

An Efficient Online Shopping System

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ABSTRACT

Our project is to develop an on-line shopping system for Metro Credit Union (MCU). MCU provides many services and benefits to its members and all MTR Corporation staffs can be MCU members after registration. Currently, during the sales promotion to MCU members, MCU staffs manually handle the purchasing information with the use of basic office software, such as Microsoft Office Word and Excel. It may result in having mistakes easily and the process is very inconvenient. As a result, MCU needs an online shopping system at their MCU Intranet. We develop the online shopping system based on the requirements of users. The MCU Online Shopping System has at least five key features: (1) to provide the user friendly online shopping cart function to members to replace hardcopy ordering form; (2) to store inventory and sales information in database to reduce the human mistakes, increase accuracy and enhance the flexibility of information processing; (3) to provide an efficient inventory system which can help the MCU staffs to gain enough information to update the inventory; (4) to be able to print invoices to members and print a set of summary reports for MCU's internal usage; (5) to design the system that is easy to maintain and upgrade.

Keywords: e-Business, e-Commerce, online shopping system

1. INTRODUCTION

Online shopping becomes increasingly popular nowadays. It brings many advantages to both sellers and buyers. In our project, we developed an online shopping system for our stakeholder, Metro Credit Union (MCU). In this paper, we introduce our stakeholder and describe the existing problem, the user requirements, the project scope and the project schedule. Next, we present our solution including the system analysis, the deviation between the final and initial design, the functions of our online shopping system and the testing plan. Finally, we evaluate our work in different aspects, present the area for further improvement and conclude our work.

2. PROJECT BACKGROUND

In this section, we briefly introduce our stakeholder and describe the existing problem, the project scope and the system specification.

2.1 Our Stakeholder

Metro Credit Union (MCU) is a co-operative, non profit association for the purpose of creating a source of credit available to its members who are the employees of MTR Corporation [1]. MCU always strives continuously to look for improvement in all related business, so that its members can benefit from its services and obtain the best value for money. Currently, MCU has 9,200 members representing 75% of the MTRC employees.

2.2 Existing Problem

MCU always organizes sales exhibition at discounted prices to members. Due to the insufficient venue and lack of manpower to manipulate the sales exhibition, MCU would like to develop an on-line shopping platform, so that members could enjoy the service via MTR intranet web server instead of on-site. In addition, MCU can easily estimate the sales volume and be able to negotiate a better discount from vendor. This is a saving time and saving money unprecedented service to its members.

2.3 Scope of Project

MCU requires an online shopping system with a database keeping the inventory and the invoicing information, and the system has to be migrated to the MTR Intranet web server. The online shopping system needs to have three key features: (1) Only accessible by MCU members; (2) User friendly for computer illegitimate; and (3) Easy to maintain by system administrators.

2.4 Potential Users of Our System

There are two groups of users in our system, they are MCU members and system administrators. They have different authorities in our system which are shown as follows:

- Members – They are MCU members. They can view the detailed product information and their shopping history. Besides, they are able to create, view, modify and cancel their shopping orders.
- Administrators – They are authorized MCU staffs to control the system. They are assigned with different level of authority to maintain the information of inventory, invoicing, members and administrators. Besides, they can make conditional refunds and print out transaction invoices. In addition, administrators can execute summary reports and be responsible to maintain database.

3. SYSTEM ANALYSIS

In this section, we present the requirement specification, software and hardware requirements for both system developers and system users, process model and data model.

3.1 Requirement Specification

In the following, we describe the functional requirements and non-functional requirements of our system.

3.1.1 Functional Requirements

Functional requirements define the functions that are requested by our stakeholder. Different functions are needed by different system users. For members, there are three types of MCU members: *Ordinary*, *Associate* and *Suspended*. An *ordinary member* is a general member. An *associate member* is a VIP member. A *suspended member* is a member having limited rights to be served by MCU. Once a member login the system, it can identify the type of the member. Besides, different administrators have different levels of authority to maintain the system information. The system can identify the authority of an administrator after he login.

- Functional Requirements for Members
 - Login
 - Shopping cart
 - Receive invoice
 - View shopping history
 - Search information of product
 - Change of password
- Functional Requirements for Administrators
 - Login
 - Update information of product
 - Update information of member
 - Update information of administrator
 - Update invoice and transaction
 - Print Invoice
 - Print Report
 - Change of password

3.1.2 Non-functional Requirements

Non-functional requirements define the operational requirements and project schedule that are requested by our stakeholder.

- Operational Requirements
 - The system can be viewed by Microsoft Internet Explorer.
 - The system can be executed on the MTR's Intranet. The MTR Intranet web server runs on the Windows server platform which supports Internet Information Server (IIS).
 - We can only use Microsoft Access to develop the database.
- Project Schedule
 - The development of system is completed by the end of June 2009.
 - The mitigation testing and final user acceptance testing is scheduled at the end of July 2009.
 - The system can be launched at the end of August 2009.

3.2 Software and Hardware Requirements

In the following, we describe the software and hardware requirements for system developers and system users.

3.2.1 Software and Hardware Requirements for Developers

During our system development, we have to design both static and dynamic website interfaces, create website functions and a database system, edit photos and pictures, and print out reports, so its has a set of software and hardware requirements.

- Software Requirements
 - Microsoft Visual Studio 2005
 - Adobe® Creative Suite® 3 Design Premium (Photoshop CS3 , Flash CS3 , Illustrator CS3, Acrobat)
 - Microsoft Office Access 2003
- Hardware Requirements
 - CPU – Intel Core 2 Duo E7300
 - RAM – 2 GB
 - Hard disk – 120 GB
 - Operating System – Windows XP with Service Pack 3 (CHT)

3.2.2 Software and Hardware Requirements for Web Server in Production

The following is the requirements for web server which is compatible with the current MTR Intranet web server.

- Software Requirements
 - Microsoft Visual Studio 2005
 - Adobe Acrobat
 - Microsoft Office Access 2003
- Hardware Requirements
 - CPU – Opteron / Xeon Server CPU (Opteron 2356/Xeon5300)
 - RAM – 4 GB
 - Hard disk – 30GB(for RAID 5)
 - Operating System – Windows Server 2003 Standard
 - LAN – at least 100Mbps

3.2.3 Software and Hardware Requirements for System Users in Production

The following is the requirements for the system users including members and administrators.

- Software Requirements
 - Web browser - Microsoft Internet Explorer 6 or above
- Hardware Requirements
 - CPU – Intel Pentium 4
 - RAM – 1.5 GB
 - Hard disk – 30GB
 - Operating System – Windows XP with Service Pack 3 (CHT)

3.3 Process Model

In this section, we briefly describe the two Data Flow Diagrams (DFD) of our system, and they are Data Flow Diagram (Context Level) and Data Flow Diagram (Level 0). Since space is limited, other Data Flow Diagrams and the Data Dictionary are not presented in this paper.

3.3.1 Data Flow Diagram (Context Level)

In the Data Flow Diagram (Context Level) shown in Fig. 1, it has two external users and one process. The two external users are Member (MCU member) and Staff (Administrator) and the process is the online shopping system. We combine some data flows together grouped by similar characteristic function in the context level.

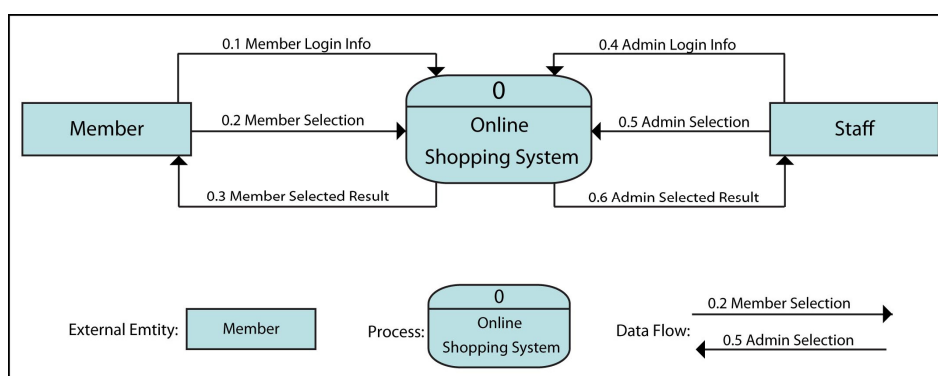


Fig. 1. Data Flow Diagram (Context Level)

3.3.2 Data Flow Diagram (Level 0)

In the Data Flow Diagram (Level 0) shown in Fig. 2, it shows our system has five major functions, four data storages and a number of data flows. It includes all the functions for MCU members and administrators. The five major functions are described briefly as follows:

- *Process 1: Login the System* – Both members and administrators have to use their user IDs and passwords to login the system. Once they enter their IDs and passwords, the system will verify the correctness of data by searching the relevant data source for comparison.

- *Process 2: Complete the Transaction Record* – When a member wants to purchase a product in the online shopping system, the system provides some product information such as the quantity of each product, the payment methods and the pickup locations. When the member selects the products he wants to purchase, the system displays the transaction information and asks the member for confirmation. Finally, the confirmed transaction information is stored into the invoice data source.
- *Process 3: Browse the System Information* – Both members and administrators can browse the system information. Besides, the system provides the searching function by using keywords to increase the efficiency. Depending on their assigned authorities, they can browse the information of products, invoice records, members and administrators.
- *Process 4: Maintain the System Information* – Depending on their assigned authorities, members and administrators can update the system information, such as the information of product, invoice, members, administrators and their passwords. Once an update occurs, the relevant data source will be updated.
- *Process 5: Print the Documents* – An administrator with the authority right can print out some reports for internal usage, such as the inventory report.

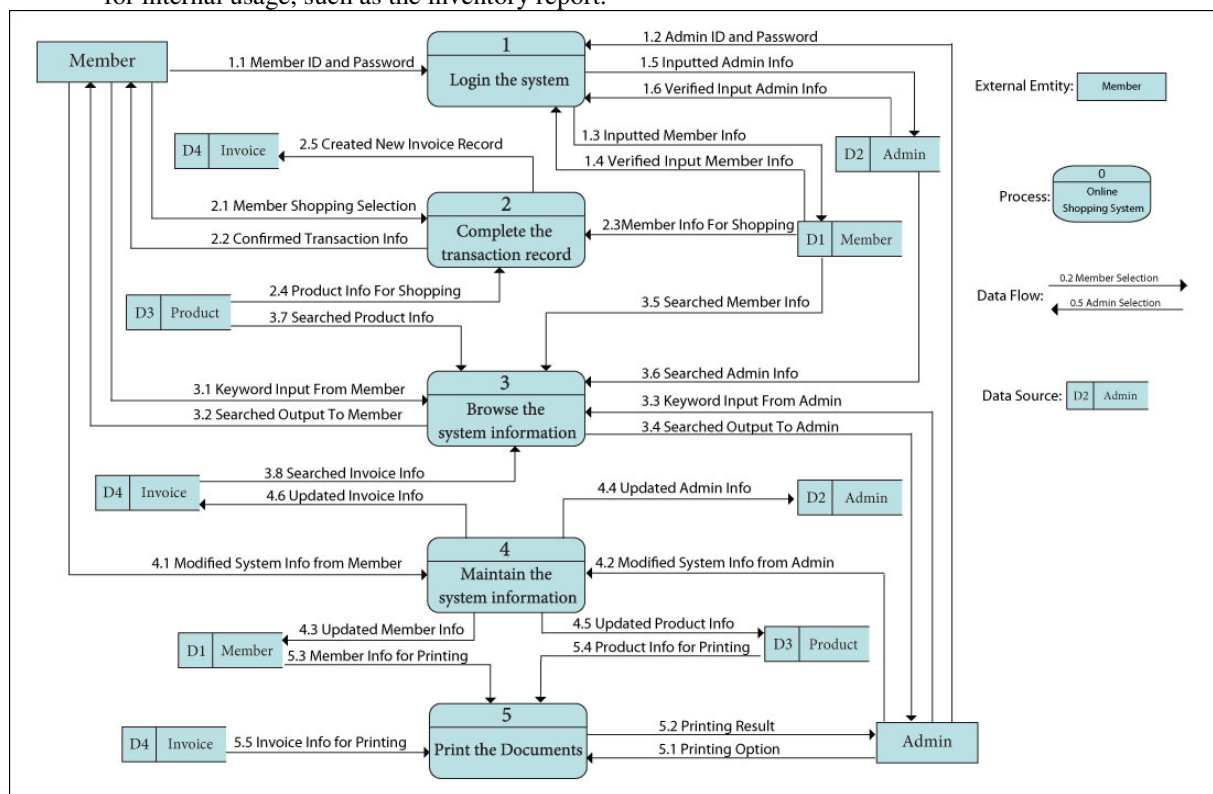


Fig. 2. Data Flow Diagram (Level 0)

3.4 Data Model

There are thirteen entities in our final Entity Relationship Diagram (ERD) as shown in Fig. 3. The brief descriptions of all the entities are shown as follows:

- *Member* – Member
- *Admin* – Administrator
- *Cart* – Shopping cart of a member
- *Cart_Item* – An item in the shopping cart of a member
- *ProType_Pay* – Product type and payment method of a product
- *Pro_Loc* – Pickup location of a product
- *Invoice* – An invoice which a member may have more than one invoices after he checks out his shopping cart, e.g, he chooses different pickup locations for different products in one shopping cart.
- *Location* – Detailed information of a pickup location
- *Payment* – Detailed information of a payment method
- *Product* – Detailed information of a product
- *ProType* – Detailed information of a product type
- *ProType_Loc* – Product type and pickup location of a product
- *Pro_Hist* – History of the inventory record of a product

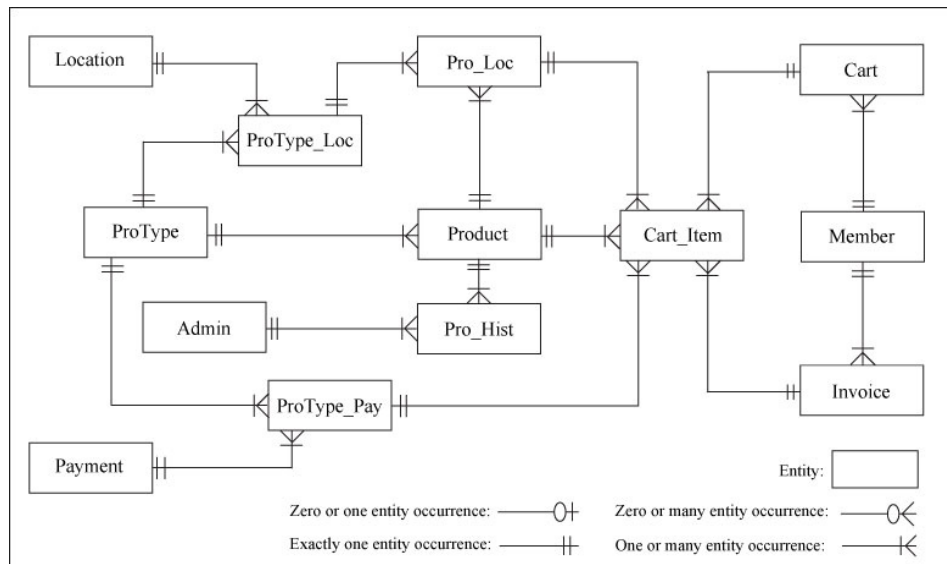


Fig. 3. Entity Relationship Diagram

3.5 Deviation between Final Design and Initial Design

There are a number of differences between the final design and initial design of our system, and we describe them in this section.

Firstly, we deleted two functions: (1) member registration; (2) messaging function. Since the MCU member registration process is already done in an existing system in MTR's Intranet, it is not necessary for us to provide this function in our system. Besides, a system administrator does not log into our system all the time, members sending messages to administrators through the messaging function in our system cannot receive the instant reply from administrators. As a result, it is better to display the contact information of MCU administrative staffs in our system, and asks members to contact the staffs directly. Therefore, the corresponding data flows in DFD and related entities in ERD are deleted.

Secondly, we designed a few reports to meet the needs of our stakeholder as follows.

- Inventory report for all locations
- Inventory report for selected location(s)
- Outstanding order list report for all locations
- Outstanding order list report for selected location(s)
- Outstanding invoice report for all invoice statuses
- Outstanding invoice report for selected invoice status(es), such as ordered, waiting for pickup

Thirdly, after understanding the sales operations of MCU, we modify our ERD diagrams to suit their needs. For example, it allows members to buy a few quantity of the same product in one shopping cart, but they can pick up the products at different locations. As a result, it is possible that more than one invoices printing out for one shopping cart.

Fourthly, after several demonstration sessions, we revised the interfaces of both members and administrators based on the comments from our stakeholder.

4 SYSTEM IMPLEMENTATION

In this section, we present our online shopping system in terms of the functions for members, the functions for administrators and the system printouts. Besides, user guides for members and administrators are also prepared for our stakeholder, but we do not present them in this paper because of limited space.

4.1 Functions for Members

Members use their member IDs and passwords to login our system. Once a member logs into the system, it identifies the type of the member, which is *Ordinary*, *Associate* or *Suspended*. The authorities are granted to the member based on the type of the member. After that, a main menu displays all the functions for members in our system as shown in Fig. 4.

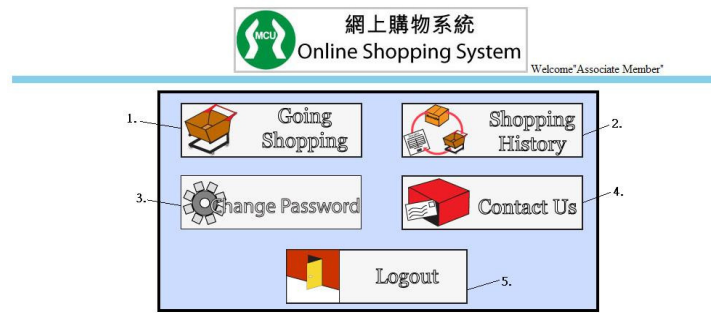


Fig. 4. Main menu for members in our online shopping system

We briefly describe the five main functions provided to members as follows:

- *Going shopping* – The system provides a searching function on goods based on the product types and brand names, and shows the inventory state to members. Members can make purchase orders on different products using the online shopping cart.
- *Shopping history* – Members can check their shopping history, ordering history and existing invoices, and cancel their orders any time.
- *Change password* – It allows the members to change their passwords by themselves.
- *Contact us* – Member can get the contact information of the system administrators.
- *Logout*

To purchase products in our online shopping system, a member can select the *Going shopping* function in the main menu. Fig. 5 shows the interface listing all the product types. When the member double-click the name of a product type, all the products of the type are displayed, for example, all the products of mobile phone type are displayed as shown in Fig. 6. When the member selects one product, he can view the detailed description of the product as shown in Fig. 7. At this page, he can input the purchase quantity and select the pickup location and time, then press the “Add to Cart” button. After that, the member can view his selected items in his shopping cart as shown in Fig. 8. Once the member decides to order the selected items, he checks out, views the information of the invoice and selects the payment method as shown in Fig. 9. Besides, the member can cancel his order at his view order page.



Fig. 5. The interface of product type list



Fig. 6. The interface of product list



Fig. 7. The interface of product description



Fig. 8. The interface of shopping Cart



Fig. 9. The interface of shopping cart

4.2 Functions for Administrators

Administrators use their administrator IDs and passwords to login our system. Once an administrator logs into the system, it identifies the authorities for the administrator to maintain the information of products, invoices, members and administrative staffs, and to print vary types of reports. After an administrator logs into our online shopping system, a main menu displays all the functions for administrators in our system as shown in Fig. 10.

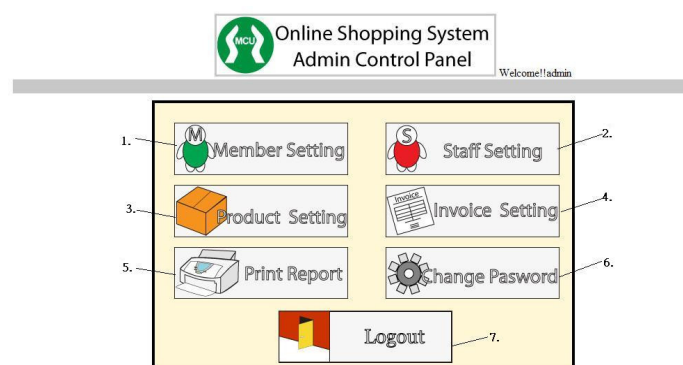


Fig. 10. Main menu for administrators in our online shopping system

We briefly describe the seven main functions provided to administrators as follows:

- *Member setting* – Administrators can view, modify and delete the personal information and passwords of members if necessary. Administrators can search the information of members by using member ID or member type.
- *Staff setting* – Administrators can view, modify and delete the personal information and passwords of administrators if necessary.
- *Product setting* – Administrators can view, modify and delete the information of products, such as the prices, pickup locations of products, inventory and ordered quantities. Fig. 11 shows the interface of product list.
- *Invoice setting* – Administrators can choose to view the invoice list of ordered but not paid, paid orders, finished pickup orders or disqualified orders. Fig. 12 shows the interface of ordered invoice list. Besides, at the interface showing the details of an invoice at Fig. 13, administrators can modify the invoice, such as completing a transaction and disqualifying a transaction. They can print out the invoice if necessary.
- *Print report* – Administrators can print out reports for internal usages, such as inventory report.
- *Change password* – It allows the administrators to change their passwords by themselves.
- *Logout*

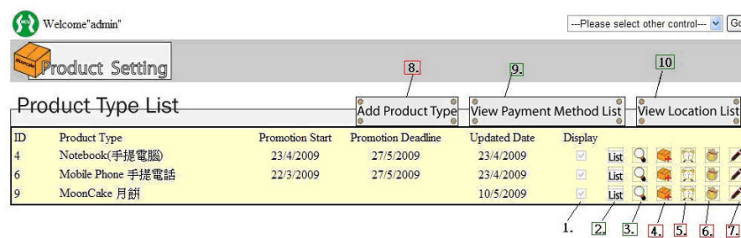


Fig. 11. The interface of product list



Fig. 12. The interface of ordered invoice list

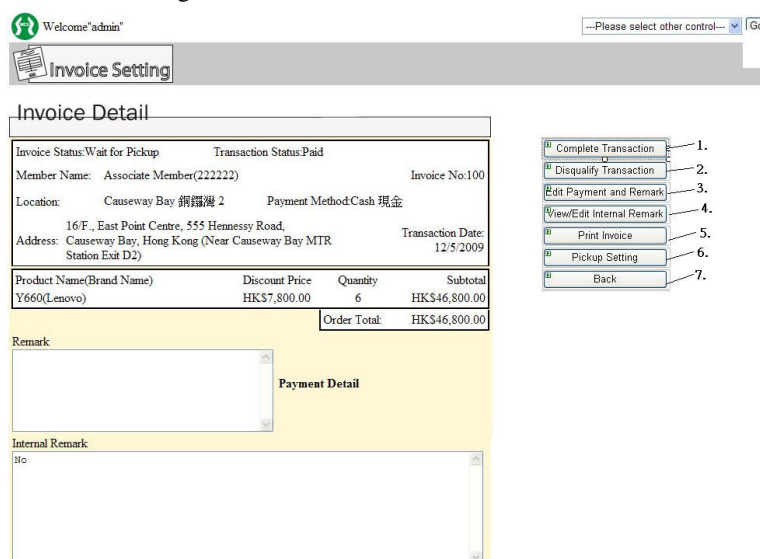


Fig. 13. The interface of the detail of an invoice

4.3 Printouts

In this section, we describe the printouts of our online shopping system, they are invoices and summary reports.

4.3.1 Invoices

In our online shopping system, the administrator can print out a selected invoice. Before printing, the print preview of the invoice is shown as Fig. 14. The administrator can enter some remarks for internal reference.

Fig. 14. The print preview of an invoice

4.3.2 Reports

For internal usage, the administrator can print out some reports, such as outstanding inventory report, outstanding invoice report and inventory report. Fig. 15 shows the interface of printing an outstanding inventory report. After clicking “Report Preview” button, the print preview of the report is displayed as shown in Fig. 16.

Fig. 15. The interface of printing an outstanding inventory report

Product Name(Brand Name)	Product Type	Inventory Qty	Order Qty	Payment Qty	Pickup Qty	Cancel Qty	Remain Qty
VGN-P15G(Sony索尼)	Notebook(手提電腦)	20	10	10	0	0	10
V4501(Lenovo)	Notebook(手提電腦)	0	5	0	0	0	0
Y990(Lenovo)	Notebook(手提電腦)	0	4	0	0	0	0
K630(SONY ERICSSON)	Mobile Phone 手提電話	0	3	0	0	3	0
R306(SONY ERICSSON)	Mobile Phone 手提電話	0	1	1	0	0	-1
J167(Sony索尼)	Mobile Phone 手提電話	0	5	0	0	5	0

Fig. 16. The print preview of an outstanding inventory report

4.4 Testing Plan

We executed a series of tests to ensure the correctness of our system. In [2], it describes different types of testing during system development, they are unit testing, integration testing, system testing, user acceptance testing. For our system, we also have migration testing. In the following, we briefly describe all the testing in our system.

4.4.1 Unit Testing

Unit Testing focuses on one unit – a program or a module that performs a specific function that can be tested. The purpose of a unit test is to ensure that the module or program performs its function as defined in the program specification. For example, we tested the login function for the unit test, so we entered the user ID and password to test until the program not displaying any error message.

4.4.2 Integration Testing

Integration Testing assesses whether a set of modules or programs that must work together do so without error. They ensure that the interfaces and linkages between different parts of the system work properly. For example, after we tested the login function and the shopping function separately without error, we tested these two functions together until we completed the transaction without error.

4.4.3 System Testing

System Testing is to ensure that all modules and program work together without error. System testing is similar to integration testing but is much broader on scope. For example, we tested all functions together in our system until the process was completed without error.

4.4.4 User Acceptance Testing

User Acceptance testing is done primarily by the user with support from the project team. The goal is to confirm that the system meets the business needs that prompted the system to be developed, and is acceptable to the users. For example, we had 4 demonstrations to our stakeholder, which are held at 26th February, 16th April, 5th May and 14th May 2009. In the demonstrations, our stakeholder revised the user requirements and our system functions. After that, we deleted some useless functions such as member registration function and messaging function, and we also defined which reports are needed by our stakeholder.

4.4.5 Migration Testing

The system is expected to be migrated into MTR's Intranet by the end of July 2009. Before the migration testing, we checked out the system environment of the MTR's Intranet and the MTR web server (Windows 2003 Server supports Internet Information Services, IIS function). We confirmed with our stakeholder that a set of current members' data in Microsoft Excel format will be transferred to our database. For example, in the migration testing, we test the performance of our system, check the compatibility of our system with the MTR's Intranet and debug the system if necessary. MCU's staffs can do the final user acceptance testing and check out whether the system performance matches their expectations.

5. CRITICAL EVALUATION

In this section, we evaluate our performance in this project in different aspects, and summarize what we have learnt in this project.

5.1 Problems Faced in our Team

At the early stage of this project, some members were quite passive in team work, so the completions of tasks were delayed. We solved this problem by increasing the frequency of project meetings and redistributing the tasks and work load from time to time if necessary.

The next problem is only one member in our team had experience in VB.NET programming. It results in the time for system development greatly increased comparing with our initial project schedule plan. After a series of demonstrations to our stakeholder, we got our stakeholder's agreement to delay the project schedule.

5.2 Gain of our Team

Through the discussions of project, we gain more experience in communication skills in a team and help us to communicate with other people more efficiently in other projects in the future. We also learn how to endure other member's weaknesses and train our patience. Besides, we understand that the skilled members shoulder other member's responsibilities in a group project. Moreover, we learn how to distribute work among members through proper communication.

In this project, we demonstrated and presented our system to our supervisor and stakeholder for several times, it enhances our presentation skills. It increases our courage during presentation and enhances our answering skills to audiences' questions. Besides, we gain the experience on writing regular and formal reports.

6. CONCLUSION

In this project, we developed an online shopping system for our stakeholder, Metro Credit Union (MCU), and the system is expected to be launched in the near future. In the system development, we applied the skills that we have learnt in the past years and gained a lot of experiences. For further improvement of our system, we suggest to add some animations in our system in order to make our system to be more attractive. Besides, we can further enhance our system's functions in order to match the development of MCU.

7. REFERENCES

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