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Image Database for Fillbrandt Observatory

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IMAGE DATABASE FOR FILLBRANDT OBSERVATORY

A graduate project submitted to Dakota State University in partial fulfillment of the requirements for the degree of

Master of Science

in

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We certify that we have read this project and that, in our opinion, it is satisfactory in scope and quality as a project for the degree of Master of Science in Information Systems.

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- **Ruby and Tristan Hawks** – thank you for helping me stay sane by just being yourselves.
- **My entire family** – thank you for your support, patience, and understanding during the entire process… well most of the process anyway.

DECLARATION

I hereby certify that this project constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions or writings of another.

I declare that the project describes original work that has not previously been presented for the award of any other degree of any institution.

Signed,

Steve Hawks 5/11/06

ABSTRACT

South Dakota State University has constructed an observatory outside of Brookings, South Dakota. Users will be able to remotely access the CCD cameras mounted on the telescopes and telescope positioning hardware. Once the user has captured the image it is stored on an FTP (File Transfer Protocol) server for later download.

The main objectives pursued for this project were the development of a method to store, organize, search, and download images captured by a user. The storage of captured image information and user data was needed for later image queries. Since a variety of users could be accessing the image search process, a user-friendly interface was required. There was also the need to limit the access to only the files that user captured.

A database was determined to be the best solution with the resources available. Three tables would be contained within the database. These tables would consist of information about images (time/date of capture, who captured it, position, etc), users (first and last name, address, phone number, etc), and organizations (name, address, phone number, etc)

A MySQL database and user interface created with PHP (stands for Personal Home Page or more recently PHP Hypertext Preprocessor) server-side scripting was designed to address these issues.

Users can log into the image database through the web browser of their choosing. They can then search for image files based upon criteria they specify. Administrators have these capabilities plus others. Administrators can add data about users, images, and the organization the user belongs to. Administrators can edit and delete information in the same areas.

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INTRODUCTION

Background of the Problem

The South Dakota State University (SDSU) Physics department recently constructed the Fillbrandt Observatory about 22 miles northeast of Brookings, South Dakota. One of the main purposes of the observatory is to allow remote access to users such as K-12 teachers, college students, and others that may be interested in the cosmos. Users will be able to remotely position the two telescopes and capture digital images that they can then download. There is a picture of the Fillbrandt Observatory located on the next page that was obtained from the SDSU Fillbrandt Observatory web site.

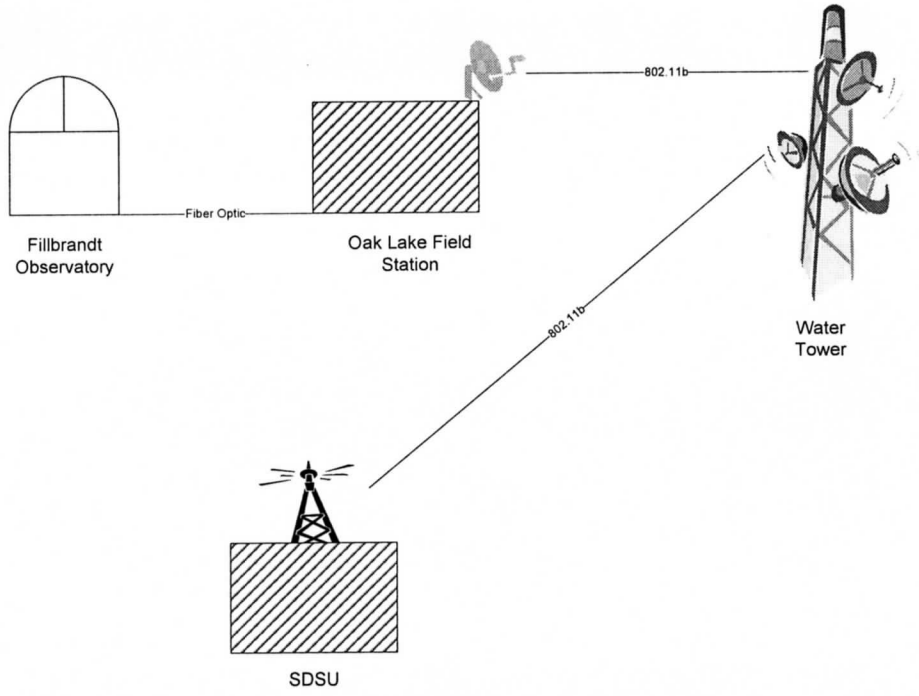

Figure 1. General connections between observatory and campus

A database is wanted to store images, image information, schedule user times for observation, and information about the user capturing the image. Image management is also desired.

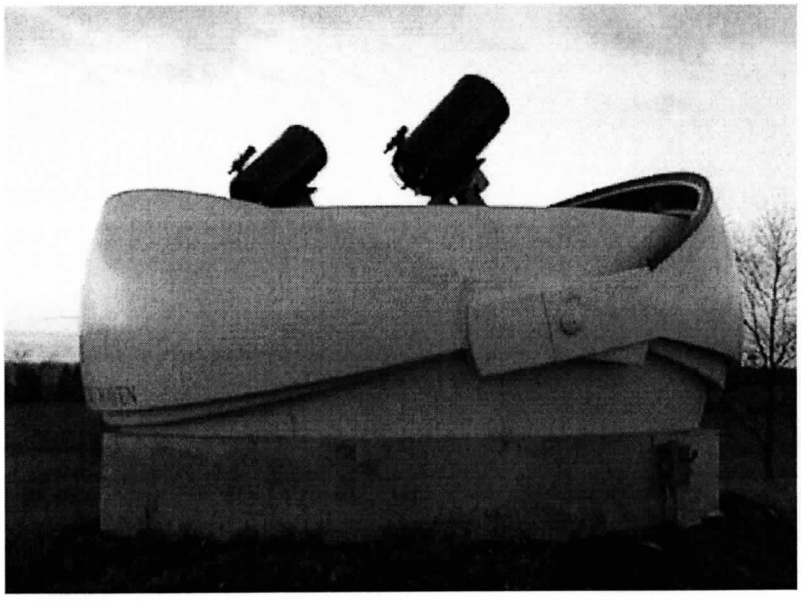

Figure 2. Fillbrandt Observatory with dome open

Statement of the problem

The SDSU Physics Department needs to store and organize images captured by the telescope-mounted digital cameras within the Fillbrandt Observatory. They want to restrict access to capture and access observatory images.

The astronomy software used to capture the images does store them in its own database; however, much of the wanted options and capabilities are not included with this database. There is also a need to interface with an existing database (currently not completed) or devise another way to upload the images for storage.

Although the observatory can be used to capture images, the remote access capabilities have not been completed. SDSU's networking services are working on the connection issue (this issue has been resolved by SDSU's University Networking Services). There are also issues with the mechanisms used to open and close the dome (SDSU Physics professor Larry Browning, Ph.D. is currently pursuing a solution). The successful completion of this project may weigh on these problems.

Objectives of the project

The primary objectives for my project include developing a method to store, organize, search, and download captured images. Storage of image and user information is needed. Since a number of people with widely different backgrounds and experience will be using the search system a user-friendly interface needs to be developed. There also needs to be a way to restrict access to the observatory system.

Secondary objectives were also defined. They include creating a process to automatically store image information and develop a method to automatically delete or transfer older image files to conserve storage resources. Since a hyper-terminal will be used to remotely open and close the dome, the development of a more user-friendly interface was discussed.

LITERATURE REVIEW

The images captured with SDSU's observatory software are saved in a FITS file format. FITS stands for Flexible Image Transport System and is the format used by most astronomers (Goldman, 2004). This is also the format that NASA and the International Astronomical Union have endorsed (The FITS Support Office at NASA/GSFC Web Site, 2005). In addition to an image, the FITS file format contains a file header. The file header allows for the storage of image specific data including but not limited to the object captured, time and date of capture, and sky position of the object (Goldman, 2004). Since both the image and detailed information about the image can be storage in the same file, the FITS file format makes it ideal for the "transport, analysis, and archival storage of scientific data sets" (The FITS Support Office at NASA/GSFC Web Site, 2005).

The FITS format has been a convenient way for professional astronomers to store data for decades. It was not until the 1990's that advanced astronomers were able to enter the FITS arena. This was brought on by the increase in popularity of CCD cameras (Goldman, 2004). Since the CCD camera operators had access to FITS software they could now view FITS files as well.

Today there are a number of FITS image views available (The FITS Support Office at NASA/GSFC Web Site, 2005). They vary from freeware downloads to software that can be purchased. Now the most novice astronomer can access the same types of data as the professionals. A FITS file viewer called IRIS was used in this project to view images and collect header data.

So with this potential for greater data access more users can gain entry to the world of astronomy. With the use of grants and other funding South Dakota State University plans to provide K-12 teachers access to this type of higher end software when the teachers complete a summer training program (SDSU Fillbrandt Observatory Web Site, 2006). There are three software packages users will need to interact with the observatory: TheSky, CCDSoft, and IAClient. TheSky allows the users to link to the telescopes and position them on the sky objects they choose. This is aided by its planetarium program to locate objects. The CCD cameras attached to the telescopes are controlled by CCDSoft. CCDSoft can be used to view and process images captured. Finally IAServer allows remote users access to telescopes and

CCD cameras around the world that are using the IAServer (Software Bisque Web Site, 2006).

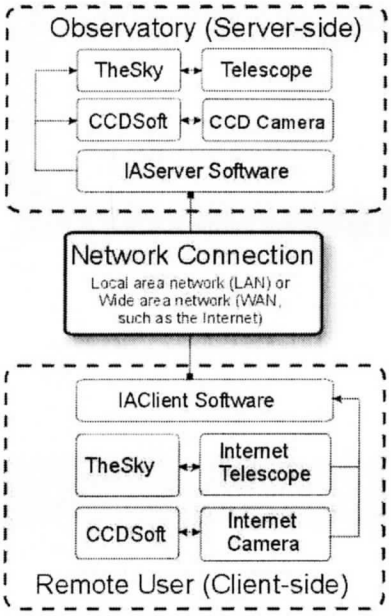

Figure 3. Interactions of Software and Hardware (Software Bisque Web Site, 2006).

No information about FITS file databases could be found at the time when this research was conducted. The Badlands Observatory in South Dakota however does use the same observatory software that is owned by SDSU (Badlands Observatory Web Site, 2005). They currently allow users to download their FITS image files as they are captured. They also use another software package that saves the images directly to a FTP server for later download. They are considering a FTP option for the FITS software as well (Badlands Observatory Web Site, 2005). No mention is made of a FITS file database.

SYSTEM DESIGN (RESEARCH METHODOLOGY)

A database appears to be the most logical solution to the image file access issue due to nature of the data and the potential that the FITS files and related data may be stored and archived in a data warehouse sometime in the future.

After evaluating the desired outcome of the project the following E-R diagram was created. It shows the relationships between the user, images, and schedule.

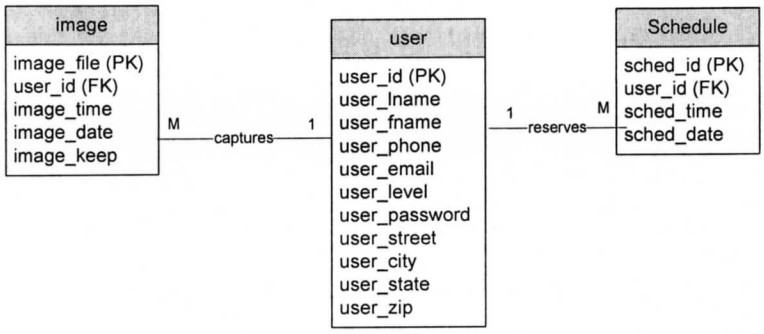

Figure 4. First E-R diagram

Upon further review of the observatory software's documentation, I discovered that the included third party observatory scheduling software interfaces with Microsoft Access. The Access database would be populated with scheduling, user name, and password information entered into the observatory software. Therefore, there was not a need to include the schedule within the image file database. This prompted the revision of the E-R diagram. The scheduling portion was removed. Organizational information was added to track which organization, school, university, or other group the individual was related. The next E-R diagram presents this revision.

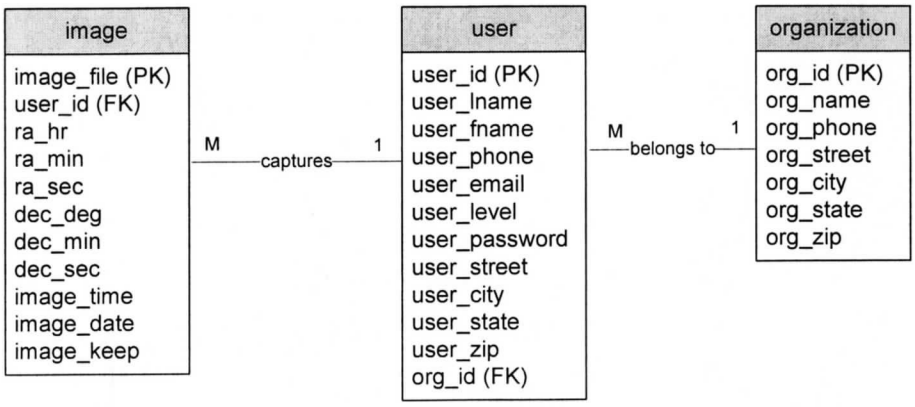

Figure 5. Final E-R diagram

Normalization was then addressed. The following dependency diagram shows that partial and transitive dependencies have been removed. Therefore the tables are in third normal form.

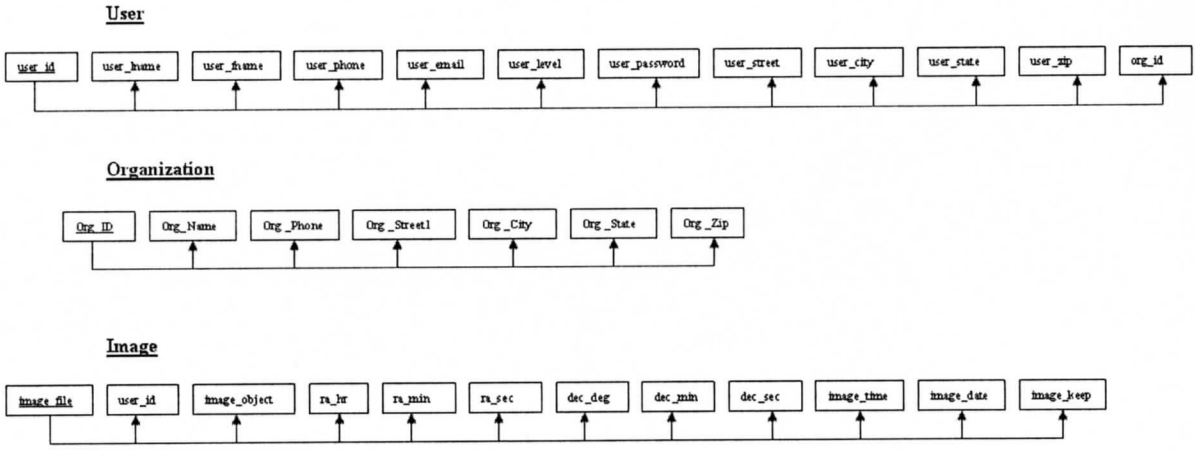

Figure 6. Dependency diagram

The next three tables show the data dictionaries for each of the database tables used for the project.

Table 1. Data Dictionary for the image table

Table Name	Attribute Name	Contents	Type	Format	Required	PK or FK	FK Referenced Table
image							
	image_file	Image file name	Char(30)	Xxxxxxxx	Y	PK	
	user_id	User ID	Char(16)	Xxxxxxxx	Y	FK	user
	image_object	Object captured	Char(40)	Xxxxxxxx	Y		
	ra_hr	Right Ascension hour	TinyInt(2)	99	Y		
	ra_min	Right Ascension min	TinyInt(2)	99	Y		
	ra_sec	Right Ascension sec	Decimal(6,4)	99.9999	Y		
	dec_deg	Declination degree	TinyInt(2)	99	Y		
	dec_min	Declination min	TinyInt(2)	99	Y		
	dec_sec	Declination sec	Decimal(6,4)	99.9999	Y		
	image_time	Time captured	Time	HH:MM:SS	Y		
	image_date	Date captured	Date	YYYY-MM-DD	Y		
	image_keep	Save image?	Char(1)	X	Y		

Table 2. Data Dictionary for the user table

Table Name	Attribute Name	Contents	Type	Format	Required	PK or FK	FK Referenced Table
user							
	user_id	User ID	Char(16)	Xxxxxxxx	Y	PK	
	user_lname	User's Last Name	Char(50)	Xxxxxxxx	Y		
	user_fname	User's First Name	Char(50)	Xxxxxxxx	Y		
	user_phone	User's phone number	Char(12)	Xxxxxxxx	Y		
	user_email	User's email address	VarChar(100)		Y		
	user_level	User's level of access	Char(5)	Xxxxx	Y		
	user_password	User's password	VarChar(40)		Y		
	user_street	User's Street address	Char(70)	Xxxxxxxx	Y		
	user_city	User's City	Char(30)	Xxxxxxxx	Y		
	user_state	User's State	Char(2)	Xx	Y		
	user_zip	User's Zip code	Char(5)	Xxxxx	Y		
	org_id	Organization ID	Char(16)	Xxxxxxxx	Y	FK	organization

Table 3. Data Dictionary for the organization table

Table Name	Attribute Name	Contents	Type	Format	Required	PK or FK	FK Referenced Table
organization							
	org_id	Organization ID	Char(16)	Xxxxxxxx	Y	PK	
	org_name	Organization's Name	Char(50)	Xxxxxxxx	Y		
	org_phone	Organization's Phone Number	Char(12)	Xxxxxxxx	Y		
	org_street	Organization's Street Address	Char(70)	Xxxxxxxx	Y		
	org_city	Organization's City	Char(30)	Xxxxxxxx	Y		
	org_state	Organization's State	Char(2)	Xx	Y		
	org_zip	Organization's Zip Code	Char(5)	Xxxxxx	Y		

The software manual (Software Bisque, 2005) also discusses what can happen to the FITS files after they are captured. The files can be automatically downloaded to the user's computer or they can be transferred to a FTP server for a later download. In order to allow the observatory user the ability to immediately proceed to capturing their next image especially in the case of slow download speeds on the user's end and the ability to search FITS files, the captured images will be stored on a FTP server. Once information from the FITS file headers are entered into the image search database users will be able to access the FITS files on FTP server by accessing the database.

After attending a SDSU College of Engineering kick off meeting in the Fall of 2005, it was discovered that Administrative and Research Computing (ARC) Resources and Services on campus manages a four processor RS/6000 UNIX (AIX) system on behalf of the College of Engineering (called COERS6000). This resource can be used for research and other appropriate applications. Since the Fillbrandt Observatory is research based, the image database would qualify to use part of these resources.

On the COERS6000 and other resources on campus the ARC group maintains access to MySQL, PHP (stands for Personal Home Page or PHP Hypertext Preprocessor more recently), FTP (File Transfer Protocol) servers, and other applications. There is no charge for the access to the COERS6000 resources or their services. Since this option carried no charge, existing campus assets could be used, and these resources would be maintained by a campus group that possesses technological background with the necessary hardware and software, the COERS6000 system was selected for the image search database.

The current versions of software being used on the COERS6000 system are Apache HTTP Server version 1.3.28, PHP version 5.0.4, and MySQL version 4.1.12 (Improved Library not enabled). The FITS file header data would be stored on the MySQL database and the users would have access to this information through browser interfaces powered by PHP scripting. Since PHP is a server-side package the user's preference in web browser would not impact the functionality of the image search pages.

CASE STUDY (RESULTS AND DISCUSSION)

The image database has been implemented on a testing area on the resource provided by ARC. The MySQL database has been setup and PHP scripts are working in this area. The links can be accessed from off campus locations. All scripts appear to be working as expected except for the actual downloading of the FITS images from the FTP server. PHP scripts are currently unable to connect to the FTP server. The reason for this is that the FTP functionality in PHP is not enabled to provide a more secure campus resource. One option being explored is to directly download the images from the observatory to the campus FTP server. From here the images would be transferred to another more secure location such as a secure http site. The user could still use the current downloading interface since the accessing of the secure site would be transparent. At the time this paper was created there was not an implemented solution.

The PHP code for presenting the web pages of the project were designed in a way for relative easy editing. Administrators only need to alter a few PHP functions to change the way the entire web site is presented. By changing HTML settings within the do_html_header() and do_menu_header() functions located in the output_fns.php file, administrators can add images as backgrounds and edit the style, font and color of text. The function table_style() allows administrators the option to change the way all tables are presented. Through the same process they can change host names, file locations, etc. in a few functions instead of multiple PHP scripts.

Both standard users and administrators log in using the PHP script called login.php. Here is the code.

```
<?php
// Load functions
require_once('astro_fns.php');
do_html_header('SDSU Fillbrandt Observatory', 'SDSU Fillbrandt Observatory Login Page');
display_login_form();
do_html_footer();
?>
```

As can be seen here none of the HTML code is visible. Almost all of the display information for this project is contained in the output_fns.php file. The above HTML code is activated by the functions: do_html_header, display_login_form, and do_html_footer. These add an HTML title and header, a login form, and end the page, respectively. The page created with this code can be seen in the next figure.

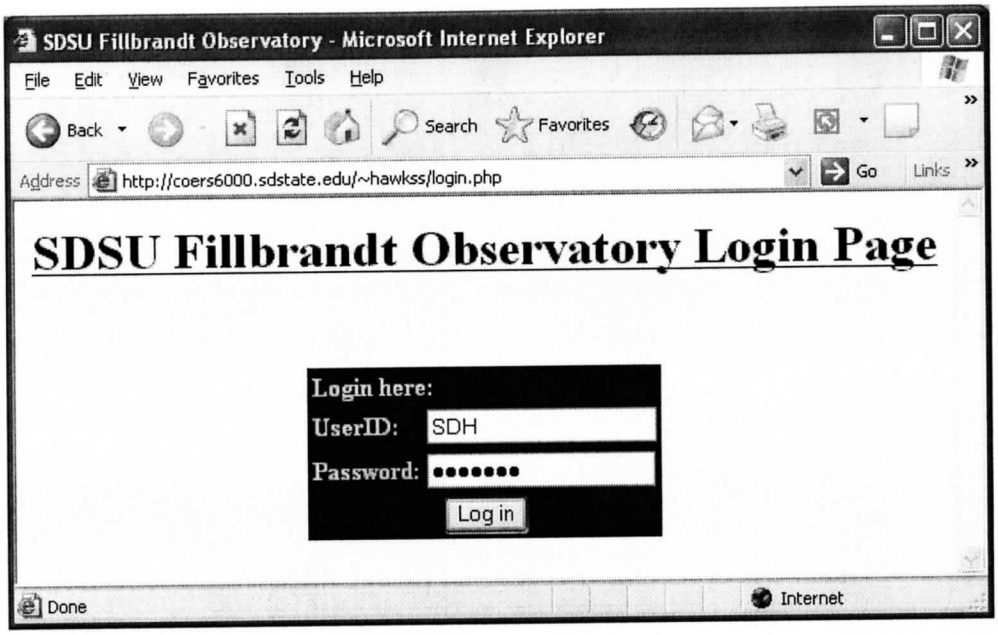

Figure 7. Fillbrandt Observatory Login Page

When the user logs in the main page (main.php file) will determine what to present next. A standard user page will be shown an image search page with a variety of querying options, the User ID of the logged in user, and an option to log out.

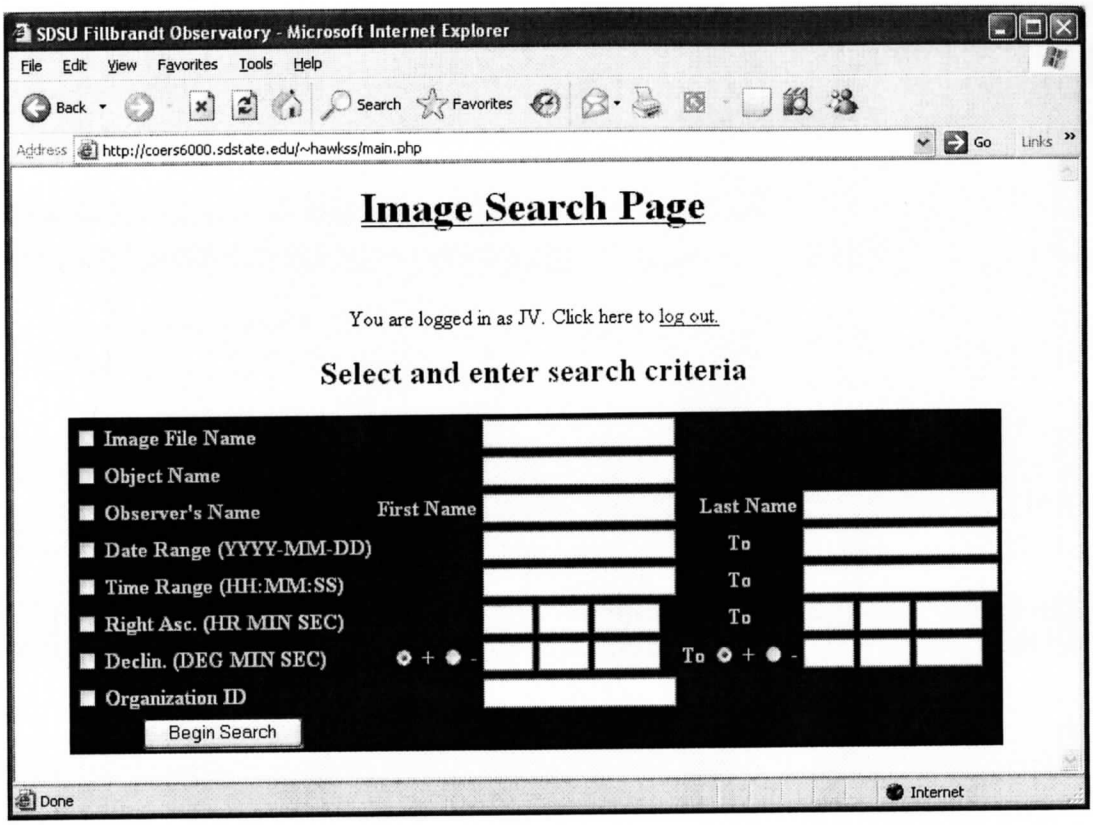

Figure 8. Standard User Main Page.

During the login process, the user's ID and encrypted password (SHA1) are compared to current values in the database. If there is an exact match the page above is shown and session variables containing the user ID (for page to page validation) and user type (for determining access privileges) are created. If there is not a match they will be notified and will need to retry the login process. They would receive a similar message if they try to access other site pages without first enter a correct user ID and password on the login page.

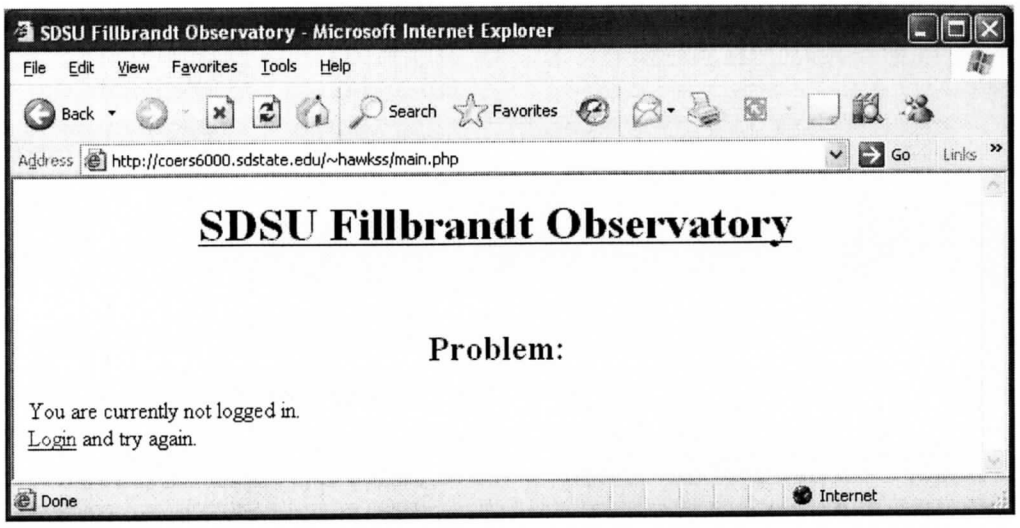

Figure 9. Displayed when login failed.

The user type mentioned earlier is either an administrator or standard user. Administrators have more access privileges than the standard users and will be discussed in more detail later. Standard users can only search for FITS files that meet their query specifications and can only download files that they have captured. They will be able to see the descriptions of FITS files captured by others that satisfy their queries without the option to download them. This can be seen in the next figure. The users can select images they wish to download by choosing the radio button in front of the desired image file name and clicking "Download". Notice the other user's files do not have radio buttons. The current user would need to contact the observatory administrator to request access to any files that are not their own.

If a user does not place a check next to any of the options on the Image Search Page, the query will retrieve all of the FITS files captured by the current user. Users can narrow their searches by selecting and entering conditions such as the name of the image file, the name of the object captured, the date and time of the capture (or a range of values), and the position of the object (right ascension and declination – can also be a range). By adding the organization ID or observer name the query can be expanded to include other users the searching individual may know.

The query string that is used to search the MySQL database becomes more complex with each option that is selected. The user's query may be simple as in the case of no

checkmarks being added. As stated above this query would only search for the files the current user has captured. Here is the code for such a query:

```
$full_query="select * from image where image.user_id = '$user_id'";
```

This query finds all tuples that meet the criteria of having the same user ID as the current user. This information is then stored in the $full_query variable. If one or more checks are present the code looks similar to the following code:

```
if ($full_query == 'not set')
 $full_query="select * from image where image.image_file = '$file_name'";
else
 $full_query = $full_query." and image.image_file = '$file_name'";
```

Here the script checks if the $full_query variable still has the 'not set' value it was assigned earlier. If it does the script will save a new query string to the variable. In the case where $full_query has already been assigned a query value, the script concatenates the additional query to the existing query contained in the variable.

Once a user has completed the tasks they wished to achieve they can log out of the system by clicking on the "log out" link on any page. Once this is done the Log Out Page appears and the PHP session variables are unset and destroyed. The same process takes place when an administrator logs out of the system.

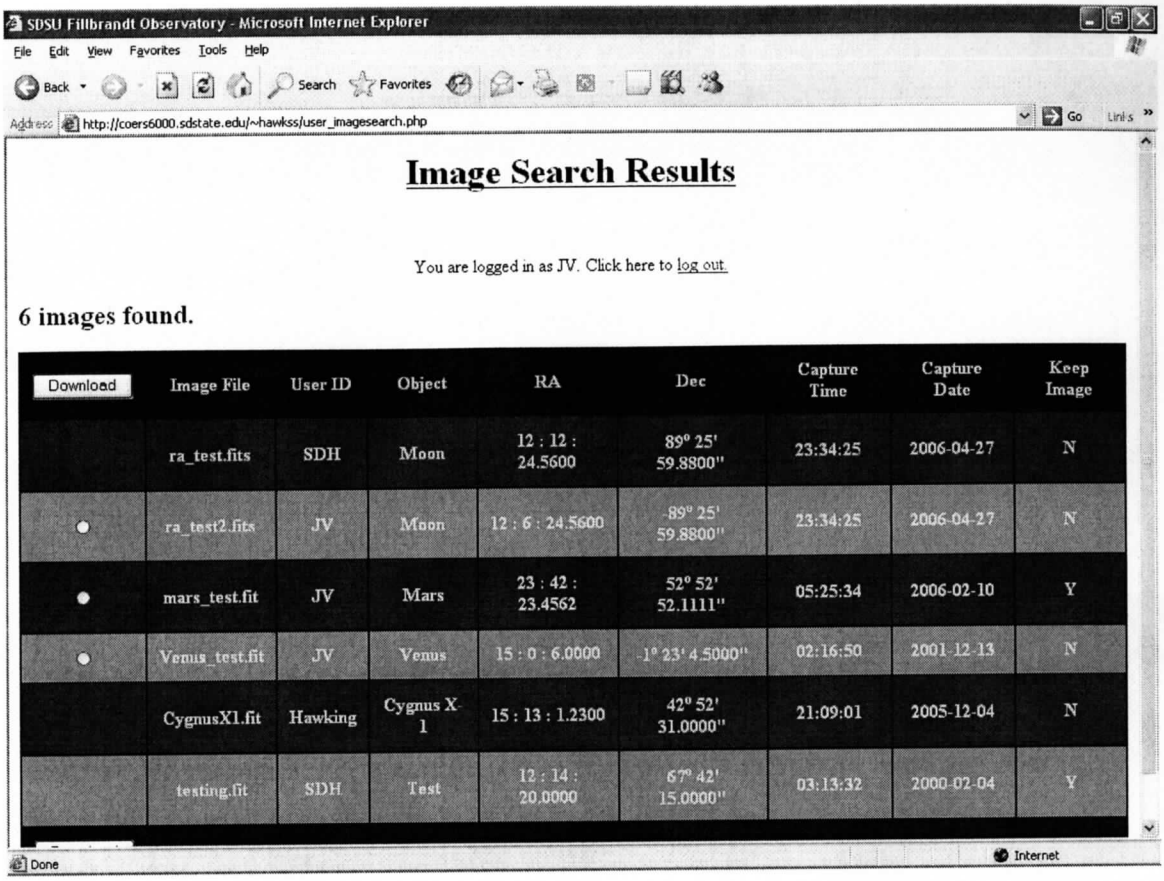

Figure 10. Results from an Image Query

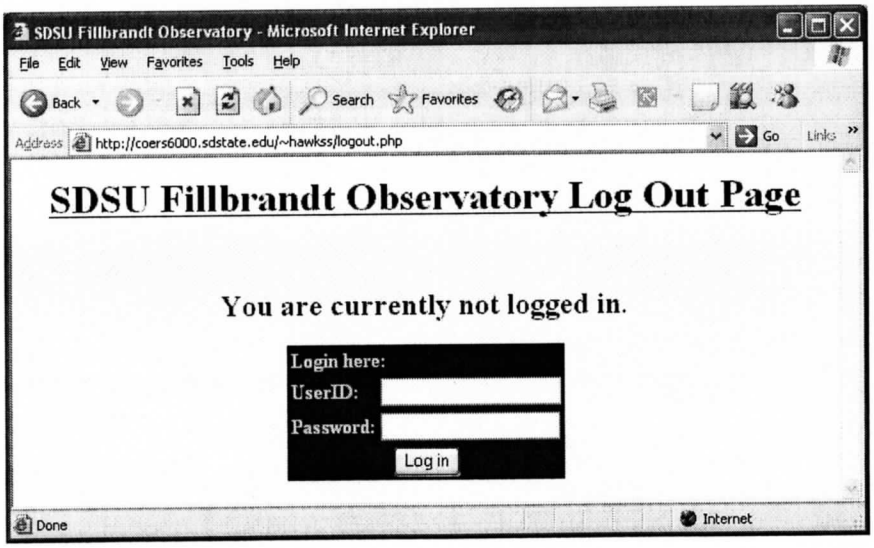

Figure 11. Log Out Page.

When an administrator logs in the main.php file behaves differently. The script still verifies the user ID and password, checks their user type, and creates the same session variables. Once it has determined the user is an administrator, a menu and options are displayed. This administrator menu is available on all administrator pages. The administrator can select to add, edit, or delete images, users, or organizations from this menu. Once they have made their choice they need to click on the "submit" button. If "Edit" or "Delete" are selected they will have an option to download FITS files later.

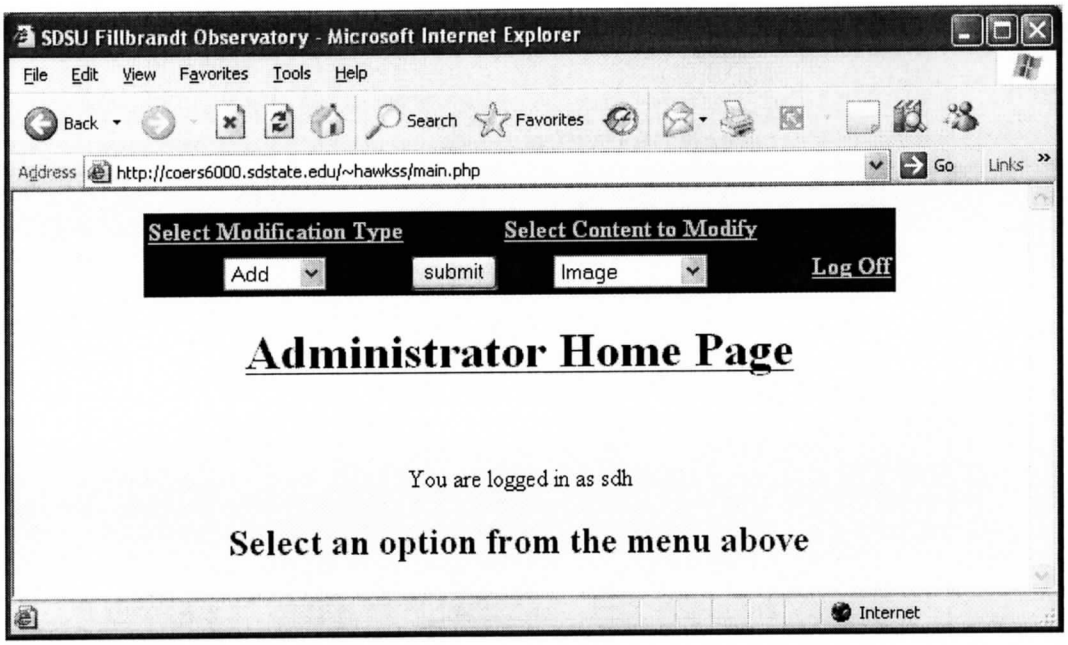

Figure 12. Initial Administrator Main Page

If the administrator needed to add a new user they would select "Add" and "User" from the drop-down menus followed by using the "submit" button. The following page with the add user information form would appear. The administrator would need to make sure all fields are filled before continuing. If not, they will be informed that the fields are blank. If the specified Organization ID does not exist they will also receive an error with an optional link to the "Add Organization" page. If no problems occur the administrator is notified the user has been added to the database. A similar process is used to add images or organizations.

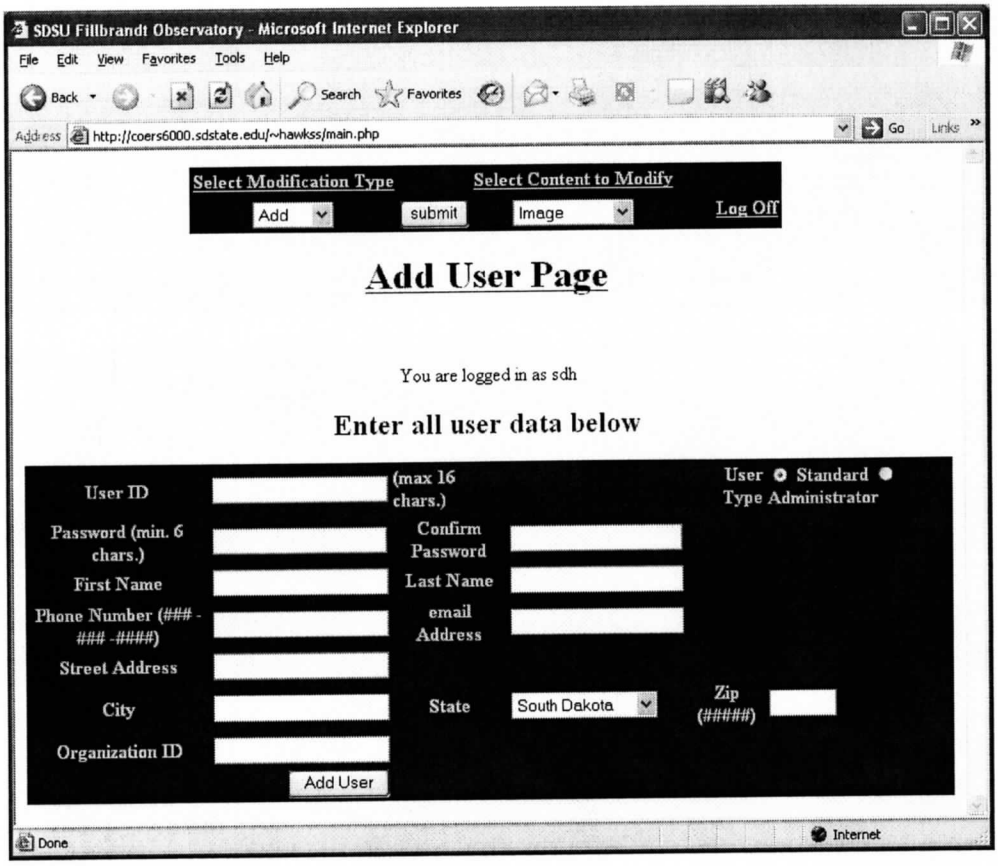

Figure 13. Add User Page.

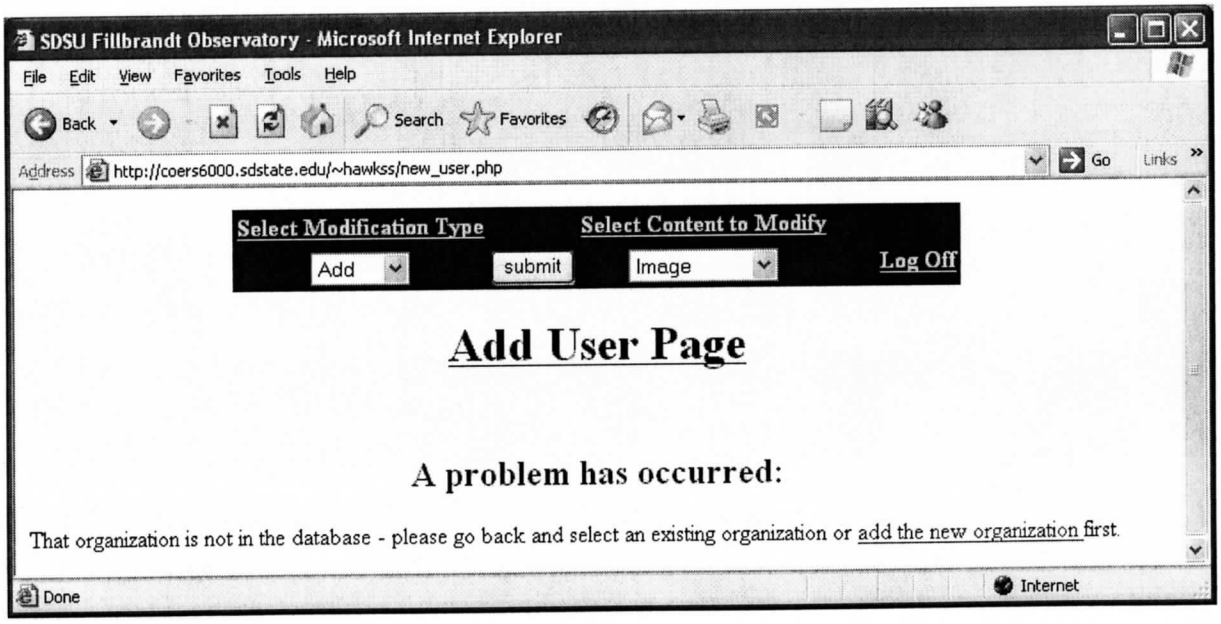

Figure 14 Appears if Entered Organization is not in the Database.

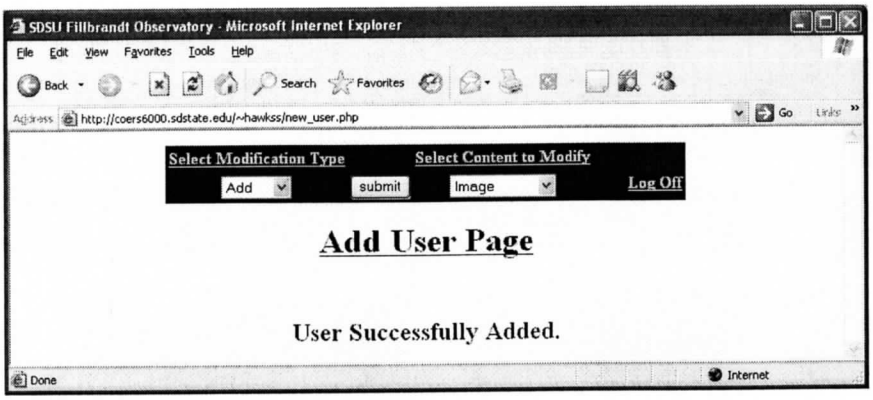

Figure 15. Appears When User is Successfully Added

Administrators can also edit the information contained within the database. If they were to select "Edit" and "Image" the following page would appear.

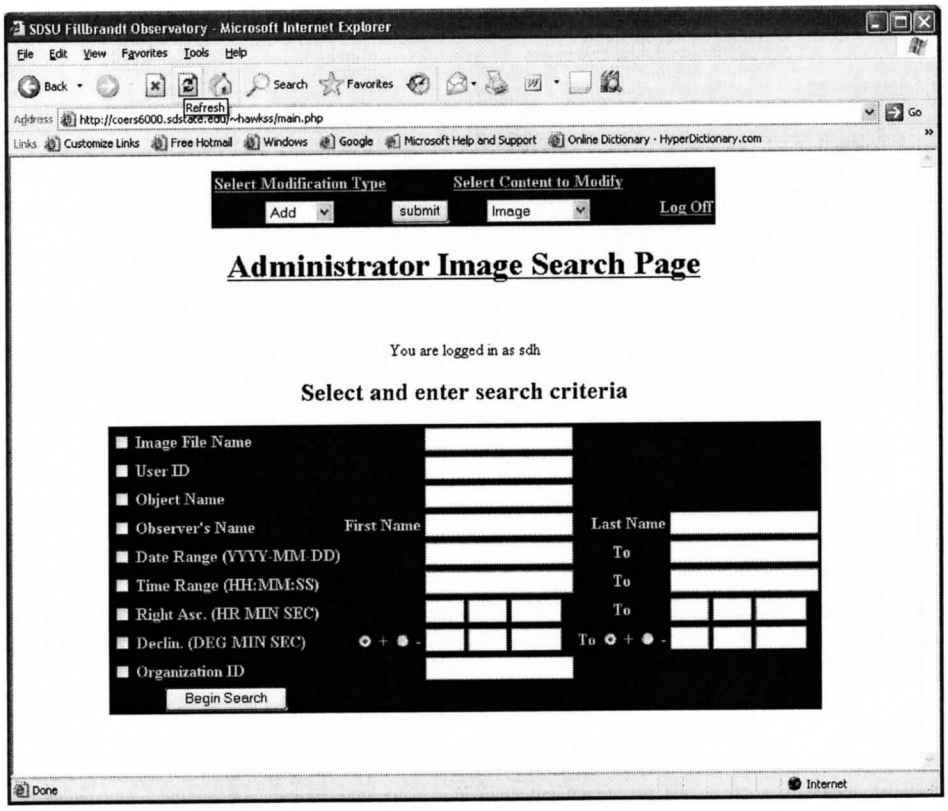

Figure 16. Image Edit/Delete Search Page

From here they can narrow their search by filling in the necessary selections. If none of the image search fields are filled, the image data for all files will be shown. The same page could have been reached by doing the same search with the delete image option.

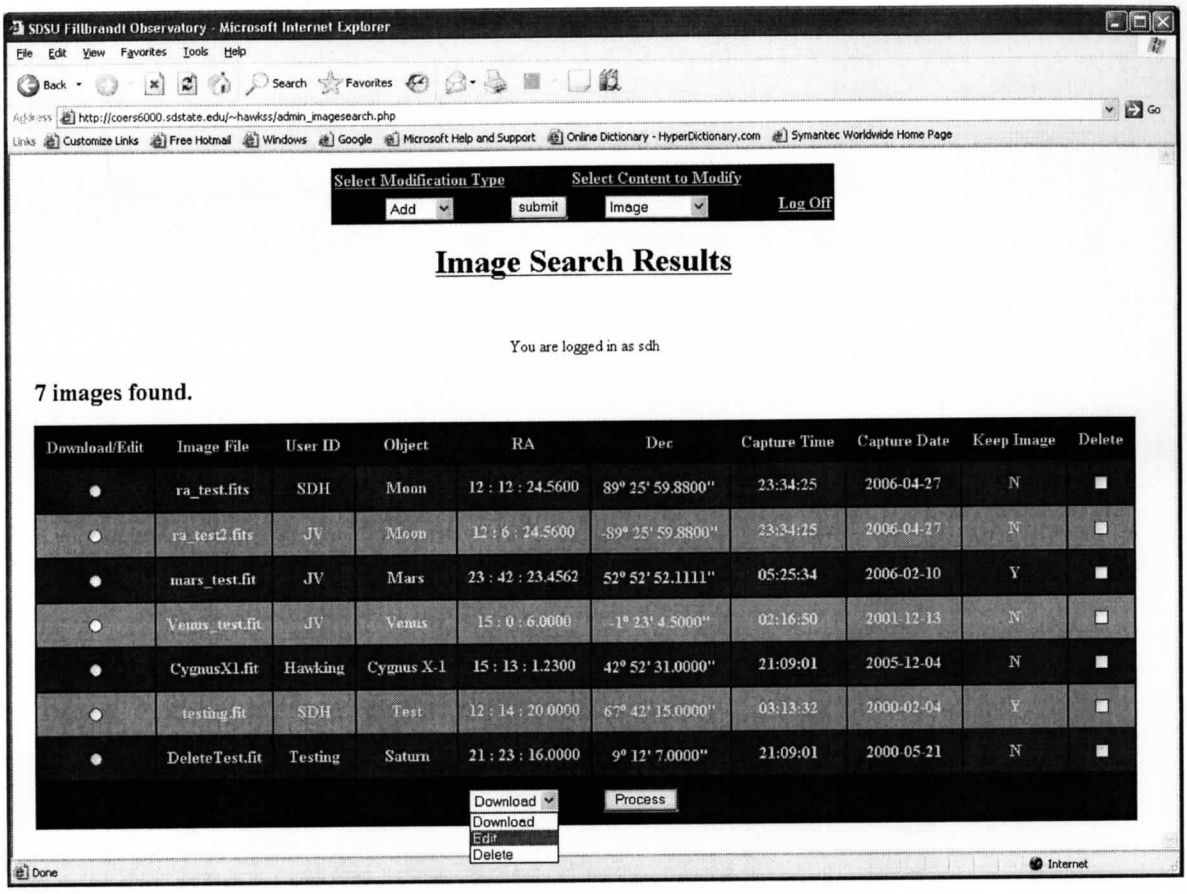

Figure 17. Image Results with No Selections Made

From the Image Search Results page the administrator has the options to download, edit, or delete the files displayed. They can download and edit one file at a time by using the radio buttons in the "Download/Edit" column or delete multiple files by placing checks in the "Delete" column. If the download option is selected the FITS file would be downloaded to the user's computer. Otherwise an error message would appear.

For the edit track the administrator would select the file to edit, select "Edit" from the drop-down menu, and click on "Process". The administrator would then be presented with a form containing the current data for the image. Once the changes were made they would only

need to click on the "Edit Image" button to make the changes to the database. Once again a similar process is available for editing the content of the other tables.

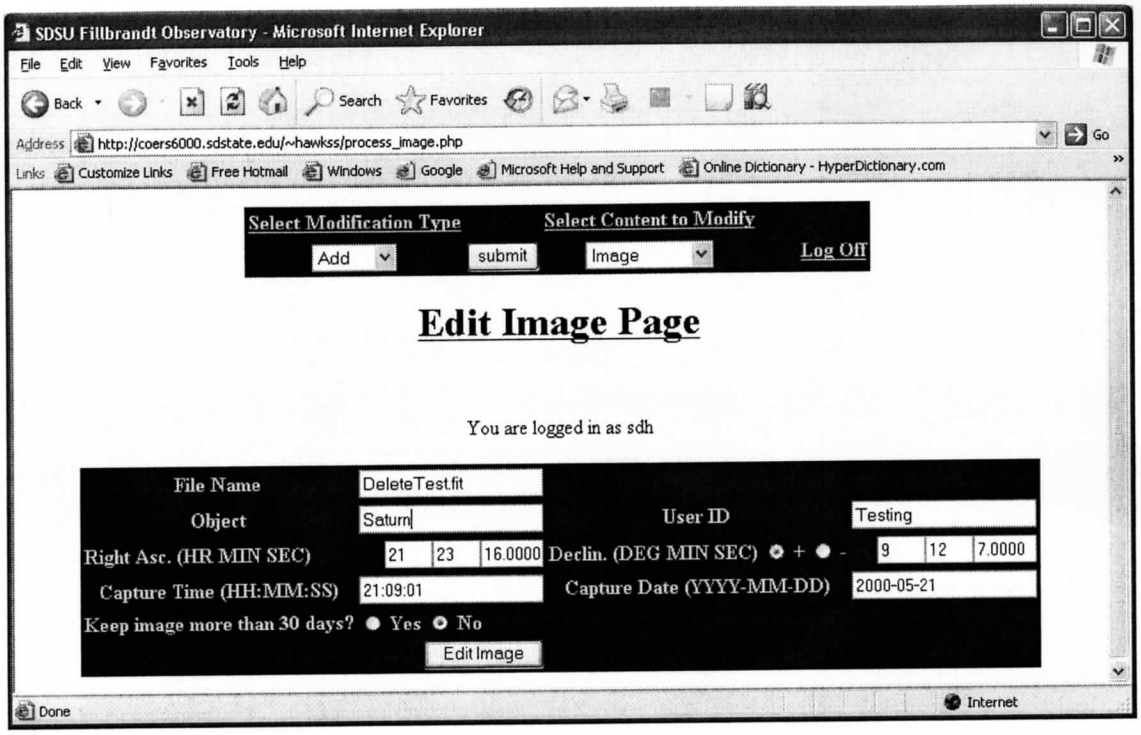

Figure 18. Edit Fields Populated with Current Data

Any of the field values can be changed except for image's file name. This is done to reduce the risk of redundant information with different file names. This also avoids the need to change the name of the stored FITS file. The primary keys of the user (user_id) and organization (org_id) tables are also read-only on the edit page.

When the administrator wishes to delete files they would need to place "Delete" checks next to all of the files they wish to delete. They would receive confirmation for each of the files deleted. As things currently stand, only the values on the image table are deleted. The FITS files will be deleted once the access issue mentioned earlier is resolved. This does not impact the deletion of entries on the user or organization tables.

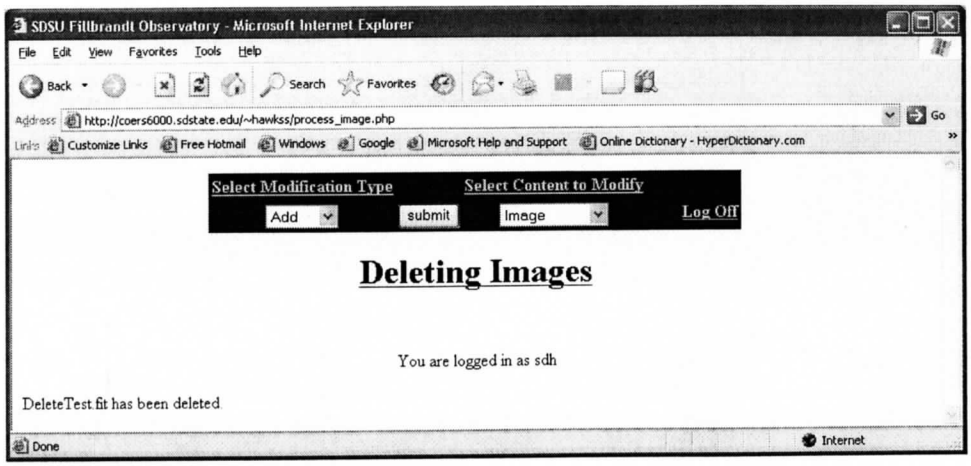

Figure 19. Confirmation FITS Image File was Deleted

If an administrator tries to delete a user that currently has images on the database, the deletion process will not complete. There would be a notice that all of the user's images should be deleted first. This is done to stop the presence of orphaned image data (user_id is the foreign key for the image table). A similar precautionary device is in place during the deletion of organizations from the database. The administrator cannot delete an organization if there are users belonging to it in the database.

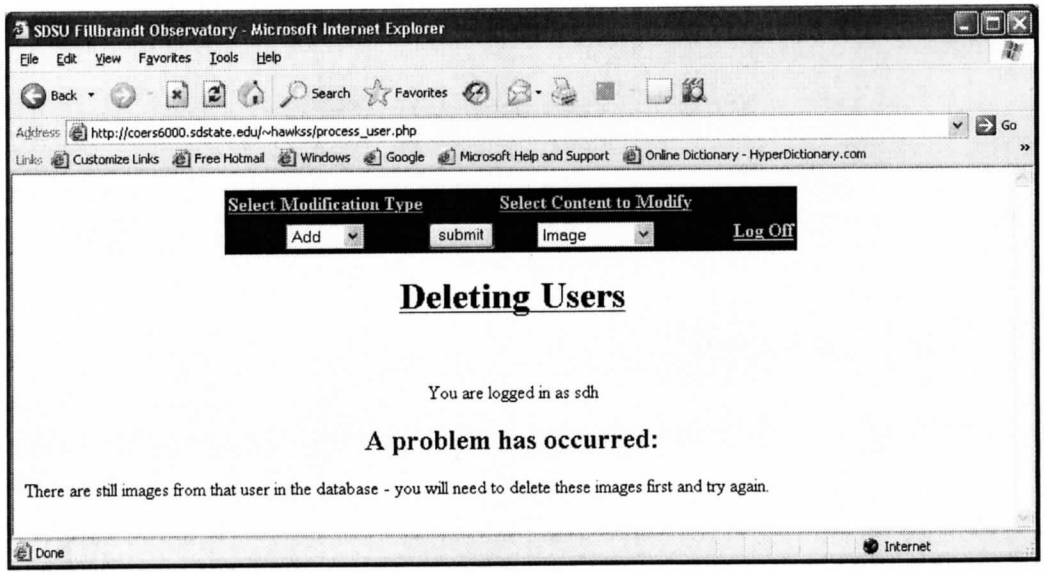

Figure 20. Unable to Delete Users that Still Have Images.

When the administrator has completed their tasks, they can log off by clicking the "Log Off" link on the administrator menu. Once again as the log out script is processed the session variables are unset and destroyed, confirmation of logging off is confirmed, and the user is presented with the option to log back on to the system.

Currently there is not an automatic method to add FITS image file data to the database. The main issue here is the variation in the format of FITS header data from one system to the next. Since the observatory is not fully functional yet there was not an easy way to test the FITS files that the Fillbrandt Observatory will be creating.

At this time the data must be manually entered. This would be done by accessing a captured FITS file, observing its header information with a program such as IRIS, and adding the image data through the PHP administrator interface. It is not the most ideal situation. It can get the system operational with the option of finding or developing a better method in the future.

CONCLUSIONS

Objectives of the project

The main objectives were mostly satisfied. Information about images and people can be stored on the developed database. People can access the image search system through a user-friendly interface. The PHP developed interface can be accessed through a web browser such as Microsoft's Internet Explorer or Mozilla's Firefox.

Access to the observatory system is restricted. Users must log in with a user ID and password in order to capture images (part of observatory's software) or to search captured images (developed during this project).

Once a FITS file is captured it is transmitted to a FTP server. From here the administrators can organize the images by entering data about each image into the MySQL database. The image search page allows users to search for images based on their specified criteria. Administrators can login and for search images, users and organizations to edit and delete.

Downloading the FITS files is currently an issue. Due to security concerns on campus the FTP is not enabled within PHP. Another option is being explored and the issue should be resolved soon. This option would still allow the direct download of the FITS files from the observatory to a FTP server. From here the files would be transferred to a location with more secure access. The user could then download the files from here. This process would be transparent to the user.

The secondary objectives mentioned earlier were not pursued due to scope and time constraints. These include the automatic updating of the image information in the database when a new image is captured, the automatic deletion or transferal of images to a new location, and the more user-friendly method to open and close the dome.

Lessons learned

Designing a smaller database (only three tables) can be fairly straight forward with the proper education and/or background with databases. The time consuming part for this project

was learning how to code the interface between the user and the database. A stronger background in the selected software (be it server-side scripting language or DBMS) can be of great use. The time needed to train and become familiar with the software (and in some cases hardware) must be seriously contemplated during the early stages of the design process. This may be the determining factor in deciding to resolve the issue in-house or outsourcing the project. Due to the scale of this project, the in-house option still appears to have been the best option.

Potential projects for the future

There are a number of possible future endeavors for other graduate students or individuals with the necessary backgrounds. These opportunities may be worth pursuing to improve and streamline the currently implemented system. Many of these are related to the secondary objectives discussed earlier. At this point the most desirable option to explore would be automatic FITS header data extraction and importing this information into the designed database. There could be a trigger or another mechanism to initialize this process once a new image is saved to the FTP server.

A data warehouse may be of use to archive "older" FITS files and header information. Even today decades old images are being studied to find useful information. Also if a data warehouse was in place the administrator could have an option to delete or archive the files off the main database after a certain point of time. As time progresses and the observatory becomes fully operational, more opportunities will undoubtedly present themselves.

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APPENDICES

APPENDIX A: USERS' MANUAL

User's Manual for
Fillbrandt Observatory Online FITS File and Database Search Engine

Standard User Instructions

Step #1 – Open the Fillbrandt Observatory's Image Search. The following window will appear:

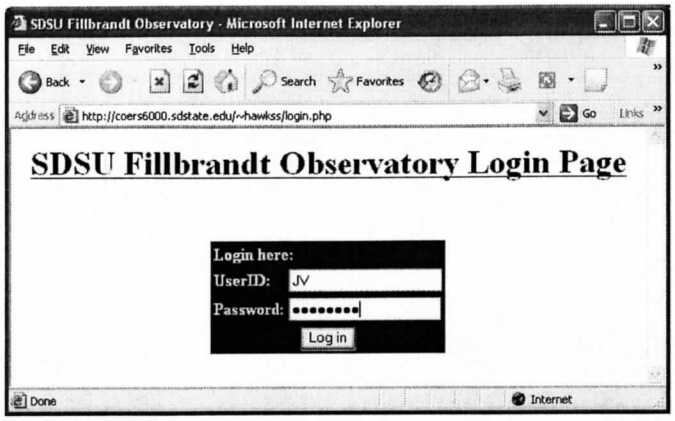

Figure 1. SDSU Fillbrandt Observatory Login Page.

Step #2 - To log in, you will need to enter your user ID and password. This information is supplied by the observatory administrator.

Step #3 - Click the "Log in" button. The Image Search Page will appear. Otherwise you will be notified that the user ID and/or password are incorrect (go back and try again in this case). This page informs you what user ID you are currently using and has the option to log out.

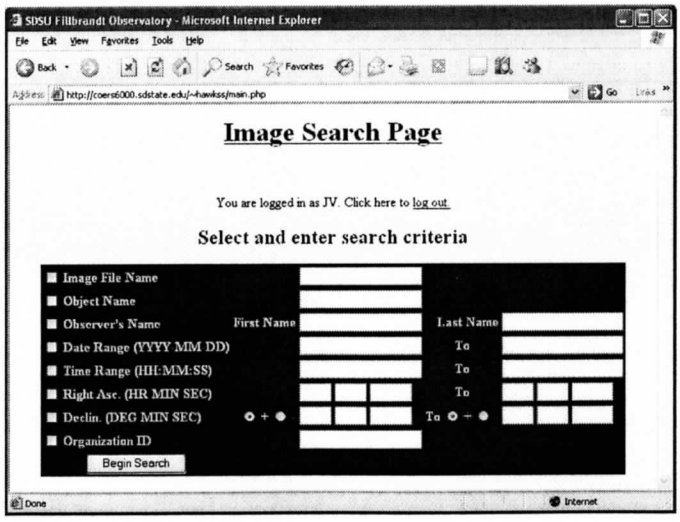

Figure 2. Image Search Page.

Step #4 - The Image Search Page (Figure 2) presents a number of search criteria that you can select. By placing check marks in front of search criteria and filling in the related field you can receive a more refined search. You can include other users in your search by selecting "Observer's Name" (need to type in both first and last names) or "Organization ID". You will not, however, be able to download any images captured by other users. If you wish to gain access to images contained in your search results that were not captured by you, you will need to contact the observatory administrator to find out if this is possible.

If no options are checked when the "Download" button is clicked, the results page will only display the images that you have captured.

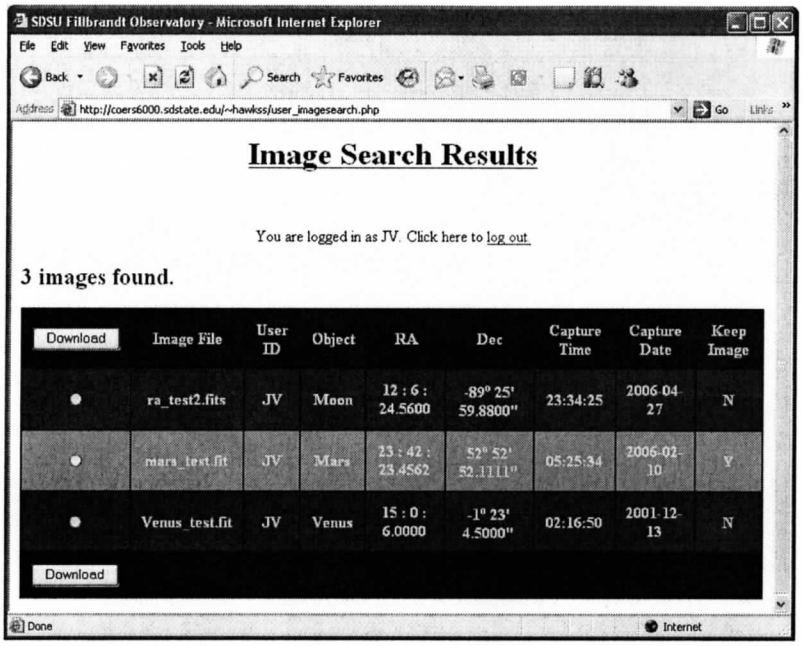

Figure 3. Results when no search options are selected.

As an example the number of results in Figure 3 could be decreased by providing a Capture Date range of 2006-01-01 to 2006-05-15.

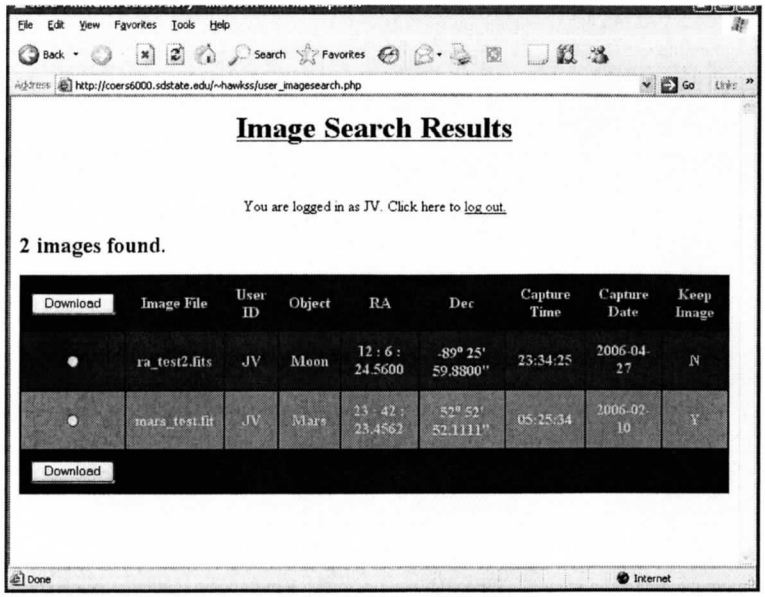

Figure 4. Refined search results.

Step #5 - You can then select the image you wish to download by clicking the dot next to the desired file and then clicking on the "Download" button. You can start another search by clicking on the new search link.

Step #6 - Once you have completed all downloads you desire, you may log out by clicking on the "log out" link next to your user ID. You can then log in again using the same user information or log in as a different user if you have more than user ID.

Figure 5. Screen that appears once logged out.

Administrator User Instructions

An administrator logs in using the same login page as any other user. If you have been assigned administrator rights you have access to administrative capabilities. Here is what is seen when you first login.

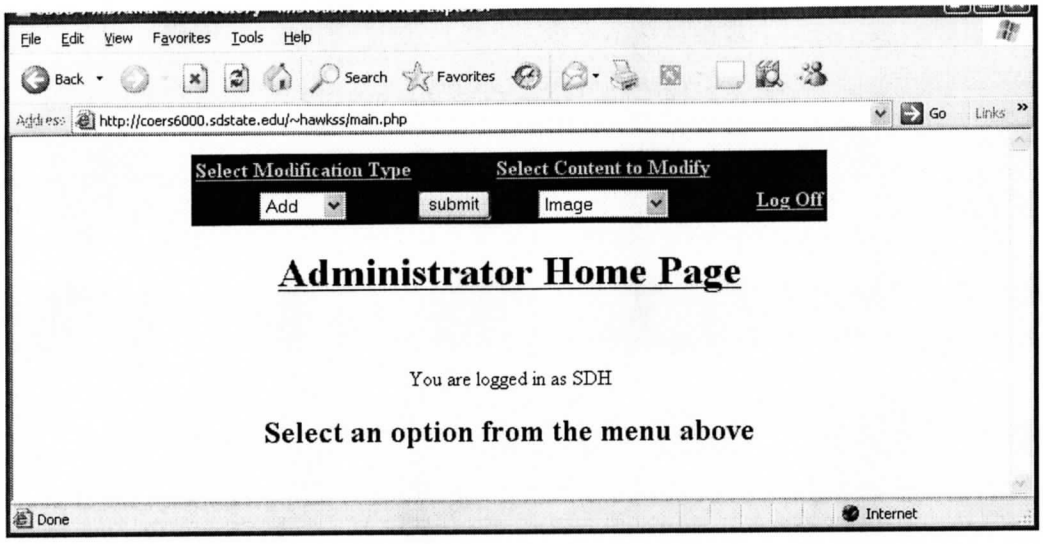

Figure 6. Main Page for Administrators.

From the menu at the top of the page, you can make selections such as adding, editing, and deleting image, user, and organization data. If you select "Edit" or "Delete" images they will also have the option to download images.

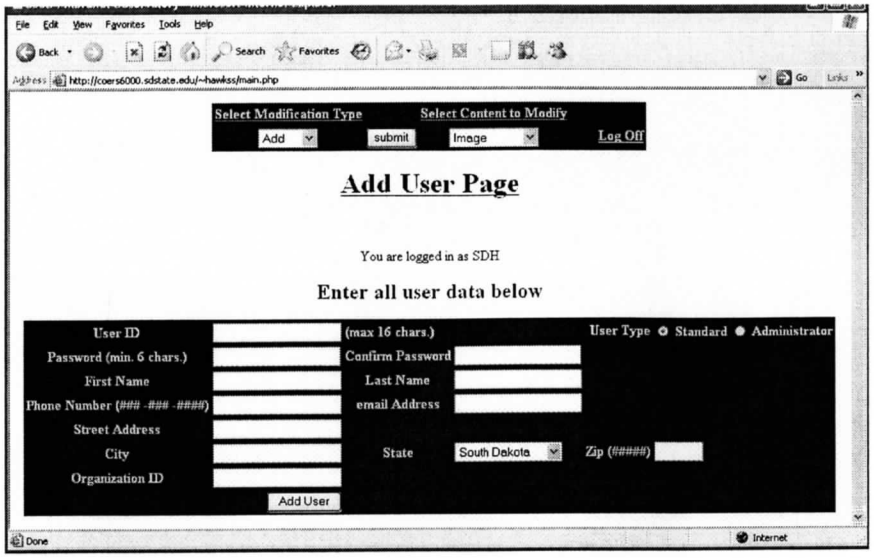

Figure 7. Admins can add image and organization data on similar pages.

When you add or edit information for the database you must make certain all fields are filled with the correct information. You will be notified if this is not the case. Once the change is complete you will be informed of the alteration.

Figure 8. Confirmation that an Image was Successfully Added to the Database.

Administrator search pages are similar to the normal users. The search result pages are where differences are noticed. When viewing the results of your searches you have the option to edit values of a result or delete one or more of the results. If you are searching images you will also have the option to download the image you select.

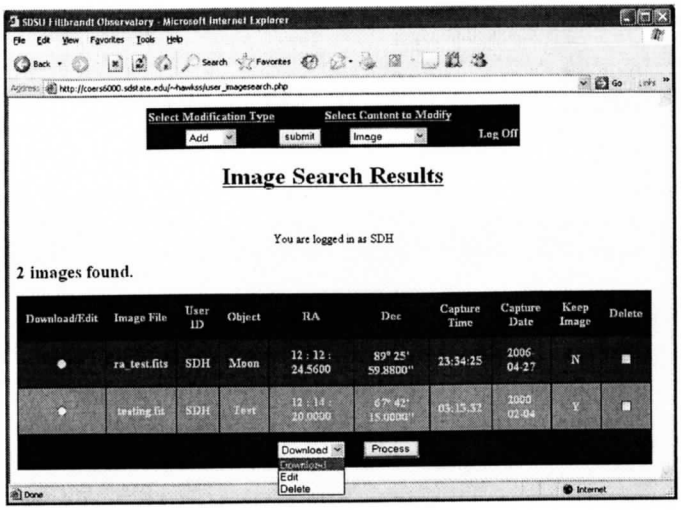

Figure 9. Admin Image Search Results.

If a check is placed in the "Delete" column, that row (or all rows that are checked) will be deleted from the database. The item will not be deleted if it is an organization and there is still a user belonging to that organization or a user and there is still an image belonging to that user. If this is on the Image Search Results page the related FITS file will be deleted, too. Confirmation of the deletion will appear upon completion.

To download an image you select the desired row from the "Download/Edit" column, choose "Download" from the drop down menu, and click on "Process" to begin the download.

You may also edit an entry by selecting the row in the first column again, choosing "Edit" from the drop down, and clicking on the "Process" button. This will load a page containing the current information for the item. The main identifier for the item cannot be changed. The rest of the information can be altered. Once the necessary changes have been made on the form, you will need to click on the "Edit" button to process the change.

The edit fields must be completely filled in order for the change to be made. The only exception to this rule is for the user password. If the password fields are left blank the user will keep the current password. If both the password and the password confirmation fields are filled and match, the password will be updated for the user.

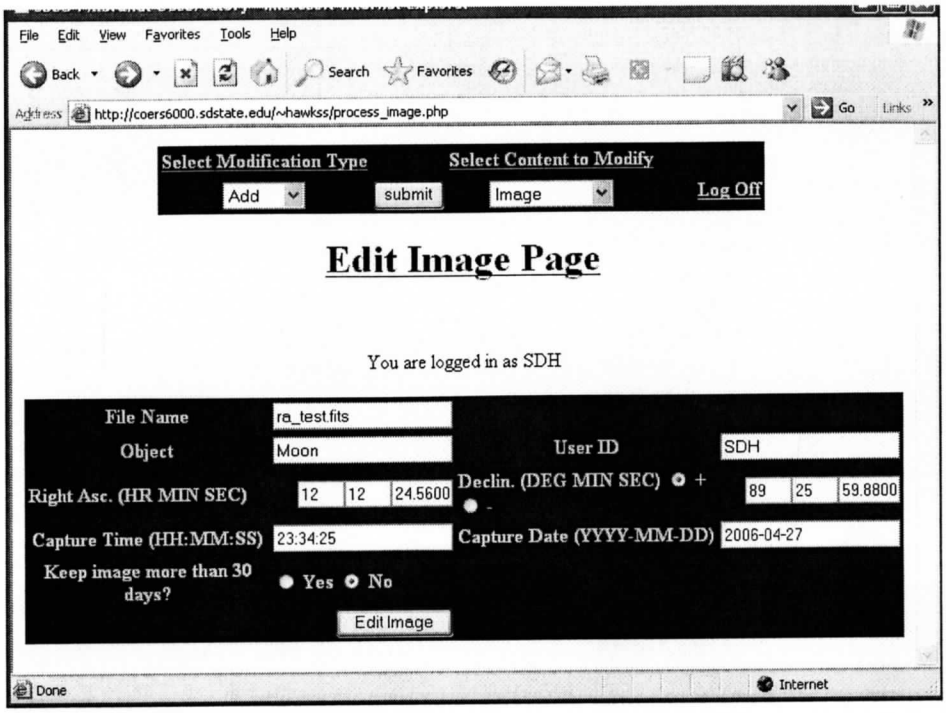

Figure 10. Edit Page for an Image.

The log out process is similar to the one for standard users. This time the "Log Off" option is located on the Administrator Menu on the top of the pages.

Advanced Administrator Instructions

If the user name or passwords for MySQL or FTP server access are changed, the updates will need to be reflected in the PHP scripts for gaining access to each. The MySQL setting will need to be changed in the db_fns.php file. FTP server alteration can be address by editing the file called ftp_fns.php. The ftp_fns.php file also contains the address for the FTP server and the location of the files.

The style of output can be changed by modifying do_html_header and do_menu_header functions in the output_fns.php file. This would include changing the background color or adding an image.

APPENDIX B: WBS AND GANTT CHART

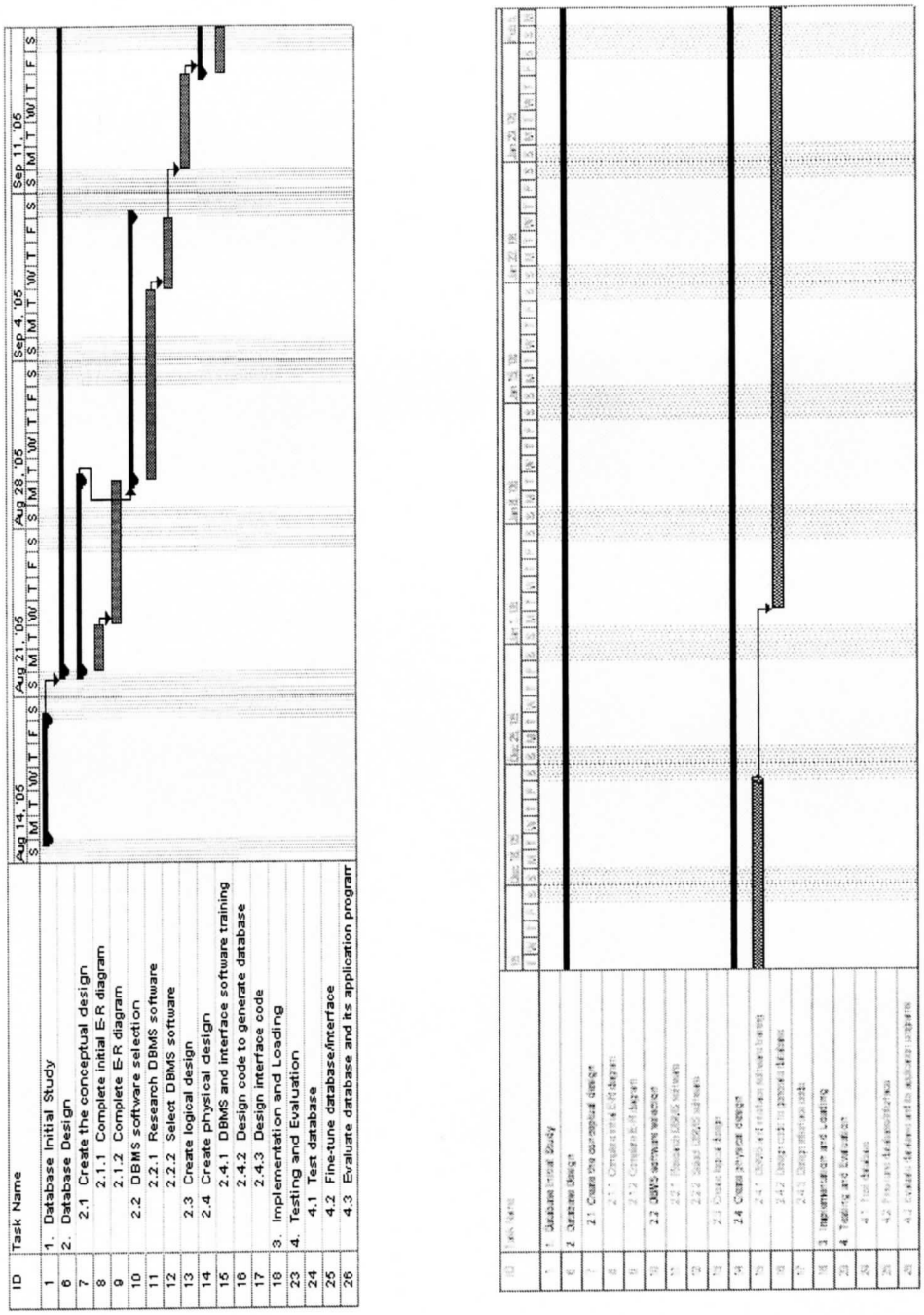

Figure 21. WBS and Gantt Chart

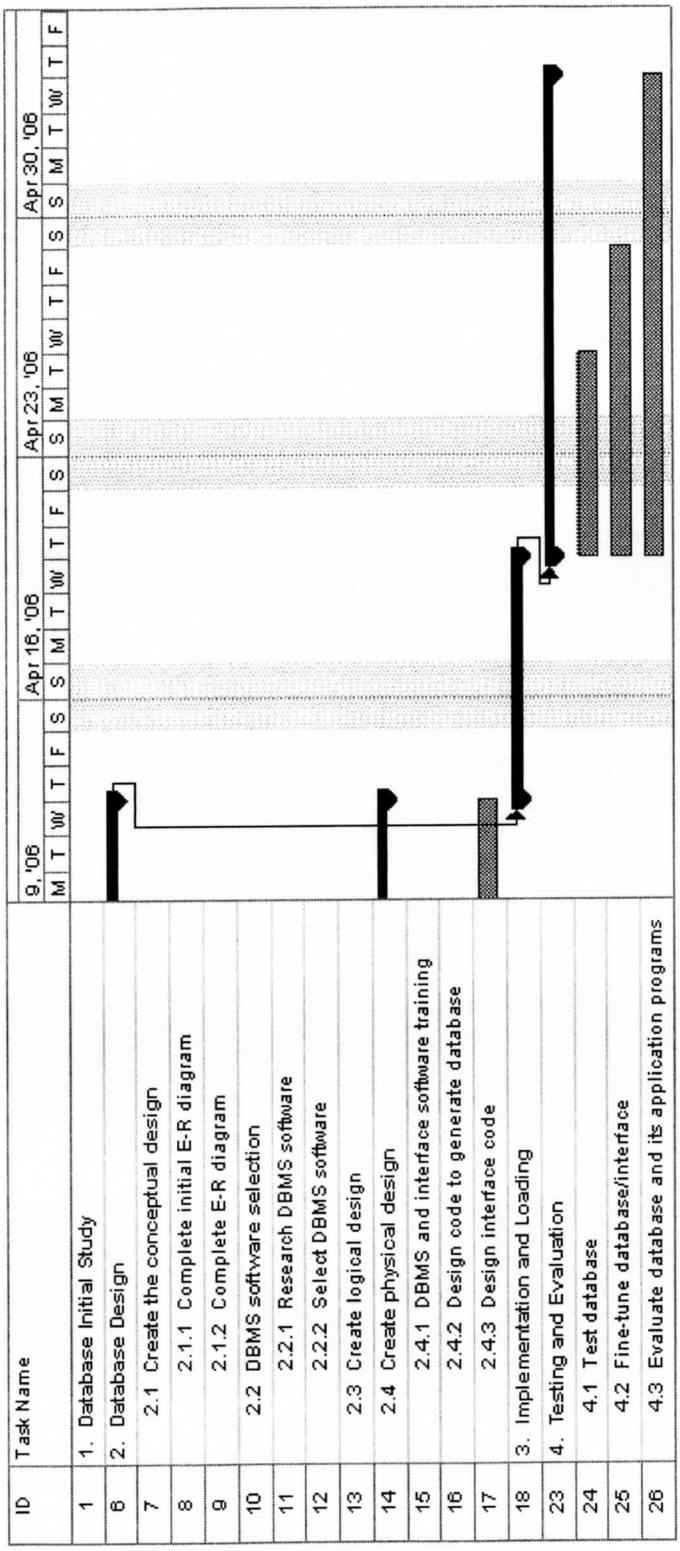

Figure 22. WBS and Gantt Chart (continued)

APPENDIX C: PROGRAM CODE

This appendix has been redacted for binding.