

## Inventory Management System

Arina Ramlee | David Henry | Bruce Chhay

Email: [arina@cs.washington.edu](mailto:arina@cs.washington.edu) | [davidvh@cs.washington.edu](mailto:davidvh@cs.washington.edu) | [chhayb@cs.washington.edu](mailto:chhayb@cs.washington.edu)

---

### Abstract

*This paper describes the Inventory Management System sufficiently to determine the feasibility and usability of a finished system. The core concept is to track the sale of items from the cash registers with additional features for interpreting the data. It uses a client-server model with a connected database to allow multiple stores and warehouses to be connected. This allows for later expansion while still supporting the targeted small businesses. The core features and final framework should be completed within 2 weeks, leaving 5 weeks to implement additional features and testing.*

**Keywords:** Inventory Management System, Inventory Control, System Requirement

---

### 1.0 INTRODUCTION

The Inventory Management System is a real-time inventory database capable of connecting multiple stores. This can be used to track the inventory of a single store, or to manage the distribution of stock between several branches of a larger franchise. However, the system merely records sales and restocking data and provides notification of low stock at any location through email at a specified interval. The goal is to reduce the strain of tracking rather than to handle all store maintenance. Further features may include the ability to generate reports of sales, but again the interpretation is left to the management. In addition, since theft does occasionally occur, the system provides solutions for confirming the store inventory and for correcting stock quantities.

### 2.0 SYSTEM REQUIREMENTS

The Inventory Management System uses a web-based interface to display inventory data to the stock manager client. The product will use of open-source software primarily due to cost of implementation. A JSP (JavaServer Pages) servlet will be hosted by an Apache Tomcat web server (on top of any choice of operating system, although a flavor of Unix is recommend). The first feature of the Stock Manager Client web interface component allows the Stock Manager Client to view the current stock of products, along with the capabilities of searching and sorting the products. The second feature of the Stock Manager Client web interface will allow the user to modify application settings, such as the threshold for email notifications, frequency of inventory scans (daily at a particular hour, weekly, monthly, etc.), and security settings. The third feature of the Stock Manager Client web interface will allow the user to update the inventory during the restocking process. *See Figure 1.* Since a web interface will be used, a network that supports the HTTP/HTTPS protocol must exist, whether it is a private network for an isolated customer deployment or an Internet connection for a multi-site customer deployment. The bandwidth of the network depends on the frequency of transactions. A bandwidth of at least 10 Mbps is recommended (small commercial deployment). The database to store the inventory data will use a MySQL database.

Since the software and hardware resources of cash registers are not available due to the variation in software and cost, we will be developing an emulated Cash Register client to interface with actual cash registers. The Cash Register client will emulate purchases by having a simple graphical interface with fields for a barcode number and quantity and a button to make a purchase. *See Figure 2.* As these resources become available, the actual implementation for specific cash register models will be considered for future releases of the *Inventory Management System*. JavaPOS will be used as a reference for emulating cash registers, and could potentially be used to create the actual implementation of the future release.

Alternatively, commercially licensed products are available. In particular, the Microsoft ASP.NET (Active Server Pages) framework can be used. This requires a Microsoft ASP.NET web server and a Microsoft SQL Server database, which also requires a Microsoft operating system. However, these alternative system requirements will increase the overall costs for both implementation and deployment.

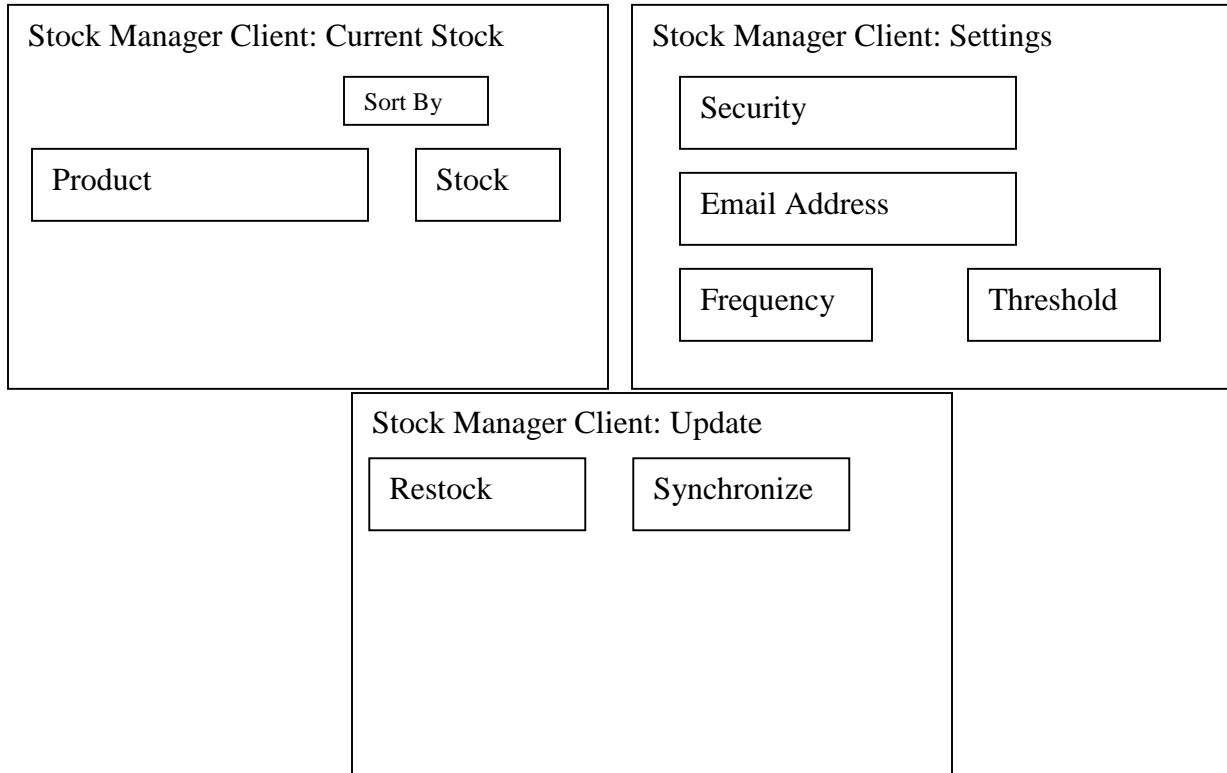


Figure 1. The three features of the Stock Manager Client web interface.

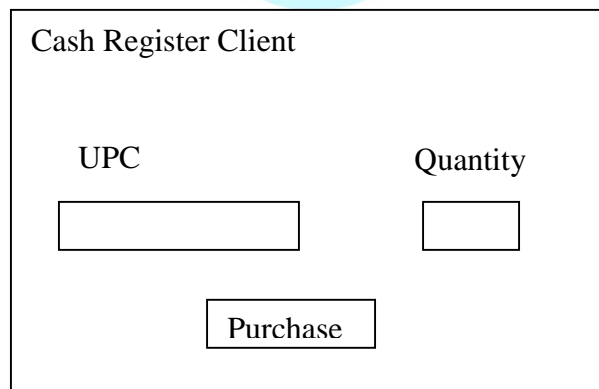


Figure 2. The emulated Cash Register Client interface.

### 3.0 SYSTEM AND SOFTWARE ARCHITECTURE

The programming language for the *Inventory Management System* application will be in Java since the JSP/Tomcat architecture will be used. Both types of clients will communicate with the server using Java Remote Method Invocation (RMI) with Secure Socket Layer (SSL). Thus, security will be upheld by HTTPS in both a private network and a network connected to the Internet. The application will use a client-server model. See Figure 3.

Furthermore, the Java Database Connectivity (JDBC) will use the MySQL Connector/J driver for the server to communicate to the inventory database. Upon receiving requests from the clients, the server will issue transactions to the MySQL database with ACID properties. The Cash Register clients will maintain local log files in the event of communication downtime between Cash Register clients and the server. Upon re-establishing communication, the Cash Register clients will re-synchronize with the server by issuing the requests that occurred during downtime.

Alternatively, if the Microsoft ASP.NET framework is used, then the programming language for the application will be Microsoft C# with a Microsoft SQL Server database. The Microsoft .NET framework includes built-ins for easy database interfacing and .NET Framework Remoting (analogous to skeleton and stub), which has the ability to also use HTTPS.

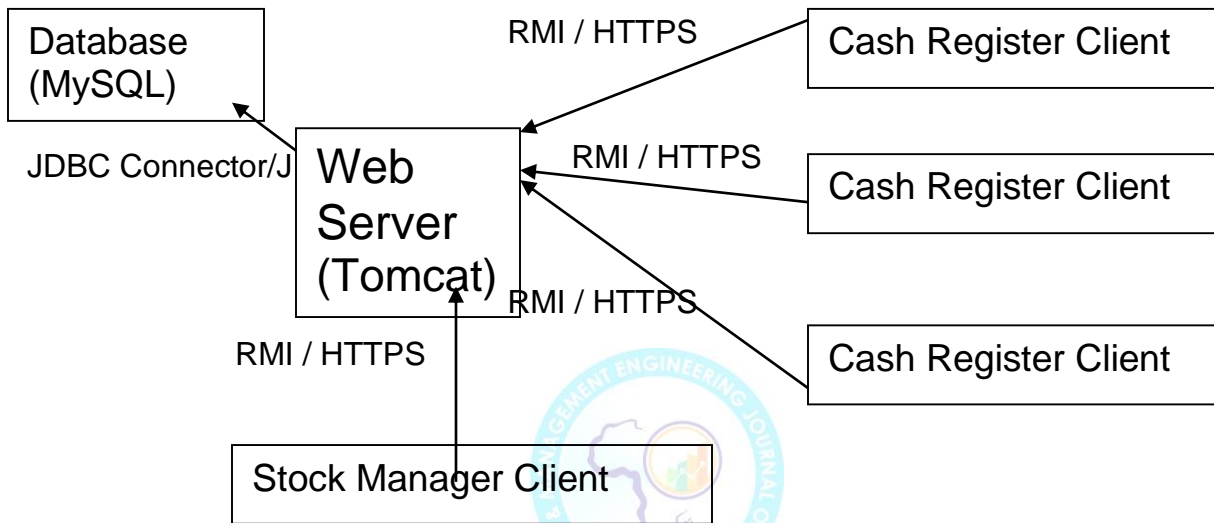


Figure 3. Client-server architecture model of the *Inventory Management System* application.

## 4.0 LIFECYCLE PLAN

### 4.1 Objectives

The main goal of *Inventory Management System* is to ensure consistent availability of supplies for consumers. Thus, *Inventory Management System* is directed toward owners of small to large stores and stock managers who are responsible of maintaining sufficient goods on hand in a retail or manufacturing business. It can scale from a single computer running both client and server software up to multiple stores and warehouses.

### 4.2 Schedules

The time estimated to complete the *Inventory Management System* project is fairly short. There will be three major Win-Win Spiral Model cycles through our prototyping stage, beta release, and final release. We will need two weeks of designing the architecture and implementing core features and five weeks of adding functionality and testing. The project can be completed by 6-8 people in at most 7 weeks.

## 5. FEASIBILITY RATIONALE

### 5.1 Assumptions

The above design should works for the *Inventory Management System* application. However, we are emulating a cash registers interface to work with our software by simulating barcode inputs. A more realistic design of cash register interface can be done to suit the integration, as the interface does not interfere with the data collected. We expect that the cash registers clients are able to update their data to the current point of sale in case of loss of connection to the server. The particular restocking procedure adopted by each store does interfere with the feasibility

and accuracy of the application as it does not remind the stock manager to update the data each time they had done any restocking. We also trust that that the Secure Socket Layer (SSL) is reliable in creating a secure connection between a client and a server.

## 5.2 Risks

One of the major risks covered by this application is theft breaks synchronization between the inventory and the database. The information could be generated by the data stored in this application. The confidence level of trusting data generated depends on the accuracy of the restocking procedure. Therefore, we are facing a risk of reckless stock manager who could detriment the accuracy of the data. As of the reliability of the SSL encryption, a resolution for this could be by developing SSL and digital certificate policy and configuration guidelines. In addition, giving a choice to the user to set the minimum level of SSL used by not violating the policy should convince them the trustworthiness of the application.

Another risk is the competition from other Point of Service software. There are several large competitors in this field including a solution from Microsoft; however, all of these tend to be expensive. *Inventory Management System* will be a low cost solution mainly targeted at smaller businesses while including the possibility of later expansion.

## References

- C. Paramasivan and T. Subramanian, (2009), *Financial Management*, 1st Ed., New Age International (P) Limited, New Delhi, India.
- Frank J. Fabozzi and Pamela P. Peterson, (2003), *Financial Management & Analysis*, 2nd Ed., John Wiley & Sons, Inc., New Jersey.
- Ivan K. Cohen, (2005), *Focus on Financial Management*, Richmond, the American International, University of London, Imperial College Press.
- J. William Petty, Arthur J. Keown, David F. Scott Jr., John D. Martin, Michael Burrow, Peter Martin and Hoa Nguyen, (2006), *Financial Management*, 4th Ed., Pearson Education Australia.
- Aliettee Leleux and Lise Malbernard (2012), *Risk Modeling – to Drive Capital Project Performance*, Accenture, High Performance Delivered, Consulting Services.
- Bernstein, P. (1995), *Risk as a History of Ideas*, Financial Analysis Journal, pp.1-5, Jan-Feb 1995.
- Chandra Prakash Gupta (1996), *Capital Budgeting Decisions Under Fuzzy Environment*, Finance India, Vol. X, Number 2, pp.385-388, June 1996.
- CIMA Official Study Text (2013), *Enterprise Management*, Kaplan Publishing, UK.
- Glyn A. Holton (2004), *Perspectives Defining Risk*, Financial Analysis Journal, Vol. 60, Number 6, Nov/Dec 2004, CFA Institute.
- Peter D. Dwyer and Monica Minnegal (2006), *The Good, the Bad and the Ugly: Risk, Uncertainty and Decision-Making by Victorian Fishers*, Journal of Political Ecology Vol. 13, The University of Melbourne
- Roger M. Cooke (2009), *A Brief History of Quantitative Risk Assessment*, Resources, Summer 2009.
- Stephen A. Boyko and Anthony J. Negus (2006), *Risk v. Uncertainty*, New York Law Journal, Dec. 8, 2006.
- Tim Rakow (2010), *Risk, uncertainty and prophet: The psychological insights of Frank H. Knight*, Judgment and Decision Making, Vol. 5, No. 6, pp.458-466, Oct 2010.
- Todd M. Alessandri, David N. Ford, Diane M. Lander, Karyl B. Leggio and Marilyn Taylor (2004), *Managing risk and uncertainty in complex capital projects*, Quarterly Review of Economics and Finance, Vol. 44, pp.751-767, May 2004, Elsevier.
- Vicent T. Covelto and Jeryl Mumpower (1985), *Risk Analysis and Risk Management: An Historical Perspective*, Risk Analysis, Vol. 5, No. 2, pp.103-20, (Re-printed and used with permission of the Society for Risk Analysis, Chpt 3, Part 1, Beginnings, pp.33-54.
- Bruce Simmons, *Chi-Square Tests Using Excel: Chapter 15*, CCC Math 244 Excel, Math 244 Statistics II, Clackamas Community College, [Online], (Available from): <http://www.brucesimmons.com/excel244chisquare2wayTestStat.p-value.html>, [Accessed: 14th February, 2014]
- ECG *Approved Budget for 2011 Cash Flow*: [Online], (Available from): <http://intranet/Reports/Budgets/Budget%20Reports%202008/Forms/AllItems.aspx?RootFolder=%2fReport%2fBudgets%2fBudget%20Reports%202008%2fYear%202011%20Budget%20Report&FolderCTID=&View={3AAA3A8A-DE38-4E08-A995-457CF9E173B3}>, [Accessed: 25th June, 2014]

- National Audit Office, *Financial Management Maturity Model*, [Online], (Available from): [www.nao.org.uk/wp.../02/financial\\_management\\_maturity\\_model.pdf](http://www.nao.org.uk/wp.../02/financial_management_maturity_model.pdf), [Accessed: 27th February, 2014]
- Theme Horse (2014), Statistics How To, *Support or Reject Null Hypothesis in Easy Steps*, WordPress, [Online], (Available from): <http://www.statisticshowto.com/support-or-reject-null-hypothesis/#general%20p>, [Accessed: 14th February, 2014]
- William N. Goetzmann, *Financing Civilization*, [Online] (Available from), <http://viking.som.yale.edu/will/finciv/chapter1.htm>, [Accessed: 27th December, 2014].

