

The Inventory Synchronized Management System

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Abstract

The Inventory Synchronized Management System (ISMS) Web application for storing and retrieving inventory in real-time. It consists of SQL Server as the database backend and APS.NET. This Web application also uses a barcode scanner. The barcode scanner reads a premade or custom barcode. On the first read the user types information through the application. From the second read and thereafter, the inventory quantity is updated in real-time each time that barcode is scanned. This application does not need an Internet connection to function, which makes it perfect for a single- or local-area network of computers. In order to access the application, the user must first log in. The owner will be able to manage the application, such as giving people access through an administration section. This application is aimed at small businesses that currently use inefficient ways of managing inventory, either paper-based or with spreadsheets.

Inventory Synchronized Management System

1 Product Description and Intended Use

Many small-to-medium businesses are trying to establish themselves in this ever-changing economy. A good inventory management system is crucial for a business to survive. Unfortunately, most businesses cannot afford a good system so they turn to alternate methods such as storing inventory in paper folders, spreadsheet files, or they do not keep track of inventory at all. A solution to this problem would be to give small and medium businesses a chance to compete in their market by offering an inexpensive way to keep track of inventory utilizing a computer and UPC bar code scanner (4).

The problem is that inventory management systems are extremely costly. The price range for a standard inventory management system is anywhere from \$3,000 to \$6,000. This project consists of an inexpensive inventory management system that keeps track of inventory by using a barcode scanner. After scanning the barcode of an item, the user will be prompted with a message saying that either the item does not exist in the inventory or that already exists and asks if the user would like to update the quantity or choose other options. If the item does not exist, the user will supply the necessary information for the item and will not need to key any more information for the next scan of the same item. Instead the quantity would be updated either manually or automatically, whichever method the user prefers. By keying the same inventory items in, users leave themselves open to errors such as misinformed items, duplicates, or leaving out inventory (4).

Shawn Ganer, who is an Inventory Product Processing Manager at BestBuy, discussed the limitless ways of storing and tracking inventory. Mr. Ganer was informed of the Web

Application that we have developed and he was enlightened with the approach of using the bar code scanner and Sql Server database to reduce user error.

Currently, there are several different options that small and medium businesses use to keep track of their inventories. A very popular method that small retailers use is tracking their inventory by hand. By using a system that tracks by hand, user error is a significant issue that could impact a business's buying habits along with its sales margin. By making a minor mistake in the inventory count, the retailer might have miscounted a high value item thereby making his/her gross profit low. Some businesses do not even keep track of their inventory and use visual inspection as a means of knowing if they need more product or not (10).

The proposed alternative solution to storing inventory data in paper folders, spreadsheet files, or not keeping inventory at all, is to design and implement a Web-based computer program using ASP.NET and SQL Server. This solution would improve productivity and profitability in addition to boosting margins and operational efficiency in any business that needs an affordable inventory management system. SQL Server is the backend database in which all the data entered by the user would be stored and retrieved. ASP.NET is the front end Web-based computer program that users would use to input the data that needs to be stored or modified. In conjunction with this innovative solution, it is implemented in real time so that the user can see the amount of inventory the user has sold within minutes, hours, or days.

A barcode scanner is implemented so items can correctly be stored and accounted for. When scanning the barcode of an item, the user is prompted with a message saying this item does not exist in the inventory or it already exists and asks if he or she would like to update the quantity and other options. If the item does not exist, the user supplies the necessary information

for the item and does not need to key any more information for the next scan of the same item. Instead the quantity is updated either manually or automatically, whichever the user prefers. This process eliminates the need to key everything which will cut down user error such as uncategorized items, duplicates, or left out inventory. The Inventory Synchronized Management System (ISMS) project stores information on various products. The information that is stored consists of product description, product name, unit cost, unit retail price, status of product, received quantity, and on-hand quantity. The ISMS is the ideal affordable solution for businesses of any size, though the focus in this project is on small-to-medium businesses.

2 Technical Details

This application was created in combination with different tools. For the most part, the application was created on a notebook computer and a desktop computer capable of handling Visual Studio and SQL Server software requirements.

2.1.1 Software Requirements for SQL Server

SQL Server 2005 or later is required for the database backend. SQL Express may also be used. SQL Server Setup requires Microsoft Windows Installer 3.1 or later and Microsoft Data Access Components (MDAC) 2.8 SP1 or later.

SQL Server Setup installs the following software components for this product:

- Microsoft .NET Framework 2.0
- Microsoft SQL Server Native Client
- Microsoft SQL Server Setup support files

2.1.2 Software Requirements for Visual Studios and ASP.NET

The following was needed to create and test the asp.net Web Application.

- IIS
- Message Queuing Services
- Microsoft SQL Server

3 The ISMS User Profiles

3.1 Administrator

The Administrator manages and maintains the Web Application and the management of user activity in the ISMS. The Administrator also conducts audits and logs user login data changes each time the inventory changes or is retrieved. The Administrator reports to the owner or the Store Manager of the respective business establishment. The Administrator's IT literacy is significantly high and to be the Administrator, he or she would have background knowledge in operating and maintaining the Web application and also have had dealt with SQL Server.

3.2 Owner/ Store Manager

The owner/ store Manager has access as the Administrator but with special privileges. The main feature of the Web application that the owner/ store manager has over the rest is the ability to update and delete from the inventory database. He or she has access to the Web application from anywhere over a secure Virtual Private Network (VPN). This feature can be added upon request. This feature will be added in the next version of the ISMS application. The IT literacy of the owner/ store Manager is sufficient so that he or she knows what they are doing and if they need additional help or direction: contacting the Administrator would be an option. Communication with the Administrator must occur regardless the issues.

3.3 Employee

The employee user profile will only have access to a few features, including adding to the inventory and viewing the database of the Web application. The IT literacy of the employee will depend upon the individual; and range from low to high. There would be direct contact with the Administrator for support issues or help. Figure 1 shows the basic flow of the user accessing the system.

Adding to Inventory

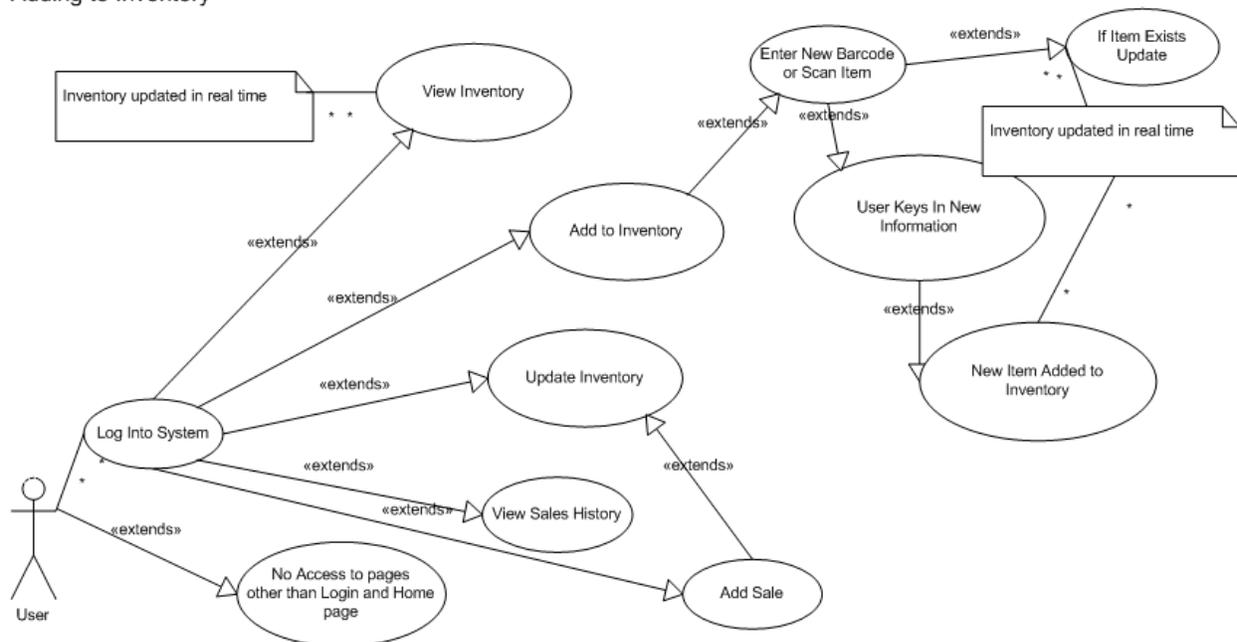


Figure 1: ISMS Use Case Diagram

4 Design Protocols

The application uses links and buttons to help the user along with notifications such as warnings and help information. An ISMS logo is placed at the top of the page along with an Inventory Synchronization Management System banner. A darker styled background is used so a light-colored font can be read easily. Warning labels and text are yellow or red depending on the situation. The default colors of the buttons are white/silver and links are initially blue and will turn purple once clicked. Users will navigate using the menu on the left side of the pages. Tool-

tips for help (place cursor over a question mark to have a bubble display information) are used along with a user manual to explain how to use the application. Below in Figure 2 is an example of how the layout will look.

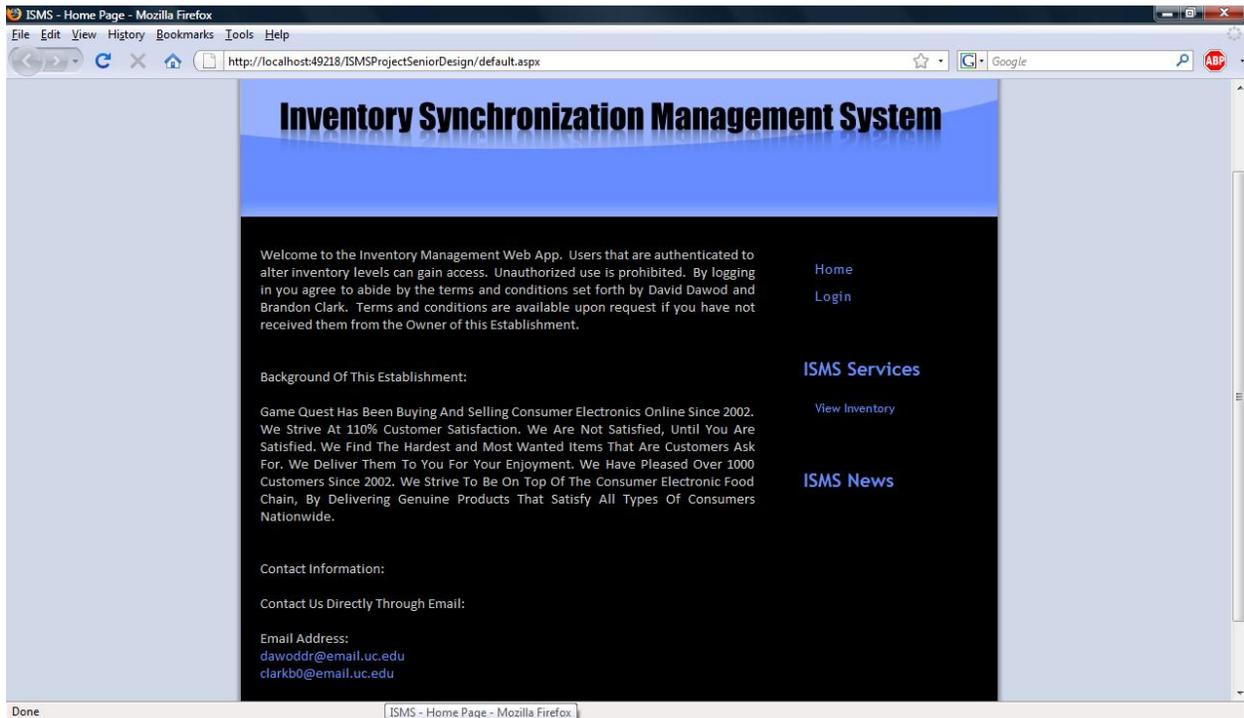


Figure 2: ISMS Main Page

The database is designed using the three tables as follows: Sales, Inventory and Customer.



Figure 3: ISMS Database Diagram

4.1 Testing Plan

This application was tested throughout the whole project as changes were made. The Web application was tested to connect to the SQL database seamlessly. SQL was created and tested to make sure SQL injection attacks are at minimum. The database was tested to make sure that it was secure whether by having access to the data or how data was retrieved through the Web application. The application was tested on laptops and desktops running Microsoft Windows XP and Vista running SQL Server 2005 and 2008. The application was tested on low-end computers to identify the threshold of the application is. By doing this a list the system requirements were able to be generated for the ISMS application.

The ISMS was not funded by any person or business, so the Web application was tested and initiated from the creators' homes. The application was tested by people who were not aware of the purpose of the project. By using people who were unaware, unbiased testing results were gathered. Suggestions were evaluated and applied to the application accordingly.

Avid video gamers tested the Web application and database with multiple video games and systems to make sure the application included the necessary concepts associated with video games. Video gamers are knowledgeable about video games and their respective pricing and suggested retail prices but business professionals were consulted with help during the testing period. As the application was in the process of completion, usability tests were conducted by the help of members from GameStop and/or Best Buy. Feedback was collected and incorporated to insure that the application was functioning properly.

5 Project Planning

Senior Design I in December 2008. Senior Design II continued Winter Quarter 2009. In Senior Design II planning began coding the Web application along with setting up the database. That task was completed on time. The Senior Design sequence was finished with Senior Design III at the end of May 2009. During Senior Design III planning on finishing development and testing were the main focus. When that was completed the application was presented at Tech Expo. Any extra time in the gaps or time off was spent researching the project. Figure 4 shows the timeline of this project.

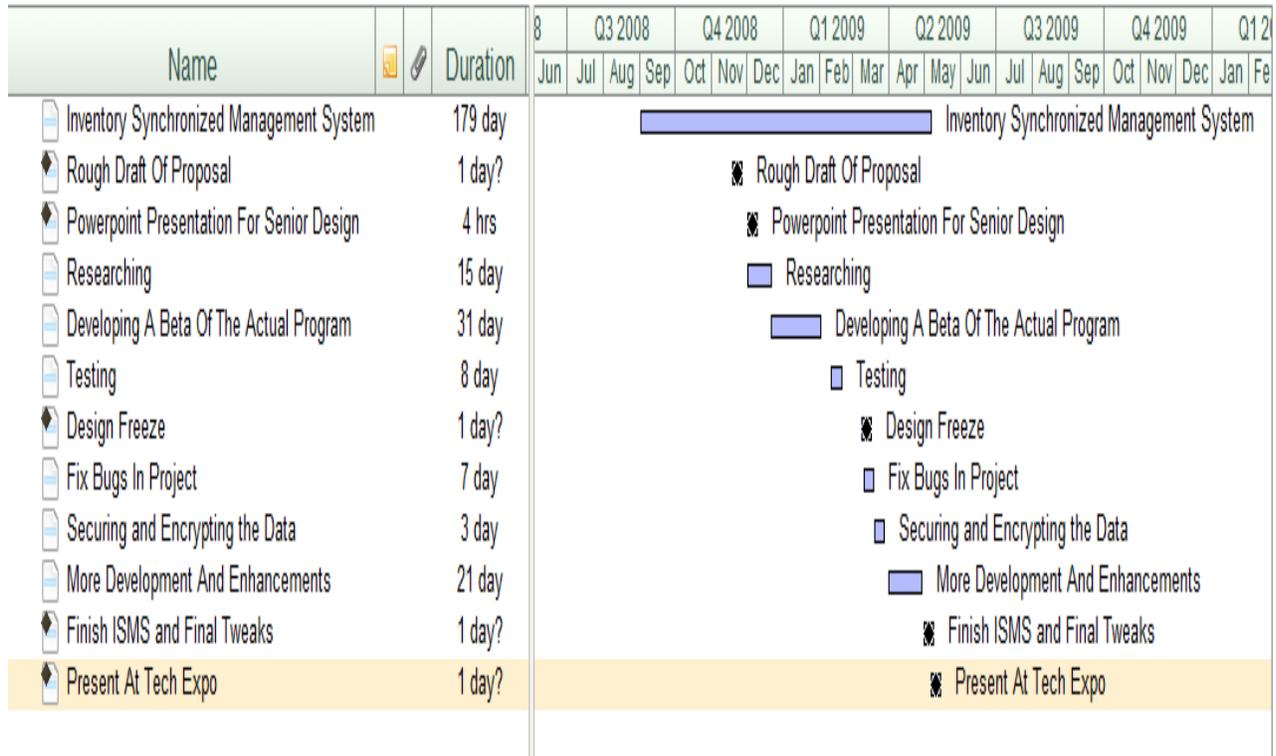


Figure 4: Gantt Chart of Timeline

Approximate Date Of Completion (Dates Are Tentative)	Task To Be Completed
Senior Design II	
January 30, 2009	Completion of the Graphical User Interface, thus completing the application design Interface.
February 19, 2009	The completion of the application programming code of the Inventory Synchronized Management System (ISMS). Intend to use ASP.Net and SQL Server 2008.
February 20, 2009 to March 3, 2009	Testing the ISMS with various products to see if any problems arise from the original application code and fix any bugs that come up during the testing phase.
March 9, 2009	Present our design freeze presentation to the Class and show off prototype.
Senior Design III	
March 10, 2009 to March 20, 2009	Securing and encrypting the project to prevent any potential threats that can arise like for example finding a way to secure the database from intrusion and encrypt the passwords and usernames that are required to access the ISMS.
March 24, 2009 to April 11, 2009	Make some enhancements during the testing phase to build an efficient system that will tend to small and medium business needs.
May 7, 2009	Present at Tech Expo.

Figure 5: Task List

The proposed budget for this project is described in Figure 6. The total retail cost of the project was \$4,000.96. Since most of the hardware, software, and licensing agreements with UC were provided by the IT computer lab, the actual cost for this project was the cost of the scanner: \$157.00(7).

Item	Description	Retail Cost	Cost Incurred
Laptop Computer	Own	\$600.00	\$0.00
Windows Vista Ultimate	Provided by the IT computer lab	\$235.00	\$0.00
2GB Flash	Own	\$29.99	\$0.00
SQL Server 2008	Provided by the IT computer lab	\$1700.00	\$0.00
Internet Information Services (IIS)	Included in Windows	\$0.00	\$0.00
Microsoft Visual Studio .NET 2005	Provided by the IT computer lab	\$1034.97	\$0.00
Microsoft Visual Studio Tools	Provided by the IT computer lab	\$490.00	\$0.00
Retail Scanner	Purchased from POSguys.com	\$157.00	\$157.00
	Retail Total:	\$4,000.96	
	Our Total:		\$157.00

Figure 6: Budget

5.1 Risk Management

Risk is a part of each and every project in the real world. Like it or not, there are people who choose to cause harm in this world. The solutions that have been made to prevent the risks that were assessed can be found in Figure 7 below.

Risk Description	Risk Level	Mitigation
Users with access that could sabotage the application by changing other user's passwords, and other sensitive data that could be compromised.	Medium	Not to give access to everyone. Ability to log every change that is made. Also have the ability to send emails to the Administrator or owner when unusual activity occurs.
The risk for user name and password cracking.	Low	Disable access to the Web. Make sure application is secure.
The ability for unauthorized users to delete or update inventory levels.	High	Define user account permissions so that only the owner or Administrator can update or delete inventory levels.
The risk of SQL injection attacks.	Medium	Check the user's input for dangerous characters like single-quotes; and use prepared statements which tell the database exactly what to expect before any user-provided data is passed to it.

Figure 7: ISMS Risk Analysis Table

6 Proof of Concept

Upon opening the application, the user is greeted at the main page. Here the user is presented with the options of reading the terms of service and history of establishment. There is a news section to indicate any updates that the application has received and an option to log in or access ISMS tools. In order to view the inventory the user must logged in.

Once logged in the user has the ability to add new items or products to the inventory. If the user chooses to view the inventory the user will have the ability to generate reports of the inventory using crystal reports. The user has the options of updating and deleting records also. If

an item has been updated or deleted, this action will be logged in the database using database triggers.

There is a section in the administration page to add customer information. The information consists of a generated customer ID number, the customer's first and last name, address, city, state, zip code, state, and phone number.

In order to remove an item from the inventory, the user will input the customer's ID number, the item, and the price at which it was sold. The item will then be subtracted from the inventory and a transaction number will be generated for the sale. The user will then be able to generate a report that can consist of the item sold, price, quantity, date, and who purchased the item.

The user will be greeted with the main page first, as show in Figure 4. Here the user will be able to login in order to access the application.

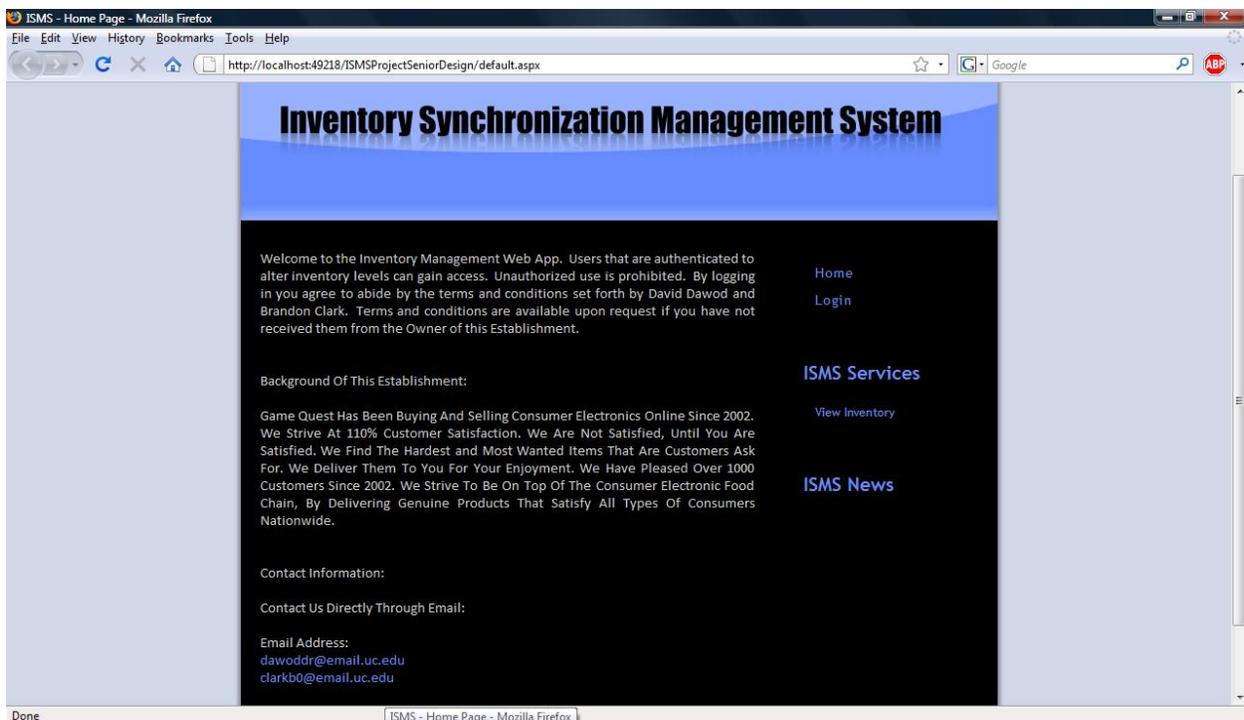


Figure 8: ISMS Main Page

Once the user has logged in (Figure 5) the user has the ability to view inventory. The user is able to add inventory (Figure 6), update inventory (Figure 7), view sales history (Figure 8), and add a sale (Figure 9). The user can also generate reports as shown in (Figure 10). Figure 11 shows the basic layout of how the Administrator creates new customers.

At the login screen as shown in Figure 9, the user needs to input his or her user name and password. If the user inputs invalid information he or she will not be granted access to the application.

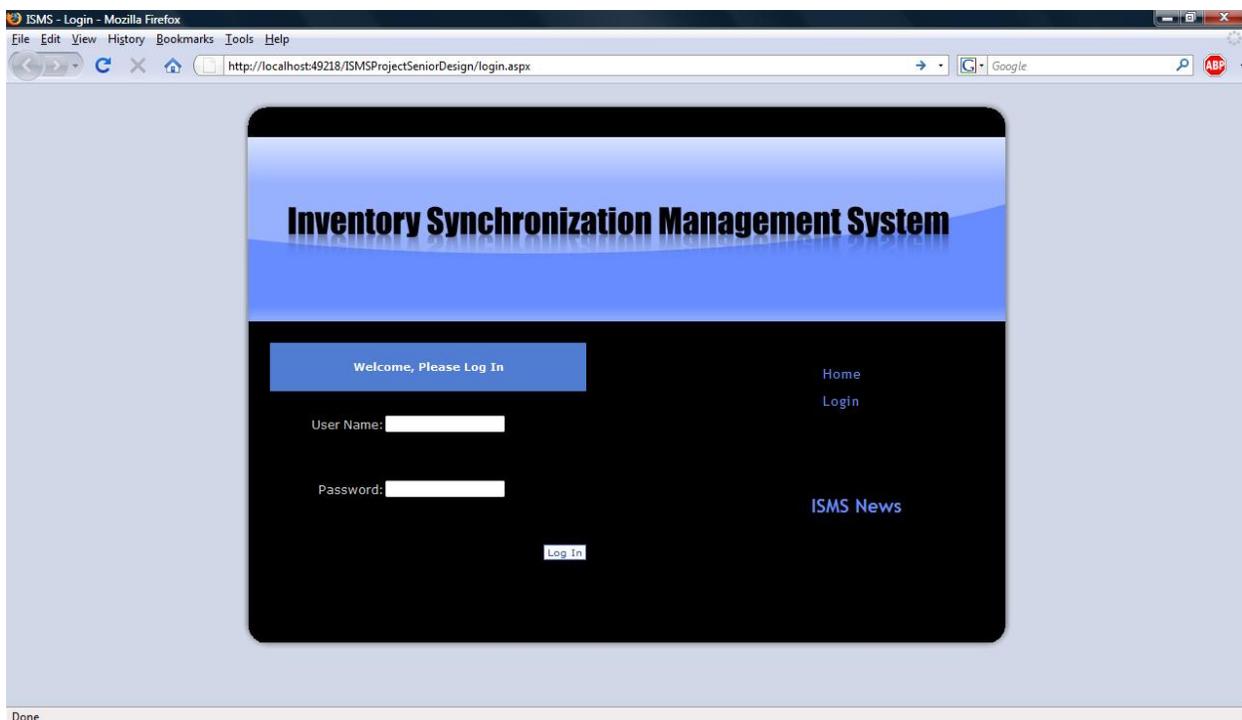


Figure 9: ISMS Log In

In Figure 10, the user adds inventory. An insertion point will automatically be inserted in the upc barcode field. Once the user has added the necessary information for adding the item, the user can click the “Add to Inventory” button. If the UPC is already in the database there will be a message telling the user to update the quantity instead.

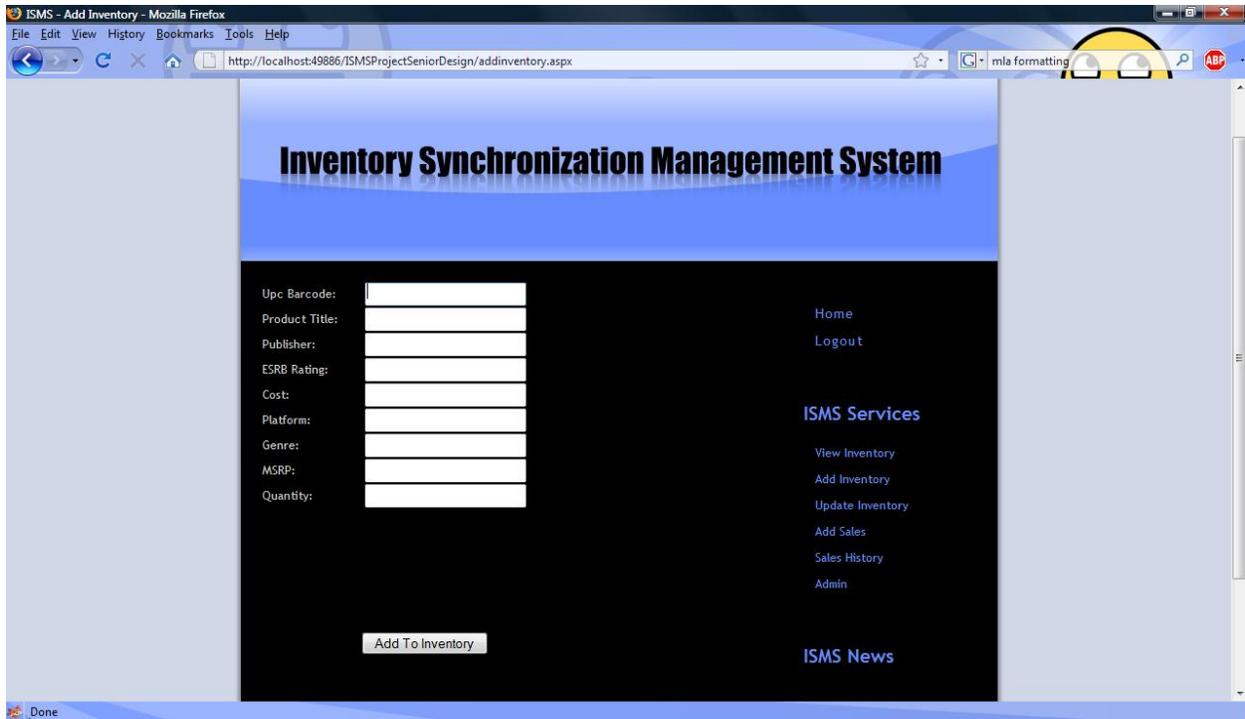


Figure 10: ISMS Add Inventory

To update the inventory, the user will need to scan or type in the barcode (Figure 11). The insertion point is automatically placed in the UPC field for quick updates to the item. An item is updated regarding the quantity of the item.

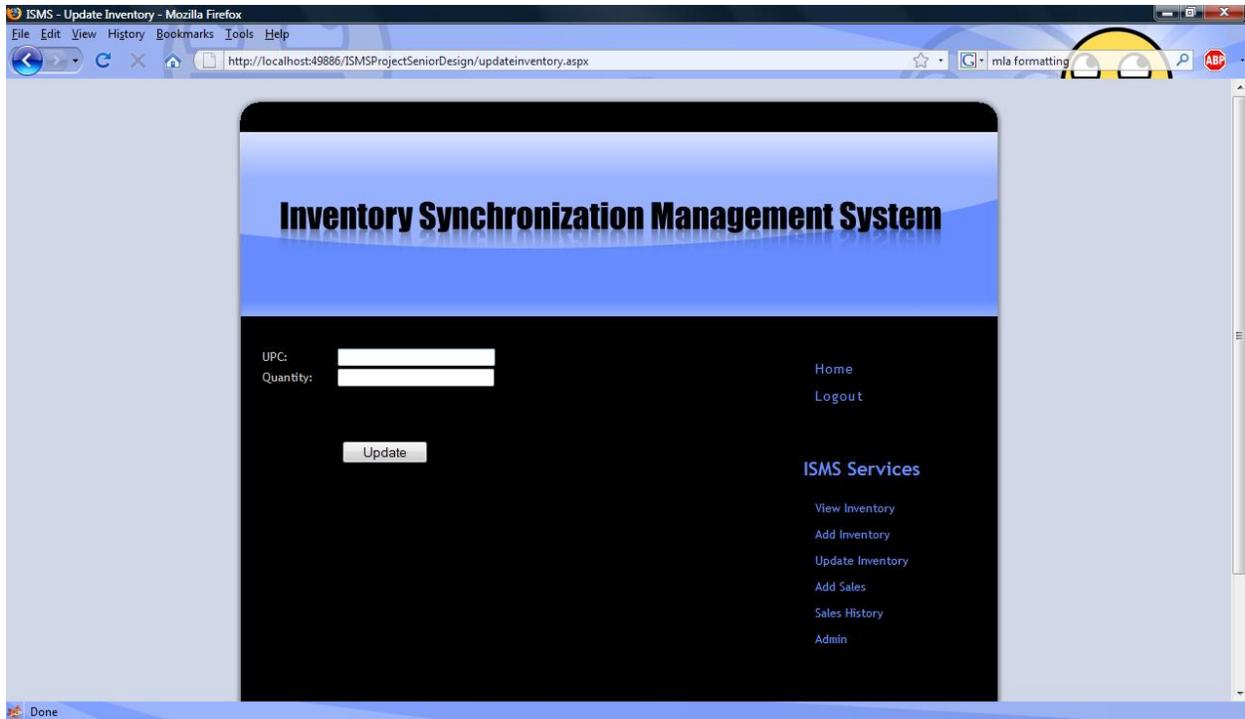


Figure 11: ISMS Update Inventory

The user will be able to view a history of the items that were sold and to whom they were sold too. The user is able to generate a report of the sales history if necessary.

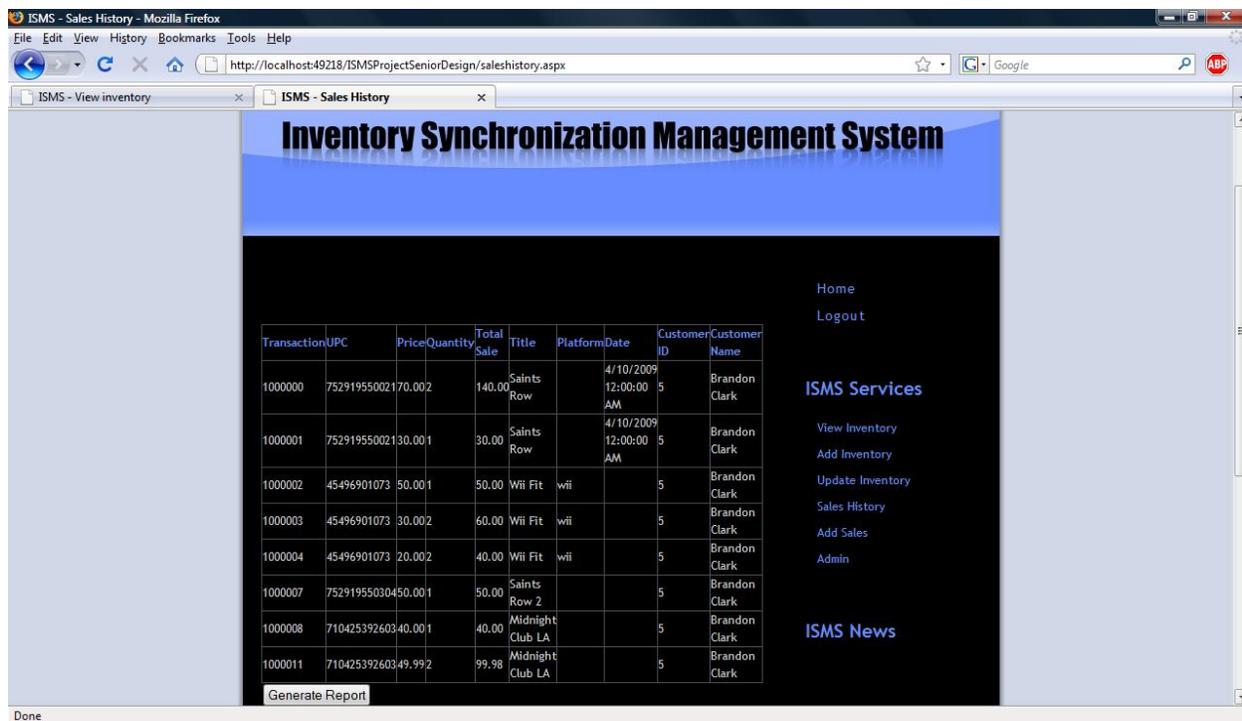


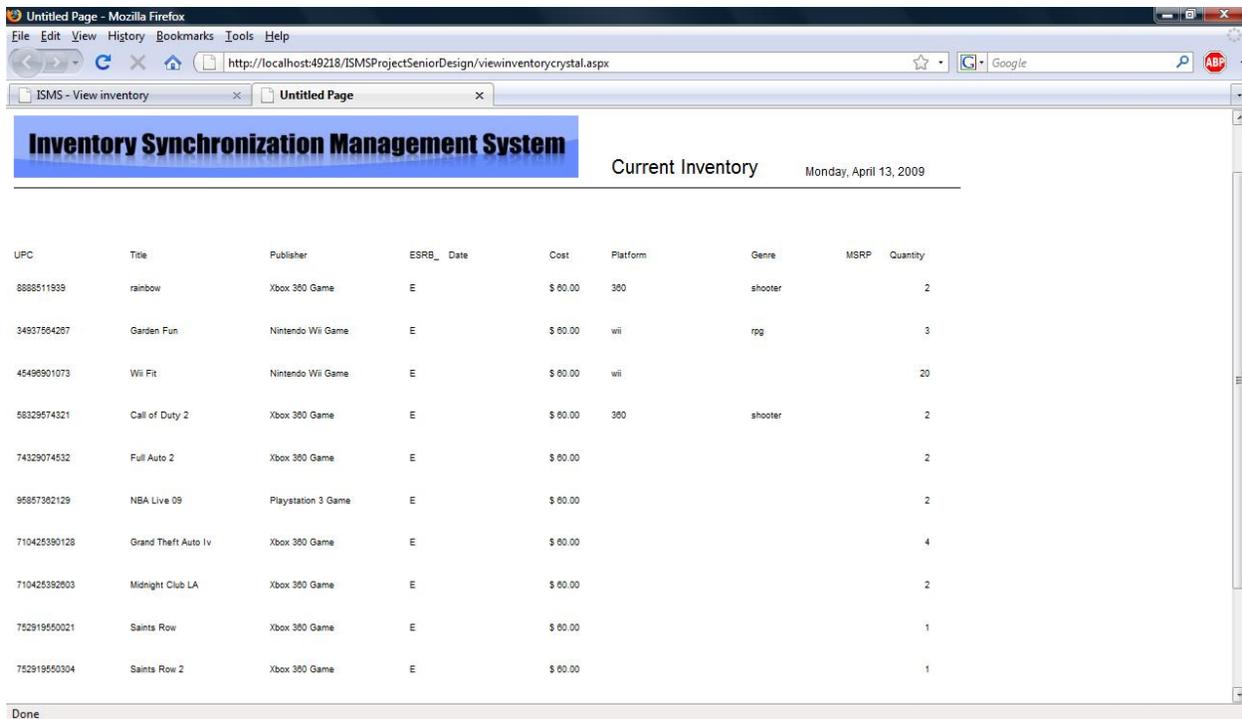
Figure 12: ISMS Sales History

To remove an item from the inventory the user will specify which item will be removed and at what sale price. The customer's ID number is used to identify who bought the item.



Figure 13: ISMS Add Sales

Figure 14 shows the basic layout of how a report will look when it is generated. This report shows what is in inventory, how many items are available and information about the inventory.



UPC	Title	Publisher	ESRB_ Date	Cost	Platform	Genre	MSRP	Quantity
8888511939	rainbow	Xbox 360 Game	E	\$ 60.00	360	shooter		2
34937664267	Garden Fun	Nintendo Wii Game	E	\$ 60.00	wii	rpg		3
45496901073	Wii Fit	Nintendo Wii Game	E	\$ 60.00	wii			20
58329574321	Call of Duty 2	Xbox 360 Game	E	\$ 60.00	360	shooter		2
74329074532	Full Auto 2	Xbox 360 Game	E	\$ 60.00				2
96857362129	NBA Live 09	Playstation 3 Game	E	\$ 60.00				2
710425390128	Grand Theft Auto Iv	Xbox 360 Game	E	\$ 60.00				4
710425392803	Midnight Club LA	Xbox 360 Game	E	\$ 60.00				2
752919650021	Saints Row	Xbox 360 Game	E	\$ 60.00				1
752919650304	Saints Row 2	Xbox 360 Game	E	\$ 60.00				1

Figure 14: ISMS Inventory report

The user will need to be able to add customers to the database. This can be completed by clicking the link in the admin page. Once the customer has been added, a unique ID is generated for them.



Figure 15: ISMS Administration Add Customer

6.1 Deliverables

The Inventory Synchronized Management System (ISMS) was developed to create a real time inventory tracking system. The ISMS has the ability to add, delete, and update existing inventory. The ISMS displays current levels of inventory seamlessly in real time at the users' discretion. The lists of Deliverables that were created is as follows:

1. Use three-tier architecture: Presentation layer, Business Layer, and Database Layer.
2. Develop a simple Web application to house the access portal to the inventory database.
3. Use ASP.NET with database connectivity to Microsoft SQL Server as primary database.
4. Secure the application: Login username, password, and encryption.
5. Add inventory to the database manually or by using a barcode scanner .The database will then assign a specific SKU number that the client can use to update inventory levels when needed.
6. Delete inventory from the database.
7. Use real time synchronization to view inventory levels.
8. Use specific alerts when inventory levels are low.
9. Create of a customer order form. Be able to add a sale
10. Ability to generate reports of inventory and sales history. Be able to search within reports for certain items.

7 Conclusion

The ISMS provides a cost-efficient, entry-level inventory management system for small-to-medium businesses to become competitive with their counterparts. The goal was to help a new business establish itself or help current businesses switch to a more efficient way of organization rather than being paper-based or using spreadsheets. By using the ISMS, the user has total control over how inventory is managed while drastically reducing user error.

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