Shopper’s Stop: Online Shopping Website  
CIS 690 – Implementation Project

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Abstract
The objective of this project is to develop an e-commerce shopping website that provides users a medium to sell / buy the products they are interested in. Registered users are provided with options such as adding items to their shopping cart, keeping track of their orders and account history, and watching different items they are interested in.

Index Terms—buying; watching; selling (keywords)

1. Introduction
This website is primarily built to enable users search for the items they wish to buy. Users can perform two roles: buyers and sellers. Users need to register in order to perform either of the roles.

A buyer can browse through the website and look for the various items that are on sale. He can add the desired items to his shopping cart or to his wish list in order to keep track of the price of the desired item everyday. He can even edit the quantity of the item in his shopping cart. He can check the status of the placed orders and also his account details and history.

A seller can sell the item on this website. He bares the sole responsibility for any defects in the product. If there are any defects he needs to mention them in item description. If the seller needs to add a new subcategory or if he thinks that the item falls into a new category, he needs to inform the administrator through feedback. Sellers can also keep track of their selling history.

User is provided with two kinds of search: basic and advanced. If a user knows the item and the configuration he is looking for, he can go for advanced search and basic search otherwise. Users can edit their profiles.

2. Related Work

2.1 Motivation
The reason behind choosing this project was to get better understanding of the concepts in ASP.NET and enhance my knowledge in Oracle along with developing my web programming skills. Features I liked about ASP.NET are its flexibility and reusability for rapid development. We see many online shopping websites but the user is more concerned about how fast he could look into the website for a desired item. This website enables the user to search for the item of desired configuration in fairly quicker way. This project helped me in getting familiar with advanced concepts like AJAX.

2.2 Tools and Technologies used
The website is built in ASP.NET using c# language. Oracle 9i database server and IIS 5.0 web server were used. Adobe Photoshop 7.0 was used to design the logo. JavaScript was used for client side validations. Encryption technique was used to secure the confidential data. AJAX was used for the asynchronous communication of the client with the web server.

Testing of the project is done with Microsoft application test server, ANTS load test and HarnessIt.

2.3 Background
The main concepts in this project are ASP.NET, C# and Ajax. ASP.NET is the next generation of ASP. It is a part of .NET framework, which is the infrastructure for Microsoft .NET platform. The .NET framework is an environment for building, deploying and running Web applications and Web Services [1]. It is language neutral and supports C++, C#, Visual Basic and Jscript. Microsoft’s Visual Studio.NET is used as an IDE for the .NET Framework. Ajax (Asynchronous JavaScript and XML) is a web development technique for creating interactive web applications. It is meant to increase the web page’s interactivity, speed, and usability. Ajax technique uses a combination of [2]:

- XHTML (or HTML), CSS, for marking up and styling information.
- The DOM accessed with a client-side scripting language such as JavaScript and Jscript to dynamically display and interact with the information presented.
- The XMLHttpRequest object to exchange data asynchronously with the web server.
- XML is sometimes used as the format for transferring data between the server and client.
3. Intended Users

Administrator:

Administrator can add new categories and sub categories. Thereby creates new forms for those added categories, so that the sellers can sell the items belonging to those categories. He can also update the database and can send email notifications to users.

Buyer

Buyer is the one who wants to buy an item from the website. The following options are available if registered:
1. Edit Profile.
2. Add item to shopping cart / Wish List.
3. Do basic/advanced search for the desired item.
4. Check order status and account history.

Seller

Seller is the one who sells an item through the website. The following options are available if registered:
1. Edit Profile.
2. Sell an item.
3. Check account history.

All the users need to login to perform the desired actions.

Fig 1: System Architecture

The above figure shows the architecture of the application built. User sends the request to the server, and the server loads the desired webpage. Webpage then loads the user controls associated with it. All the implementation code for the webpage is written in its class file.

A separate class file (db.cs) is written for all the functions to be performed on the database. This avoids re-writing similar functions in two or more class files. Appropriate function call is invoked from the db.cs class file. Some of the function calls then invoke the oracle procedures on the database and others just perform the operations on the database. Thus the required data is retrieved and displayed on the webpage.

Fig 2: Use Case Diagram
5. Class Diagram

Fig 3: Class Diagram
6. Sequence Diagram

Fig 4: Sequence Diagram
6. Database Schema

The above figure shows the database schema used for this website. For every main category, there are sub categories. I have created tables for laptops, apparel, photography etc to keep the configuration of each sub category separately. For advanced search, user can select criteria from these sub category fields.
7. Implementation

7.1 Functionality

The home page features links to all the various features of the website.

Browse Items

User can browse through the website for items by navigating through the menu present on the left hand side of the page. Registration is not needed for browsing through the website. By selecting the main category user is redirected to the homepage of that category displaying all the popular products and giving the option to browse through the subcategories on the left hand side. User can view all the details pertaining to the item by clicking the item.

Search Items

Basic:
User can search for an item by specifying the item name and selecting the category the item belongs to. This is a basic search and user can find the desired item with a little detail.

Advanced:
Here, the user can find the desired item with a single click. He can specify all the details pertaining to the item. There are a lot of filters like manufacturer, price, popularity and all the other specific details of the item.

Login

User needs to register to access some of the features of the website such as adding item to shopping cart, checking out an item, watching an item, editing profile, tracking an order status, account history. Once registered, he can login to access all the features discussed.

If user forgets his password he can get it back by selecting forgot password feature. He needs to mention his username and password will be emailed to him.

Edit Profile

The website provides an interface for the user to edit his profile. To update his personal information, the user needs to be logged in.

View Account history

User (Seller/buyer) can track his account history. The items he has bought or sold.

View Order Status

User can track the status of his order. He will be notified if the shipment is delivered. Status of the order will let the user know in how much time he can expect the delivery of the item.

Compare Items

User can select multiple products and compare them. This will list the selected items side by side and gives a detailed comparison as to how each item is differing from the other item for every specification. To compare products, the items selected should be from the same sub category.

Sell Items

User can sell any item in this website. He needs to select the category and then the sub category the item belongs to. Then he needs to specify the configuration of the item. If the user doesn’t find any category or sub category for his item, he needs to send a feedback to the website.

Administrator login

Administrator is the one who can add new categories and sub categories. He can go through the feedback of the customers.

7.2 Flexibility

This website is browser compatible. It has got the same look and feel in all the browsers such as Internet Explorer 6.0, Mozilla Firefox, Netscape Navigator etc. The user interface (UI) is made to look similar for all the web pages. One can easily modify the UI by modifying the cascading style sheet used.

7.3 Extensibility

I have created user controls for header and left panel of the website. This can be used for all the WebPages and thus makes it easier to build a new webpage in the same format as the others by just dragging and dropping the appropriate user control.

7.4 Scalability

Administrator has the right to add new categories and subcategories. The added categories and subcategories will be reflected in the main menu, and the seller can also see the new categories and sub categories and can sell the items belonging to these new divisions.

7.5 Security

As we will be dealing with a lot of confidential data such as credit card information and user passwords, we need the website to be secure. I have implemented Luhns Algorithm for validating the credit card provided by the user. I have used ASP.NET’s encryption technique to encrypt the date before storing it into the database.
8. Cool Features

Adobe Photoshop
Logo of the website is designed using Adobe Photoshop. This brings in a feel good factor for the website.

XML
Xml is a simple, flexible text format derived from SGML (ISO 8879). Originally designed to meet the challenges of large-scale electronic publishing, XML is also playing an increasingly important role in the exchange of a wide variety of data on the Web and elsewhere [3].

In this website, the password for the provided username is retrieved in XML format. This is stored in an hidden field on the client side and is compared with the provided password thus eliminating the request.

Ajax
Once the user enters his username and password, he will be notified if the entered password is incorrect before he clicks the login button. After entering the username an asynchronous request is sent and password is retrieved, and this is then checked with the entered password thus eliminating the need to send the request to the server and load the page again.

Browser Compatibility
This website is browser compatible and has the same look and feel in Mozilla Firefox, Internet Explorer 6.0 and Netscape Navigator.

9. Testing

9.1 Microsoft Application Centre Test
Application Center Test is designed to stress test Web servers and analyzes performance and scalability problems with Web applications, including Active Server Pages (ASP) and the components they use. It simulates a large group of users by opening multiple connections to the server and rapidly sending HTTP requests. Application Center Test is compatible with all Web servers and Web applications that adhere to the HTTP protocol [4].

I have tested my laptops page that has the advanced search criteria. This is the webpage where the users can get the desired item by specifying the configuration they want and is the most visited webpage.

5 simultaneous browser connections for the duration of 3 minutes were used for this test. Results can be seen from the figure below. Total of 6032 requests were sent to the website in this duration. As we can observe from the statistics of the error count, there are no HTTP, DNS and Socket errors. Moreover even as the number of requests kept increasing, the response rate was consistent. Average requests per second is 33.5 as opposed to 52 of the homepage.

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<thead>
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<td>Test type:</td>
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<tr>
<td>Simultaneous browser connections:</td>
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<tr>
<td>Warm up time (secs):</td>
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<tr>
<td>Test duration:</td>
<td>00:00:02:00</td>
</tr>
<tr>
<td>Test iterations:</td>
<td>6,032</td>
</tr>
<tr>
<td>Detailed test results generated:</td>
<td>Yes</td>
</tr>
</tbody>
</table>

| Summary             |
|---------------------|----------|
| Total number of requests: | 6,032    |
| Total number of connections: | 6,032    |
| Average requests per second: | 33.51    |
| Average time to first byte (msec): | 141.79    |
| Average time to last byte (msec): | 142.54    |
| Average time to last byte per iteration (msec): | 142.54    |
| Number of unique requests made in test: | 1        |
| Number of unique response codes: | 1        |

| Errors Counts       |
|---------------------|----------|
| HTTP:               | 0        |
| DNS:                | 0        |
| Socket:             | 0        |

<table>
<thead>
<tr>
<th>Additional Network Statistics</th>
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<tr>
<td>Average bandwidth (bytes/sec):</td>
</tr>
<tr>
<td>Number of bytes sent (bytes):</td>
</tr>
<tr>
<td>Number of bytes received (bytes):</td>
</tr>
</tbody>
</table>

Application Center Test
Overview: Summary

<table>
<thead>
<tr>
<th>Test Name:</th>
<th>Shop: shoppers stop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Run Name:</td>
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</tr>
<tr>
<td>Test Started:</td>
<td>6/2/2004 7:59:32 PM</td>
</tr>
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<td>6,032</td>
</tr>
<tr>
<td>Test Notes:</td>
<td></td>
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</table>

![Application Center Test Results](Fig 4: Microsoft Application Centre Test Results)
9.2 Functionality Testing

HarnessIt is the tool used to test the functionality of the website. It performs Unit Testing for .NET applications. We need to write test cases to check the correctness of the functions used in the application. I wrote 9 test cases for my project and built the project. Then using HarnessIt, the dll of the project was loaded as an assembly and executed. All the test cases executed successfully. The test cases I used are:

1. Check every user has unique user id.
2. Validity of the user.
3. Credit card validity.
4. Validity of the phone number.
5. Validity of the email address.
6. Validity of the zip code.
7. Check every credit card information has an expiry date entry.
8. Check selling history is reported properly.
9. Password is retrieved properly for every user.

Results are shown in the following figure:

Fig 6: Unit Testing Results
9.3 ANTS Load Test

ANTS Load is a load testing system that predicts a web application’s behavior and performance under the stress of a multiple user load. It is a tool for load testing websites and web services and works particularly well for applications written using Microsoft technologies such as ASP.NET.

Following are the results generated when I tested my homepage and 3 category homepages viz., Apparel, Photography and Computers. These 3 category pages have a lot of database queries to pull the specifications of the items that are needed for advanced search, and they also pull a lot of images stored in the blob format.

The above result shows the average timings for each object for this test. Here we can identify the fastest and the slowest objects in our web application. As we can observe, homepage is the fastest object and photography webpage is the slowest. This is quite understandable considering that the category pages have a lot of querying to do with the database, pulling out lot of images stored in blob format and have more dynamic content compared to the homepage.

Trial version of this software runs only for a maximum of 5 virtual clients. The above result shows that no user has been abandoned.
The left hand side of the above result shows the actual data over the course of the test while the charts on the right show distribution. The chart on the left is to spot cyclic patterns in performance counters, while the charts on the right are useful for determining overall behavior.

10. Problems Faced
I faced some problems while working on this project. I had problems starting a project on ASP.NET. I was getting authentication failure. I had to set a password for my user login and then provided that password in the web config file. This was a minor problem to start with. Then I had problem connecting to CIS oracle server. I overcame this by setting the impersonate property in the web config file. I thought of implementing Ajax for the entire website. But I encountered problems in storing and retrieving images asynchronously in the XML format and will try to enhance the project in future to overcome that. I thought of finishing the project earlier itself, but the database server was down couple of times and I had to postpone the completion of this project.

11. Future Enhancements
1. I started this project to build a similar website as www.Amazon.com. But that just didn’t happen as it had a lot of features and due to time constraints I couldn’t implement all of them.
2. Adding advertisements to this website.
3. Having product reviews for each item.
4. Implementing SSL to make the website more secure.
5. The seller should be given an option to edit/update the item details.
6. Giving option to buyer to rate a seller and vice versa.
7. Implementing the entire website using Ajax.

12. Experience
The main purpose for choosing this project was to gain knowledge in ASP.NET, get familiar with advanced concepts such as Ajax and XML, and some testing tools such as HarnessIt and Ants Load Test, and enhance my web development skills in general. I am pretty happy with the progress I made and the concepts I learnt. I even had fun working with Adobe Photoshop to create a logo for my website.

13. Acknowledgements
I am thankful to Dr. Daniel Andresen for accepting my proposal for this project and providing inputs as to which feature needs more concern. I am also thankful to our CIS support team for being quick to fix some of the problems I had connecting to the database server.

14. References
1. w3 schools team, http://www.w3.org