantID, intTimeID, intStudentID,
                           intCourseID, strAssignment, intAppointmentStatusID)
VALUES                      ( @intConsultantID, @intTimeID, @intStudentID,
                              @intCourseID, @strAssignment, 1)

-- Check for errors

```

```

IF @@ERROR <> 0
BEGIN
ERROR:
    --
    -- Rollback the transaction and return to the caller
    --
    SET @intReturn = -1
    ROLLBACK TRANSACTION AddStudentAppointment
    RAISERROR('Add Student Appointment Failed.',18,1)
    SELECT @intReturn AS intReturn
    RETURN -1
END

COMMIT TRANSACTION AddStudentAppointment

--Return the status
SELECT @intReturn AS intReturn

GO

```

Figure 14. Example of Stored Procedure Sample

4.1.6.2 Data Access Layer

A data access layer is used to encapsulate database-specific code, separating the details of the database from the business logic layer. This separation allows the aggregation of different databases without requiring changes to the business logic layer and presentation layer. The **Microsoft Data Access Application Blocks (DAAB)** is used to implement the data access layer.

The DAAB is a .NET component that contains optimized data access code for issuing commands against a SQL Server Database. Using the DAAB reduces the amount of custom code needed to create, test, and maintain database access. Database access calls can be reduced to as little as one line of code instead the usual six or more lines required.

```
DataSet ds = SqlDb.ExecuteDataset(  
    ConfigurationSettings.AppSettings[Web.Global.CfgKeyConnString],  
    CommandType.StoredProcedure, "sp_GetConsultantProfiles");
```

Figure 15. Example of SqlDb. DataSet

In the code above, the “sp_GetConsultantProfiles” stored procedure is called and the result set is assigned to a DataSet. This call requires just one line of code.

Alternatively, the code requires six lines of code without using the DAAB and using ADO.NET (System.Data) directly.

```
SqlConnection myConnection = new SqlConnection(  
    ConfigurationSettings.AppSettings[Web.Global.CfgKeyConnString]);  
  
SqlCommand myCommand = new  
SqlCommand("sp_GetConsultantProfiles ", myConnection);  
myCommand.CommandType = CommandType.StoredProcedure;  
SqlDataAdapter myDataAdapter = new SqlDataAdapter(myCommand);  
DataSet myDataSet = new DataSet();  
myDataAdapter.Fill(myDataSet);
```

Figure 16. Example ADO.NET

ExecuteDataSet vs. ExecuteReader

Throughout the code, the WCOS application uses the ExecuteDataSet method in places where normally the ExecuteReader is used.

The DataReader is a connected reader that provides a forward-only view of data. Because DataReaders are forward only, they are very fast at reading data. A drawback is that, in the DAAB, the ExecuteDataReader method is tightly tied to SQL Server whereas the ExecuteDataSet is not database specific. In addition, the DataReader needs to be explicitly closed after using it.

4.1.6.3 Business Logic Layer

The business logic layer separates the code specific to the application, or the way a company does business from the user interface and the database-specific code. Other line of business applications a company builds can use the business logic layer if needed, maximizing code re-use. The separation also allows the ability to create Web services that use the functionality provided by the business logic layer.

Security for determining the data a user can see and not see is enforced by the Business Logic layer and stored procedures. For instance, a Student can see schedule availability for a Consultant for the selected date. Therefore, the `GetDayScheduledAppointments()` method takes as a parameters `dtmDate`, `intConsultantID` of the user making the request. The two parameters are passed to the underlying stored procedure via the Data Access Layer and only data viewable to that user, based on their role, is returned to the Business Logic Layer.

The WCOS application uses lightweight classes to wrap information that is returned from the database access layer.

The `CDayConsultantScheduledAppointments` class is a good example of one of the classes used in the WCOS application.

View Consultant Appointments

The `CDayConsultantScheduledAppointments` class encapsulates all time entry details.

Name	Type
<code>m_intTimeID</code>	Integer
<code>m_intStudentID</code>	Integer
<code>m_intConsultantID</code>	Integer

Figure 17. Public Properties

Constructors

- Initializes all object properties.

Methods

- AppointmentStatus(Q): Returns a list with all the appointment statuses for a given day.
- AddAppointment(): Adds a student appointment once the business rules have been checked.

4.1.6.4 Custom Collections

Since the WCOS presentation layer is very list-centric, the application uses its own custom collections to pass around information between the business logic layer and the presentation layer. The possible alternatives are to use a DataSet, DataTable, DataView, or any other object that implements the ICollection and IEnumerable interfaces. Using custom collections instead of these alternatives provide several benefits:

- The custom collection is more lightweight than a DataSet.
- The custom collection provides a cleaner separation from the data layer and the presentation layer.
- Each collection is a class specific object.

The custom collections used in the WCOS application are derived from ArrayList base. The ArrayList is customized so that it can handle sorting of its internal objects and their fields.

4.1.6.5 Presentation Layer

The presentation layer is responsible for the user interface and communicates directly with the business logic layer. Separating the presentation layer from the rest of the application enables the development of different user interfaces (i.e. Web Forms,

Windows Forms, Mobile Devices) that all use the same business logic and database access code.

4.1.6.5.1 Student Presentation Layer

The following screen shots are taken from Student Role of the Presentation Layer.

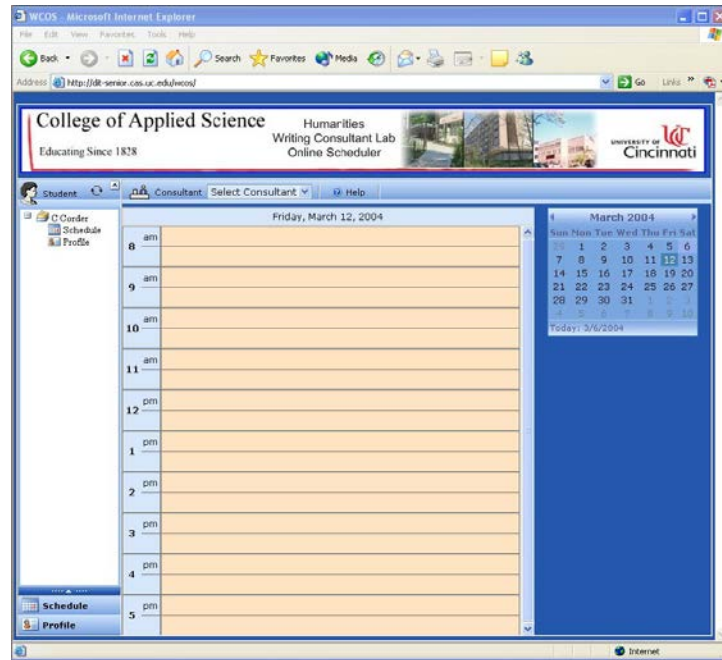


Figure 18. View Student Appointments (Student Role)

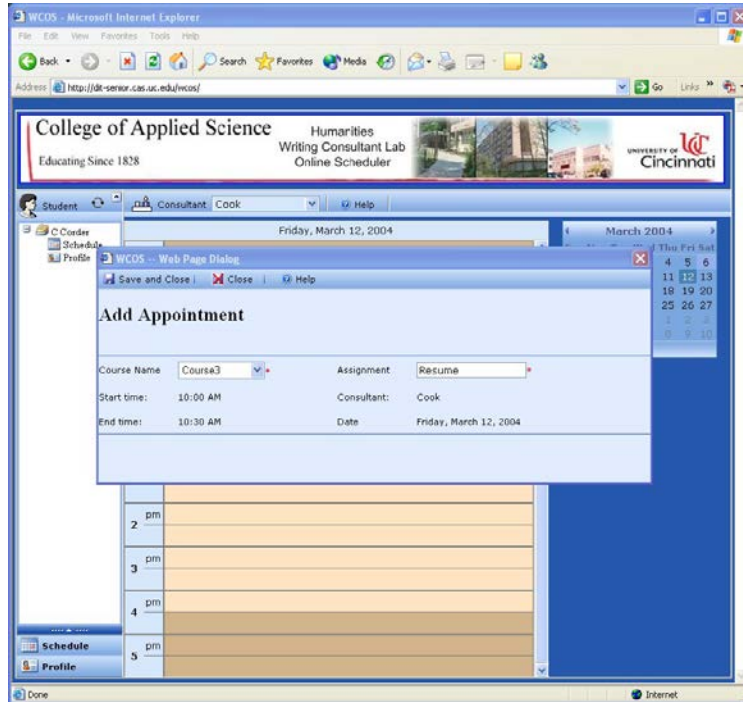


Figure 19. Add Student Appointments (Student Role)

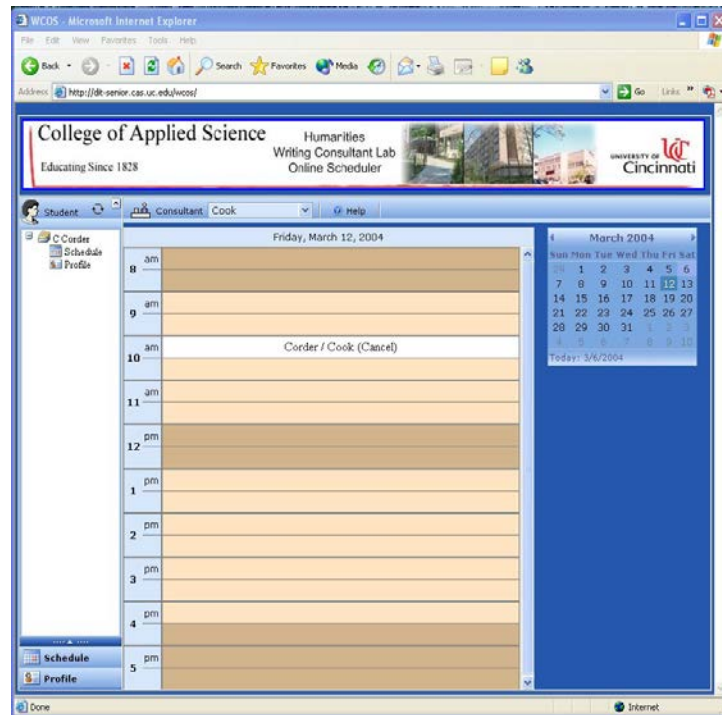


Figure 20. View Consultant Schedule (Student Role)

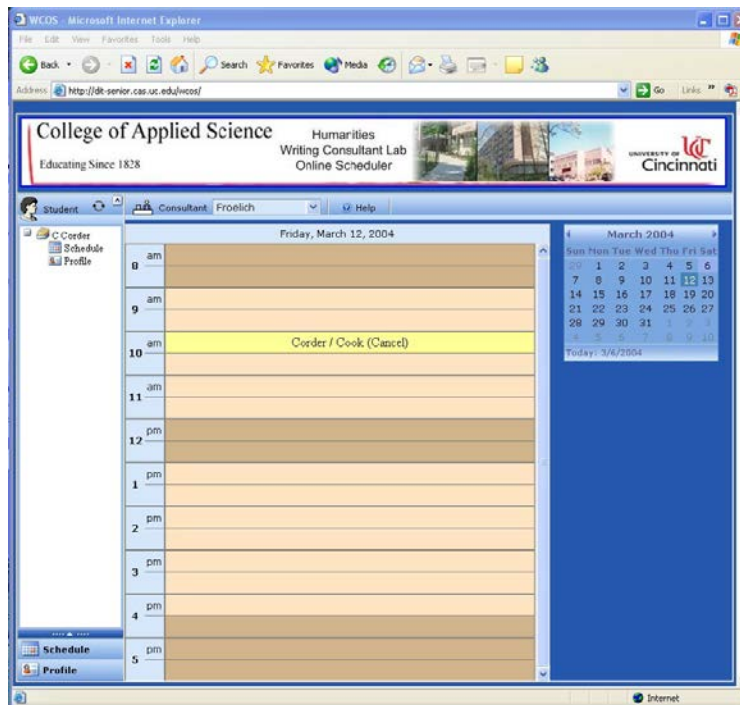


Figure 21. View Consultant Schedule – Appointment Possible Conflict (Student Role)

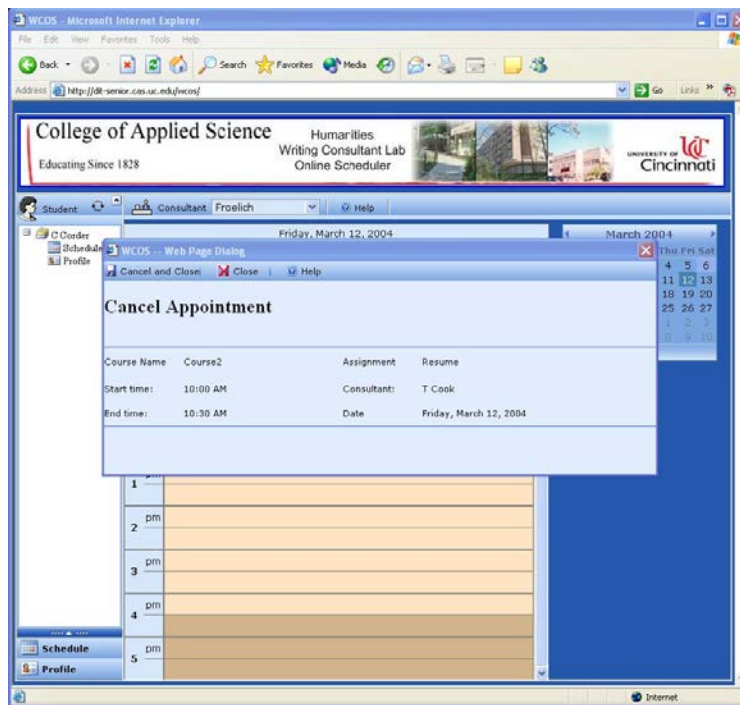


Figure 22. Cancel Appointment (Student Role)

4.1.6.5.1 Student Presentation Layer (Continued)

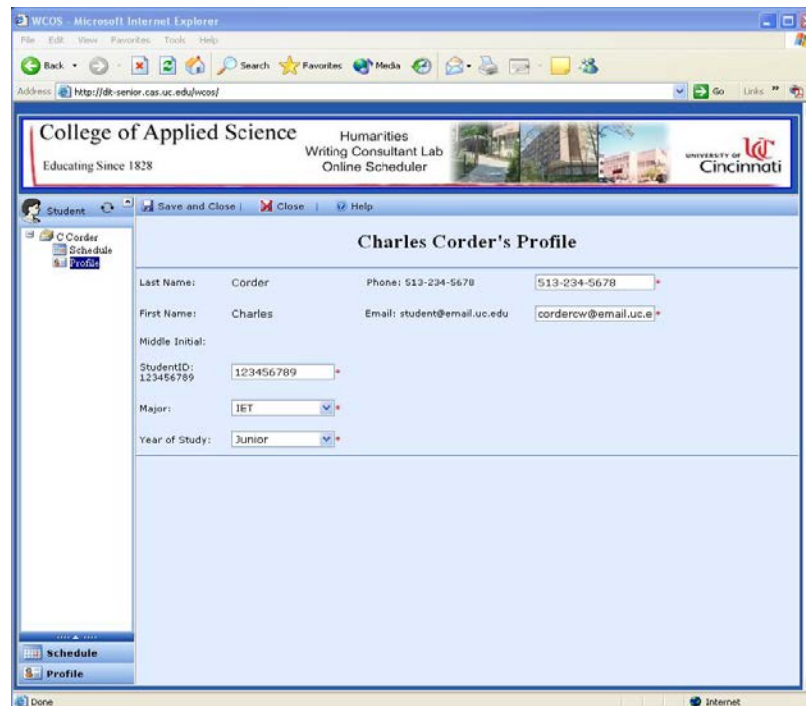


Figure 23. View/Edit Student Profile (Student Role)

4.1.7 Security

Authentication is the process in which the application verifies a user's identity and authorization. The security design makes use of both authentication and authorization credentials. Authorization will actually verify the authenticated user's permissions for a requested resource.

The WCOS application supports windows based authentication. The authentication mode is defined in the Web.config, and the User.Identity.Name property maintains the user name. Windows authentication uses a domain/active directory with the NTLM challenge/response protocol.

Authorization for the WCOS is handled by using role based security to determine whether or not a user has access to a particular resource. Users are grouped into various roles (Administrator, Consultants, and Students) and the role mappings are stored in the database. The navigation list checks the role of the current user to determine which pages to display. A check occurs in the page load event for every page, making sure that the user has the correct role required for accessing the page. These checks prevent a user from accessing functionality they should not be able to access.

Similarly, a user's role in the WCOS application determines which tasks they can and cannot do. For instance, a Consultant can only add time entries to their own schedule.

The following table shows the capabilities of each role.






















Task	Student	Consultant	Administrator
View student appointments			
View student profile			
Add student appointment			
Cancel student appointment			
Create consultant schedule			
View / Edit Consultant schedule			
Create facility schedule			

Figure 24. Role Functions

4.2 Budget

Item	Cost
Development Budget	
Microsoft Office XP Premium	\$ 500.00
Microsoft Windows 2000 Server	\$3,743.00
Microsoft SQL 2000	\$1,300.00
Microsoft Visual Studio 2003	\$2,390.00
Infragistics (GUI)	\$495.00
Reference Material	\$200.00
Developmental Total	\$8628.00
Production Budget	
Dell Web Server Windows 2000	\$12,220.00
Dell Microsoft Windows 2000 Server *	\$8,945.00
Microsoft SQL 25 Users	\$7,629.00
Internet Explorer 4.0	Free
UC – Intranet Network	Existing
Production Total	\$28,794.00
Developmental Total	\$8,628.00
PROJECT TOTAL	\$37,422.00

Figure 25. Budget

4.3 Timeline

4.3.1 Senior Design I Fall 2003

Weeks 1-5

- Gather Information
- Progress Report
- Problem/Area of Inquiry

Week 6-10

- Proposal Draft
- Proposal Presentation

4.3.2 Senior Design II Winter 2004

Weeks 1-5

- Design Use Case Diagram
- Design User Interface and Web Page Design
- Draft of Project Description and Intended Use and User Profile
- Program Student Appointment Web Page

Week 6-10

- Program Student/Consultant Page
- Design Database
- Program Code to Connect Database to Presentation
- Documentation
- Demonstrate Working Prototype (March 11, 2004)

4.3.3 Senior Design III Spring 2004

Weeks 1-10

- Complete Project Functionality
- Complete Testing and Troubleshooting.
- Submit Preliminary Documentation.
- Submit Final Documentation and Demonstrate Final Project

4.4 Software Requirements

- Microsoft Window 2000 Server
- Microsoft SQL 2000 Server
- Web Browser (Internet Explorer 6)

4.5 Hardware Requirements

- Server computer for MS Windows 2000 and SQL 2000 Server
- UC Intranet network
- Client workstation with UC-Intranet access

5. Testing Procedures

Acceptance testing will be divided into three separate areas of testing. The three majors test groups are Administrator, Consultant, and Student Web pages.

5.1 Senior Design II Presentation Testing

The Senior Design II Presentation will be the functionality of the (WCOS) Student user role on College of Applied Science (CAS) Senior Design Server. The presentation will demonstrate a Student role doing the following functions:

- Logging on (CAS) Senior Design Web Server for the first time
- User authentication process by the (CAS) Domain Server
- Completing the Student profile
- Viewing a selected Consultant schedule
- Making a Consultant appointment request
- Viewing Student appointment schedule
- Canceling Student appointment schedule
- Logging on (OCAS) Senior Design Web Server for the n^{th} time

Writing Consultant Online Scheduler																
Consultant - Student Scheduler																
TUsers 1 - 6	TAdministrators 1, 1	TConsultants 1, 2 2, 3	TStudents 1, 4 2, 5 3, 6	TQuarters 1, 2, Start, End, 1												
TTimes Day 1 (1, 1, '2004/03/08 08:00:00', 1) (8, 1, '2004/03/08 11:30:00', 1) (9, 1, '2004/03/08 12:00:00', 0) (10, 1, '2004/03/08 12:30:00', 0) (11, 1, '2004/03/08 13:00:00', 1) (20, 1, '2004/03/08 17:30:00', 1) Day 2 (21, 1, '2004/03/09 08:00:00', 1) (28, 1, '2004/03/09 11:30:00', 1) (29, 1, '2004/03/09 12:00:00', 0) (30, 1, '2004/03/09 12:30:00', 0) (31, 1, '2004/03/09 13:00:00', 1) (40, 1, '2004/03/09 17:30:00', 1) Day 3 (41, 1, '2004/03/10 08:00:00', 1) (48, 1, '2004/03/10 11:30:00', 1) (49, 1, '2004/03/10 12:00:00', 0) (50, 1, '2004/03/10 12:30:00', 0) (51, 1, '2004/03/10 13:00:00', 1) (60, 1, '2004/03/10 17:30:00', 1)	TSchedules Day 1 (1, 3) Thru (1, 8) (1, 11) Thru (1, 17) (2, 3) Thru (2, 8) (2, 11) Thru (2, 17) Day 2 (1, 23) Thru (1, 28) (1, 31) Thru (1, 37) (2, 23) Thru (2, 28) (2, 31) Thru (2, 37) Day 3 (1, 43) Thru (1, 48) (1, 51) Thru (1, 57) (2, 43) Thru (2, 48) (2, 51) Thru (2, 57)	TAppointments -- Consultant 1 -- Time 7 '2004/03/08 11:00:00' -- Student 1 -- Course 1 -- Assignment 'Assign 1' -- Notes null -- Status 1 Approved -- Consultant 1 -- Time 11 '2004/03/08 13:00:00' -- Student 2 -- Course 2 -- Assignment 'Assign 2' -- Notes null -- Status 1 Approved -- Consultant 2 -- Time 56 '2004/03/10 15:30:00' -- Student 1 -- Course 3 -- Assignment 'Assign 3' -- Notes null -- Status 3 Student Canceled -- Consultant 2 -- Time 56 '2004/03/10 15:30:00' -- Student 2 -- Course 3 -- Assignment 'Assign 3' -- Notes null -- Status 1 Approved														
		<table border="1"> <tr> <td>Title</td> <td colspan="2">Senior Design II - Database Design</td> </tr> <tr> <td>Created By</td> <td colspan="2">Charles W. Corder / Renee Merz</td> </tr> <tr> <td>Date</td> <td colspan="2">March 06 , 2004</td> </tr> <tr> <td>File</td> <td>WCOS DB Design.vsd</td> <td>Sheet 1 of 1</td> </tr> </table>			Title	Senior Design II - Database Design		Created By	Charles W. Corder / Renee Merz		Date	March 06 , 2004		File	WCOS DB Design.vsd	Sheet 1 of 1
Title	Senior Design II - Database Design															
Created By	Charles W. Corder / Renee Merz															
Date	March 06 , 2004															
File	WCOS DB Design.vsd	Sheet 1 of 1														

Figure 26. Beta Test – Database Preload Test Data

The presentation demonstrated the Proof of Concept on how Information Technology can be utilized to solve Consultant appointment scheduling difficulties. My original goal is to have a demonstration of the Microsoft Outlook scheduler style user interface showing a Student viewing and making appointments with a writing Consultant. My time schedule is right in line with the presentation date March 11, 2004.

5.2 Proof of Design

5.2.1 Proof of Design – Schedule Engine Logic Flow - Administrator Role

The WCOS Web Site first user login after installation set the one time default user role identification to the Administrator. It is the function of the Administrator to prepare the WCOS Web Site for the scheduling of the Consultants and the Students. The figure below shows the Administrator after the first user login.

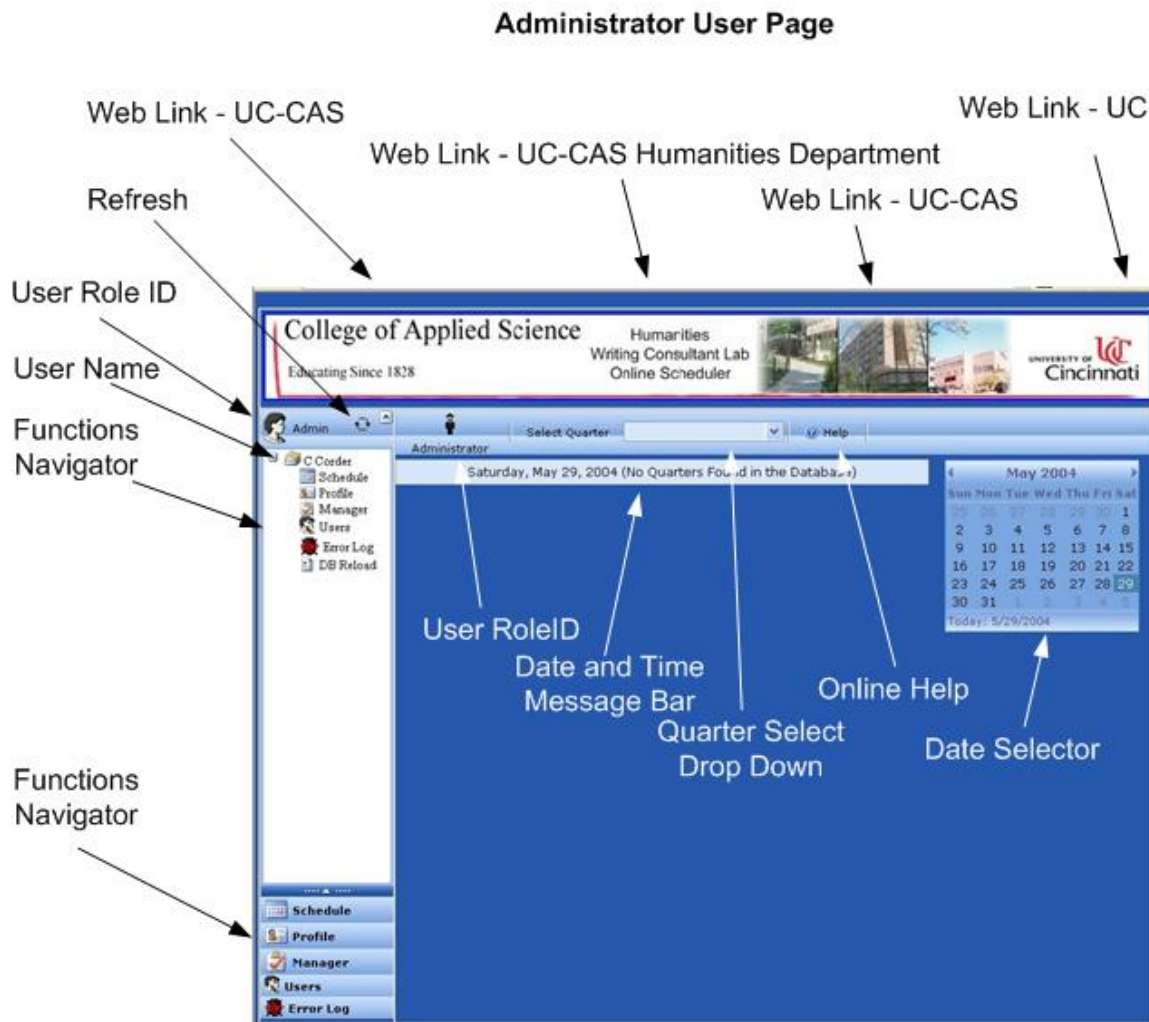


Figure 27. Administrator first user login Web Page Explorer

The WCOS Administrator defines the school year periods as (Quarter, Semester, or Periods) which ever calendar the school system is using. University of Cincinnati uses the quarter system to define the academic calendar year. This demonstration will use the quarter system. The WCOS Administrator defines the school year periods as (Quarter, Semester, or Periods) which ever calendar the school system is using. University of Cincinnati uses the quarter system to define the academic calendar year. This demonstration will use the quarter system. The quarter's attribute statuses control what user can view and interact with the quarter schedules. The Administrator uses the quarter status to program which group of user roles can use the scheduler.

Quarter attribute status

1. **Active** – Consultants and students can view and schedule appointments
2. **Closed** – Administrator use only
3. **Edit** – Administrator use only to schedule room availability
4. **Consultant's Only** – Consultant use to schedule their availability for the next quarter

Once the Quarters are defined the room availability is scheduled and the current quarter status is to Active as needed.

The picture below demonstrates in a step by step procedure of defining the quarter start and end dates along with setting room availability with the selected quarter.

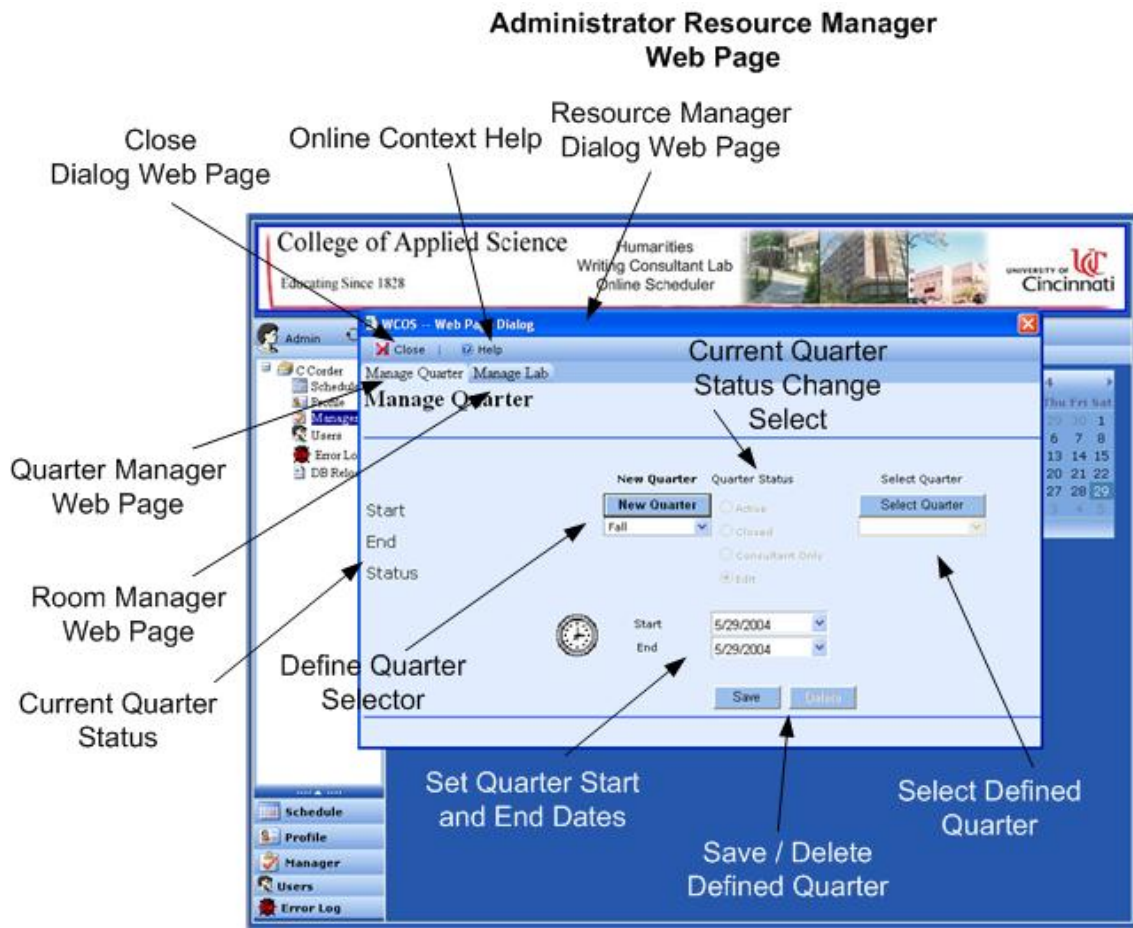


Figure 28. Step 1 Administrator Resource Manager Dialog Page Explorer

Administrator Resource Manager Web Page

Define New Quarter

Define New Quarter
Selection

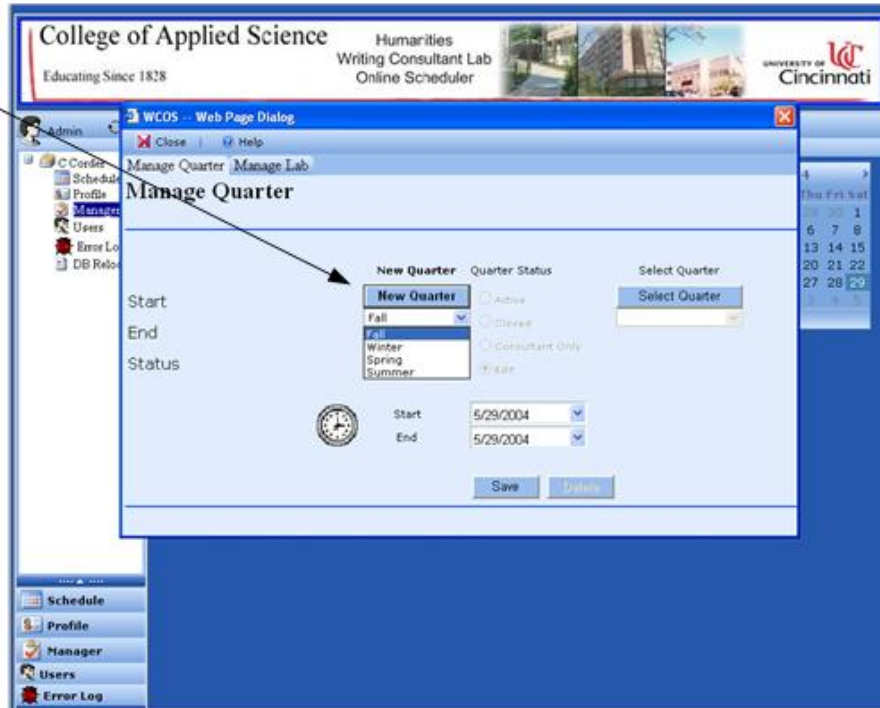


Figure 29. Step 2 Select New Quarter Definition

Administrator Resource Manager Web Page

Define New Quarter
Start and End Dates

Set Quarter Start and
End Dates

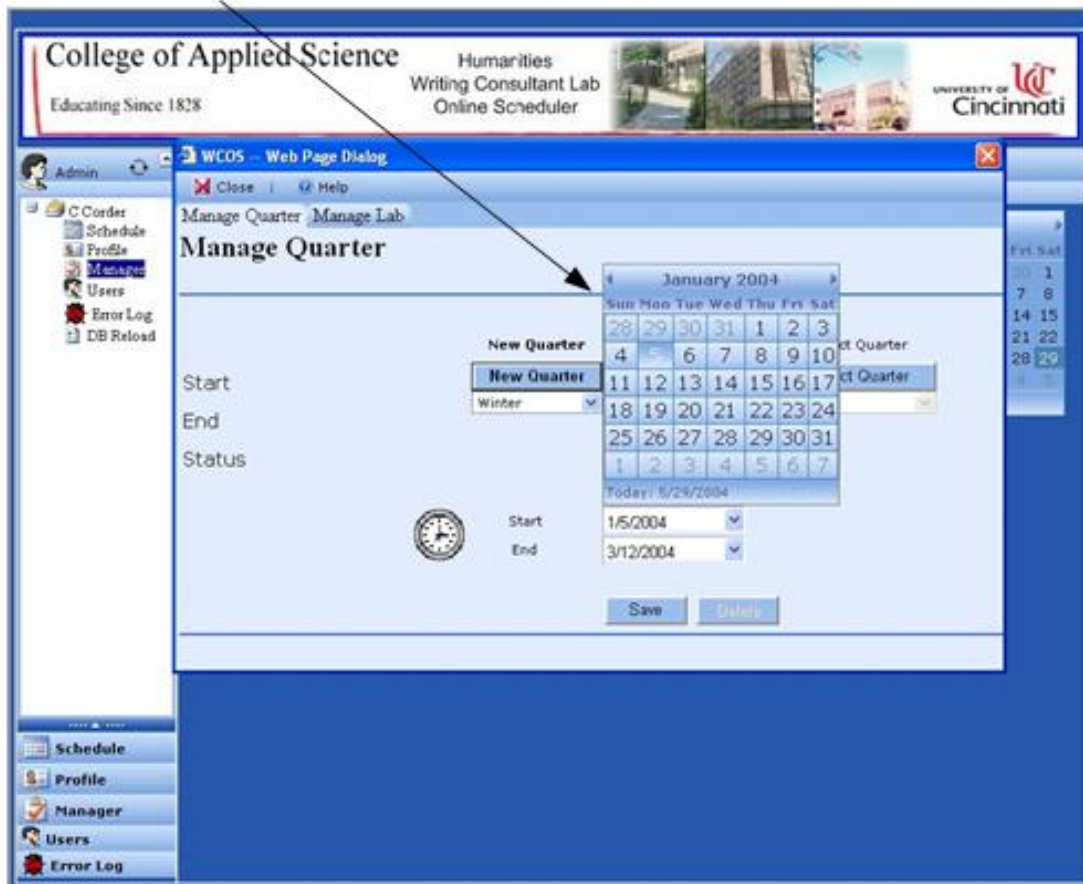


Figure 30. Step 3 Set New Quarter Start and End Dates

Administrator Resource Manager Web Page

New Quarter
Defined

Selected Quarter
Status

Quarter
Start
End
Status

The screenshot displays the 'Available Quarter Selector' dialog box within a web browser window. The dialog box has a title bar that reads 'WCOS -- Web Page Dialog'. It features a menu bar with 'Close' and 'Help' options. The main content area is divided into several sections: 'Manage Quarter' and 'Manage Lab' at the top; 'New Quarter' with a dropdown menu set to 'Winter'; 'Quarter Status' with radio buttons for 'Active', 'Closed', 'Consultant Only', and 'Edi' (selected); and 'Select Quarter' with a dropdown menu set to '2004 Winter...Edi'. Below these are 'Save' and 'Delete' buttons. The background shows the 'College of Applied Science' website with a navigation menu on the left and a calendar on the right.

Figure 31. Step 4 Administrator Resource Manager Dialog Page Explorer

Repeat Steps 1 through 4 for each new defined quarter.

Administrator Resource Manager Web Page

New Quarter
Defined

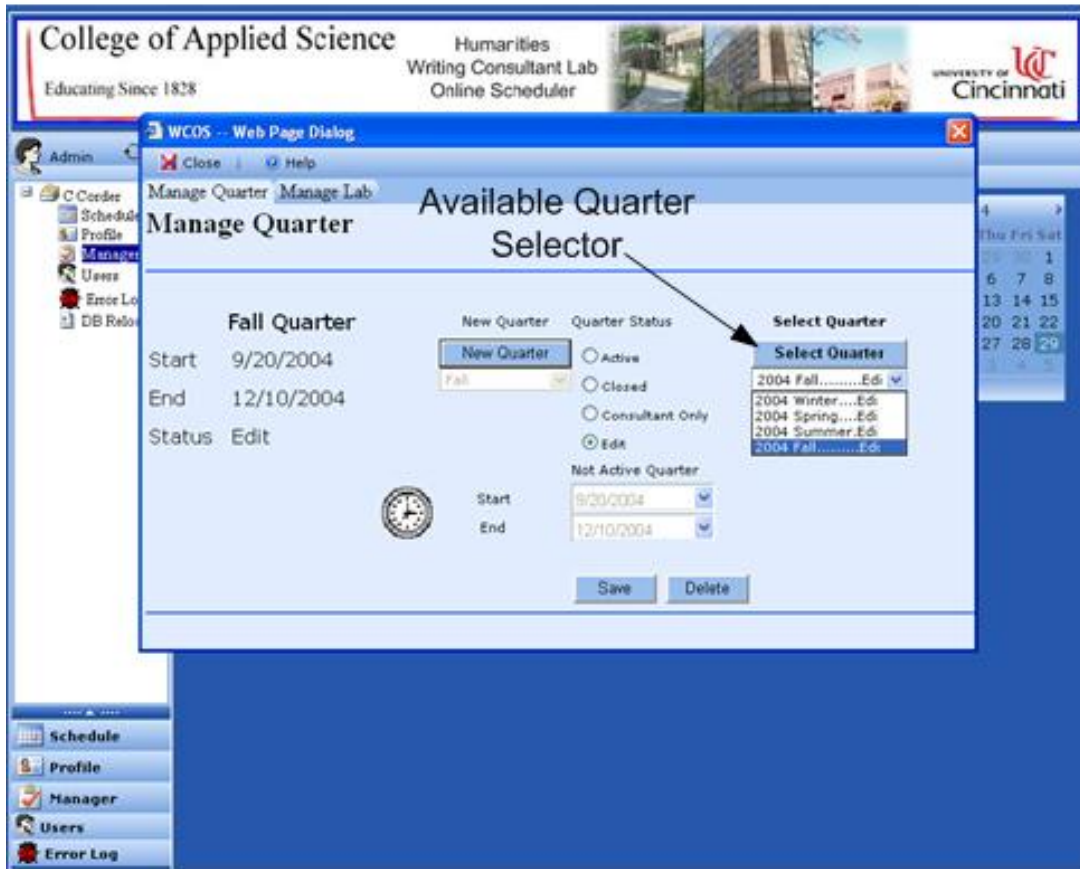


Figure 32. Steps 1 through 4 repeated four times

Repeat steps 1 through 4 as many times as needed for academic calendar year.

Administrator Resource Manager Web Page

Manage Lab
Dialog Web Page

Room Schedule

Selected Quarter
Information

The screenshot shows a web browser window displaying the Administrator Resource Manager Web Page. A dialog box titled "Select Desired Quarter" is open, showing the "Manage Lab Hours" section. The dialog box contains the following information:

- College of Applied Science (Educating Since 1828)
- Humilities Writing Consultant Lab Online Scheduler
- UNIVERSITY OF CINCINNATI
- Today is Saturday, May 29, 2004
- Winter Quarter
- Start: 1/5/2004
- End: 3/12/2004
- Status: Edit
- Lab Date: Start (1/5/2004) End (3/12/2004)
- Lab Closed: 08:00 AM to 05:30 PM
- Buttons: Save, Delete

The dialog box also features a "Select Quarter" dropdown menu with a "Refresh Quarter" button. The dropdown menu is open, showing a list of quarters: 2004 Winter...Edi, 2004 Winter...Edi, 2004 Spring...Edi, 2004 Summer...Edi, and 2004 Fall...Edi. The "Closed Option" checkbox is unchecked.

Figure 33. Step 5 Select Desired Quarter in the Manage Lab Dialog Page

Note: The selected quarter must be in Edit Mode to change the lab room availability.

Administrator Resource Manager Web Page

Room Schedule

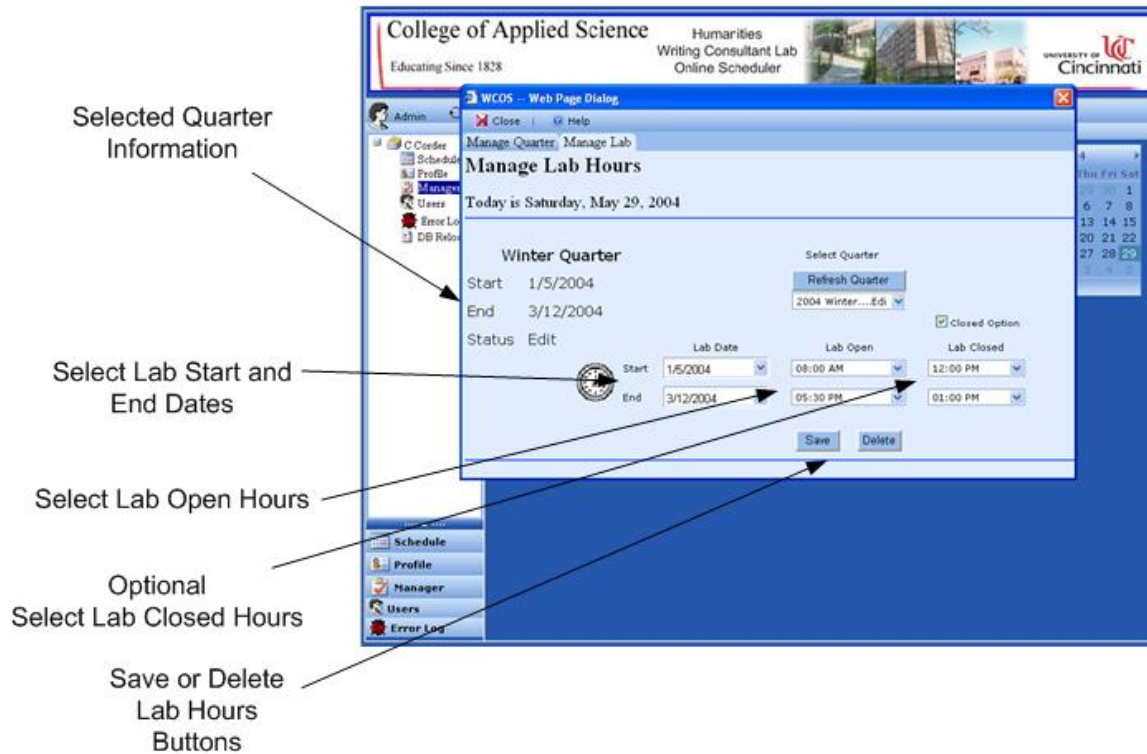


Figure 34. Step 6 Set Lab Room available hours.

Note: Repeat Step 6 as many times as needed to add or delete lab available hours.

Note: The work week is defined in the program web configuration file (webconfig.aspx).

Note: The default hours are defined in the program web configuration file (webconfig.aspx).

Administrator Resource Manager Web Page

Quarter Status

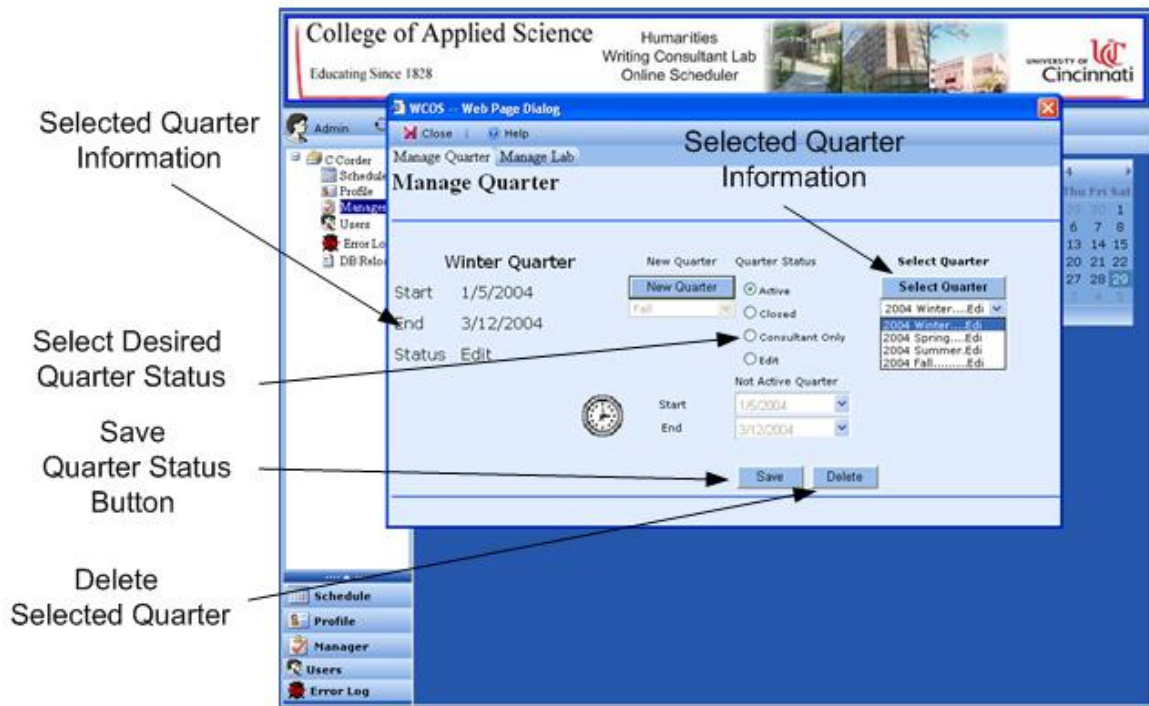


Figure 35. Step 7 Select Desired Quarter in the Manage Lab Dialog Page

Select the desired quarter in the Select Quarter Drop Down Box.

Set the desired quarter status and click the save button.

The Delete Button will remove the selected quarter.

When finished, click on the Close Button to exit the Quarter Manager Dialog Page.

Administrator Resource Manager Web Page

Main Schedule Page

Quarter Selection

Bisque - Lab Open

Brown - Lab Closed

The screenshot shows the 'Administrator Resource Manager' web page. At the top, it says 'College of Applied Science' and 'University of Cincinnati'. Below that, there's a navigation menu with 'C Order', 'Schedule', 'Profile', 'Manager', 'Users', 'Error Log', and 'DB Reload'. The main area is titled 'Main Schedule Page' and shows a schedule grid for 'Monday, March 22'. The grid has time slots from 8 am to 5 pm. A dropdown menu for 'Select Quarter' is open, showing options: '2004 Spring...Act', '2004 Winter...Clo', '2004 Spring...Act', '2004 Summer...Con', and '2004 Fall...Edi'. The grid shows a bisque (light orange) background for the 8 am to 11 am slot and a brown background for the 12 pm to 1 pm slot. A calendar for March 2004 is visible on the right side of the page.

Figure 36. Step 8 Returned to Main Schedule Page

Select the Quarter in Edit Mode.

Administrator Resource Manager Web Page

Main Schedule Page

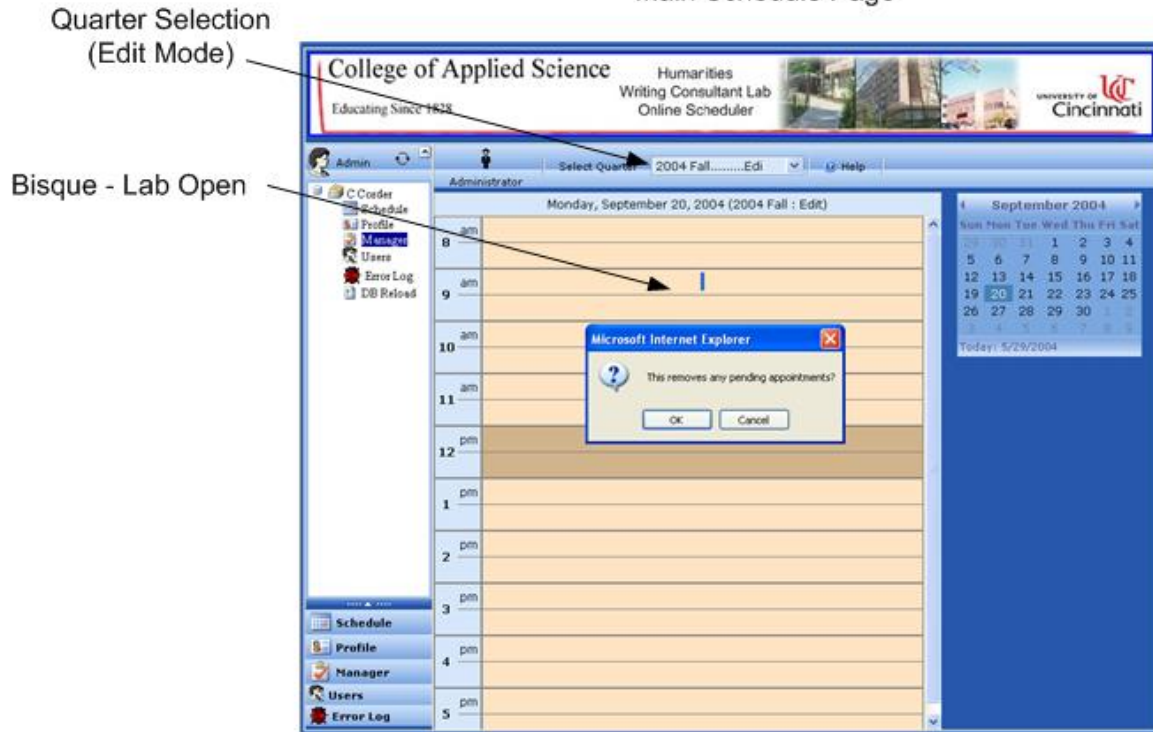


Figure 37. Step 9 Click on Bisque to Close Lab

Selecting a quarter in Edit Mode you can graphically close or open the lab by individual time slot.

Click on the Web Calendar to pick the desired date.

The Web Calendar is bounded by the selected quarter start and end dates.

Click on the Bisque Color time slots to close the lab.

Click on the Brown Color time slots to open the lab.

5.2.2 Proof of Design – Schedule Engine Logic Flow - Consultant Role Scheduler

This is a proof of design that a Consultant can manage their only schedule hours. Once the Administrator has defined the quarter and the lab open hours, the quarter schedule is ready for the Consultants to use. The quarter in Edit Mode allows the Consultant to view the open lab hour schedule. Only the Administrator and the Consultant can view the quarter lab available hour's schedule in Edit Mode. The quarter in Edit Mode is designed for the Consultant to set their available hours for the next quarter. In the Active Quarter the Consultant and the Student can view and interact with the schedule engine. It is expected that the Consultant has set their available hours in the Edit Mode. The schedule is flexible in the Active Mode to allow the Consultants to change their available hours. However, changing the Consultant available hours in Active Mode can cancel Student appointments.

The Consultant is bound to the business schedule integrity rules. There are two types of business integrity rules:

1. Hard Rules – Business rules that can not be modified.
2. Soft Rules – Business rules that can be modified by the Administrator.

Hard Business Schedule Integrity Rules is software that can not be modified without recompiling the WCOS Program. These rules apply to scheduled data that is in History Mode. History Mode is defined by the server time of day clock. The date for data that is after the server time of day clock is in History Mode and can not be modified. This business rule is to maintain the schedule integrity of the schedule engine.

Example of this rule would be – no appointment can be added that is defined in History Mode. Consultants can not add nor delete office hours that are in History Mode.

Soft Business Schedule Integrity Rules is software that can be modified without recompiling the WCOS Program. These rules govern when an appointment can be added or deleted from the schedule engine.

Example of this rule would be - an appointment can not be canceled thirty minutes before the scheduled appointment time. An appointment can not be added to the scheduler thirty minutes before a desired schedule time.

The pictures below are a step by step operation used in setting Consultant available hours.

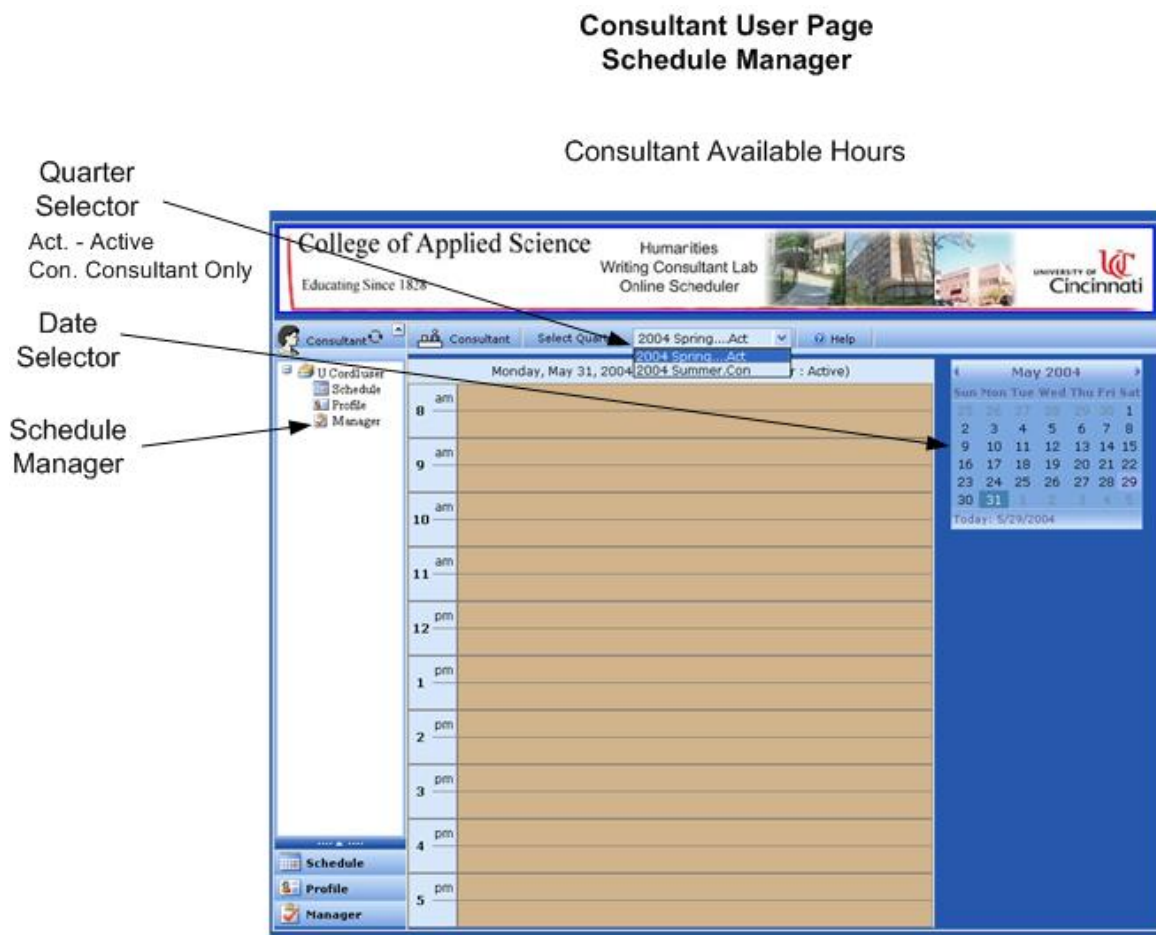


Figure 38. Step 1 Consultant Schedule Manager – Select Manager from the navigator

Consultant User Page Schedule Manager

Consultant Available Hours

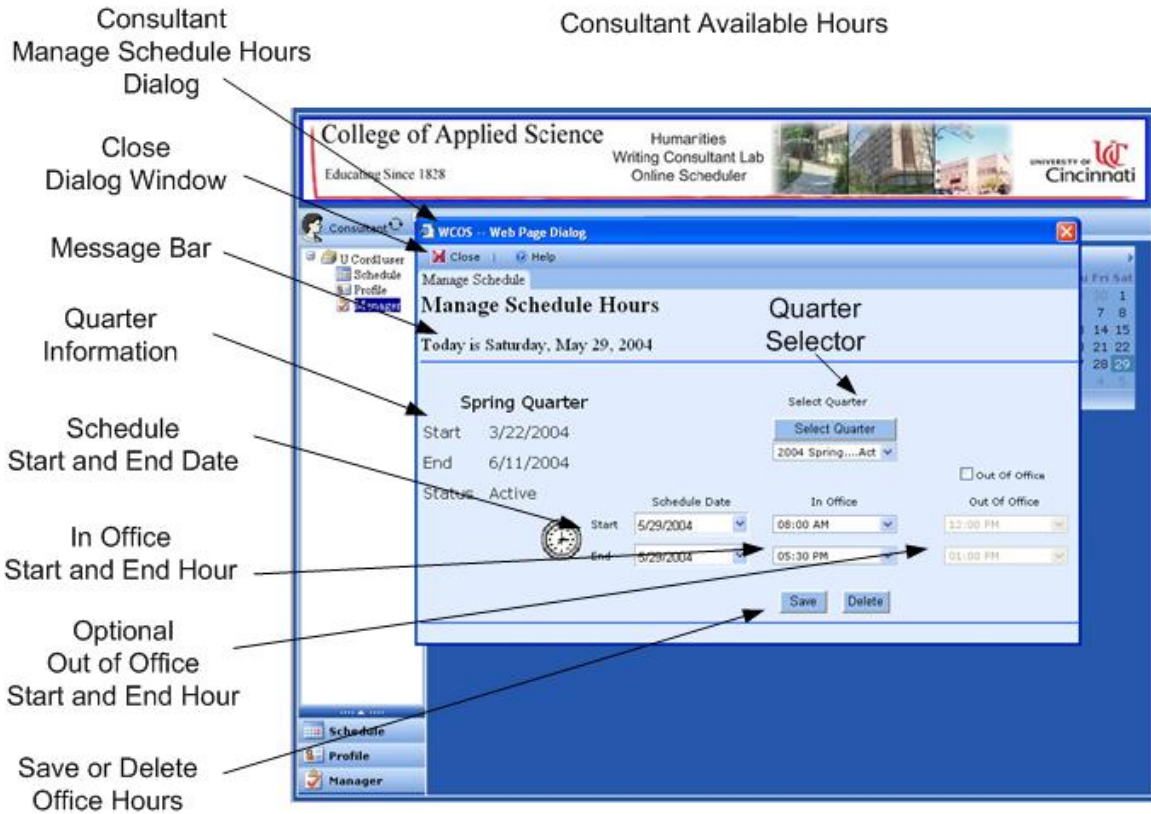


Figure 39. Step 2 Consultant Schedule Manager Dialog – Explorer

Consultant User Page Schedule Manager

Consultant Available Hours

Consultant
Manage Schedule Hours
Date Picker

Selected
Quarter Information

The screenshot displays the 'Manage Schedule Hours' web page. At the top, it identifies the user as 'Consultant' and the page as 'WCOS - Web Page Dialog'. The main heading is 'Manage Schedule Hours'. Below this, it states 'Today is Saturday, May 29, 2004'. A calendar for May 2004 is open, with the date 5/29/2004 selected. The selected quarter is 'Spring Quarter', with a start date of 3/22/2004 and an end date of 6/11/2004. The status is 'Active'. The start time is set to 08:00 AM and the end time to 05:30 PM. There is an 'Out of Office' section with a checkbox and a time field set to 01:00 PM. 'Save' and 'Delete' buttons are located at the bottom of the form. A sidebar on the left contains links for 'Schedule', 'Profile', and 'Manager'.

Figure 40. Step 3 Set the Start Date Picker

Note: The Web Calendar Date Picker is bounded by the selected quarter.

Note: The Web Calendar Date Picker can not be set to a date that is in History Mode. The Consultant is bound to the business rules of schedule integrity.

Consultant User Page Schedule Manager

Consultant Available Hours

Consultant
Manage Schedule Hours
End Date Picker

Selected
Quarter Information

College of Applied Science
Educating Since 1828

Humarities
Writing Consultant Lab
Online Scheduler

UNIVERSITY OF
Cincinnati

WCOS - Web Page Dialog

Close | Help

U Coordinator
Schedule
Profile
Manager

Manage Schedule Hours

Today is Saturday, May 29, 2004

Spring Quarter

Start 3/22/2004
End 6/11/2004
Status Active

Start
End

Today: 5/29/2004

05:30 PM

Quarter
Act

Out of Office
Out of Office

12:00 PM
01:00 PM

Save Delete

Schedule
Profile
Manager

Figure 41. Step 4 Set the End Date Picker

Note: The Web Calendar Date Picker is bounded by the selected quarter.

Consultant User Page Schedule Manager

Consultant Available Hours

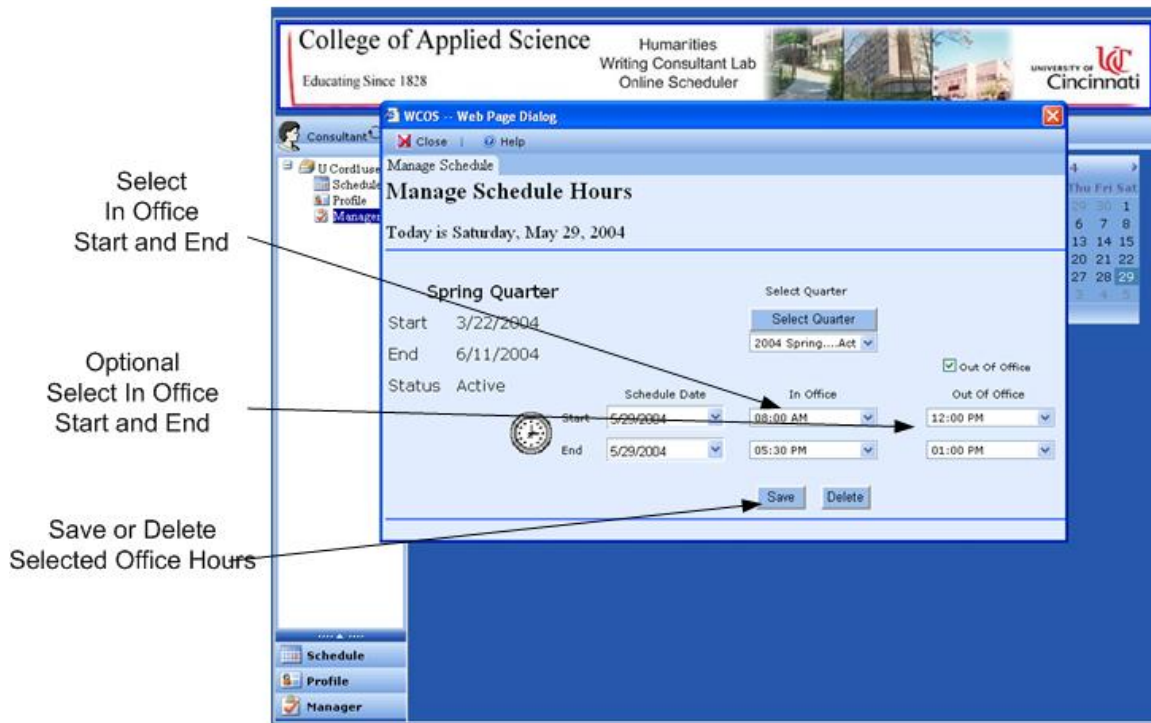


Figure 42. Step 4 Select In and Out of Office Hours and Save

If the quarter status is Active the schedule engine is ready for the Students to make appointments.

Consultant User Page Schedule Manager

Consultant Available Hours

The screenshot displays the 'Consultant User Page Schedule Manager' interface. At the top, it identifies the 'College of Applied Science' and the 'Humarities Writing Consultant Lab Online Scheduler'. A 'Quarter Selector' is positioned at the top left. Below the header is a navigation menu with 'Schedule', 'Profile', and 'Manager' options. The main area features a time slot grid for 'Thursday, June 03, 2004 12:00 AM (Spring Quarter : Active)'. The grid shows slots from 8 am to 5 pm. A 'Web Calendar Date Picker' is located on the right side. Arrows from labels on the left point to the 10 am slot (labeled 'Consultant In Office') and the 12 pm slot (labeled 'Consultant Out of Office').

Figure 43. Step 5 Schedule Engine ready for the Students

At this point the schedule engine is ready to accept appointments from the Student.

5.2.3 Proof of Design – Schedule Engine Logic Flow - Student Role Appointments

This is a proof of design that a Student can manage their only appointment hours.

Once the Consultant has their available hours, the Student can make appointments. Each Student appointment makes an entry in the database schedule engine. The soft business rules apply when making and canceling an appointment. Soft business rules are programmable by the Administrator without a recompile of the program. The first appointment soft business rules is: no appointment may be made within the thirty minutes

before the desired schedule date. The second soft business rule for appointments is: no appointment may be cancelled within the thirty minutes before the appointment time.

Student can only view their own appointments within the Active Quarter. The schedule engine integrity rules apply to all Student activities on the WCOS Program. The Scheduler Integrity rule is: no History Mode information can be changed by the Student. History mode information is time sensitive data that is post marked after the server time of day clock.

A student can make appointments with an available consultant on a first come first serve bases. If two or more students are making an appointment with same consultant at the same time, the first student in will get the appointment. Any other student applying for the appointment will receive back a message that the appointment is taken by another student.

Student appointment soft business rules govern how many appointments a student can make in a day or a week. The soft business rule by default allows one appointment per day and two appointments per week for each student. The reasons for these business rules are to allow all students a reasonable opportunity to visit a consultant. This also keeps the malicious user from over whelming the allotted appointment availability. All student user activity is recorded in the database for later data mining analysis.

Appointment add or cancel confirmation will be emailed to the student, consultant and the administrator. The administrator can program different information messages in add or cancel appointment confirmation mail.

The following pictures are step by step operation of the student making an appointment with a selected consultant.

Student User Page Appointment Manager

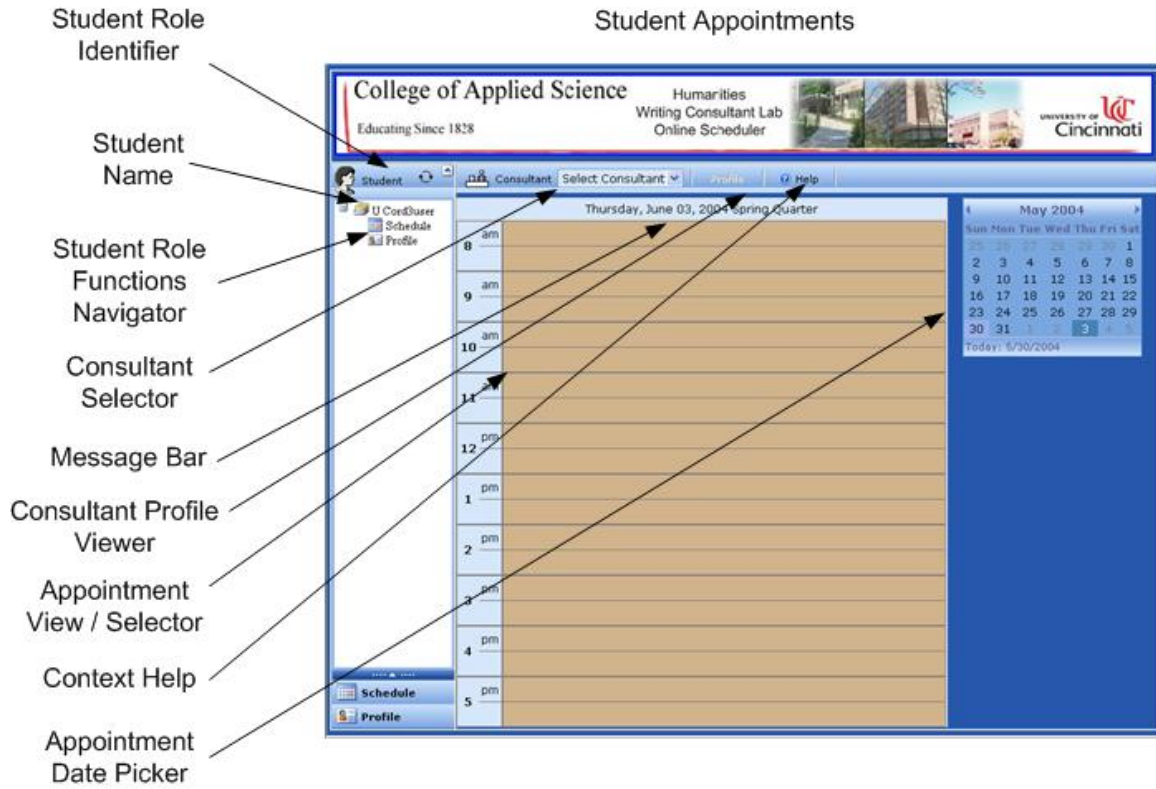
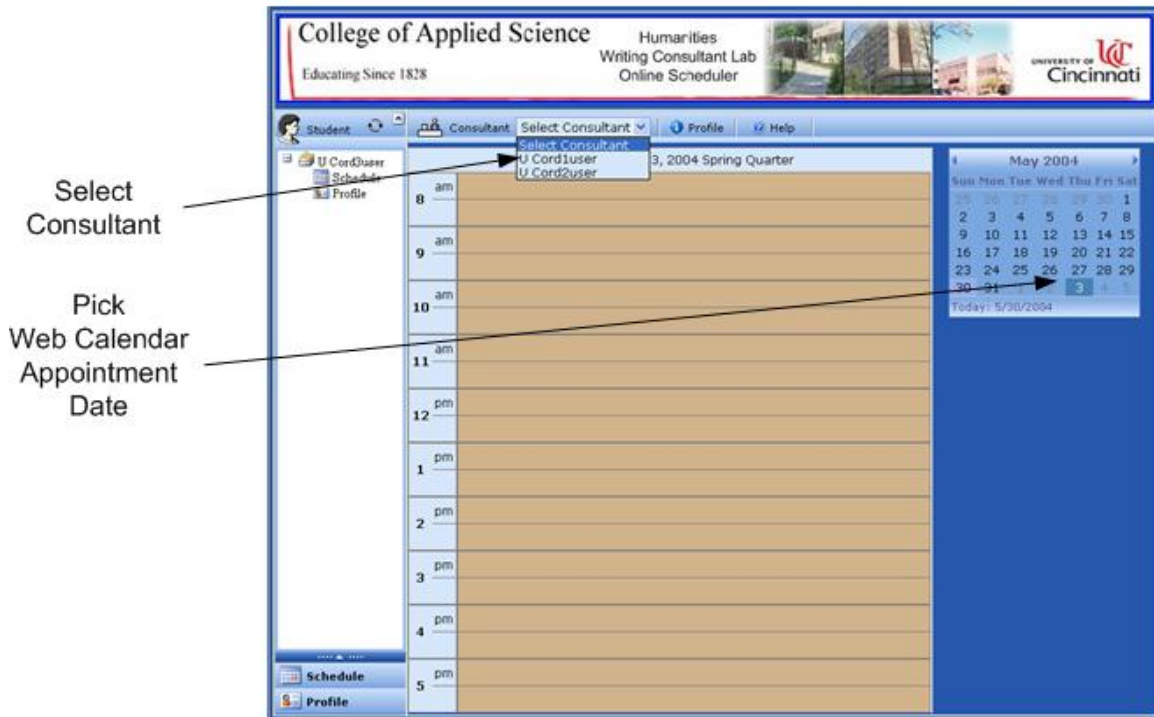


Figure 44. Step 1 Student Appointment Manager – Explorer

Student User Page Appointment Manager

Student Appointments



**Figure 45. Step 2 Student Appointment Manager – Consultant Selected
Student Appointment Mode**

The Student Calendar is viewed in one of two modes.

1. Student Appointment Mode
2. Consultant Schedule Mode

The Student Appointment Mode View shows the Student the scheduled Active Appointments page. An Active Appointment is a scheduled appointment made with a Consultant that is not Closed or Cancelled. This is a default mode of the Student Scheduler View page.

The Consultant Schedule Mode View shows the Student the Consultant's Schedule available time slots. The available time slots in the Consultant Schedule are active links for new Student appointments.

Consultant User Page Schedule Manager

Consultant Available Hours

The screenshot displays the 'Consultant User Page Schedule Manager' interface. At the top, the header includes the 'College of Applied Science' logo and the text 'Educating Since 1828'. To the right, it says 'Humanities Writing Consultant Lab Online Scheduler' and features the 'UNIVERSITY OF Cincinnati' logo. Below the header is a navigation menu with 'Consultant', 'Schedule', 'Profile', and 'Manager' (highlighted). The main content area shows a schedule for 'Thursday, June 03, 2004 12:00 AM (Spring Quarter : Active)'. The schedule is a grid with time slots from 8 am to 5 pm. A 'Quarter Selector' is located at the top right of the main area. A 'Web Calendar Date Picker' is on the right side, showing 'May 2004'. Labels with arrows point to the 'Quarter Selector', 'Web Calendar Date Picker', 'Consultant In Office' (10 am slot), and 'Consultant Out of Office' (12 pm slot).

Figure 46. Step 3 Student Appointment Manager – Consultant Selected Consultant Schedule Mode

Once a Consultant is selected, the schedule engine switches modes to Consultant Schedule Mode showing the available Consultant appointments. Each time bar in the main page schedule view represents one appointment. Clicking on a time bar will activate the schedule appointment reservation form.

Student User Page Appointment Manager

Student Appointments

College of Applied Science
Educating Since 1828

Humanities
Writing Consultant Lab
Online Scheduler

UNIVERSITY OF
Cincinnati

VCOS - Web Page Dialog

Student Appointment

Student Appointment

Time: Sunday, May 30, 2004 10:44 AM

Consultant: User1 Cord1user

Ready To Add New Appointment
Select Course and Assignment

Appointment

Date 6/3/2004 Course Select Course

Start 10:00 AM

End 10:30 AM Assignment

Status New

Add Cancel

1
2
3 pm
4 pm
5 pm

Schedule
Profile

Student Appointment Dialog Window

Information Bar

Appointment Information

Course Selection

Assignment Text Box

Appointment Add / Delete

Figure 47. Step 4 Student Appointment Manager – Add Appointment Dialog Window Explorer

The Student Appointment Dialog window is an appointment form with the selected Consultant. The form shows the appointment information and requested course and assignment where the Student is asking for help. Once the form is completed it may be submitted to the schedule engine by clicking the Add Button. This is a first come first serve appointment submission process.

Student User Page Appointment Manager

Student Appointments

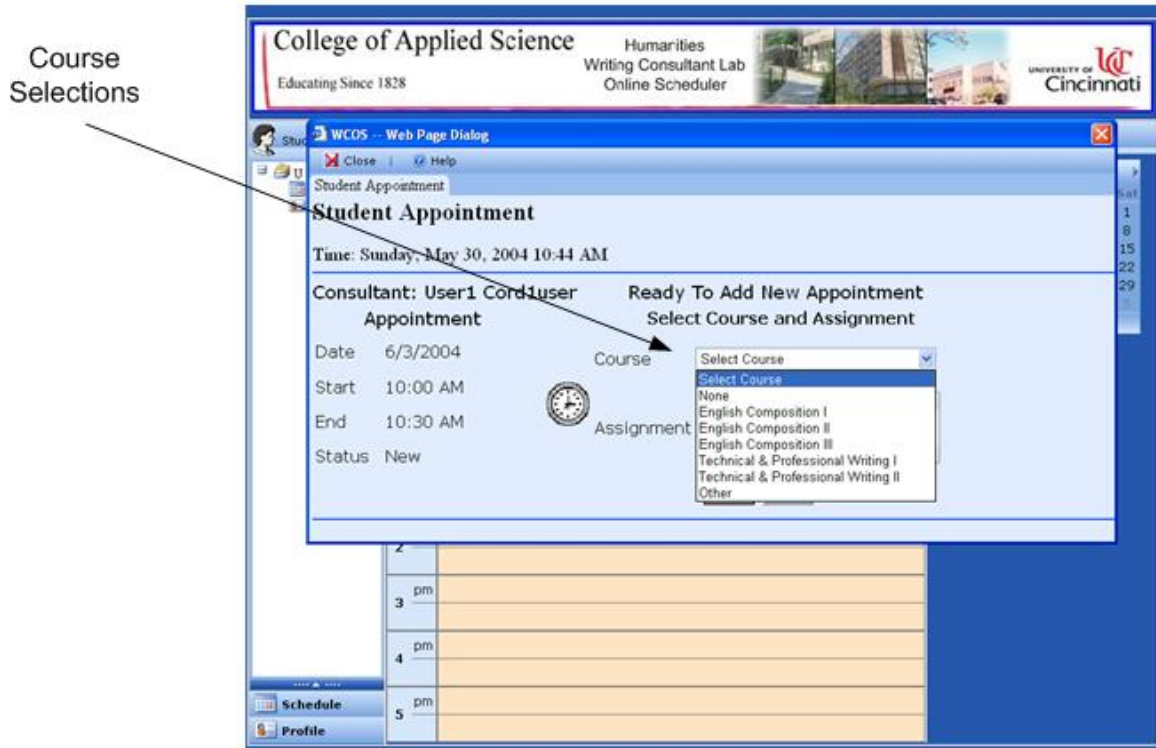


Figure 48. Step 5 Student Appointment Manager – Select a Course

Student User Page Appointment Manager

Student Appointments

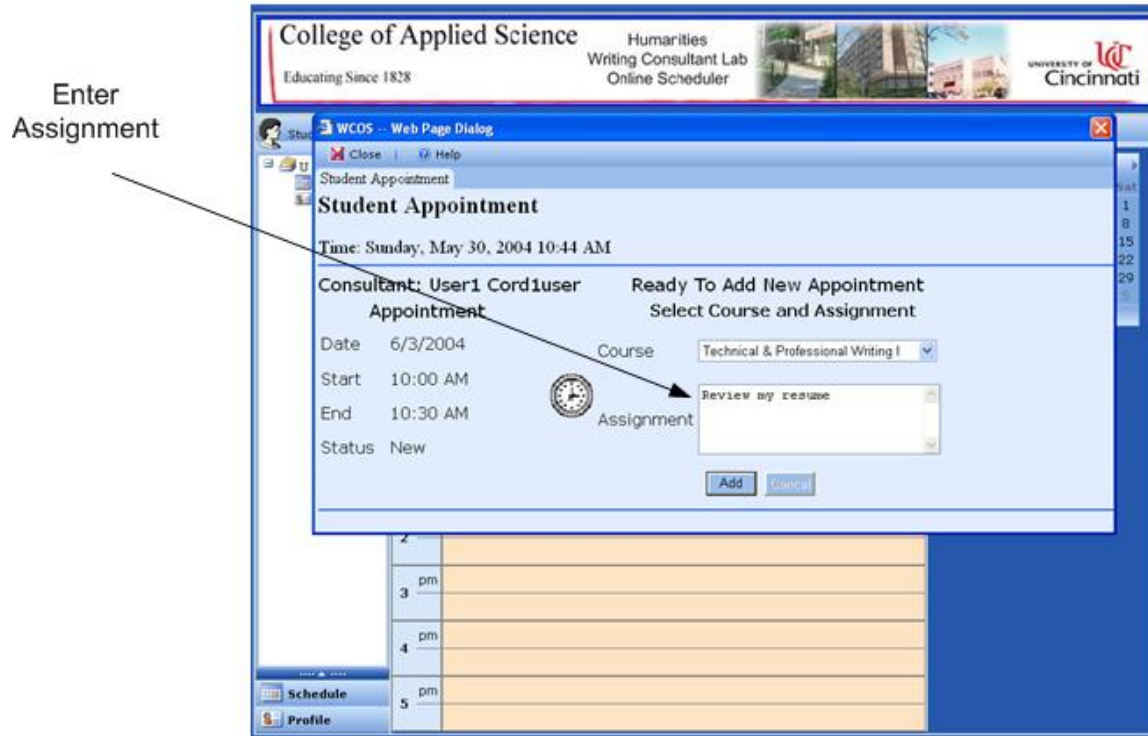


Figure 49. Step 6 Student Appointment Managers – Enter Assignment

Student User Page Appointment Manager

Student Appointments

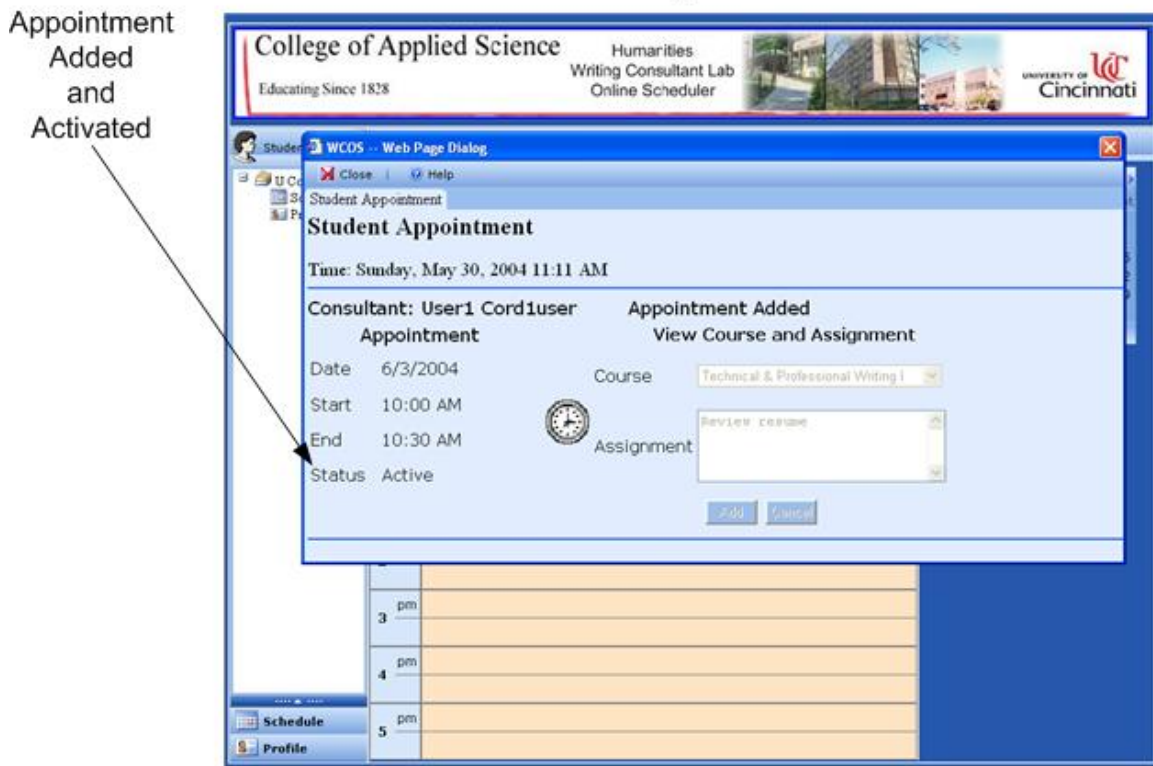


Figure 50. Step 7 Student Appointment Managers – Appointment Activated

The Student clicks the Add Button to submit the appointment to the server schedule engine. The appointment is activated if the time slot is open at the moment the appointment is received at the server.

The activated appointment now can be cancelled by the Student or the Consultant up to thirty minutes before the appointment. Once the appointment is in History Mode it can not be cancelled. The Consultant has one of two options once the appointment is in History Mode.

1. Close appointment with comments
2. No Show Appointment with comments

The appointment will remain visible to the student until the Consultant acts on the History Mode appointment.

Student User Page Appointment Manager

Student Appointments

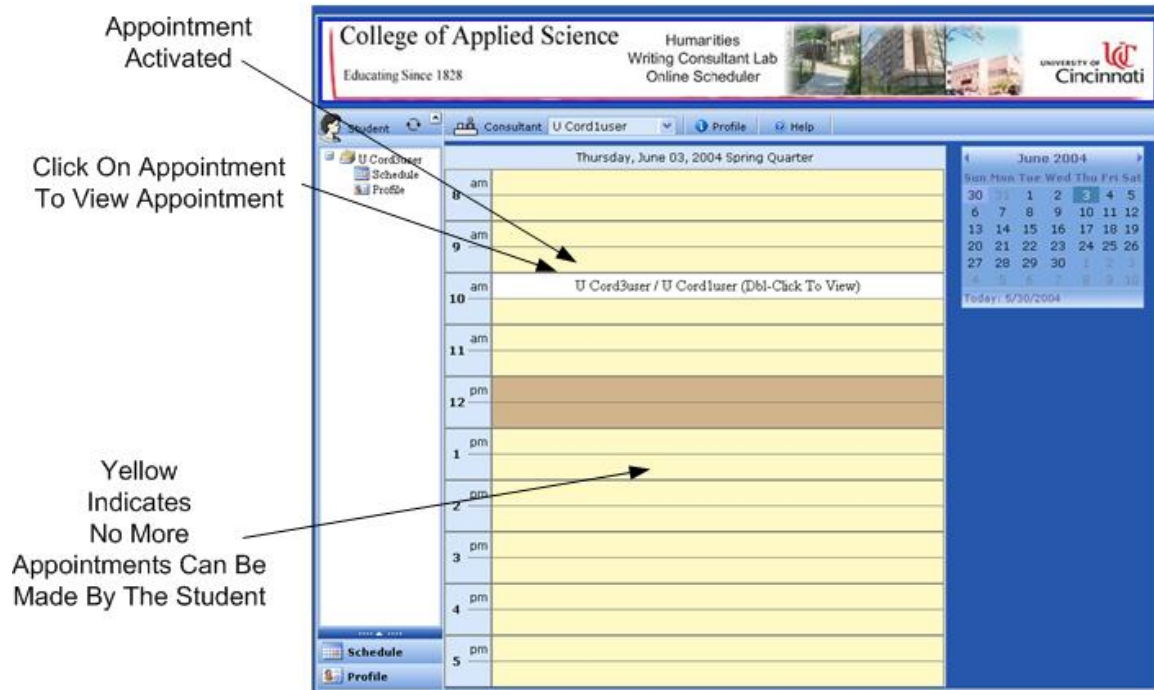


Figure 51. Step 8 Student Appointment Managers – Appointment Activated in Consultant Schedule Mode

The Student appointment is activated and the Consultant available time bars turn to yellow. The yellow color is a caution warning indicating an appointment soft business rule has been met. (One appointment per day per student) This business rule can be changed by the Administrator without a recompile.

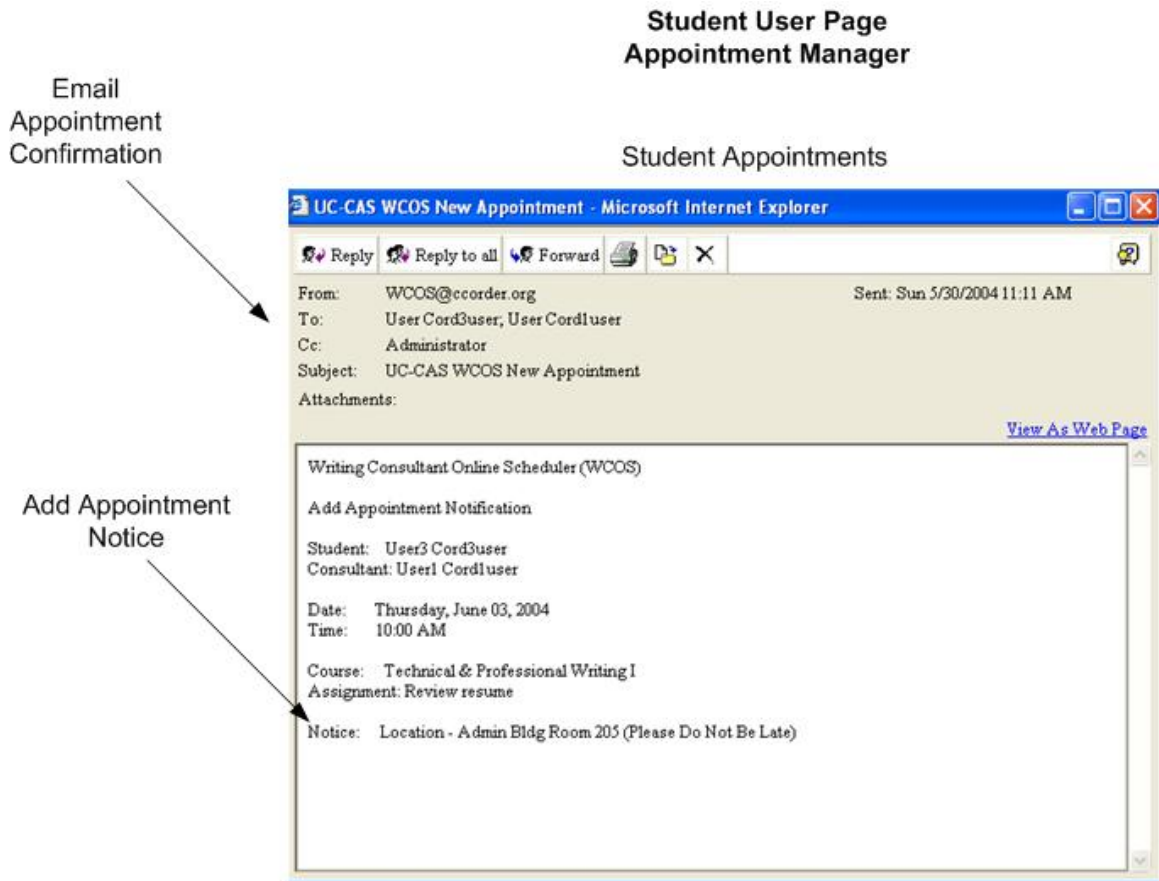


Figure 52. Step 9 Student Appointment Managers – Add Appointment Email Confirmation

Email is sent to Student, Consultant and optionally to the WCSO Administrator to confirm the appointment. The Add Appointment Notice text is a programmable text message set by the WCOS Administrator.

There are four programmable email notices:

1. Add Appointment – notice text
2. Cancel Appointment – notice text
3. Close Appointment – notice text
4. No Show Appointment – notice text

Student User Page Appointment Manager

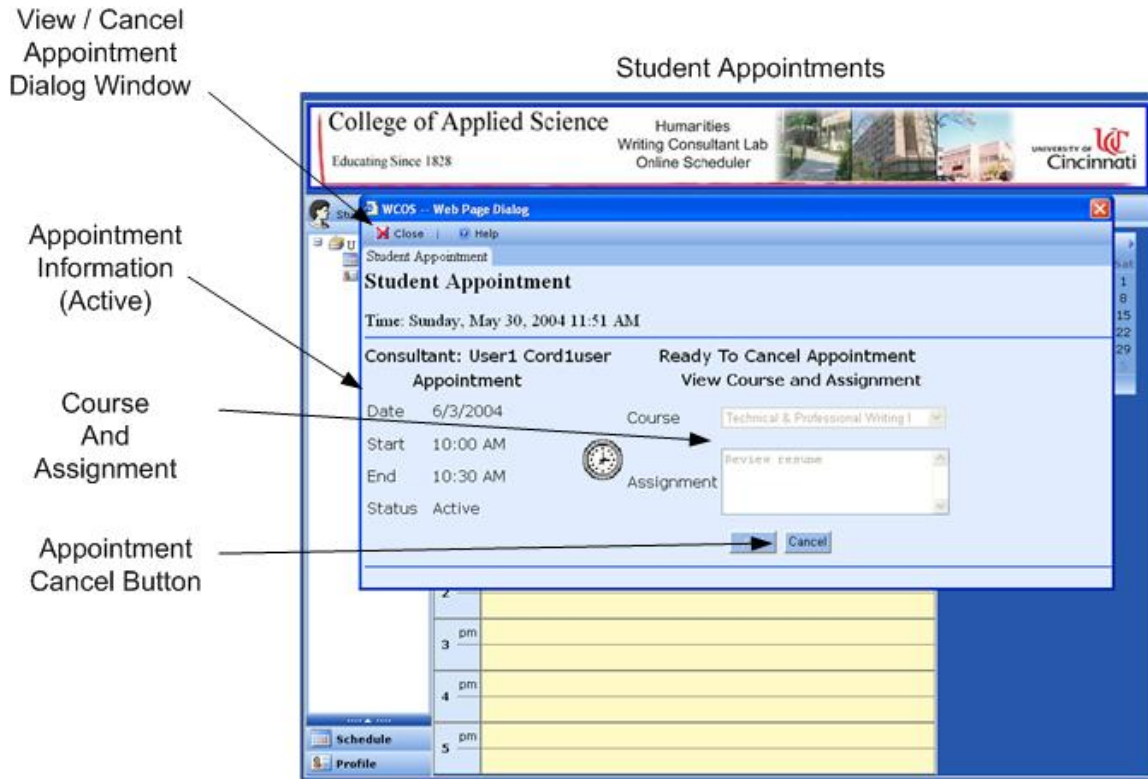


Figure 53. Step 10 Student Appointment Managers – View / Cancel Appointment

The Student has the option to cancel an appointment that is not in History Mode. The cancelled appointment changes the appointment from Active to Student Cancelled. The record remains in the database for post quarter data mining purpose.

The pictures following are views showing canceling an appointment and viewing the appointment in a different Consultant schedule view.

Student User Page Appointment Manager

Student Appointments

College of Applied Science
Educating Since 1828

Humanities
Writing Consultant Lab
Online Scheduler

UNIVERSITY OF
Cincinnati

Student: U Cord3user
Consultant: U Cord2user
Profile Help

Thursday, June 03, 2004 Spring Quarter

8 am
9 am
10 am → U Cord3user / U Cord1user (Dbl-Click To View)
11 am
12 pm
1 pm
2 pm
3 pm
4 pm
5 pm

May 2004
Sun Mon Tue Wed Thu Fri Sat
1 2 3 4 5 6 7 8
9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30 31
Today: 5/30/2004

Schedule Profile

View Appointment In a Different Consultant Schedule

Select a Different Consultant

Student Appointment (Pink)

Available Consultant Appointments (Yellow)

Unavailable Consultant Appointments (Brown)

Figure 54. Student Appointment Managers – Student Appointment viewed in a Different Consultant Schedule

This picture show how colors are used to indicate schedule time bars statuses.

Yellow – (Caution) Indicates Appointment Business Rule met.

Pink – (Stop) Indicates a Student appointment is with another Consultant than selected.

Brown – (Unavailable) – Consultant is unavailable.

Student User Page Appointment Manager

View Appointment In Student Appointment Mode

Student Appointments

College of Applied Science
Educating Since 1828

Humarities
Writing Consultant Lab
Online Scheduler

UNIVERSITY OF Cincinnati

Student [User Icon] [Refresh] [Logout] [Consultant] Select Consultant [Profile] [Help]

U Cord3user [Schedule] [Profile]

Thursday, June 03, 2004 Spring Quarter

8 am

9 am

10 am U Cord3user / U Cord1user (Dbl-Click To View)

11 am

12 pm

1 pm

2 pm

3 pm

4 pm

5 pm

May 2004

Sun	Mon	Tue	Wed	Thu	Fri	Sat
29	30	31	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Today: 5/30/2004

Schedule Profile

Consultant Unavailable (Brown)

Student Active Appointment (White)

Consultant Selector in "Select Consultant"

Figure 55. Student Appointment Managers – Student Appointment viewed Student Appointment Mode

Colors are used in the schedule section to indicate status of the each time bar.

White – Indicates an Active Student Appointment.

Brown – Consultant is unavailable due to the fact no Consultant is selected.

Student User Page Appointment Manager

Student Appointments

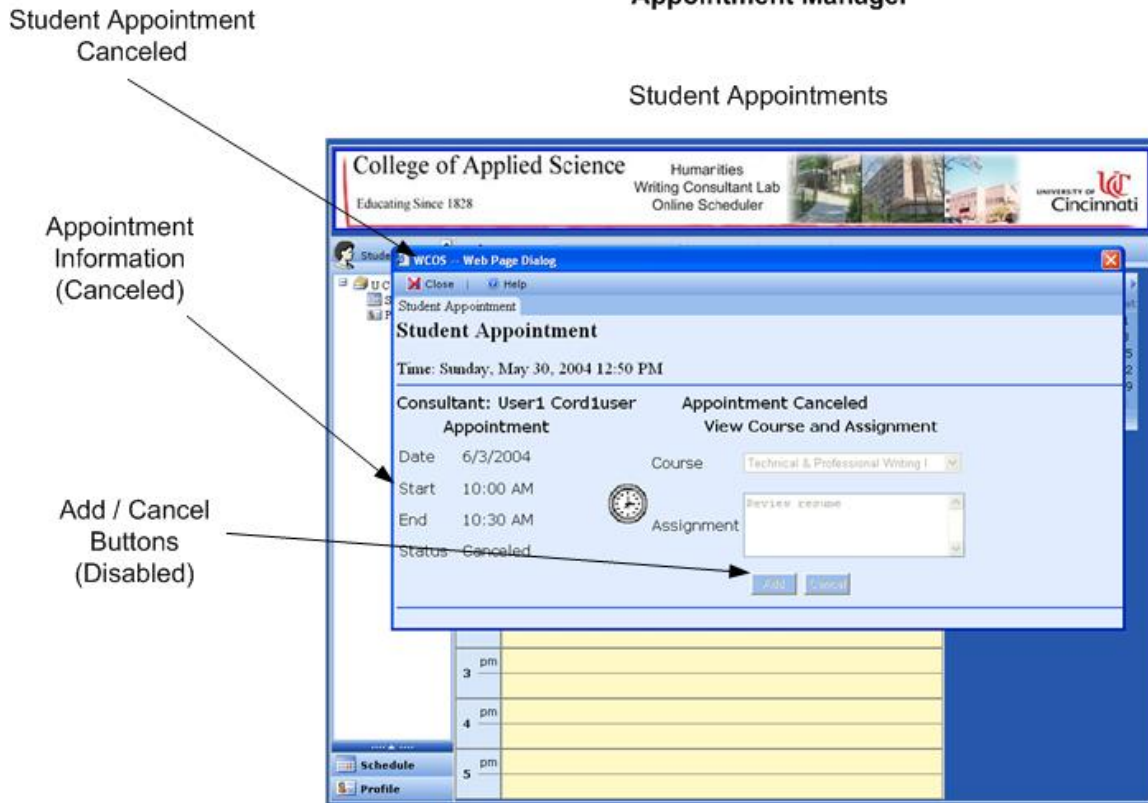


Figure 56. Student Appointment Managers – Student Appointment Cancelled viewed in the Dialog Window

The picture shows a Student appointment cancelled by the Student. The appointment information indicates the appointment is cancelled. The cancelled appointment remains in the schedule engine database for the entire quarter. The Student may make another appointment at the same time; however the schedule engine will retain the cancelled appointment information.

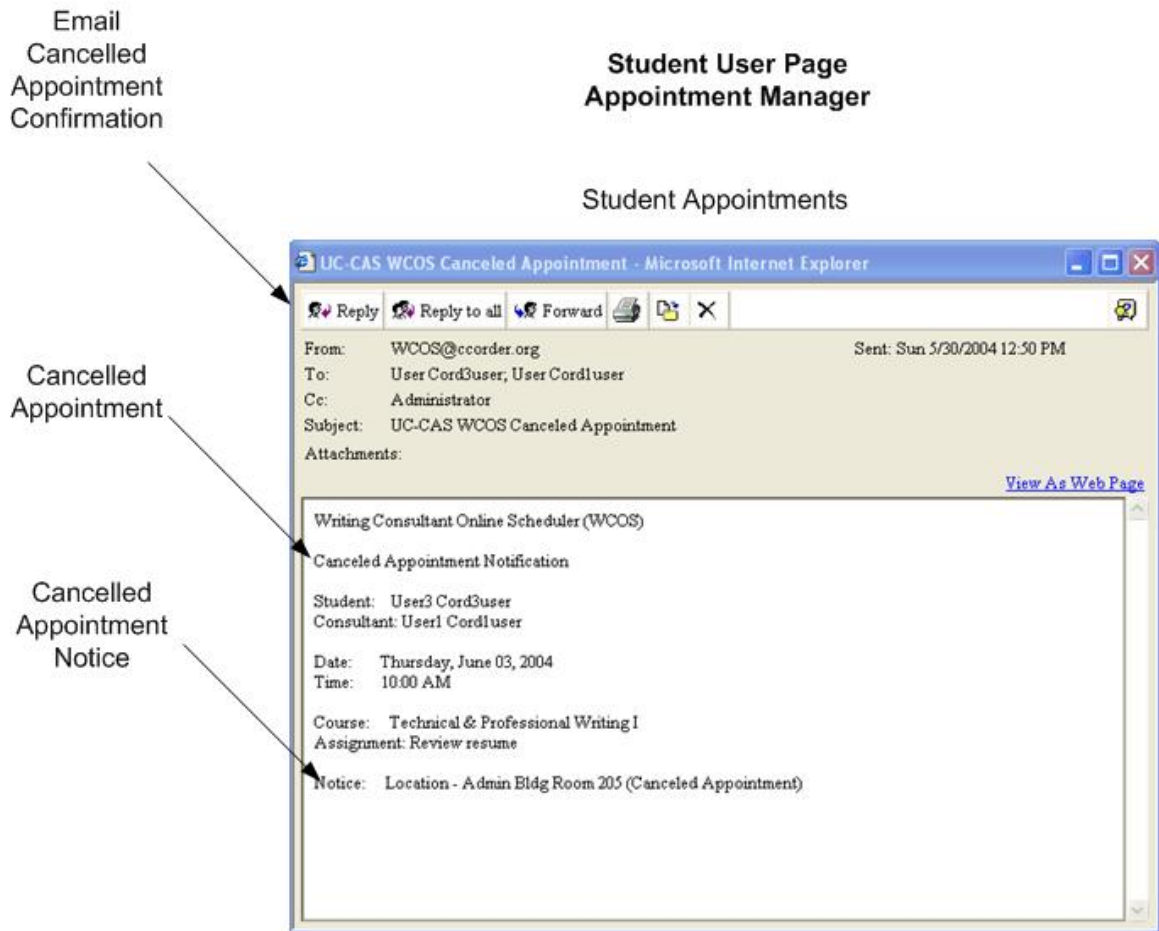


Figure 57. Student Appointment Managers – Student Appointment Canceled Email Notification

The schedule engine will notify the Student, Consultant and optionally the WCOS Administrator of a cancelled appointment by email. The email address in the user profile is used to contact the user of their appointment changed status.

5.2.4 Proof of Design – Schedule Engine Logic Flow – Consultant Role – Student Appointments

This is a proof of design that a Consultant can interact with the Student appointments. The Consultant can view all the Student appointments. If multiple cancels are in the same appointment time the Consultant can choose which appointment to view.

The Consultant is expected to close out active appointments in History Mode. An active appointment in History Mode is an appointment where that time stamp is smaller than the WCOS server time of day clock. The Consultant has one of two options to act upon with these appointments.

1. Close Appointment – Option to add appointment comments
2. No Show Appointment – Must add appointment comments

An active appointment will remain visible to the Student until the Consultant closes the appointment.

An appointment closed in No Show will increment the Student No Show counter. The Student will be denied access to WCOS for the remainder of the quarter. In this case, the Student must contact the WCOS Administrator to receive access to the scheduler. The Administrator can reinstate the Student by setting the Student's No Show Max Count to a higher number. The Student's No Show Count will then be retained by the scheduler for the entire quarter. The Student's No Show Count and the No Show Max Count are reset once a new quarter is activated.

The pictures following are the proof of design that the Consultant can view and manage their own appointments.

Consultant User Page Appointment Manager

Student Appointments

Consultant View of
Student
Appointments

Student Active
Appointments

The screenshot displays the 'Appointment Manager' interface for a consultant. At the top, the header includes the 'College of Applied Science' logo and the text 'Educating Since 1828'. To the right, it says 'Humarities Writing Consultant Lab Online Scheduler' and features the 'UNIVERSITY OF Cincinnati' logo. Below the header, there is a navigation bar with 'Consultant' selected, a 'Select Quarter' dropdown set to '2004 Spring...Act', and a 'Help' link. The main area shows a schedule for 'Thursday, June 03, 2004 12:00 AM (Spring Quarter : Active)'. The schedule is a grid with time slots from 8 am to 5 pm. Two white time bars are visible, indicating active student appointments. The first white bar is at 9 am and the second is at 10 am, both labeled 'U Cord4user / U Cord1user (Dbt-Click To View)'. Other time slots are shaded in light blue or light orange. On the right side, there is a calendar for 'May 2004' showing the current date as 'Today: 5/30/2004'. At the bottom left, there is a navigation menu with 'Schedule', 'Profile', and 'Manager' options.

Figure 58. Step 1 Consultant Scheduled Appointments

The white color time bars in the Consultant schedule viewing area are active Student appointments. Click on the white time bar to view the scheduled Student appointment.

**Consultant User Page
Appointment Manager**
Student Appointments

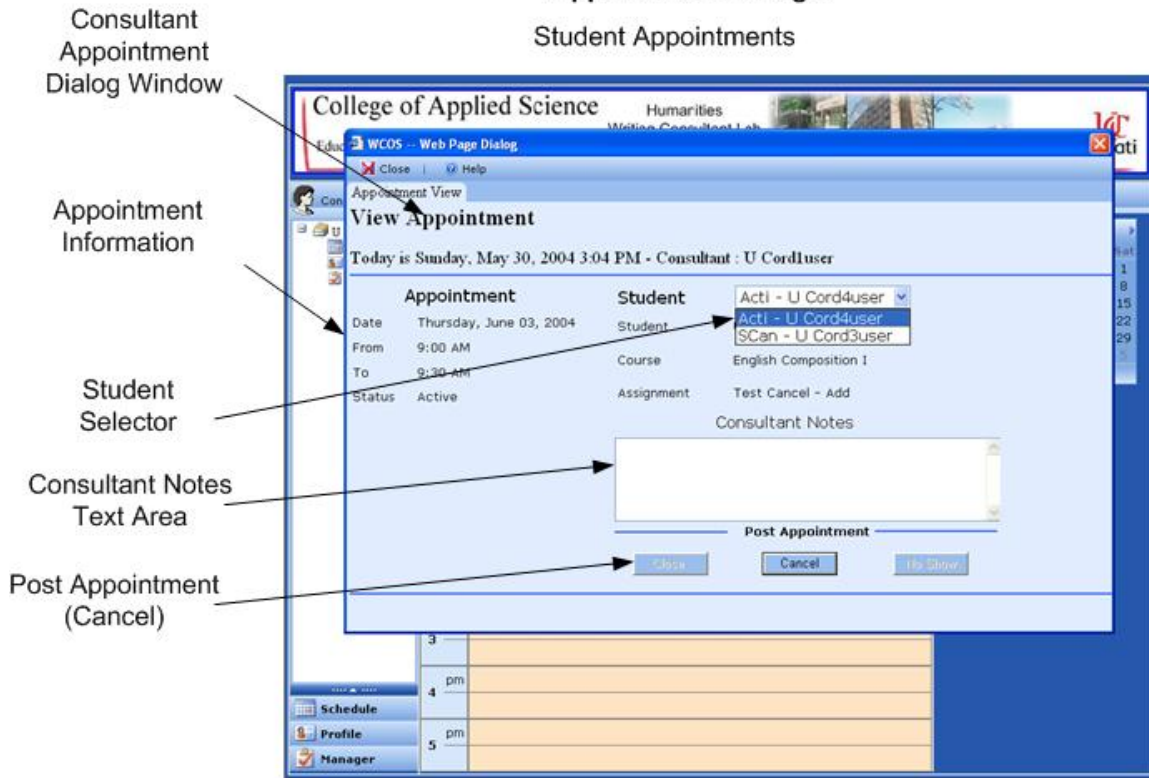


Figure 59. Step 2 Select the Student appointment to view

The schedule engine retains all scheduled appointments. In this scenario one Student (Cord3user) has cancelled the appointment. The second Student (Cord4user) has made a new appointment. Neither Student can see the cancelled appointment in the Student Schedule View pages. Only the Consultant can see the activity in that time slot.

The appointment is in the Future Mode Status, which indicates it is in the future to the server time of day clock. The appointment at this time can only be cancelled.

Appointment Status

1. Active (Acti) – Active Student appointment
2. Closed (Clos) – Student appointment closed by the Consultant
3. No Show (NoSh) – Student appointment set to No Show Status by the Consultant
4. Student Cancelled (SCan) – Student cancelled appointment
5. Consultant Cancelled (CCan) – Consultant cancelled appointment
6. Administrator Cancelled (ACan) – Administrator cancelled appointment

**Consultant User Page
Appointment Manager**

Student Appointments

The screenshot displays the 'Consultant Scheduler' interface. At the top, it identifies the user as 'Consultant' and shows the selected quarter as '2004 Spring...Act'. The main area is a calendar grid for Thursday, June 03, 2004, at 12:00 AM. The grid shows time slots from 8 am to 5 pm. Two appointments are visible:

- At 9 am: 'Closed-Cancelled / U Cord3user (Dbl-Click To View)'
- At 10 am: 'U Cord3user / U Cord1user (Dbl-Click To View)'

Annotations on the left side of the image point to these appointments:

- 'Consultant Schedule View' points to the top of the grid.
- 'Closed - Cancelled Student Appointment' points to the 9 am slot.
- 'Active Student Appointment' points to the 10 am slot.

The interface also includes a header for 'College of Applied Science' with the tagline 'Educating Since 1828', and a right-side calendar for June 2004. A navigation menu at the bottom left includes 'Schedule', 'Profile', and 'Manager'.

Figure 60. Consultant Scheduler showing Cancelled-Closed and Active Student Appointments

All Student appointments will remain viewable by the Consultant.

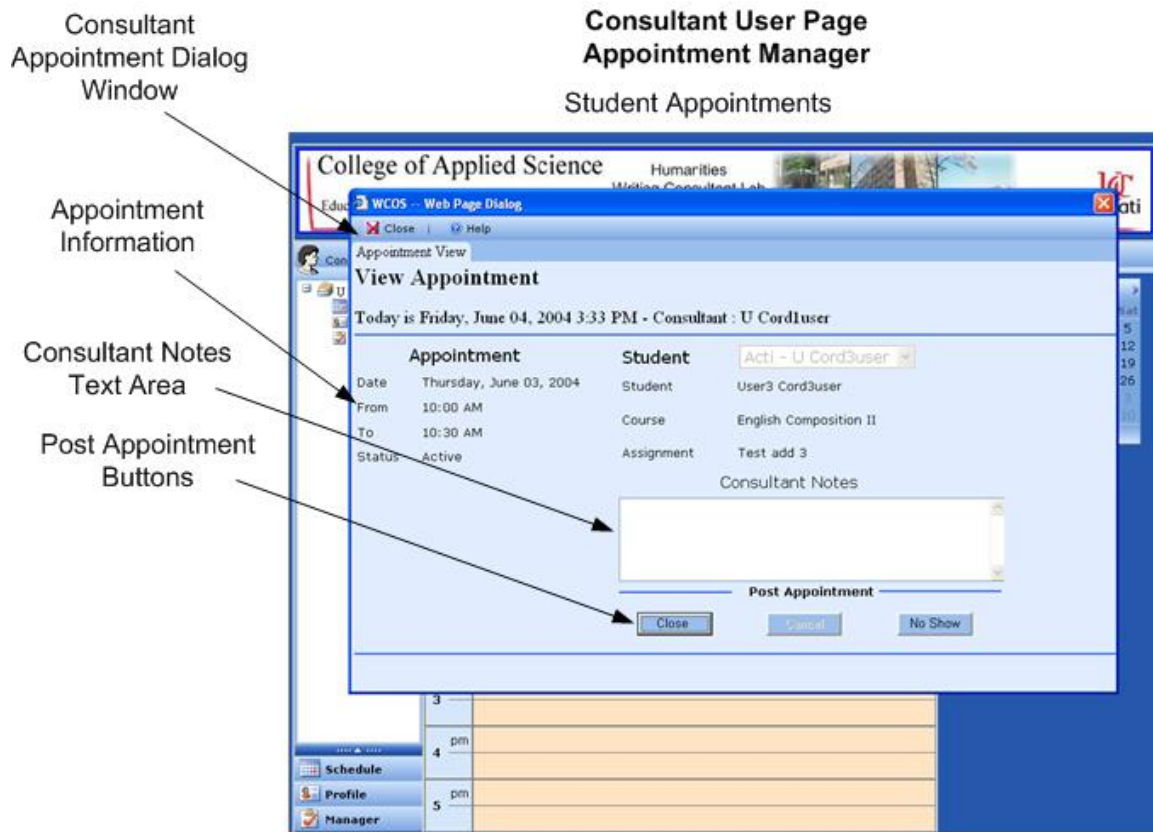


Figure 61. Consultant Appointment Dialog Window – History Mode

The Student appointment viewed in History Mode allows the Consultant to add notes to appointment and close the appointment. Closing the appointment completes the schedule engine appointment cycle. The appointment is closed by the Close Button, which would be the normal action. If the Student did not show for the appointment the Consultant can close the appointment with the No Show Button. The No Show Button increments the Student's No Show Counter which can deny the Student any further appointments and cancels any pending appointments. The No Show Count can not be reset; only the Administrator can set a higher No Show Max Count.

Once the appointment is closed it can only be viewed; no modifications to the appointment are allowed. This hard business rule maintains the schedule data integrity of the WCOS Program.

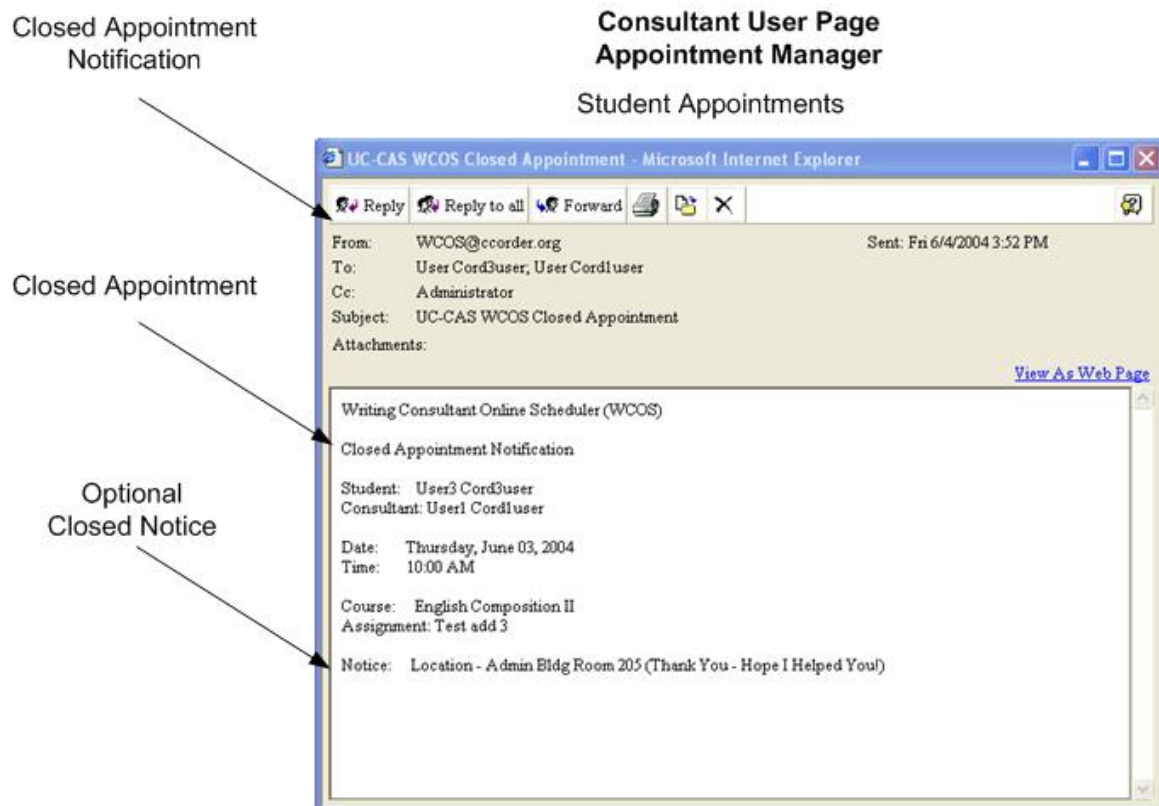


Figure 62. Appointment Closed Email Notification

Appointment Closed notification is sent to the Student, Consultant and optionally the WCOS Administrator.

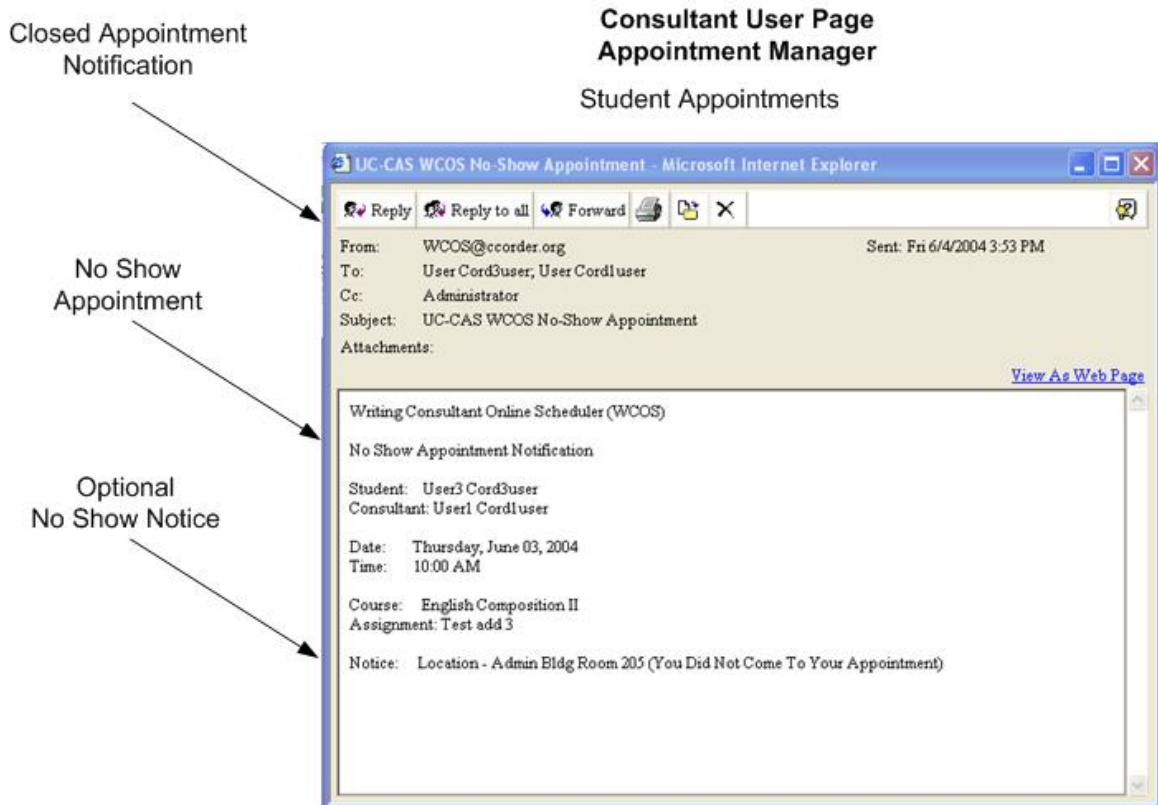


Figure 63. Appointment No Show Email Notification

5.2.5 Proof of Design – Administrator User Manager

This is a proof of design to show that an Administrator can manage the users in the WCOS Database. The users are all originally in the Domain Controller Active Directory. When the user is authenticated by Domain Controller the user information is copied from the Active Directory to the WCOS database. The network authentication is done by the Domain Active Directory each time the user needs to be authenticated. The WCOS database stores the user profile by the domain user identification name.

The pictures following are the proof of design that the Administrator can manage the WCOS Users.

Administrator User Page Appointment Manager

Users Manager

The screenshot displays the 'Users Manager' interface. At the top, it shows the 'College of Applied Science' logo and 'University of Cincinnati' branding. Below this is a navigation menu with options like 'Admin', 'Schedule', 'Profile', 'Manager', 'Users', and 'Error Log'. The main area features a table of users with the following data:

Last Name	First Name	Role ID	Is Updated	Is Enabled	User Name
Cord1user	User1	Consultant	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	ccorder\cord1user
Cord2user	User2	Consultant	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	ccorder\cord2user
Cord3user	User3	Student	<input type="checkbox"/>	<input type="checkbox"/>	ccorder\cord3user
Cord4user	User4	Student	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	ccorder\cord4user
Cord5user	User5	Student	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	ccorder\cord5user
Corder	Charlie	Administrator Consultant	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CCORDER\charlie

Annotations on the left side of the image identify key features: 'Users In Database' points to the table; 'Student Users' points to the 'Student' role; 'Update Display' points to the 'Update' button; 'Users In Active Directory' points to the 'Users in AD' tab; 'Change User Role Selection' points to the role dropdown menu; 'Request Update User Profile' points to the 'Update' button; and 'Enable User' points to the 'Is Enabled' checkbox.

Figure 64. Administrator User Manager – List all users in the database

The Administrator can change a user role, request profile update and disable a WCOS current user. The pink bar is an indicator that the user is either in Profile Request State and/or Disabled. The pink color is to help the Administrator locate users that are not in normal operation mode.

Administrator User Page Appointment Manager

Users Manager

Student Users In Database

Change Student User No Show Counter

Last Name	First Name	Is Updated	Is Enabled	No Show	No Show Max
Cord3user	User3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	2
Cord4user	User4	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0	5
Cord5user	User5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0	1

Figure 65. Administrator User Manager – List Student User in the database

The purpose for listing the Student users is to view a Student No Show Counter and set the No Show Max Count. The Student No Show Count can not be changed.

Administrator User Page Appointment Manager

Users Manager

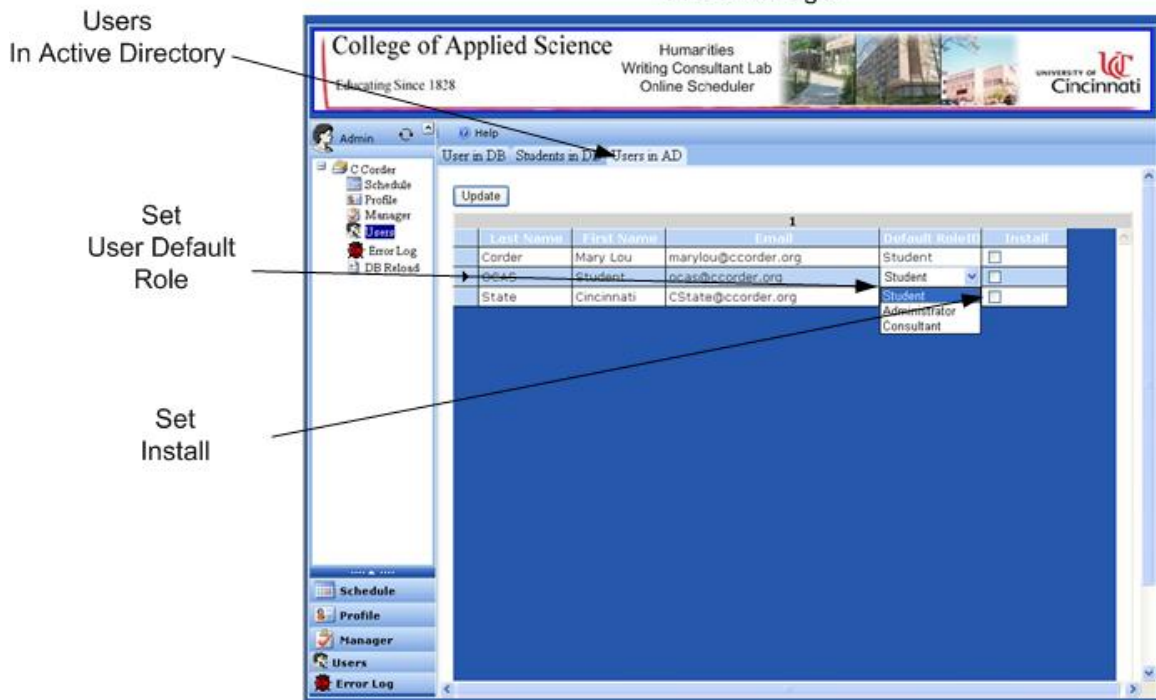


Figure 66. Administrator User Manager – List all users in the database

The Administrator can view a filtered list of users in the Domain Active Directory that are not listed in the WCOS Database Users Table. A domain network user can be loaded in the WCOS Database. This way the WCOS user is ready to use the scheduler.

5.2.6 Proof of Design – User Profile

This is a proof of design that each user can manage their profile. There are two profile types, Administrator/Consultant and Student Profiles. The Administrator and Consultant information have the same profile types. The Student Profile has all the information types as the Administrator/Consultant with additional information related to the student.

The following picture is of the two profile types

User Profiles

Administrator/Consultant Profile

The screenshot shows a web application interface for the College of Applied Science. The header includes the college name, "Educating Since 1828", and the University of Cincinnati logo. The main content area displays "Charlie Corder's Profile" with fields for Last Name (Corder), First Name (Charlie), Middle Initial, Phone (513-234-5678), and Email (administrator@email.uc.edu). There are also input fields for phone and email. A sidebar on the left contains navigation links for Schedule, Profile, Manager, Users, Error Log, and DB Reload.

College of Applied Science
Educating Since 1828

Humanities
Writing Consultant Lab
Online Scheduler

UNIVERSITY OF Cincinnati

Admin Save Close Help

Charlie Corder's Profile

Last Name: Corder Phone: 513-234-5678

First Name: Charlie Email: administrator@email.uc.edu

Middle Initial:

Schedule
Profile
Manager
Users
Error Log

Figure 67. Administrator/Consultant Profile

User Profiles

Student Profile

The screenshot displays a web browser window titled 'Student' with a menu bar containing 'Save', 'Close', and 'Help'. The page header features the 'College of Applied Science' logo with the tagline 'Educating Since 1828', the text 'Humanities Writing Consultant Lab Online Scheduler', and the 'UNIVERSITY OF Cincinnati' logo. The main content area is titled 'User3 Cord3user's Profile' and contains the following form fields:

Last Name:	Cord3user	Phone: 513-234-5678	<input type="text" value="513-234-5678"/>
First Name:	User3	Email: student@email.uc.edu	<input type="text" value="Cord3user@coorder.org"/>
Middle Initial:			
StudentID:	<input type="text" value="111111111"/>		
Major:	<input type="text" value="IET"/>		
Year of Study:	<input type="text" value="Senior"/>		

The 'Year of Study' dropdown menu is open, showing the following options: Select Year, None, Freshman, Sophomore, Junior, and Senior.

At the bottom left, there are buttons for 'Schedule' and 'Profile'.

Figure 68. Student Profile

5.2.7 Proof of Design – Administrator Error Logger

This is a proof of design where the Administrator can view online the WCSO Error Log. The errors are recorded and saved on the file system in a XML Formatted file. A new XML File is generated for each day. The Log Files are stored in the Error Log Directory. The Log Files are maintained for a period of thirty days by the WCOS Error Log Utilities. The Error Log Files are deleted automatically on the thirtieth date of the file time stamp.

The WCOS Error Utility captures each error all the way down to the source. When an error occurs the program stack is traced back to the initiating procedure at the presentation level. The initiating procedure calls the WCOS Error Log Utility to process and store the detailed error log stack.

The following picture is of the Administrator Error Log.

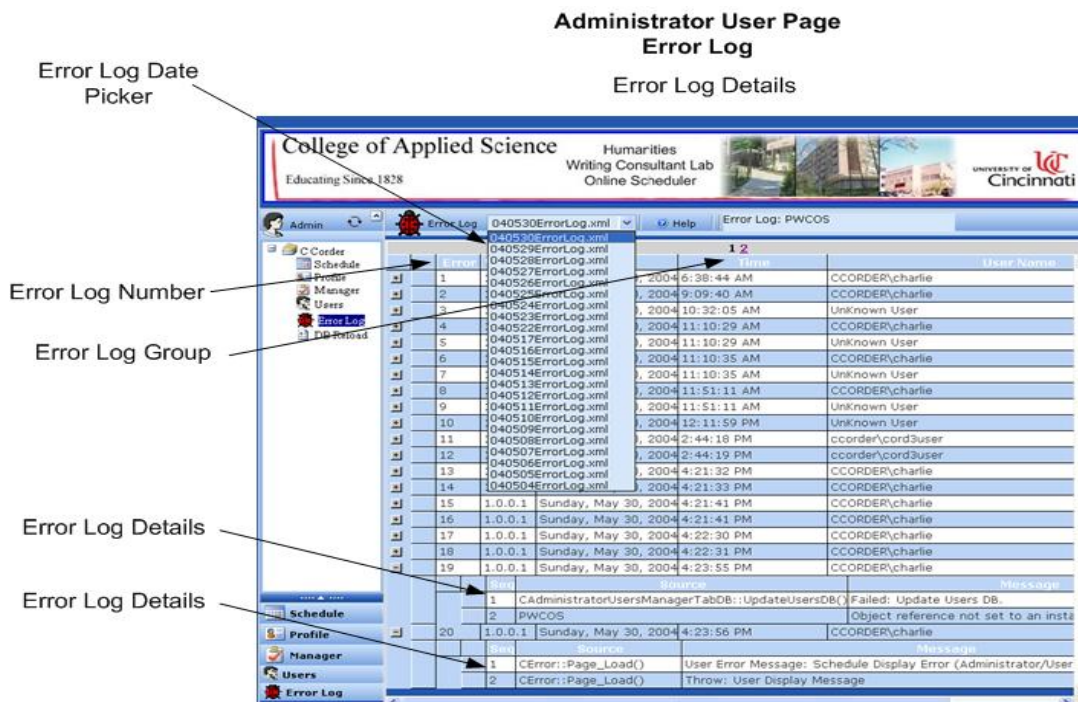


Figure 69. Administrator Error Log Viewer

6. Conclusions and Recommendations

6.1. Conclusions

This project was created in response to University of Cincinnati, College of Applied Science Humanities Department for scheduling students with writing consultants. I created a Microsoft Outlook style of resource scheduler so that the user will be familiar with the operation and navigation of the web pages. The project was completed over

three quarters in the Senior Design sequence. The project fulfilled all but one Design Freeze deliverable. The Crystal Report Section is left to be done. The report section would take most of one quarter to learn and complete.

6.2 Recommendations

While working on this project, I encountered several challenges. One was in creating human computer interfaces. How can the user intuitively interact with the scheduler? I reviewed Microsoft Outlook in detail only to realize that Microsoft had a team of developers building this easy to use complex program. I had a total of twenty weeks to design and build my resource scheduler while working on my other classes and my co-op job. My past experiences with software development in Computer Aided Machine Control and Measurement was a great help in the organization, design and writing object oriented programming. I would highly recommend that more up front time be given to Human Interface Design. The code between the interface and the database flowed with very little problems other than the volume of code needed in a short time. The database design was completed in one week. The database is the foundation level of the WCOS Empire Structure. Only a few minor modifications were required to the database during code development. I credited my past software development to the rapid completion of this massive software design project. I completely ran out of time to complete or even start the Administration Online Reporting Section. I would recommend that a project of this size be done over a longer period of time.

APPENDIX A

WCOS Web Configuration File

Soft Business Rules

The business week that the schedule engine used to configure the time slices per week.

```
<!-- FIRST DAY OF WEEK
    0 = Sunday
    1 = Monday
    2 = Tuesday
    3 = Wednesday
    4 = Thursday
    5 = Friday
    6 = Sunday
-->
<add key="FirstDayOfWeek" value="1" />
<add key="LastDayOfWeek" value="5" />

<!-- Time Slices Per Day (Expected)
    Example 8:00 am to 6:00 pm 30 minutes time
slice = 20 time slices per day)
    Time Slice Value - 30 Minutes
-->
<add key="TimeSlicesPerDay" value="20" />
<add key="TimeSliceValue" value="30" />
```

The business rules to determine number appoints a student can make.

```
<!-- Business Appointment Rules
    AppointmentsPerDay    = 1 (Maximum number of
appointments per day)
    AppointmentsPerWeek   = 2 (Maximum number of
appointments per calendar week)
-->
<add key="AppointmentsPerDay"    value="1" />

<add key="AppointmentsPerWeek"  value="2" />
```

The business rules to determine when an appointment can be added or canceled.

```
<!-- Appointment Business Minute Rules
    Add    = 30.0 (minumin minutes before
appointment can be requested)
    Cancel = 30.0 (minumin minutes before
appointment can be canceled)
-->
<add key="AddAppointmentMinuteRule"    value="30"
/>
<add key="CancelAppointmentMinuteRule" value="30"
/>
```

The Lab hours default schedule hours.

```
<!-- Lab Administrator Select Schedule Lab Hours
(Expected)
    Example 8:00 am (08:00) to 6:00 pm (18:00)
30 minutes time slice = 20 time slices per day)
    Time Slice Value - 30 Minutes
-->
<add key="TimeLabStartHour" value="08:00" />
<add key="TimeLabEndHour" value="18:00" />

<!-- Lab Administrator Select Schedule Closed
Hours (Expected)
    Example 12:00 pm (12:00) to 1:00 pm (13:00)
60 minutes lunch
-->
<add key="TimeClosedStartHour" value="12:00" />
<add key="TimeClosedEndHour" value="13:00" />
```

Appointment change notification.

```

        <!-- Notification
            EnableNotification                = Enable
Notification                               true/false
            WCOS_Email_Address                = WCOS Return
Address                                     Address / ""
            WCSO_Email_Add_Subject            = Email
Subject for Add Appointment                 string
            WCSO_Email_Cancel_Subject        = Email
Subject for Cancel Appointment              string
            WCSO_Email_Cc                    = Email
Address Courtesy Copy                       Address / ""
            WCSO_Email_Bcc                    = Email
Address Bind Courtesy Copy                  Address / ""
        -->
        <add key="WCOS_EnableNotification"
value="true"/>
        <add key="WCOS_Email_Address"
value="WCOS@ccorder.org"/>
        <add key="WCSO_Email_Add_Subject"    value="UC-
CAS WCOS New Appointment"/>
        <add key="WCSO_Email_Cancel_Subject" value="UC-
CAS WCOS Canceled Appointment"/>
        <add key="WCSO_Email_Close_Subject"  value="UC-
CAS WCOS Closed Appointment"/>
        <add key="WCSO_Email_NoShow_Subject" value="UC-
CAS WCOS No-Show Appointment"/>
        <add key="WCSO_Email_Cc"
value="administrator@ccorder.org"/>
        <add key="WCSO_Email_Bcc"            value="" />
        <add key="WCSO_Email_Add_Message"
value="Location - Admin Bldg Room 205 (Please Do Not Be
Late)"/>
        <add key="WCSO_Email_Cancel_Message"
value="Location - Admin Bldg Room 205 (Canceled
Appointment)"/>
        <add key="WCSO_Email_Close_Message"
value="Location - Admin Bldg Room 205 (Thank You - Hope I
Helped You!)/>
        <add key="WCSO_Email_NoShow_Message"
value="Location - Admin Bldg Room 205 (You Did Not Come To
Your Appointment)"/>
```

Notes

References

1. *Programming Microsoft Windows With C# Developer Core Reference*, Redmond, Washington: Microsoft Press 2002, Charles Petzold
2. *Microsoft ADO.NET Core Reference*, Redmond, Washington: Microsoft Press 2002, David Sceppa
3. *Developing Web Applications Visual C# .NET*, Redmond, Washington: Microsoft Press 2002,
4. *Programming Microsoft .NET*, Redmond, Washington: Microsoft Press 2002, Jeff Prosise
5. *Microsoft Visual C# .NET*, Redmond, Washington: Microsoft Press 2002, Mickey Williams
6. *ASP.NET Professional Secrets*, Indianapolis, Indiana, Wiley Publishing, Inc.