Table of Contents

i. Title Page i

ii. Table of contents ii

iii. List of figures iii

iv. URL: http://robin.tamu.edu:8891/apps/bhatt.serurchk.loginpage

1. Abstract 1

2. Background and Rationale 2

3. Narrative 5

4. Project Environment 11

5. Procedure 12

6. Conclusion and future enhancement 29

7. References 30

8. Appendix 31
List of figure

Figure 1 Communication process between the user and PCA database  
Figure 2 Example using a Line Chart  
Figure 3 Example using a Bar Chart  
Figure 4 ORACLE Web-Server  
Figure 5 Operational flow diagram  
Figure 6 Welcome page module  
Figure 7 GetPassword module  
Figure 8 MainPage module  
Figure 9 BrowsePage module  
Figure 10 reportPage module  
Figure 11 updatePage module  
Figure 12 viewTablePage module  
Figure 13 addDataPage Module  
Figure 14 removeDataPage module  
Figure 15 updateDataPage module  
Figure C.1 Administrator login  
Figure C.2 Administrator’s page  
Figure C.3 User administration page  
Figure C.4 User Login  
Figure C.5 User Welcome page  
Figure C.6 Browse database page  
Figure C.7 Choose table page  
Figure C.8 Chart  
Figure C.9 Update Database Page  
Figure C.10 Change Password Page  
Figure C.11 New Password Page
ABSTRACT

This project is the design and implementation of a graphical data-analysis system to monitor hydrocarbon levels near oil platforms in the Gulf of Mexico. This platform-independent system provides database retrieval and data observation capabilities through a clear graphical presentation of data to show pollution levels with respect to time and depth, and is available to users through the World Wide Web. The system is designed to be user-friendly so it is available for use in education and research work in environmental monitoring, and to carry out Principal Component Analysis (PCA) to find different components of the contamination.
Background and Rationale

Background

Hydrocarbon is one of the major pollutants near oil platforms. When oil is spilled in the marine environment, it is generally believed that mortality and (or) morbidity are restricted to the immediate vicinity of the discharge. Dispersion and dilution of the oil hinges on the existing weather conditions, but usually organisms that live in the area eventually become exposed to diluted concentrations. The effects vary from inhibition of feeding and growth to severe organ and tissue damage.

The Principal Component Analysis (PCA) is an environmental conservation program that emphasizes monitoring hydrocarbon levels near the oil platforms in the Gulf of Mexico. It provides useful information to educate students about the ecological and economic importance of the region. The Department of Chemistry at Texas A & M University-Corpus Christi, with the cooperation of the Environmental Protection Agency in Mexico, is gathering samples from water, soil and sea species. Samples are taken on a monthly basis. Tests are carried out near the site to determine the hydrocarbon levels in sub ppm, and stored in an Excel spreadsheet [2].

At present, there is no database available. Data is used for keeping records only. The present form of data is difficult to analyze or to use to teach students.

Problem

The goal of the PCA program is to help teachers effectively present the abstract concepts of biology, chemistry and ecology by teaching students how to measure components of the environment around them. It should help researchers to establish correlations between environmental parameters and to analyze data using graphical charts. With a broader understanding of environmental quality issues, they will be better prepared to form solutions to environmental concerns. Since the end user may be a student, PCA requires a system that is easy to use, easy to understand, capable of providing immediate feedback, and is an attractive database interface that has educational and informative capabilities.
The present form of data is insufficient for complete data analysis. A tool is required to access the data and to provide an environment so that a user can interact with the data. For instance, when a user tries to retrieve the data during a certain period, a plain digital number is displayed. Assuming the user is a student, who is interested in understanding the data of a monitored site after submitting his own data, he/she may feel bored when facing plain digital numbers in multiple rows and columns [8]. And, assuming that a teacher would like to show students the relationship between hydrocarbon levels in water and the depth of water, he has to retrieve all the data, and then input it into a software package to get the desired line chart, or else draw the chart by hand, which is somewhat impractical.

Solution and Benefits

The purpose of this project was to establish the data-analysis features by developing a graphical, data-analysis system. It has taken advantage of the Graphical User Interface (GUI) capabilities available on the internet. It has provided database retrieval capabilities and also has generated different charts based on user requirements. It has helped researcher to carry out Principal Component Analysis to find out different components of contamination and to establish correlations between them. This project has greater ability to provide school students and education professionals a strong connection between the environmental data they collect and real-world problems. It has enhanced classroom teaching greatly.

Changes made since the proposal

1. Addition of new Columns in Users table.

   Following columns have been added to the users table:
   
   Email, address1, address2, city, state, zip, country, passwd, request.
   
   These columns have been added to users table so that additional information about each user can be kept in the database. The request column will keep track of users request for new password. If user forgets his password, he can send request by filling out Forgot Password form. This will cause request parameter set to 1 in users table. Next time when Administrator logs in he will
get the request. Administrator can then contact user to provide him new password.

2. **Change in security section.**
   
   It is recommended that user changes his password at regular interval. This part will allow user to change their password. It will ask user to enter his user Id, Old password, New password and confirmation of new password. If information entered is valid then the password is changed other wise he gets an error message.

3. **Forgot password hint question section has been removed.**
   Originally forgot password section was designed such a way that it asks user a hint question (like what is your mother’s maiden name? or what is your social security number?) and if he answers it correctly then this section would display the password. There is a security hazard in this approach because anybody could enter correct answer for the question and get the password. Forgot password section has been replaced by request new password section where user send request to administrator by filling out a request form. It is administrator’s responsibility to make sure that request has been made by user himself and provide him new password. Once user gets new password he can change it so administrator wouldn’t know the new password.

4. **Security tables have been removed.**
   Since forgot password section no longer exists, the security table that had hint questions and answers is also not required. Hence the security table has been removed.

5. **Sgm, Tami_arohc, Tami_eqhe tables have been combined to create one table.**
   These tables were designed to hold the data gathered from different places. They have the same attributes. All the tables can be combined to create one table. Sgm table has been created such that it can hold data from all three table.

6. **Bar chart section has been removed.**
   Bar chart can be used to show the average change for definite period of time. This project has data for 10 years. In such situation Bar chart can’t show the relationship between parameters effectively.
The purpose of this project was to effectively represent components of environmental pollutants. The PCA database is a relational database with two tables described in the appendix A. It contains the information of wells, users and samples. It is designed according to the type of data available.

This project was to design and implement a data-analysis system by presenting the retrieved data through a graphical-chart presentation. This system provided a friendly Web interface that provided instant, up-to-date and clear information about the environmental status of the monitoring sites in the Gulf of Mexico to the users. The system is developed and implemented with user-friendly features like clicking a button to select a menu or an object. The object-oriented concept is used to design this information system. Online help is available to learn how to use the system. The system also provides a graphical user interface (GUI). For instance, data can be viewed in the easy-to-understand form of charts. Reports may also be viewed and printed in the database.

The following diagram (see Figure 1) shows the communication process between the user and PCA database through the internet.
Figure 1 Communication process between the user and PCA database.
Major Components of the system.
1. Data-analysis system input interface
2. On-line user-guide.
3. Data presentation.

The user enters the system by typing the URL through World Wide Web Browser. This takes him to Data-analysis system input interface.

**Data-analysis system input interface.**

Upon entering into system there is a welcome page that has two options.
1. Browse the database.
2. Login for full access.

**Browse the database:** This interface allows the user to do data analysis based on the retrieved data by presenting and organizing the data in different types of charts, which displays complex relationships among the data. This interface is presented first as a request form to ask the user to select chart options. There are two option buttons, which allow the user to choose either of two different types of charts to present the data. Upon selecting one of the options, user enters another page where a set of pull-down menus allow the user to select the desired attribute names and periods for a specific monitoring site. After the user selects and submits this request form, the system queries the data from the database and present the data in a graphical chart format. If user chooses to get a report of the data in a graphical chart format, there is an option for that. One button is provided on that page to get the report. All data will be presented in the form of reports so that user can get printouts. User is able to start again by choosing the "start again" button. This allows user to browse the database page.

This interface is public, therefore no userid or password is required to use it. On every page there is a help button, which takes the user to an on-line user guide.
Login for full access:
This module allows the user to update data or to do data analysis based on the retrieved data by presenting and organizing the data in different types of charts, which displays complex relationships among the data. Upon selecting this option a window asks the user to enter his username and password. If the user is not authorized to use this section then he gets an error message. Upon entering in to the system, the user has the option of both "browse the database" (as described in the previous paragraph) and "update the database". Browse the database is same as the one explained earlier. If the user chooses the "update the database" option then, he would be asked to choose the table he wants to update. The user would be able to enter new rows in the table or update any existing rows. There are some primary keys in the table that the user must enter while updating, otherwise he will get an error message. Once updating is finished, the user can start again by selecting the "start again" button. This button is available on all pages during the update process. This takes the user again to the page from where he can select the option of "browse the database" and "update the database". An on-line user guide is available on each page for help.

The following components are available at various parts of system.

On-line user guide.

This is a hypertext user guide, which contains step-by-step instructions that explains how to use the software. A user can access this manual just by selecting the help option.

There are two parts of the On-line user guide. The first part of the user guide can be viewed from the page where the system prompts the user to select the chart types. This part of the user guide explains how each type of chart can be selected and how to select and submit the chart type that the user expects. After the user submits the chart type, the second part of the user guide page can be viewed with the sample-attribute and the time-period input form. This part of the user guide explains what kinds of sample attributes can be chosen to generate a chart, and how to choose and submit this
input form. Once this input form is submitted, the sample attribute chart for a time period is displayed on the screen.

**Security:**
This feature was added to the system to provide a tool for the system administrator. It restricts the user to enter in this section in order to update the database. The system administrator may not want every user to add, delete or modify data. Therefore, only certain users are given usernames and passwords [1]. The password should be one to ten characters long and should not contain any blank spaces. When the user selects the update option, he is asked to enter his username and password. If they are correct then he is able to access the update section, otherwise an error message is displayed on the screen. In case the user has forgotten the password, there is one more option for forgotten passwords. The user needs to enter his username, so upon selecting the ok button his request would be sent to the database administrator. When the Database administrator logs in the next time, he gets the request sent by the user. The Administrator then contacts the user and provides him/her with a new username and password. Only the system administrator has the permission to enter a new user and provide a password to him.

**Data presentation.**
The system leads the user step-by-step through the chart processing. In order to better represent the environmental-information data, this system provides two chart types, line charts and vertical bar charts, to represent the data according to the need of the presentation. Both are two-dimensional charts with X and Y axes. For instance, line charts are good for showing trends in the data during a period of time, so it is reasonable to use a line chart to present a single particular environmental data type such as %hydrocarbon or temperature, etc. during a time period. The bar chart is good for illustrating relationships among items. Therefore, in this system, vertical bar charts is used to illustrate relationships among items, and is used to present a set of relative data.
**Presentation of a line chart.**

In the line chart (figure 2), the X-axis values are placed as the sample time and Y-axis as values of the sample attributes. The line in the chart is for the %hydrocarbon value for a sample with respect to time.

![Line Chart](image)

**Figure 2**
Example using a Line Chart

**Presentation of bar chart.**

In the bar chart (figure 3), the X-axis values are represented the sample time, and Y-axis values represented values of a pair of the sample attributes that are shown as two different color bars.

![Bar Chart](image)

**Figure 3**
Example using a Bar Chart
Environment

This tool is designed to run on any Java-compatible browser on the World Wide Web. The application uses ORACLE 8.0.5 relational database management system to hold the data. PL/SQL code is used to compute the results, do database operations and provide security. A Java program (applet) is used to draw the graphs. ORACLE Web-Server is used as a platform for SQL operations from the Web (PL/SQL procedures). Oracle Web Server, PL/SQL and Java installed on the Unix server running HTTP protocol is used in the back end. The ORACLE Web-Server toolkit is used as Common Gateway Interface (CGI) to generate data reports dynamically. JavaScript is used to customize Java applets. This relational database system is operated on Intel Pentium II PC's with 16MB of RAM and 1.28 GB of hard disk, and on Intel 486 DX2-66 notebook computers.