CIBER MEASUREMENT REPOSITORY

A Thesis
Presented to the
Faculty of
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In Partial Fulfillment
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Master of Science
in
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by
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DEDICATION

I dedicate my work to my parents Mr. Surendra Kant Jain and Mrs. Sulochana Jain, who have always loved me and supported me. I would also like to thank my family members for their continuous support throughout my Master’s degree.
ABSTRACT OF THE THESIS

CIBER Measurement Repository
by
Sachin Jain
Master of Science in Computer Science
San Diego State University, 2011

The objective of my thesis is to enhance the Measurement Repository for the Center for International Business Education and Research (CIBER). This Repository is a one-stop unique web portal to assist with construction, discussion and dissemination of measurement constructs in international business research. It has been created to collect and store measurement data which are easily accessible by authenticated users. Initially, it was designed with simple search functionality with the limited measures entered by the administrators of the Repository.

This thesis is focused on enhancing the repository with several features like Advanced Search that adds additional fields to the simple search, Login System with admin features, Input Section to enter a measure or concept and a Forum for social interactivity. Search results will be displayed in an enhanced way that provides rich browsing experience to the user. In Advanced Search, users will be given additional fields which can be used to qualify searches by other criteria such as author name, measurement, year or title. Login System allows researchers to sign up and use input section. Data provided by external user will be stored separately for additional security. It greatly eases repository administrator work. Input section is the key section of the repository where researchers can sign up and input the measure or concept which they have designed (or used). These entries will be screened and published in the database and will be made searchable. A forum has been integrated to the repository for social interaction among website users and researchers. They can perform discussions with other users and share their experience with the measure.

It is a web portal that not only provides specific functionalities, but also provides flexibility for enhancements in future. This project has been implemented as a three-tier architecture consisting of Client Tier, Application Tier and Database Tier.
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First, I would like to thank my project advisor, Dr. Gangaram Singh for giving me the opportunity to work on this thesis project. I am grateful for his continuous support, enthusiastic encouragement, and guidance throughout the project.

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Lastly but not the least, I wish to thank my family members, Smita Jain, Deepak Jain, Shubhra Jain and Ajit Jain for their support and encouragement throughout my study.
CHAPTER 1

INTRODUCTION

1.1 BACKGROUND AND MOTIVATION

"Nothing is so powerful as an idea whose time has come" says a famous literary Victor Hugo. The revolutions in the field of computer technologies have dramatically changed the face of scholarly communications. It has pervaded almost every aspect of sharing knowledge. These technologies not only provide the solution to build an efficient system but also to maintain these systems for long time and flexibility to enhance these systems easily when needed. Idea of using these technologies to advance the measure of International Business has motivated Professor Gangaram Singh, Director, Center of International Business and Research to build an electronic repository.

The scholarly resources of International Business that had limited access on the web are now visible to the world under this open source mechanism and researchers are participating actively in web-based repositories [1]. The aim of CIBER Measurement Repository is to disseminate International Business data in such a manner that it enhances interoperability among scholarly communities [2]. This web-based repository overcomes the limitations of paper-based repositories: Large storage requirement, limited distribution and access [1].

This thesis project aims at providing the efficient web-based repository that facilitates researchers to share their knowledge and search for scholarly resources provided by other researchers. It provides a solution which is effectively connecting researchers of International Business globally. Towards the end, this project will be able to integrate several features in CIBERMR.

1.2 FUNCTIONALITY OVERVIEW

The CIBER Measurement Repository (CIBERMR) is a unique web portal to assist with the assembly and constructs of international business research that was developed at the Center for International Business Education and Research at San Diego State University [3].
This repository will house large collection of articles from Journals that will serve as a rich resource for researchers involved in international business. Using CIBER Measurement Repository, researchers will be able to search the articles by performing either a basic or an advanced search. A well-organized search results output will be displayed with description of article like measure, its operationalization, and any psychometric quality to determine whether that article contains useful material for their work as well as find the link to the article if available on this repository or another repository. Researchers can also enter measures that they used or designed and add useful content to repository database. Forum adds social interactivity to the repository and attracts vast variety of users. Teachers, students, business leaders and researchers can perform discussion on any measure.

1.3 WEBSITE USERS

Anyone interested in International Business research is welcome to use the repository. The Repository has room for five different types of users:

- Faculty;
- Students;
- Researchers;
- Business leaders;
- System administrator;

System administrator will be the most powerful user and will assign roles to new sign in. It targets higher education by offering an outlet for faculty/professors to share their best practices and research with students of international business. Researchers who have designed and used international business measures can share their researches. Business leaders benefit through discussions on forum and the measurement data stored in repository. All users and organizations benefit by accessing valuable resources across wide range of international business concepts. System administrators will be the most powerful users who will manage the website and user accounts.

1.4 THESIS ORGANIZATION

The rest of this document is organized into the following chapters:

- Chapter 2: Technologies and Tools. This chapter gives a brief overview of technologies employed in enhancing the Repository.
- Chapter 3: System Design. This chapter describes the architecture of Measurement Repository.

- Chapter 4: User Interface. This chapter describes user interface of the enhanced Measurement Repository.

- Chapter 5: Feature Implementation. This chapter covers the feature implementation with coding snippets.

- Chapter 6: Installation and Migration. This chapter covers the installation of Repository website on server and migration to another server.

- Chapter 7: Future Work. This chapter covers the scope of future enhancement.
CHAPTER 2

TECHNOLOGIES AND TOOLS

Functional design and useful content are needed to develop an efficient web-based repository. There are four key components of website development: front-end elements, back-end elements, server and server side scripting. The first step in achieving a functional design is to select the right combination of these components. Considering this, I have used PHP as server side scripting language, MySQL as back-end, HTML, CSS and JavaScript as front-end and Apache as web server for hosting the repository website. This combination is compatible with all operating systems and all technologies are open source which reduces the cost of building a website. I have also considered few other things while creating this website like browser compatibility and efficient debugging tools. Different browsers render HTML differently so I have tried my best to make this repository compatible with all browsers with the help of CSS. I have used Firebug debugging tool to debug the website. Firebug is available for all the browsers and is an efficient debugging tool.

Apache, MySQL and PHP are a successful combination for creating a functional website. These technologies are also available as a bundle. WAMP, XAMPP, LAMP and MAMP are commonly used as web development packages. These packages are categorized based on operating system compatibility.

- X for “Cross platform compatibility;”
- W for “Windows;”
- L for “Linux;” and
- M for “Mac OSX”

Principal components are Apache, MySQL and PHP. XAMPP includes Perl scripting language along with Apache, MySQL and PHP. WAMP has been used for developing this repository and Apache HTTP server was set up on a Windows machine.

MySQL GUI tools and phpMyAdmin were used to manage the MySQL databases. MySQL GUI tools package includes three separate tools that are MySQL administrator, MySQL query browser and MySQL migration toolkit. MySQL administrator tool helps in
administrating databases such as backup/restore database and add/remove users. MySQL query browser tool is used to access the database and execute queries on. MySQL migration toolkit is used for migrating databases from various relational database systems to MySQL.

Reasons for choosing these technologies are [4]:

- Cross platform compatibility: PHP and MySQL run on every popular operating system. PHP is compatible with the three leading web servers that are Apache HTTP server, Microsoft IIS and Netscape Enterprise server. It is most commonly used with Apache. PHP handles MySQL so MySQL compatibility with web servers is not required.

- Open Source: PHP and Apache web server are open source projects. MySQL is open source for many uses. It greatly reduces the cost of a website.

- Less hardware requirements: Hardware requirements for these technologies are almost nothing.

- Stability: PHP, MySQL and Apache server are considered most stable. Apache server doesn’t need to be rebooted often. It seemingly never crashes. Not many changes can be seen in release to release for Apaches and same applies to PHP and MySQL. For these technologies, improvements in new releases don’t compromise compatibility.

- Speed: Execution time for PHP scripts is less than any other server side scripting language or any CGI scripts. With Apache server, it takes less time when compiled as its module. MySQL server executes complex queries in no time. Zippy speed with no cost seems like the best solution for all individuals and organizations. So many features with no cost make these technologies very popular.

- Ease of use: These technologies are in demand because they are easy to use. Major percentage of websites is based on these technologies and every web developer finds this combination of technology easier to use when compared to other solutions in market and that too without any cost.

2.1 PHP

PHP stands for “Hypertext Processor.” It is a server-side scripting language which is widely used to create dynamic web pages for website development. In order to generate dynamic web pages, a developer embeds PHP code in HTML source document and sends it to web server with a PHP processor module where the code is interpreted. PHP can be deployed on all leading web servers and is compatible with almost every operating system. It can interact with various databases especially with MySQL. Large percentage of web developers use PHP to develop web based projects [5].
PHP can be described as [6]:

- **Server-side scripting language**: With HTML pages, a user’s browser interprets all of the code and displays the page which the user intended to see. Opposed to this process, PHP code first runs on server and sends the output to the browser to interpret and the user sees the HTML generated by the browser. That’s the reason why we can’t see PHP code in source of the page and this makes the website secure because code is running on server and users don’t have access to that code.

- **Free-form language**: PHP is a free form language because it won’t display white spaces in the output of your browser even if you have too many whitespaces while coding. That makes the language lightweight. HTML shows all the whitespaces in the output if you have any while coding.

- **Dynamic language**: Output of the PHP web pages can be changed dynamically anytime which is not feasible with static pages. Because of easy interaction with back-end components, PHP can pull any information anytime which cannot be done in static web pages.

- **Object-oriented programming**: We can create endless number of objects that can send/receive data with other pages on the web. It organizes the application and makes it functional.

Features of PHP are as follows [7]:

**Application Control**: PHP started as an application control language. Specifically, it was designed to handle access logging for HTTP servers. This ability has expanded greatly and now PHP can even be used as a scripting language in such applications as Microsoft Word and Excel.

**Database Access**: PHP with MySQL is a widely-used combination in web development. It has become so common and popular that core PHP releases are coming out with MySQL interface. PHP can easily interact with other databases by using their modules. PHP can be used to pull data out and push data in the database. All kinds of web based portals are using PHP with MySQL combination.

**Graphics**: One of the common uses of PHP is to manage graphic content like creating charts and graphs and generating images mainly GIF and PNG. It can dynamically add content in order to make a website attractive and functional.

**File Access**: Using PHP, we can view and edit files remotely. It can be used to process XML and HTTP distribution in which it takes data and sends out that data as an e-mail through standard mail protocol.
Extensible: PHP is written in C and the source can be modified merging new modules. This makes PHP extensible.

PHP can be used to create forums, search engines, message boards, blogging software, E-commerce, web-based repositories and functional websites.

2.2 MySQL

MySQL stands for “My Structured Query Language” [8]. It is an open source relational database management system. It is developed, distributed and supported by Oracle Corporation. Database Management Systems are employed to manage data stored on computers. Management of data includes various functions like adding, accessing and processing data. MySQL server is a widely-used database management system. It can be used as a dedicated MySQL server or as a service of any application. MySQL is an Open Source software so anyone can use and modify the software. It is free to download and free to modify so it can be modified according to a user’s needs [9].

MySQL is a relational database that stores data in the form of tables. SQL in “MySQL” stands for “Structured Query Language” which is defined by ANSI/ISO Standard. This language is used to create the database, access and modify it. The term “Relational” refers to relations generated among data and tables that allow high degree of data independence. It has the capability to generate relations among data items from different files. A large portion of the web developer community is using MySQL as the back-end element. Because of its popularity with PHP, MySQL interface is now a part of core PHP releases. MySQL was original designed to handle large databases and it is a much faster solution than any other database management systems in the market [9].

Some key Features of MySQL [10]:

- It works on almost every popular platform
- It provides both transactional and non-transactional engines
- It can be used as a server in client/server environment or as a service with standalone applications.
- MySQL system is scalable and it supports large databases.
- Clients can connect to the MySQL server using several protocols and on any platform.
MySQL utility programs include both command line programs like mysqladmin and graphical programs like MySQL administrator and MySQL Query Browser.
CHAPTER 3

SYSTEM DESIGN

CIBERMR is a database driven website which was originally built using MySQL and PHP. Its interface was written in PHP to create dynamic web pages. The website was hosted on Apache web server and the goal was to provide the users with simple search feature to retrieve the information they are looking for via related results. This thesis proposes a challenging task where the goal is to enhance the website by adding features to make it more than a static website. This enhanced repository provides an approach to the users to access those additional features such as advanced search with additional fields to allow users to search effectively, registration portal to allow users to store their research assets in the database, another database to ease the workload of the repository administrator for handling outside user’s content and forum to interact.

3.1 SYSTEM ARCHITECTURE

We adopted three-tier client server architecture to develop this Measurement Repository.

Figure 3.1 describes the traditional three-tier architecture which is defined by three layers: Presentation tier; Logic tier; Data tier.

THREE-TIER ARCHITECTURE

![Three-tiered client/server architecture](image)

Figure 3.1. Three-tiered client/server architecture.
Figure 3.2 describes the repository website architecture which adopted the traditional three-tier client/server architecture. The presentation tier is responsible for user interface that displays data to user and accept input from the user. The logic layer is responsible for enforcing the business rules on the user’s input and formatting the data retrieved from data sets before displaying in the user interface. The data tier is responsible to managing all the data and setting up connections between logic tier and data tier. The main advantage of using a three-tiered architecture can be seen while maintaining the website. Technologies and system requirements change over time and it requires less effort to make the website adapt the new requirements. Let us take a look at a three-tiered client/server architecture of our repository [11].

### 3.1.1 Presentation Tier

The presentation tier in web development often refers to the front-end of the website which involves the content that different browsers render. In other words, this tier communicates with other tiers by taking input from user and displaying the output to the user. Content may be either static or dynamically generated [12]. Markup languages and client side scripting languages define the look, feel and layout of the website such as HTML, JavaScript and CSS. User interacts with the website in this tier; therefore browsers define the presentation layer in our repository architecture.

In our enhanced the CIBERMR website, the presentation tier consists of whole website’s interface where user enters the keyword and gets the search results as output in the browser, web form through which the user add entries in the database and the forum where the user can view, add posts or comments. HTML and CSS was used for interface components and to make those components render by different browsers as desired.

### 3.1.2 Logic Tier

The logic tier is responsible for the functionality of the system and serves as the middle tier that communicates with both presentation layer and data layer. It takes input from the presentation tier, communicates with the database to process the query and sends the results as formatted output to the presentation tier. This tier separates the business logic from other tiers in multitier architecture. The biggest advantage of having a logic tier as a separate
Figure 3.2. Three-tier architecture of repository.
module is that it doesn’t require much modification with changing requirements over a period of time. It is not dependent on the languages used in the presentation tier or databases in the data tier. The data tier may need to be modified to pull out data from different database, the presentation tier may need to be modified to enhance the user interface according to the requirements, but the logic behind the system stays the same other than few minor changes [13]. It eases the site administrator’s work in the context of managing the website. It’s easier to manage separate modules than as a whole. There are two sub-layers within the logic tier: business objects and data access layer. Business object is a temporary means to store data and the processing logic. The logic tier also contains logic to pull out persistent data from the data-tier and places it into business objects. It also contains the logic to retrieve data from objects and places it into database. Data access layer contains methods that are specific to database and every time business tier calls these methods to access the database instead of accessing the database directly. This proves to be the biggest advantage when the requirement specifications demand different database later at some point of time. We can easily create another access layer with same set of methods that now supports a different database [14]. The goal is to access the data tier, and as such is refined to the data access logic layer.

In our system, the web server and server side scripting languages define the logic tier. I have used Apache web server and PHP for this website. All the functionalities of the website have been written in PHP such as simple search, advanced search, registration portal, formatted search results and interface to add entries in the database. That clearly explains the difference in roles of the presentation tier and logic tier. Presentation layer defines the appearance of the website and the logic tier defines the logic behind every feature of the website. PHP, server side scripting language, makes it easy for a web developer to write the logic without any hassle because of its simplicity, easy to understand and code and flawless support for large number of external modules.

3.1.3 Data Tier

The data tier is responsible for managing data in a system. It is a key component in a repository website. It communicates with the logic tier only and not with the presentation tier in a three-tier architecture system. The logic tier is dependent on the data tier for persistent
storage of data and its retrieval. Database management system and data sets define the data

tier of a system. MySQL has been used as a database server in this project. Database tables

are the physical storage of data in a database. Storage of data, retrieval, backup and all the

other functions like update and delete belong to this tier. A database server communicates

with the data access layer of the business tier and provides access to the data storage.

Clients send their requests for search via the presentation tier. The logic tier receives

that request at the web server where it stores the keyword data temporarily in business

objects, establishes a connection to the data tier to retrieve the data related to the search. The

data tier authenticates and establishes the connection, and sends the data to the logic tier. The

logic tier formats the data and sends it to the presentation tier as response. Registered users

enter data in the input section to add their entries via the presentation tier. The logic tier

processes that data and sends it to the data tier. The data tier stores that data in the database

and makes it searchable with indices.

3.2 System Requirements

Advanced Search: Advanced search feature that provides additional fields to the user
to use multiple keywords or criteria to search more efficiently and effectively. These fields
are database specific that either limits the search criteria or expands it. This advanced or
refined search allows users to show results from specific category.

Enhanced User Interface: Interface must be unified and user-friendly so as to
effectively and efficiently serve the goal for a website user. “Advanced Search” screen with
additional fields to refine the search based on keywords provided by the user. When the user
performs the search, the set of relevant items returned must be well-organized.

Registration/Login System: Only authenticated users of the Repository are allowed to
add an entry into the database. A Registration/Login system which has the functionality to
allow a user to register and login to enter a measure/concept of international business.

Forum: Forum supports for social interactivity among researchers, students, faculty or
any other user of the website. It also enables researchers to perform discussions and share
their experience with a measure. Forum administration can be done by setting the privileges
to various features of forum.
Data Management: Creation and management of another database which stores data entered by researchers. Enables administrator to keep track of incoming data and securely manage the data entered by administrator.

3.3 USE CASE DIAGRAM OF REPOSITORY

Figure 3.3 shows the Use Case Diagram of the Measurement Repository with all the entities of the system with their roles and repositories.

3.4 ACTORS AND THEIR ROLES

Table 3.1 describes the roles and description of Administrator. This entity is the most powerful user and controls the whole website.

Table 3.2 describes the roles and description of Authenticated User. This entity has access to all the features of the website.

Table 3.3 describes the roles and description of Guest. This entity has limited features of the website.
Figure 3.3. Use Case Diagram.
<table>
<thead>
<tr>
<th>Table 3.1. Administrator's Use Case</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Use Case:</strong> User Management, Website Management, Data Management, User Interface Management, Register and Login, Profile Management, Forum Management, Simple or Advanced Search, Add Entry</td>
</tr>
<tr>
<td><strong>Actor:</strong> Administrator</td>
</tr>
<tr>
<td><strong>Description:</strong> Administrator is the most powerful user and manages the website, users, forum, user interface, profile. Admin can register, login, search and add entry into the database. Database management is the key role of a Repository’s administrator. Administrator controls the profiles of all the users and assigns privileges based on whether the user is an authenticated user or a guest. All these roles and responsibilities make admin the key entity of this system.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3.2. Authenticated User's Use Case</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Use Case:</strong> Profile Management, Register, Login, Simple or Advanced Search and Add Entry, View, Create &amp; Edit Posts, Comments</td>
</tr>
<tr>
<td><strong>Actor:</strong> Authenticated User</td>
</tr>
<tr>
<td><strong>Description:</strong> Users register and become authenticated users. They manage their profile and login to add entry into the database. Researchers register, login, and share their experience on forum by creating posts, providing comments. These users receive email containing encrypted password at the time of registration.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3.3. Guest's Use Case</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Use Case:</strong> Simple or Advanced Search, View Posts</td>
</tr>
<tr>
<td><strong>Actor:</strong> Guest</td>
</tr>
<tr>
<td><strong>Description:</strong> Guests have access to Simple and Advanced Search but they don’t have access to Add Entry. Guests can only view posts and don’t have access to write, edit or delete posts.</td>
</tr>
</tbody>
</table>
CHAPTER 4

USER INTERFACE

I presented a brief overview of the presentation tier in Chapter 3. In this chapter I will discuss about the implementation of the presentation layer in the CIBERMR website. The user interface once again, of this web portal has been implemented in PHP with embedded HTML and JavaScript. PHP was used to design the interface for number of reasons:

- PHP Provides built-in support for MySQL that is used as back-end component in this project and Apache modules that allow easy to work with Apache web server to host this website.
- PHP provides flexibility to add more pages going forward without changing the whole structure because every component of this repository was designed as a separate interface and since PHP is open source community support provides an extensive set of libraries.
- PHP provides access control mechanism support that allows us to make some pages password protected.

4.1 HOME PAGE WITH SIMPLE SEARCH

The home page was designed earlier with simple search feature. I have done some minor changes on the homepage as a part of my thesis for a better look, feel and layout of the website. One of the major changes was to write fixes in CSS to make the website render as expected in different browsers such as Mozilla Firefox, Internet Explorer, Safari and Opera. Simple search functionality remained intact and it was not changed in my thesis work. Left panel of homepage consists of following:

- Links: Home, Input, Forum, National CIBER Program, SDSU CIBER.
- Simple Search: Simple Search page consists of a text box where the user provides the keyword to search in Repository database and gets the relevant search results.
- Advanced Search: Right below Simple Search, I have added the link to Advanced Search. It enables users to add specificity to simple search in order to get refined results.

Figure 4.1, Figure 4.2 and Figure 4.3 demonstrate the layout of the website in Opera, Firefox and Internet Explorer correspondingly. All three shows the same desired layout.
Figure 4.1. Website interface in Opera.

Figure 4.2. Website interface in Mozilla Firefox.

Figure 4.3. Website interface in Internet Explorer.
4.2 ADVANCED SEARCH

Figure 4.4 shows the Advanced Search page which is displayed when a user clicks the link to Advanced Search below the simple search box. This Repository is a data-driven website so these additional fields are database-specific and enable the user to add specificity to refine the search based on the criteria provided. If user provides a keyword in any of these fields, then the search will be narrowed down to that specific field in the database. It helps users maximize their search efforts to refine the search and retrieve desired results.

Figure 4.4. Advanced search.

4.3 SEARCH RESULTS

As we discussed above, a user has two options to perform a search: A standard Simple Search and a precision Advanced Search
We can clearly see in Figure 4.5 and Figure 4.6 the difference between Simple Search and Advanced Search. Results are accurate when the user performed the search of an article based on a specific year. Year filter of Advanced Search reduced the results to more relevant results only. This shows the desired functionality of Advanced Search.

Figure 4.5. Simple search results for “2004”.

Figure 4.6. Advanced search results for “2004”.
An important factor in a user’s search experience is the Search Results page. I have followed best practices to display the results. Results of both Simple and Advanced Search are displayed in grid view. Layout of the Results page is very well-organized and user-friendly. Below are some of the best practices which have been followed to design the Repository’s Search Results page [15]:

- Search box remains prominent at top;
- Option to view an “advanced” search page;
- Total number of search results displayed on top;
- Results Authors are hyperlinked that enables user to search further with Author as filter;
- Searched words are shown at the top; and
- All the fields in a result item are shown in a different color.

Both guests and registered users are allowed to use Search features of the Repository.

4.4 MENU

Figure 4.7 shows the Menu items of the Repository. These items are displayed on the left sidebar of the layout. It consists of links to: Homepage, Input Section (Registration and Login included), Forum, CIBER’s national website, and SDSU CIBER website.

4.5 REGISTRATION AND LOGIN

Figure 4.8 shows the Registration page where a user can register to gain access to the Input Section. The top three fields are bold and mandatory. A user has to provide the first name, last name and email to register. Ajax code behind this Login mechanism checks email in the database against the input of a user. It returns an error if the user already exists in the database.

Figure 4.9 shows the Login page of the Repository where a user can login and add measure/concept to the database which will be displayed in the search results if any user wants to see that measure.

Sometimes users can’t remember the password. Figure 4.10 shows the Forgot Password page where the user can enter all three mandatory details and click on the button below. The user will be sent an email containing an encrypted password. She/he can change
Figure 4.7. Menu.

Figure 4.8. Registration.
the password on the Change Password page shown below in Figure 4.11. It requires a user’s old password and new password.

4.6 Input Section

Figure 4.12 shows the Input Section. Users can see this section only as registered users. This section is to add a new measure entry into the database. It contains eight mandatory fields that need to be filled in by the user. All of these fields are database-specific with indices to make them searchable. The Reset button resets all the fields at one click.
Figure 4.11. Change password.

Figure 4.12. Input web form.
Category dropdown menu consists of four categories: International Marketing, International Finance, International Accounting and International HRM.

### 4.7 FORUM

Figure 4.13 shows the profile of an authenticated user. It also shows two folders created by Admin: Experimental Constructs and Established Constructs. Users can post here and discuss their experience with the measure. It is very useful in designing a measure and seeking international collaboration. Figure 4.14 shows the Administration screen where the administrator can change the settings to manage the forum, registered users, guests, posts and comments.

![Figure 4.13. Forum.](image-url)
Figure 4.14. Forum administration.
CHAPTER 5

FEATURE IMPLEMENTATION

5.1 DATABASE CONNECTION

I have created a Data Abstraction Layer (DAL) with PHP and MySQL. My Database class consists of local variables and methods. Local variables keep track of the connection parameters such as database server name or host, database name, username and password to access the database. I have created four functions in this class: connect() function to establish the connection to the database using connection parameters stored in the above mentioned local variables, close() function to close the connection whenever needed, execSQL() function to execute the queries and getQuery() function to return MySQL statement as a string to search in database against the keyword provided by the user. This statement was prepared on the basis of which search option (Simple or Advanced) the user has selected. Below is the code snippet from DAL:

```php
function getQuery()
{
    if($_REQUEST["h"] == "simple"){
        return "MySQL statement 1 for Simple Search";
    }else if($_REQUEST["h"] == "advanced"){
        return "MySQL statement 2 for Advanced Search";
    }else{
        return null;
    }
}
```

5.2 SEARCH

Below is a code snippet which I have created to implement the search functionality using the above mentioned DAL:

```php
$query = $db->getQuery();
$result1 = $db->execSQL($query);
$i = 0;
while ($db_field = mysql_fetch_array($result1)) {
    $i++;
}
$query = str_replace("DB1", "DB2", $query);
$result2 = $db->execSQL($query);
```
while ($db_field = mysql_fetch_array($result2)) {
    $i++;
}
if($i==0){
    print "No results found.;"
}else{
    print "$i results found.;"
}

The above mentioned code only executes if the connection with the database is successfully established. Using the functions of DAL, search functionality has been implemented. Function execSQL() executes the query returned from getQuery() function and Mysql_fetch_array() is a built-in function of MySQL that fetches the result as an array. These results get formatted and displayed.

Other features such as Registration/Login, Input Section and formatted Search Results page are implemented in exactly the same way. Registration system uses Ajax in JavaScript functions. It checks whether the username provided by the user while registering already exists in the database or not. Similarly, the Input section code checks for Title of the article and returns error if it already exists in the database.

Forum is implemented with Open Source forum software by Simple Machines (SMF). Appearance of the forum pages was modified as per Repository’s theme. Its configuration was changed according to Repositories MySQL server.
CHAPTER 6
INSTALLATION AND MIGRATION

The goal of this project is to develop a web-based repository that needs to be hosted on a web server. It doesn’t require any installation on client side. Clients can access this web Repository using browsers. Any browser can be used to browse this website because the Repository pages are designed as cross browser compatible. Three software components were required to be installed on the server side:

- PHP: To run PHP scripting engine;
- Apache web server: To host the website;
- MySQL database server: To manage databases since the website is data-driven;
- MySQL GUI tools or Workbench: To visually design and manage databases; and
- One of the following Operating Systems:
  - Microsoft Windows XP, Vista, Windows 7;
  - Linux/Unix;
  - Mac OSX;

Hardware requirements vary on website traffic and database size.

Web pages are hosted on the ROHAN server at San Diego State University for this project and the database server was installed on Professor Gangaram Singh’s desktop computer. Recently, the databases have been migrated to the ROHAN server. Configuration files have been modified and now points to the ROHAN server. MySQL server environment was set up on it and the default port for MySQL connection was opened with firewall exceptions. Web pages are still hosted on the ROHAN server.
CHAPTER 7

FUTURE WORK

CIBER Measurement Repository is a dynamic website. It is designed in such a way that additional features can be integrated going forward. The user interface is designed with PHP, JavaScript, CSS and Ajax. All of these technologies are open source and therefore community support provides several libraries to integrate in their releases. So, there is always a scope to enhance the user interface design of the CIBERMR. Some of the future enhancements are as follows:

- This Repository can be designed to use as a Native application on mobile framework.
- The administrator of the Repository currently manages users and data visually with the help of MySQL GUI tools. A separate and secure administrator section can be designed to ease administrator work.
- Other features such as chat, audio and video conference can be added for social interactivity.
- Ajax can be used to display the search results without reloading the page.
REFERENCES


