Department of Computer Science and Engineering

The Chinese University of Hong Kong

LYU0001

Wireless based Mobile E-Commerce on the web

Final Year Project Report, Spring 2001

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1. Abstract

In this report, we will mention briefly the e-commerce trend and the behavior of usage of wireless Internet nowadays. Then we will describe our project motivation and objective. Then a System Facilities section follows to describe each of the system functions, and screen captures are included to give idea on how the features look like.

During design and implementation of the system, we encounter a number of limitations, which mostly due to the limited support of some features in WAP. Facing these limitations, we figured out solutions accordingly, and are listed in the section of Limitations and Solutions.

A System Architecture section then follows to explain how different parts of the system work with each other. A section of System Design will include a site map and the database schema concerning our system. Then a System Implementation section will describe the system and programming language used in this project.

We have learned a lot of things during design and implementation, which will be listed in a section about our learning and experience. A conclusion then follows.

For appendix, a Wireless Application Protocol (WAP) section is included to introduce its background, architecture, advantage, limitations and its future, and a brief introduction of Wireless Markup Language (WML) will also be included. Another section of appendix is on XML and XSL, which involves the mechanism and advantage of using XML and XSL.

2. Background

2.1 E-commerce

In the past, Internet is only used by people to search for information, and later evolved to be a tool for communication. As the Internet is gaining its popularity, merchants begin to use the Internet as a tool for advertising and doing transactions. This is known as electronic commerce, E-commerce.

According to a study “2000 America Online/Roper Starch Cyberstudy”, online commerce has become an everyday activity for millions of users. This year, more than half of the survey's respondents (56 percent) say that they currently shop online, nearly double the percent of those who did in 1998 (31 percent). In addition to shopping more frequently, consumers are also spending more when they shop online.

Internet Use 1998 vs. 2000

Use	1998	2000
Shop online	31%	56%
Intend to shop online in future	14%	28%
Plan to increase online purchases	41%	49%
Banking	16%	25%
Trading stocks	11%	16%
Source: AOL/Roper Starch Cyberstudy		

As users grow accustomed to integrating the online medium in their everyday lives, they are also increasingly demanding access to it from any place, at any time. "That increased consumer reliance on popular online services can be seen in strong and growing demand for Internet-accessible cell phones, PDAs, two-way pagers, small kitchen devices, and TV set top boxes." said Marshall Cohen, America Online Senior Vice President of Brand Development.

2.2 Trend on Wireless Internet

According to a research of the E-Business Unit (EBU) of Cap Gemini America (http://www.usa.capgemini.com/) and Corechange Inc (http://www.corechange.com/), seventy percent of the present users use wireless data applications on their cell phones at least once a day and 60 percent use it for at least 1 to 3 minutes per occasion. In the future, 88 percent will use it at least once a day and 19 percent will use it more than three times a day. Sixty-six percent will use it more than three minutes every time. This indicates an enormous growth in wireless traffic data.

As predicted by International Data Corp (http://www.idc.com/), by mid-2001, all digital cellular/PCS handsets shipped in the world will be WAP-capable, and by the end of 2002, there will be more wireless subscribers capable of Internet access than wired Internet users. When this happens, there will be a fundamental shift in the thinking of the Web community and the IT industry as a whole. "Once there are more wireless Internet users than wired users, Web masters may first consider the needs of the wireless users and secondly, the wired PC users," said Iain Gillot, vice president, Worldwide Consumer and Small Business Telecommunications research at IDC. "Today, Internet sites have to be retro-fitted for wireless users, but three years from now, it is conceivable they might have to be redesigned for wired users."

Recently, mobile phones can get connected to the Internet, but this not the same way as we do from our wired computer. Since there is a different computational environment with much more limitations on wireless devices, a new protocol, WAP, is being developed that best suit the mobile situation.

3. Introduction and Project Objectives

3.1 Motivation and Objective

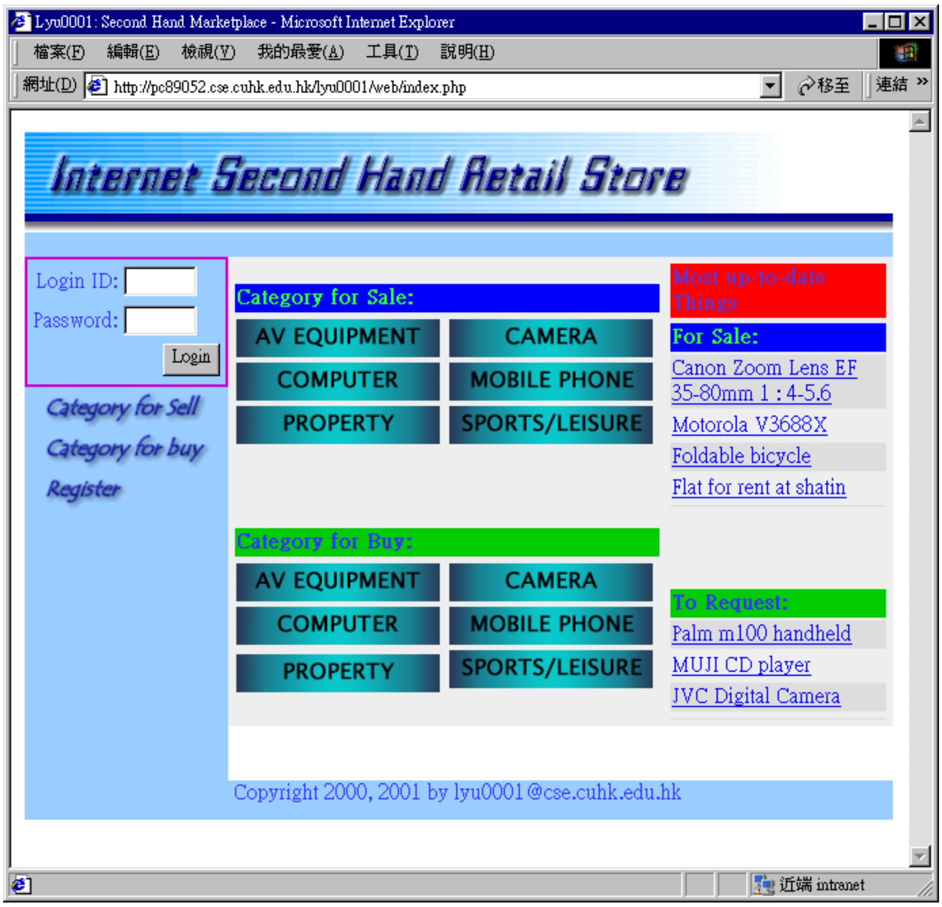
As prediction on the Internet shows that there will be more wireless subscribers capable of Internet access than wired Internet users in a few years, it is inevitable that the way people doing e-commerce will change from the current wired network to wireless means. Our project is to explore the world of e-commerce in it's beginning age of moving to the wireless world.

3.2 Introduction

One of the advantages of using wireless Internet access over the traditional wired access is the ability to let user access the get online anytime, anywhere, which allow user to get more update and more interaction from Internet sites. In order to take advantage of this feature through e-commerce, we have chosen to implement a second hand market system that allows users to access through traditional web, and through WAP enabled devices.

4. System Facilities

4.1 Index Page


Lyu0001: Second Hand Marketplace - Microsoft Internet Explorer
檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)
網址(D) http://pc89052.cse.cuhk.edu.hk/lyu0001/web/index.php
移至
連結 »
近端 intranet

Internet Second Hand Retail Store

Login ID:

Password:

Login

Category for Sell

Category for buy

Register

Category for Sale:

AV EQUIPMENT	CAMERA
COMPUTER	MOBILE PHONE
PROPERTY	SPORTS/LEISURE

Category for Buy:

AV EQUIPMENT	CAMERA
COMPUTER	MOBILE PHONE
PROPERTY	SPORTS/LEISURE

Most up-to-date Things

For Sale:

- Canon Zoom Lens EF 35-80mm 1 : 4-5.6
- Motorola V3688X
- Foldable bicycle
- Flat for rent at shatin

To Request:

- Palm m100 handheld
- MUJI CD player
- JVC Digital Camera

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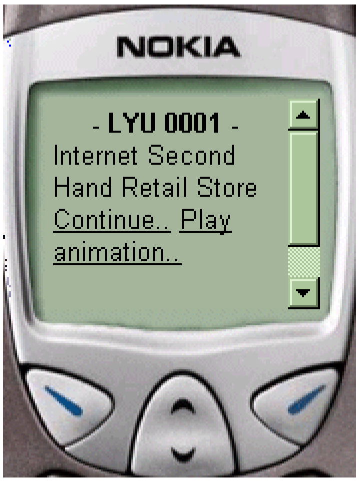
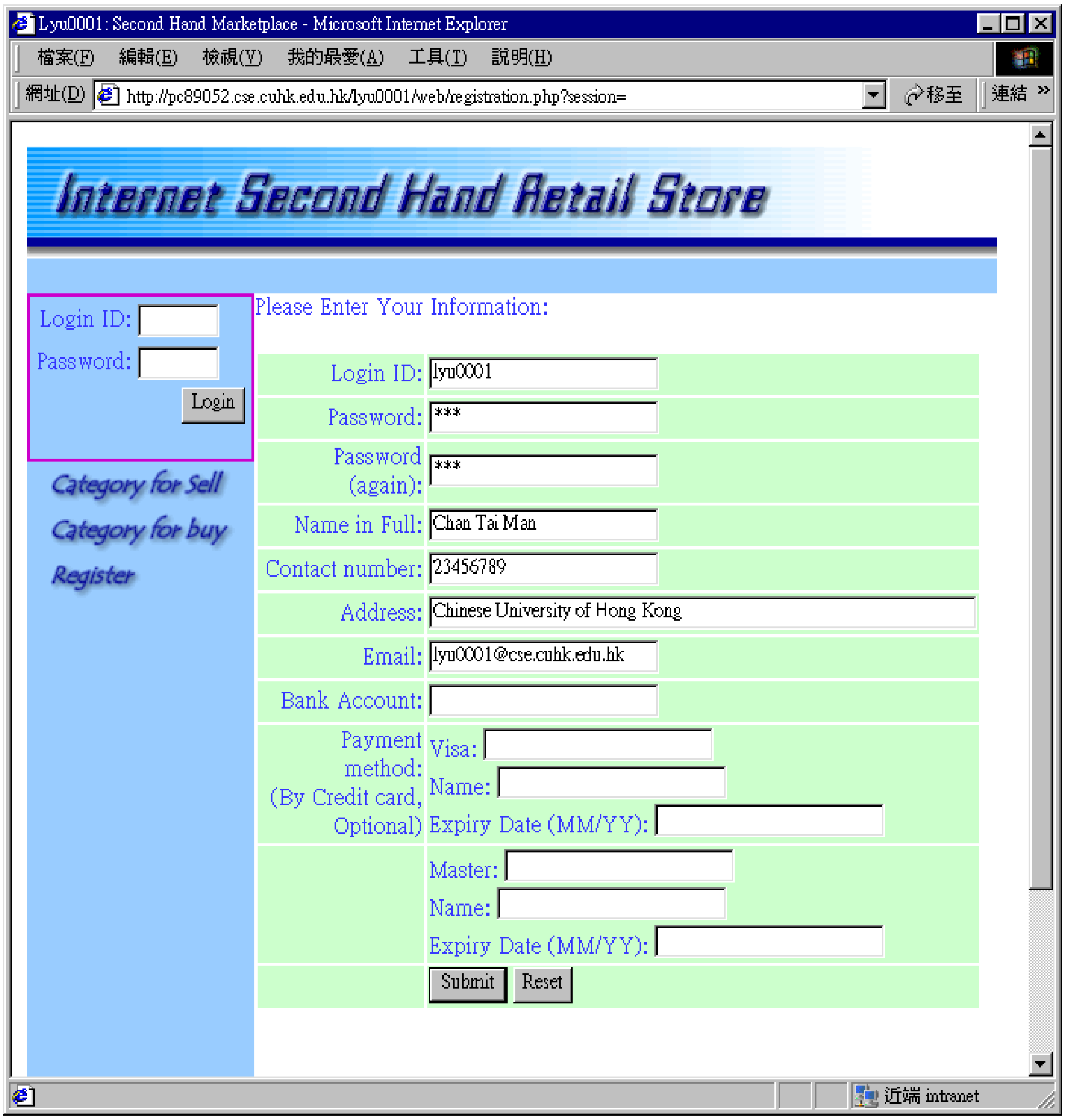
Figure 1 Index page (web)



- LYU 0001 -
Internet Second
Hand Retail Store
Continue.. Play
animation..

Figure 2 Index page (WAP)

4.2 User Registration


Lyu0001: Second Hand Marketplace - Microsoft Internet Explorer
檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)
網址(D) http://pc89052.cse.cuhk.edu.hk/lyu0001/web/registration.php?session=
移至
連結
Internet Second Hand Retail Store
Login ID:
Password:
Login
Category for Sell
Category for buy
Register
近端 intranet

Please Enter Your Information:

Login ID:	lyu0001
Password:	***
Password (again):	***
Name in Full:	Chan Tai Man
Contact number:	23456789
Address:	Chinese University of Hong Kong
Email:	lyu0001@cse.cuhk.edu.hk
Bank Account:	
Payment method: (By Credit card, Optional)	Visa: Name: Expiry Date (MM/YY):
	Master: Name: Expiry Date (MM/YY):
	Submit Reset

Figure 3 User Registration (web)

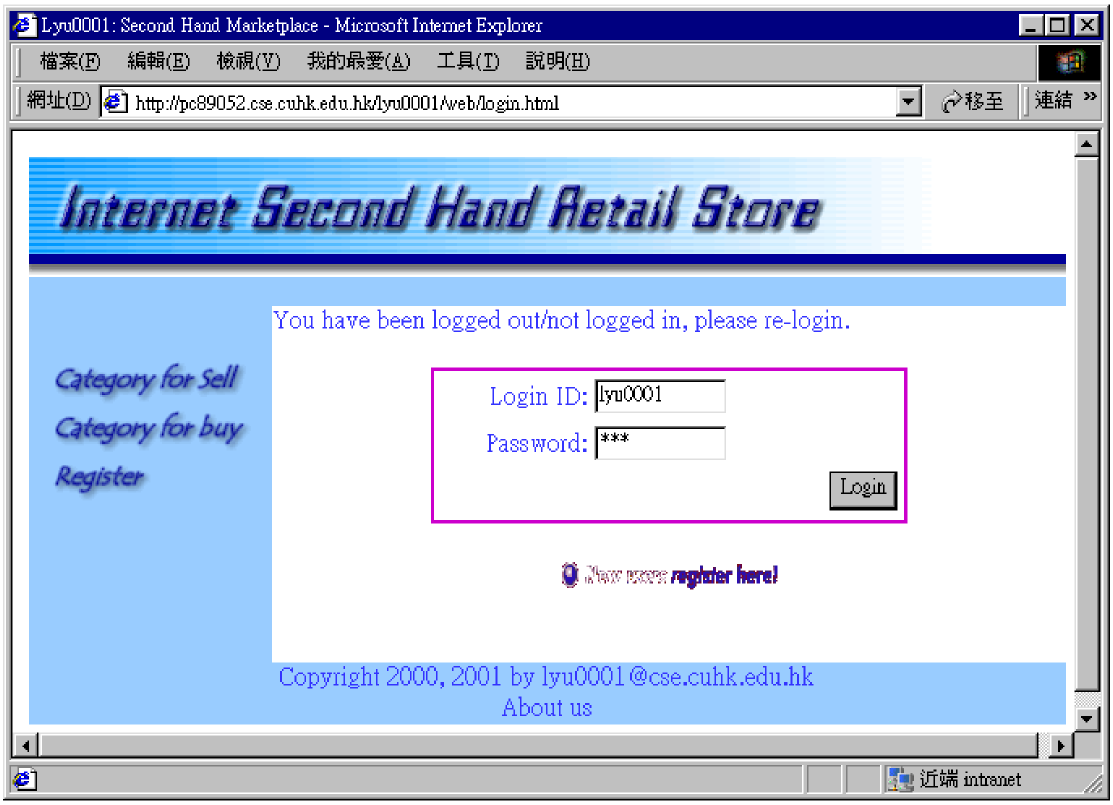
Users are required to register in our system to get an account before posting products for sell and request, although pure browsing through categories do not require a user account. There is a page for users to register to open an account in our system. Users are required to enter:

- Their names,
- The preferred username and password,

- Telephone number
- Email and Address

Bank account number is also needed if the user wants to sell products through our system so that money credited through the selling of the products are transferred to the user's bank account. Users are able to fill in credit card information, such as card number and expiry date, so that they can use the card information to make purchasing in the future without having to type in every time, especially when user is using a WAP phone of which is time consuming to input a long string.

4.3 Login


Lyu0001: Second Hand Marketplace - Microsoft Internet Explorer
檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)
網址(D) http://pc89052.cse.cuhk.edu.hk/lyu0001/web/login.html
移至 連結
Internet Second Hand Retail Store
Category for Sell
Category for buy
Register
Login
New users register here!
近端 intranet

You have been logged out/not logged in, please re-login.

Login ID: lyu0001

Password: ***

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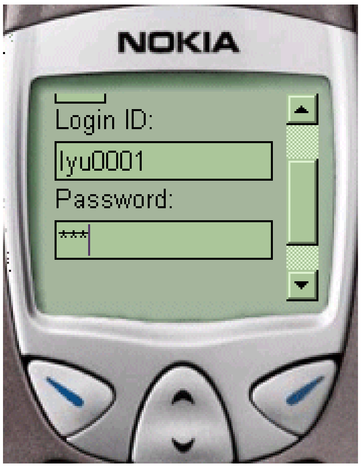
About us

Figure 4 Login Page (web)

After the users have got account in our system, they can login to use our system. When they successfully login, a pseudo-random session id is generated to represent the users' login session. The session id will become invalid once the user logout the session or the session is idle for long time that the automatic logout is activated. With this mechanism, even if people can peep another user's session id or see the session id from browser history, they still cannot get access to the user's account without knowing the password since the session id is different for every login of the user.



Login ID:

lyu0001

Password:

***

Figure 5 Login page (WAP)

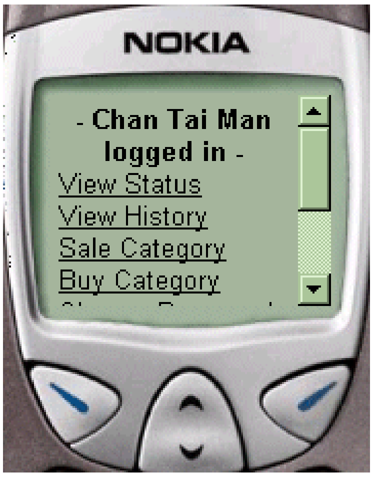

- Chan Tai Man logged in -

Figure 6 Menu after logged in (WAP)

After users logged into our system, there will be several facilities provided.

Unread message: indicate the number of message leave to the logged in user from other registered people.

Product response: indicate the number of product response message leave to the user.

View Status: display information about current products status posted for sale or requesting for buy. (Default page for Web version)

View History: display the information about the transaction of products made before.

View/Edit info: change their personal information registered in the system before.

Send message: leave any message to other registered users as an interaction

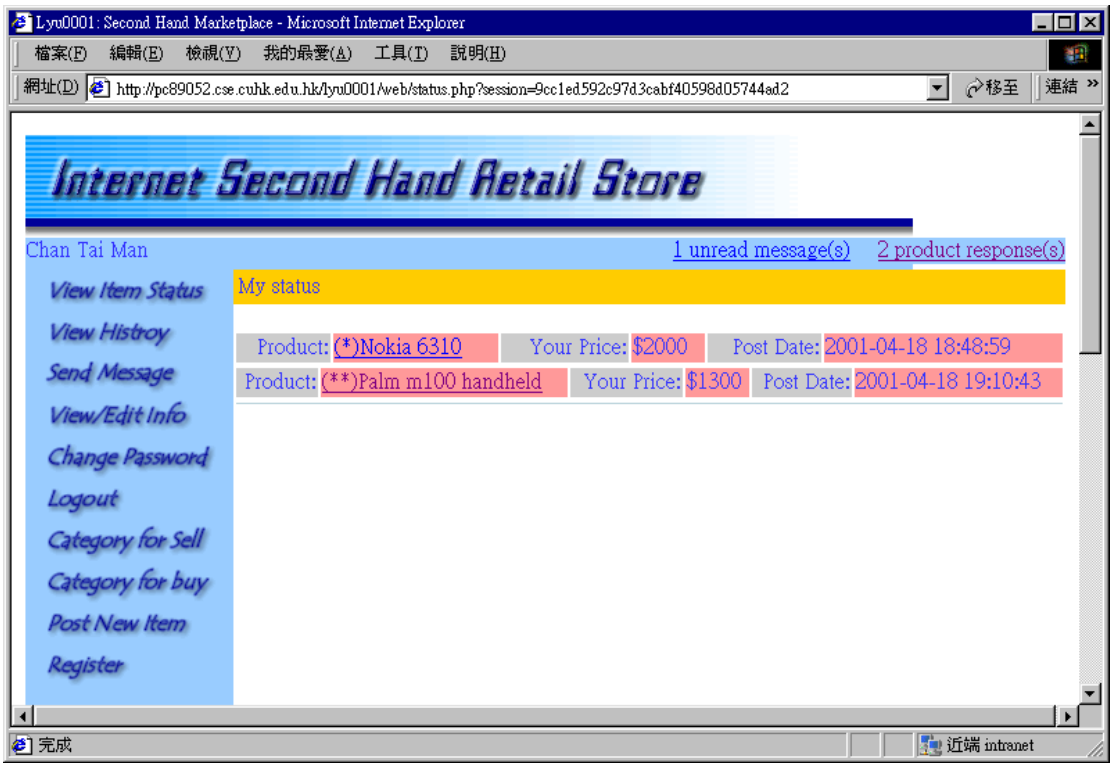
Change Password: change the current password.

Category for sell/buy: let users browse products that are posted by other registered users.

Posting new item: post a product for others' browsing and make any response.

Register: register for another new users.

4.4 View Status


Lyu0001: Second Hand Marketplace - Microsoft Internet Explorer
檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)
網址(D) http://pc89052.cse.cuhk.edu.hk/lyu0001/web/status.php?session=9cc1ed592c97d3cabf40598d05744ad2
移至
連結
Internet Second Hand Retail Store
View Item Status
View Histroy
Send Message
View/Edit Info
Change Password
Logout
Category for Sell
Category for buy
Post New Item
Register
完成
近端 intranet

Chan Tai Man 1 unread message(s) 2 product response(s)

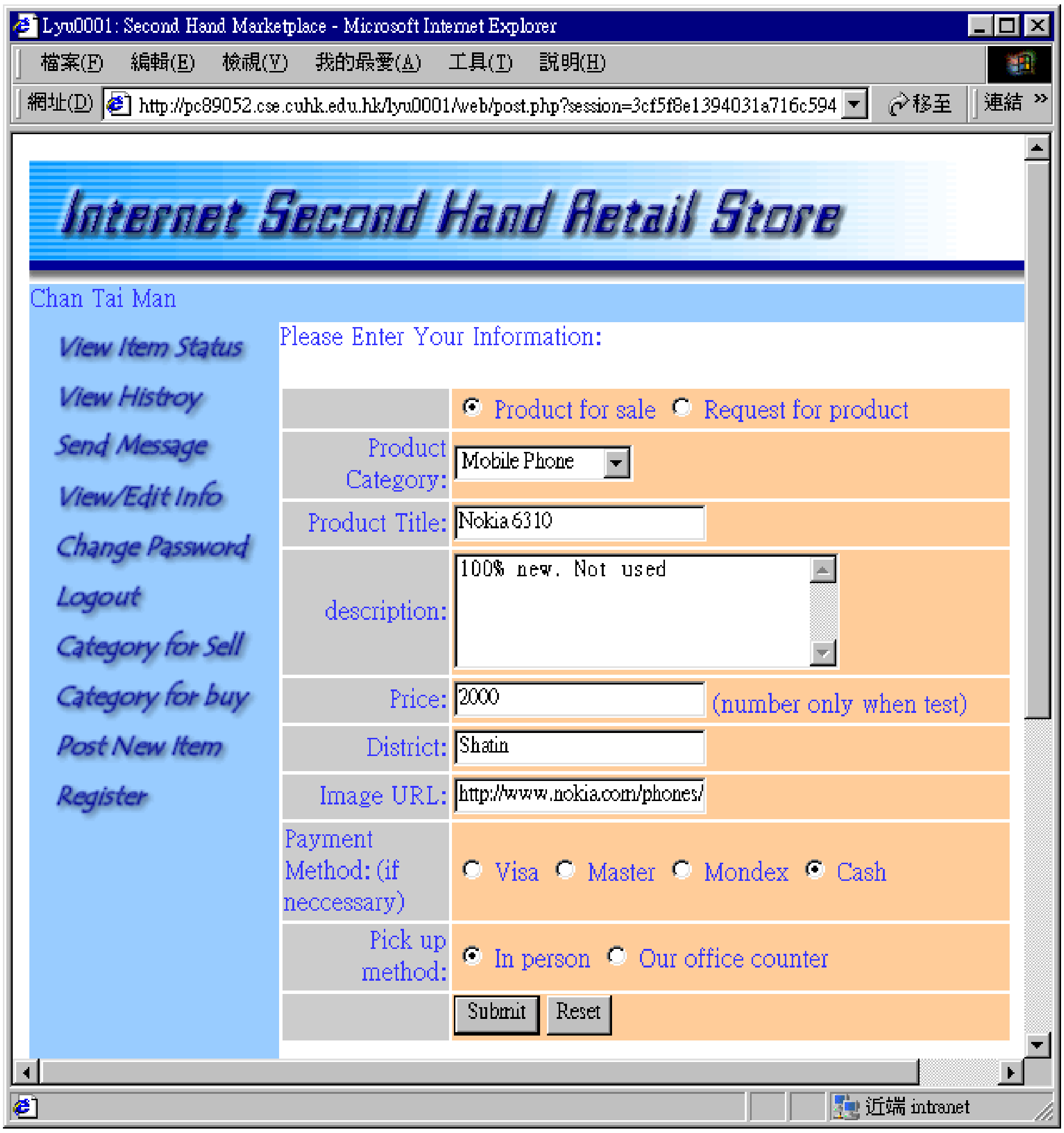
My status

Product:	(*)Nokia 6310	Your Price:	$2000	Post Date:	2001-04-18 18:48:59
Product:	(**)Palm m100 handheld	Your Price:	$1300	Post Date:	2001-04-18 19:10:43

Figure 7 View Status (web)

After the users logged in to the system, the users can check the product they post for sale or request to see if there is any person replying. If there is reply, they can choose to adjust the price if they found the price suggested by the respondent is not good enough, or they can accept the response and make a deal.

4.5 Post Product Information


Lyu0001: Second Hand Marketplace - Microsoft Internet Explorer
檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)
網址(D) http://pc89052.cse.cuhk.edu.hk/lyu0001/web/post.php?session=3cf5f8e1394031a716c594
移至
連結
Internet Second Hand Retail Store
View Item Status
View Histroy
Send Message
View/Edit Info
Change Password
Logout
Category for Sell
Category for buy
Post New Item
Register
近端 intranet

Chan Tai Man

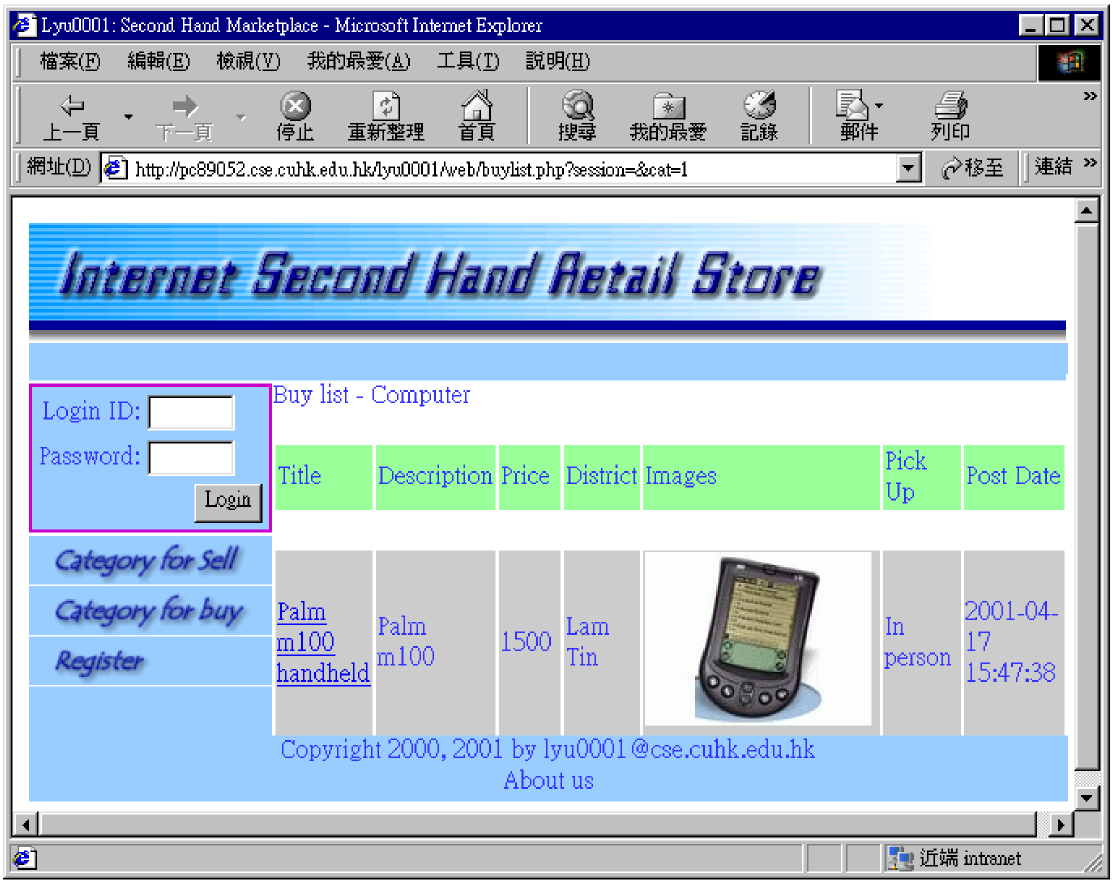
Please Enter Your Information:

	● Product for sale ○ Request for product
Product Category:	Mobile Phone
Product Title:	Nokia 6310
description:	100% new. Not used
Price:	2000 (number only when test)
District:	Shatin
Image URL:	http://www.nokia.com/phones/
Payment Method: (if neccessary)	○ Visa ○ Master ○ Mondex ● Cash
Pick up method:	● In person ○ Our office counter
	Submit Reset

Figure 8 Post New Product (web)

Registered users can post product information to sell product or request for a product. They can input product name, description and price etc for the product, and can choose the pick-up method for the product of either in person or from counter. When chosen to pick-up in person, the buyer and seller are required to meet at some time to settle the transaction, and when chosen to pick-up from counter, the seller is supposed to put the product in our physical counter, and the buyer choose a time they want to get the product from the counter.

4.6 Browse Product Data


Lyu0001: Second Hand Marketplace - Microsoft Internet Explorer
檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)
上一頁 下一頁 停止 重新整理 首頁 搜尋 我的最愛 記錄 郵件 列印
網址(D)
移至 連結
Internet Second Hand Retail Store
Login
Category for Sell
Category for buy
Register
近端 intranet

http://pc89052.cse.cuhk.edu.hk/lyu0001/web/buylist.php?session=&cat=1

Login ID:

Password:

Buy list - Computer

Title	Description	Price	District	Images	Pick Up	Post Date
Palm m100 handheld	Palm m100	1500	Lam Tin		In person	2001-04-17 15:47:38

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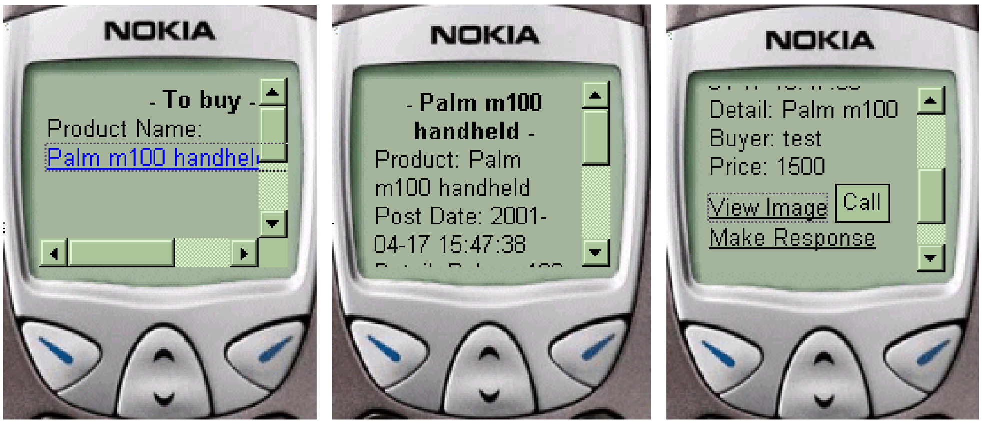
About us

Figure 9 Browse product data (web)

Users with and without account in our system are able to browse the products requested and for sale from other users. The products are divided into different categories. Click on the product title can read the details of that product. For WAP version, there will be a "View Image" link if there is any image posted for browsing. If users registered an account and logged into our system, they can also give any reply to those products they interested in and send message to they corresponding seller/buyer with such interaction involved.



- To buy -
Product Name:
Palm m100 handhel

- Palm m100 handheld -
Product: Palm m100 handheld
Post Date: 2001-04-17 15:47:38

Detail: Palm m100
Buyer: test
Price: 1500
View Image Call
Make Response

Figure 10 Browse product data (WAP) (1)

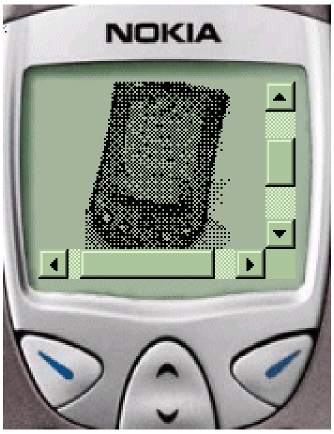
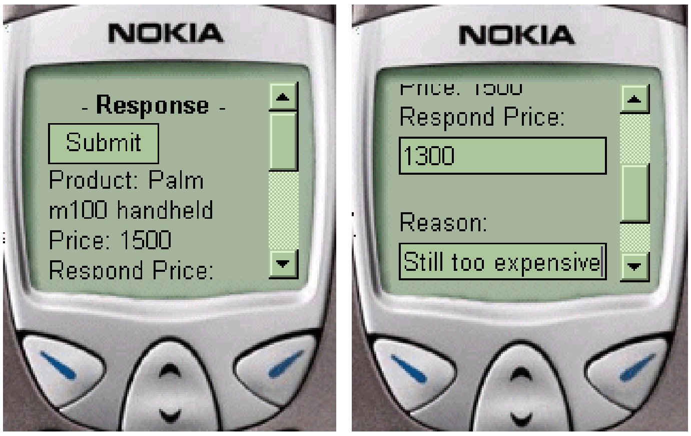


Figure 11 Browse product image (WAP)

4.7 Give Product Response

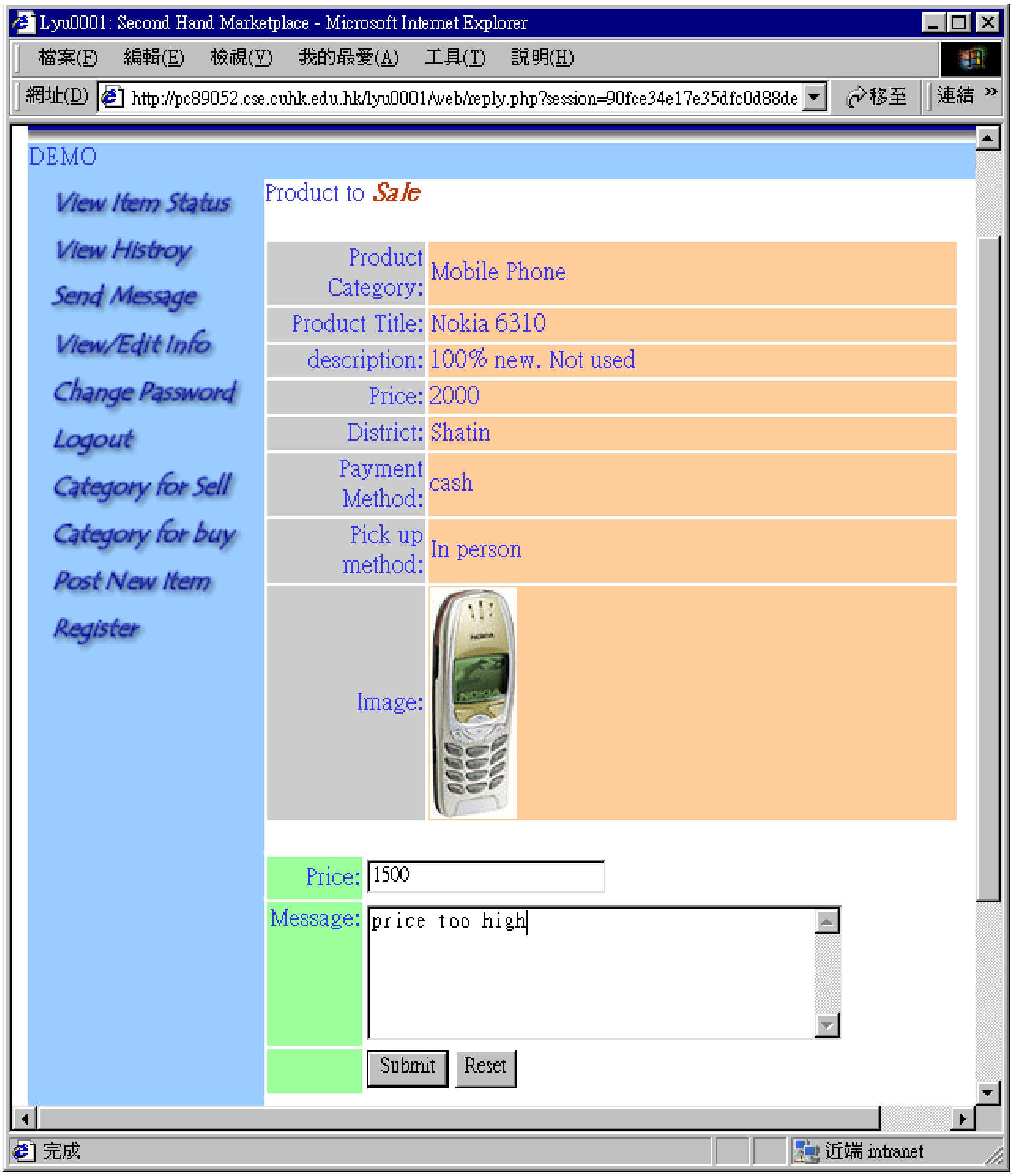


- Response -
Submit
Product: Palm m100 handheld
Price: 1500
Respond Price:

Respond Price:
1300
Reason:
Still too expensive

Figure 12 Give product response (WAP)

When users browse a product for sale or a product request which attract them, they can give response to the posting by sending the price the user suggest, and any reasons and information involved.



http://pc89052.cse.cuhk.edu.hk/lyu0001/web/reply.php?session=90fce34e17e35dfc0d88de

Product to Sale

Product Category:	Mobile Phone
Product Title:	Nokia 6310
description:	100% new. Not used
Price:	2000
District:	Shatin
Payment Method:	cash
Pick up method:	In person
Image:	

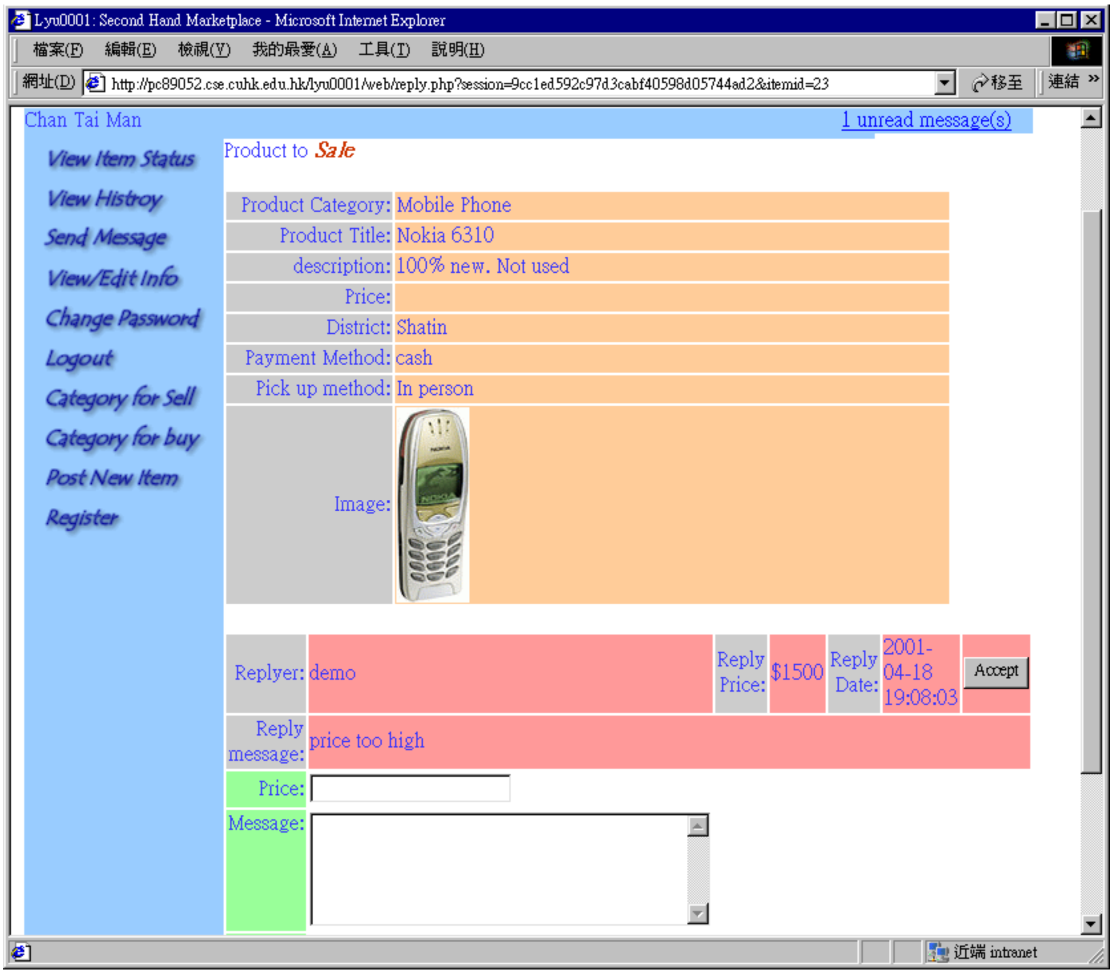
Price: 1500

Message: price too high

Submit Reset

Figure 13 Give product response (web)

4.7 Read and Reply Product Response



http://pc89052.cse.cuhk.edu.hk/lyu0001/web/reply.php?session=9cc1ed592c97d3cabf40598d05744ad2&itemid=23

Chan Tai Man 1 unread message(s)

Product to *Sale*

Product Category:	Mobile Phone
Product Title:	Nokia 6310
description:	100% new. Not used
Price:	
District:	Shatin
Payment Method:	cash
Pick up method:	In person
Image:	

Replyer:	demo	Reply Price:	$1500	Reply Date:	2001-04-18 19:08:03	Accept
Reply message:	price too high					

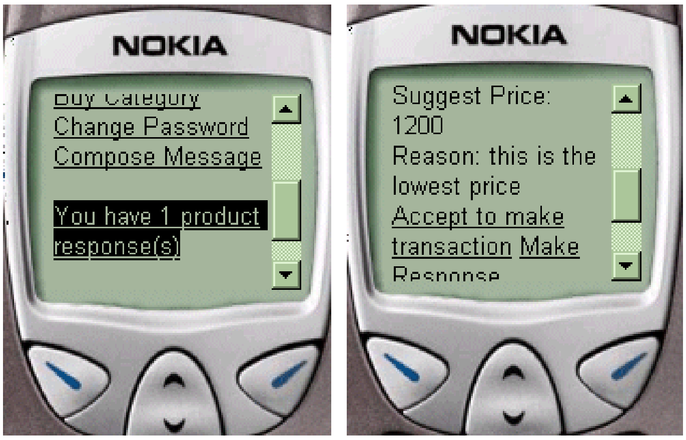
Price:

Message:

Figure 14 Read Product Response (web)

For web version, if there is any users send a message about particular products they interested in, another party will receive a message alert hyperlink at the top right hand corner. Once the hyperlink is clicked, it will go back to the page of "View Status". The product(s) with one asterisk (*) indicate the response message from users interested in the product you posted. If there are two asterisks (**), it means the owner of the products send back you product response message. Click on that hyperlink for the product can read the product response message. Then you can reply with a new product response message.

For WAP version, unread response message is shown at the bottom of the page. Click on the link can read the product response message and the user is able to reply that message by clicking "make response" link or read another unread response message one by one.



Buy Category
Change Password
Compose Message

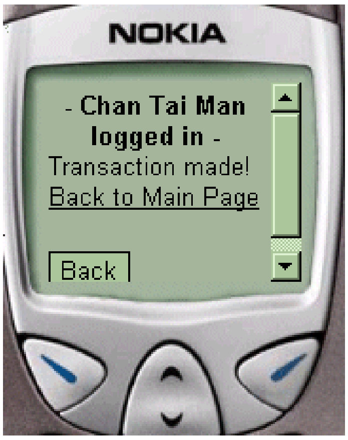
You have 1 product response(s)

Suggest Price: 1200
Reason: this is the lowest price
Accept to make transaction Make Response

Figure 15 Read Product Response (WAP)

4.8 Accept and Make Transaction

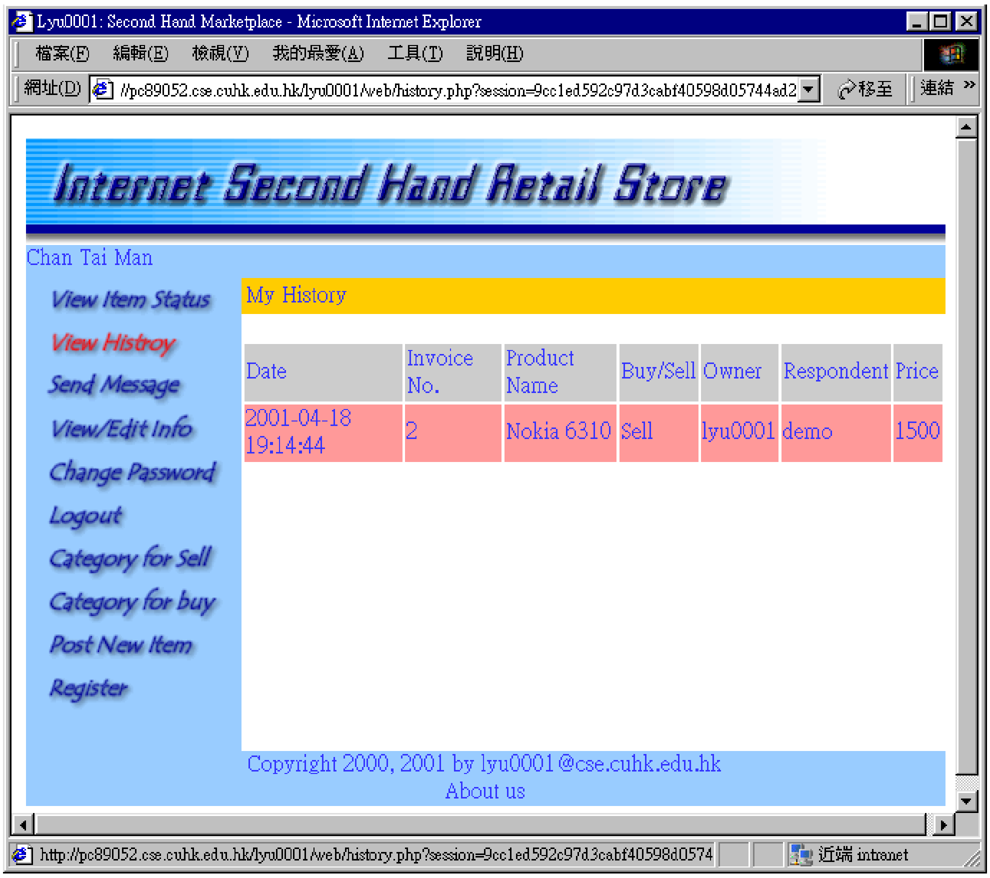
When a product response message is received and read, users can also accept the final discussion and make transaction by simply clicking the "Accept" button. Then the product is removed from the sell/buy category that no other users can browse the product and assume the transaction is done.



- Chan Tai Man logged in -
Transaction made!
Back to Main Page

Figure 16 Transaction Made (WAP)

4.9 View History



//pc89052.cse.cuhk.edu.hk/lyu0001/web/history.php?session=9cc1ed592c97d3cabf40598d05744ad2

Chan Tai Man

My History

Date	Invoice No.	Product Name	Buy/Sell	Owner	Respondent	Price
2001-04-18 19:14:44	2	Nokia 6310	Sell	lyu0001	demo	1500

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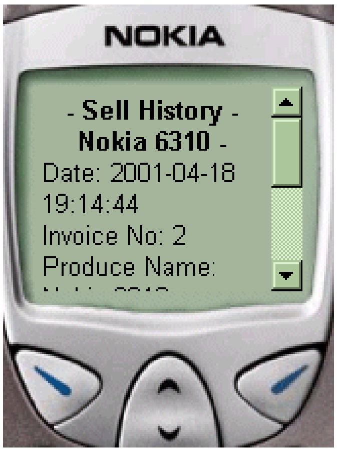
About us

http://pc89052.cse.cuhk.edu.hk/lyu0001/web/history.php?session=9cc1ed592c97d3cabf40598d0574

Figure 17 View History (web)

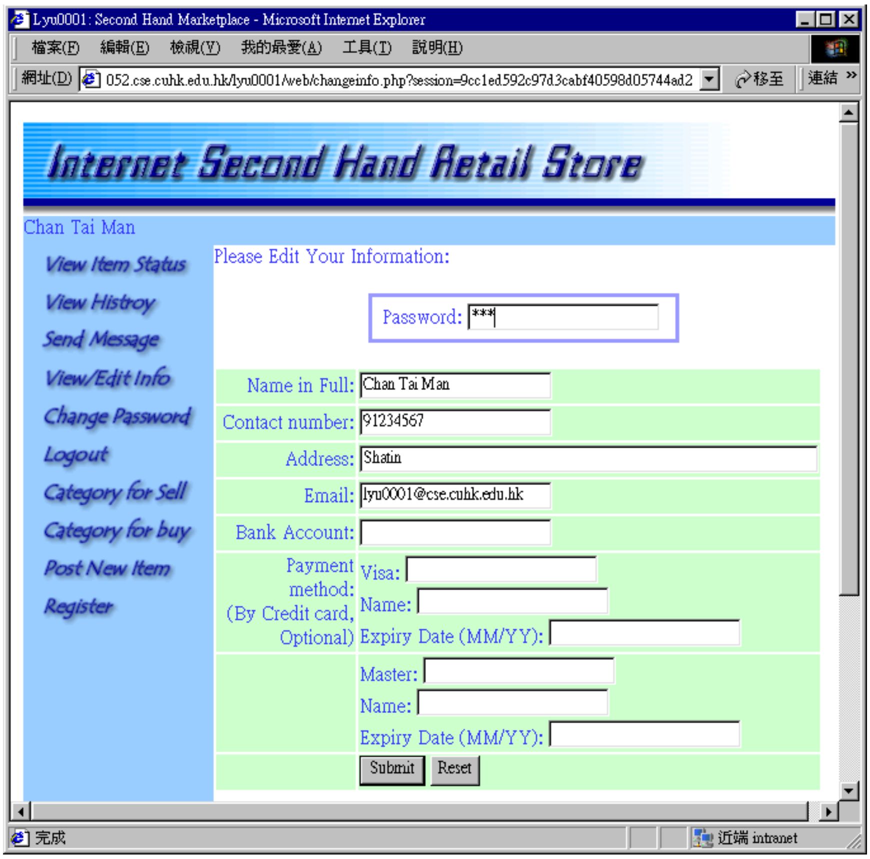
Once there is any transaction made, this page will show to the users which product(s) transacted before and the detail about the product(s) and transaction(s). Date of transaction, invoice number, product name, product posted for sale/buying, owner and respondent, and the transaction price.



- Sell History -
Nokia 6310 -
Date: 2001-04-18
19:14:44
Invoice No: 2
Produce Name:

Figure 18 View History (WAP)

4.10 User Profile Management


Lyu0001: Second Hand Marketplace - Microsoft Internet Explorer
檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)
網址(D)
移至
連結
完成
近端 intranet

052.cse.cuhk.edu.hk/lyu0001/web/changeinfo.php?session=9cc1ed592c97d3cabf40598d05744ad2

Internet Second Hand Retail Store

Chan Tai Man

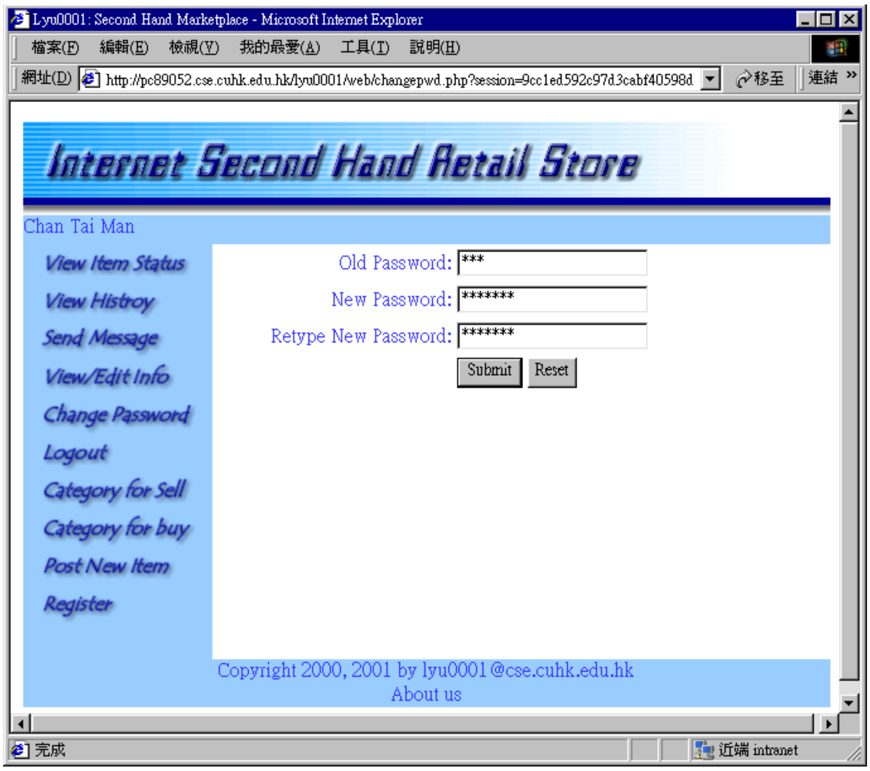
View Item Status
View Histroy
Send Message
View/Edit Info
Change Password
Logout
Category for Sell
Category for buy
Post New Item
Register

Please Edit Your Information:

Password: ***

Name in Full: Chan Tai Man
Contact number: 91234567
Address: Shatin
Email: lyu0001@cse.cuhk.edu.hk
Bank Account:
Payment method: (By Credit card, Optional) Visa:
Name:
Expiry Date (MM/YY):
Master:
Name:
Expiry Date (MM/YY):

Figure 19 Edit user profile (web)


Lyu0001: Second Hand Marketplace - Microsoft Internet Explorer
檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)
網址(D)
移至
連結
完成
近端 intranet

http://pc89052.cse.cuhk.edu.hk/lyu0001/web/changepwd.php?session=9cc1ed592c97d3cabf40598d

Internet Second Hand Retail Store

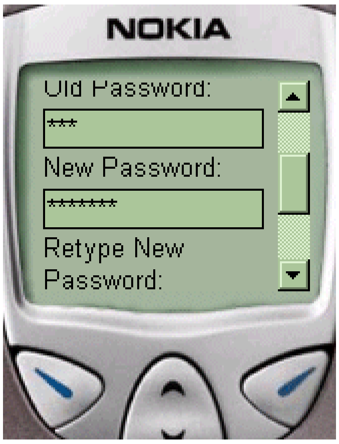
Chan Tai Man

View Item Status
View Histroy
Send Message
View/Edit Info
Change Password
Logout
Category for Sell
Category for buy
Post New Item
Register

Old Password: ***
New Password: *******
Retype New Password: *******

Copyright 2000, 2001 by lyu0001@cse.cuhk.edu.hk
About us

Figure 20 Change password (web)



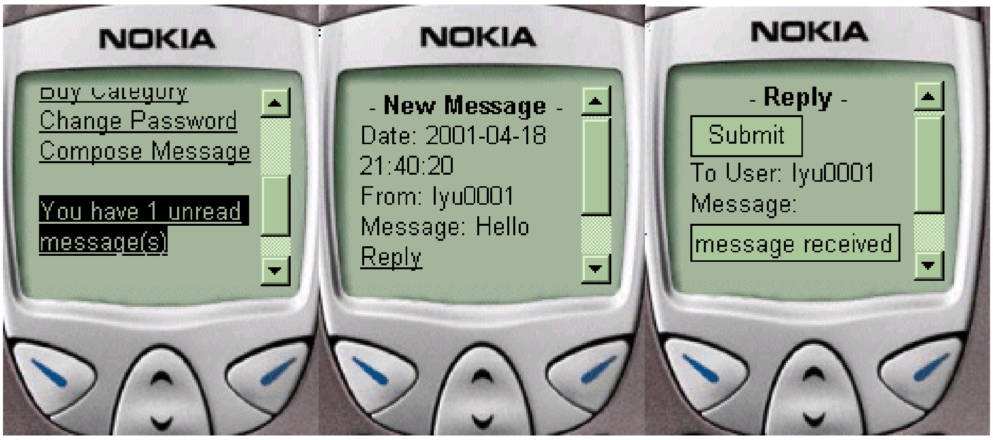
Old Password:
***
New Password:
****
Retype New Password:

Figure 21 View History (WAP)

From time to time, users may want to change their phone number and their credit card may expire. Therefore, there is a need for user to modify their own profile in our system. And they may need to change their password from time to time. In order to avoid the situation that a user using a public terminal and forget to logout, and other people try to change the password and change the bank account and other personal information, both changing of user profile and changing of password require entering the old password so that unauthorized user cannot change the account information without knowing the password.

4.11 Send and Receive Message

To enhance the system with more interaction involved for all users, every users can send a simple message to others with their username. When users navigate our pages and receive a message, an unread message alert hyperlink will show up (at the right hand corner for web version, bottom for WAP version). Click on the link and users will be able to read all the messages to them and make any further reply.

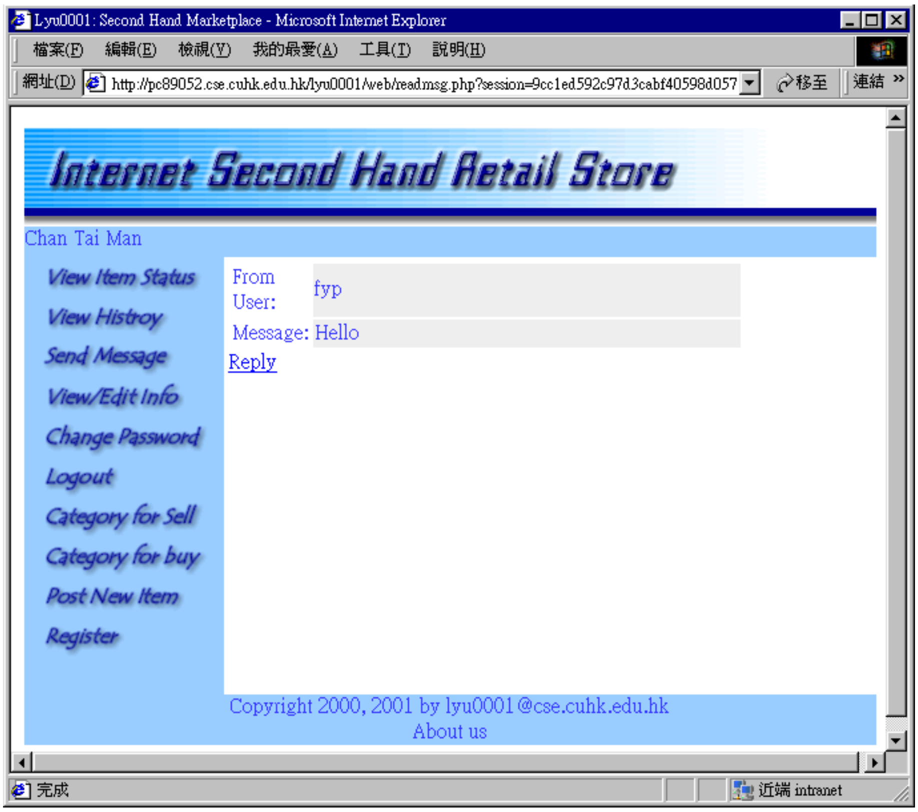


You have 1 unread message(s)

- New Message -
Date: 2001-04-18 21:40:20
From: lyu0001
Message: Hello
Reply

- Reply -
To User: lyu0001
Message:
message received

Figure 22 Send and Receive Message (WAP)



http://pc89052.cse.cuhk.edu.hk/lyu0001/web/readmsg.php?session=9cc1ed592c97d3cabf40598d057

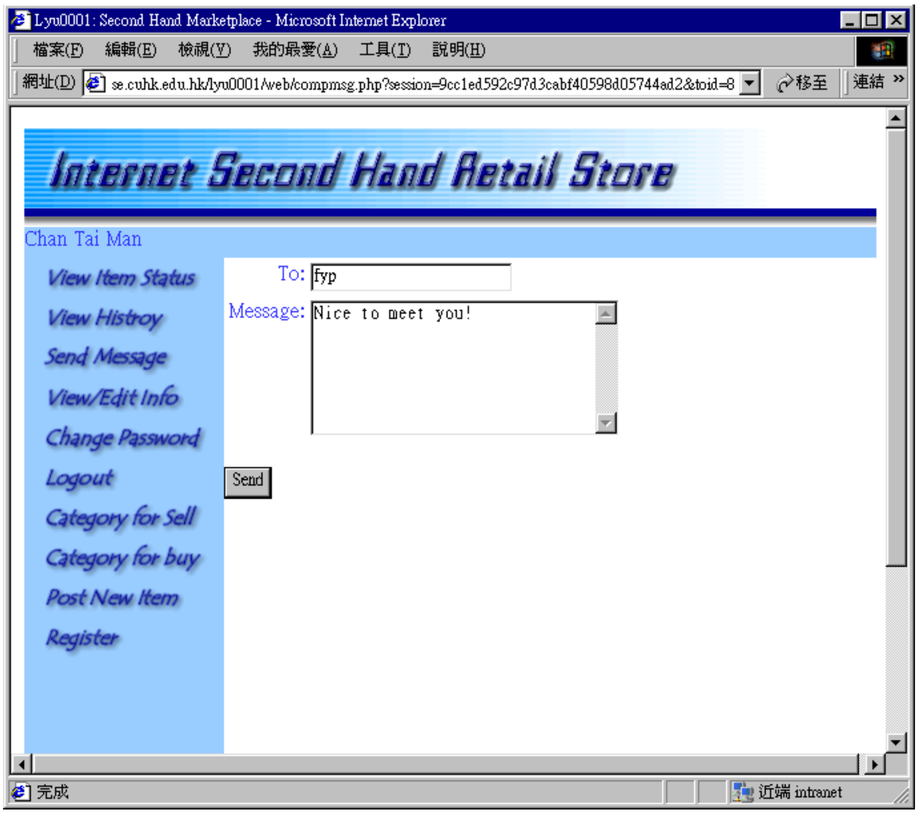
Chan Tai Man

From User: fyp

Message: Hello

Copyright 2000, 2001 by lyu0001@cse.cuhk.edu.hk
About us

Figure 23 Viewing a message (web)



se.cuhk.edu.hk/lyu0001/web/compmsg.php?session=9cc1ed592c97d3cabf40598d05744ad2&toid=8

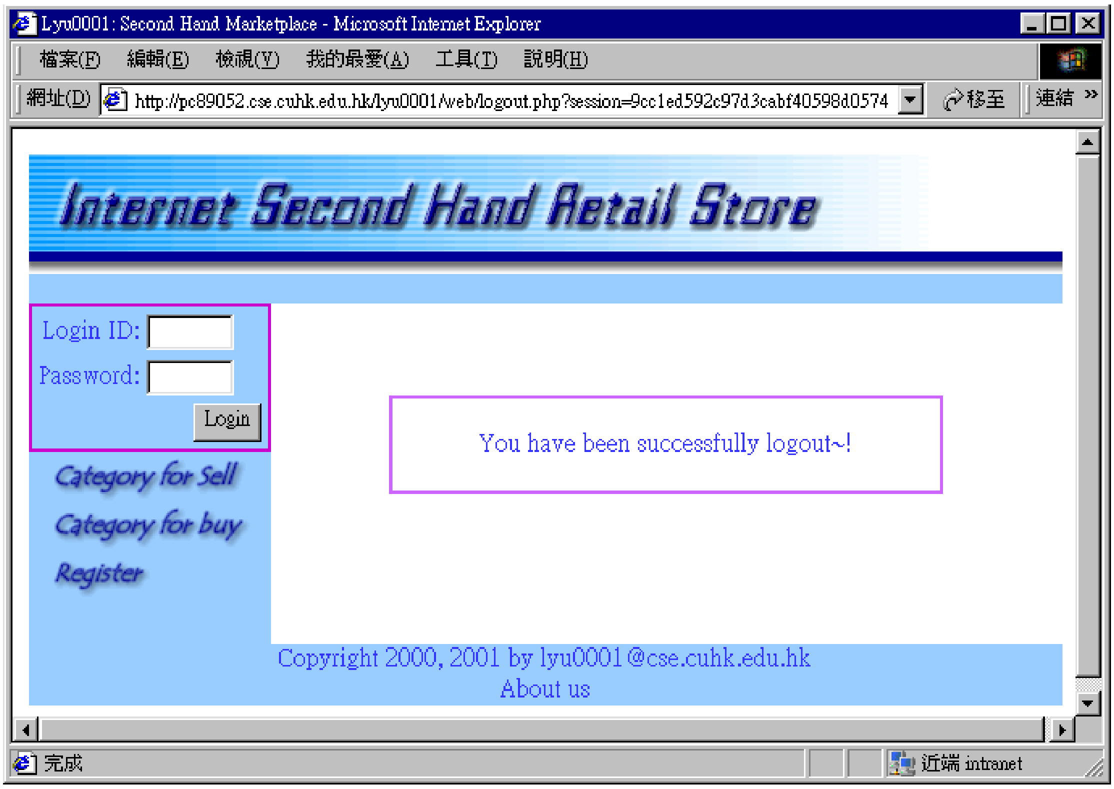
Chan Tai Man

To: fyp

Message: Nice to meet you!

Figure 24 Send a message (web)

4.12 Logout


Lyu0001: Second Hand Marketplace - Microsoft Internet Explorer
檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)
網址(D) http://pc89052.cse.cuhk.edu.hk/lyu0001/web/logout.php?session=9cc1ed592c97d3cabf40598d0574
移至 連結
Internet Second Hand Retail Store
Login ID:
Password:
Login
Category for Sell
Category for buy
Register
Copyright 2000, 2001 by lyu0001@cse.cuhk.edu.hk
About us
完成
近端 intranet

You have been successfully logout~!

Figure 25 Logout (web)

For web version, when user wants to exit the system, simply click the “Logout” icon any time. The user session is expired and if the user want to get services from the system, re-login is needed. For WAP version, user only needs to exit the WAP browser in the phone or select another URL (service provided by phone handset) will automatically logged out.

5. Limitations and Solutions

5.1 Browser Detection

Aim:

Convinence is one of the major design goal of a web site. Before the introduction of WAP, web site designer already have to design different version of the site for the different incompatible browsers. Now comes the WAP, a new series of browsers is to be accessing the site and browser detection mechanism is to be employed to identify the browser type and the web site has to be returning the suitable output format for the client browser.

Limitation:

When the web site is to support web and WAP at the same time, there will be different kind of browsers accessing the web site requiring different output format. Web browsers are expecting HTML pages while WAP browsers are expecting WML pages. For marketing reason, it is better to advertise the site with a single URL instead of giving out an URL for each kind of browsers.

Our approach:

We then detect the browser type (whether it is a web browser or a WAP browser) at a starting URL and once the browser is identified, the user will be redirected to an appropriate version of the site. Web browser will be getting the HTML version of the site while WAP browser will be getting the WML version of the site.

Our approach of this is that most browser when sending HTTP request, it will include a list of acceptable file type to let the server know what file type the client is wanting. At the server side, the list of file type can be obtained from the HTTP_ACCEPT environment variable. We detect the existance of "wml" in this variable to determine whether the client is a WAP device. If yes, we will redirect the browser to the WAP version of the site, if no, we will redirect the browser to the web version of the site. The following two browsers (one web browser and the other WAP browser) are accessing the same URL and it automatically detect and redirect to HTML or WML version accordingly.

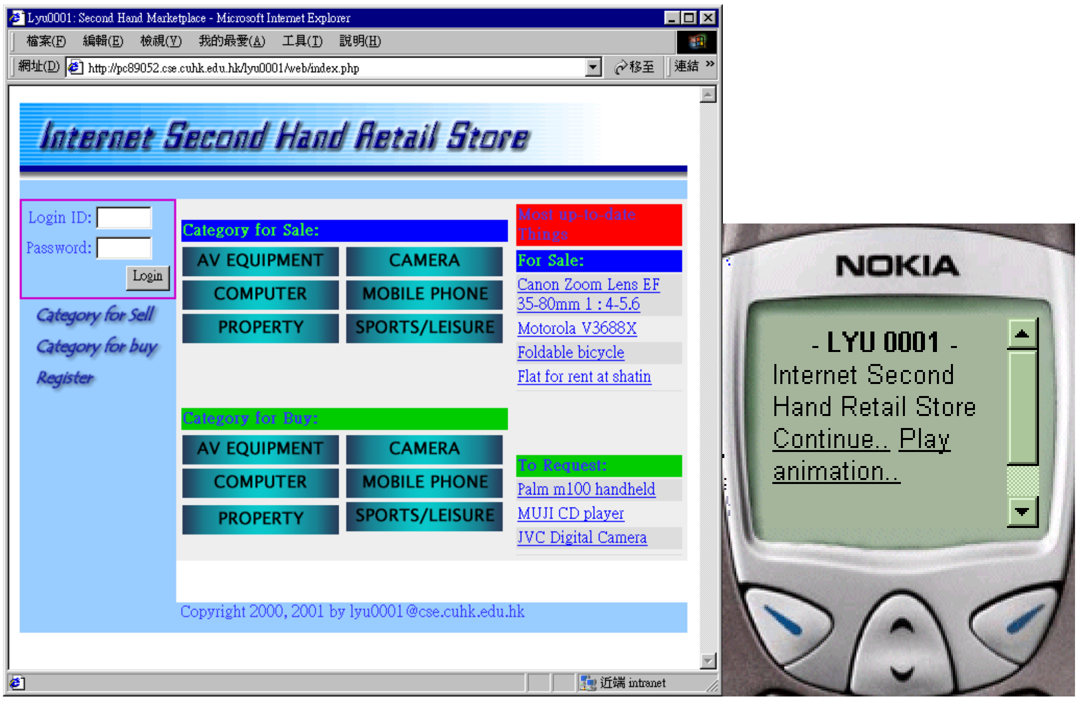


Figure 26 Browser redirection

5.2 Supporting WBMP in Addition to Web Image Formats

Aim:

Web browsers and WAP browsers expect different kind of image format. Web browsers are expecting GIF/JPG/PNG images while WAP browsers are expecting the wbmp image format. A web site of both web and WAP version has to get a GIF image to display a product to a web browser and prepare a wbmp image counterpart to display to a WAP browser.

Limitation:

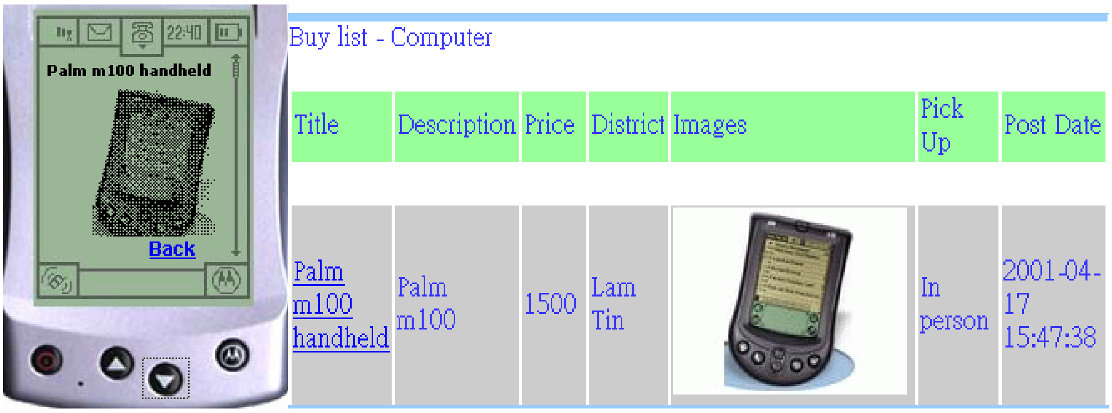
While having the web site designer to prepare different set of images for different type of browsers is still feasible, having the user to prepare that is not feasible.

If a web site allows users to upload or link to an image and have this image to be browsed by others, the users will only feel comfortable if they just have to upload a file format they want. It will be troubsome if user has to prepare an image in web version and having the same image converted to WAP format since the user may not want to do extra things and they may not have the converter for wbmp images.

Our approach:

Our second hand market system allows users to link to an image with a second hand product so that other users can see the image of the product to get a better idea of the product. In order to let both traditional web browsers and and mobile users to see the image, we have written an image conversion program to convert the given image (user specified image) to an appropriate format when needed.

The open source GD library is used to read different image formats and for generation of output images. Since a colour image is to be converted to black and white wbmp format, a dithering algorithm is applied to the colour image to get optimal result for the converted wbmp image.



Buy list - Computer

Title	Description	Price	District	Images	Pick Up	Post Date
Palm m100 handheld	Palm m100	1500	Lam Tin		In person	2001-04-17 15:47:38

Figure 27 Image is converted to appropriate format

5.3 Separate Data Manipulation from Layout Design

Aim:

Creation of a web site involves data manipulation (mostly connected with database related programming) and layout design (on colouring and positioning of images and text). Sometimes, a programmer for database related programming is not good at layout design, and a layout designer is not good at programming. Even if the programmer is good at layout design, the effort to do both for a web site maybe too large. So it is good to separate data manipulation from layout design for a medium to large web site.

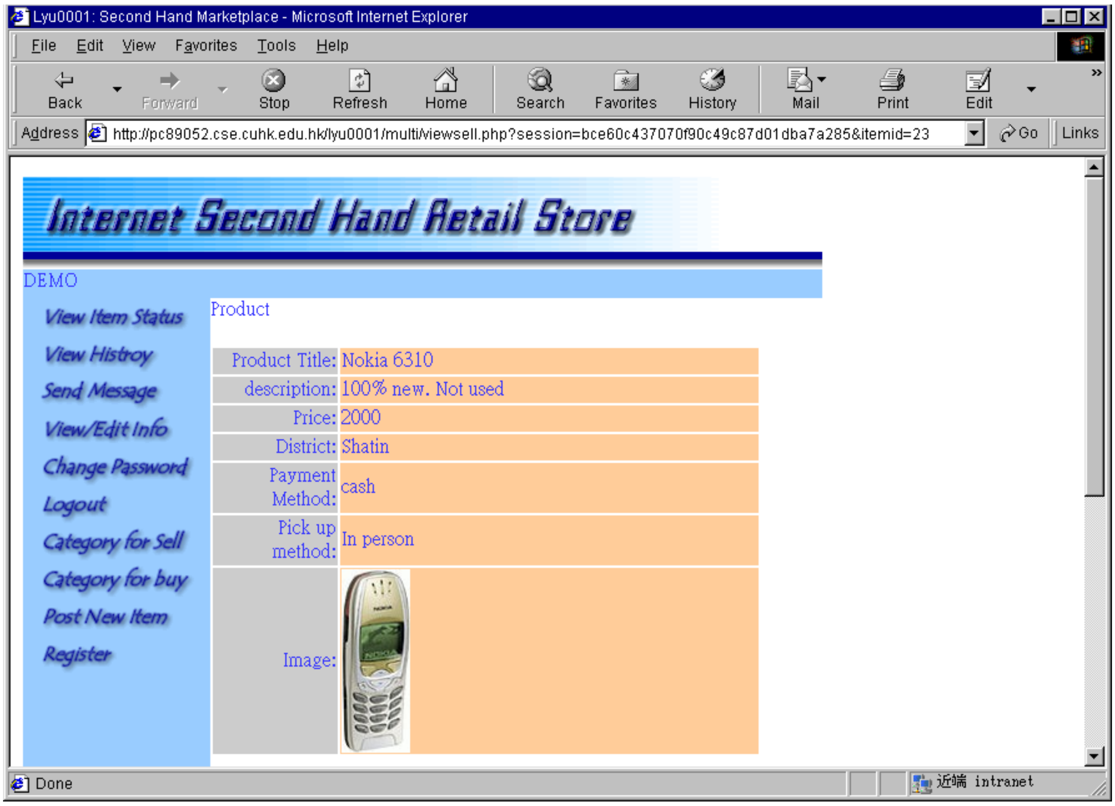
Limitation:

With the introduction of WAP, web site developers not only have to design a layout for web browser, they also have to design another layout for WAP browser. If the data manipulation and layout design is done together, which do not have seperation of focus, it will introduce redundancy in the data manipulation part since most probably only the layout is different for web and WAP version while the backend data manipulation is still the same.

Our approach:

Using XML and XSL, we can separate the data manipulation task from layout design task. The data manipulation is done first to generate a XML document containing the data to be presented. Then an appropriate XSL document is to apply to the XML document to translate that to HTML or WML format.

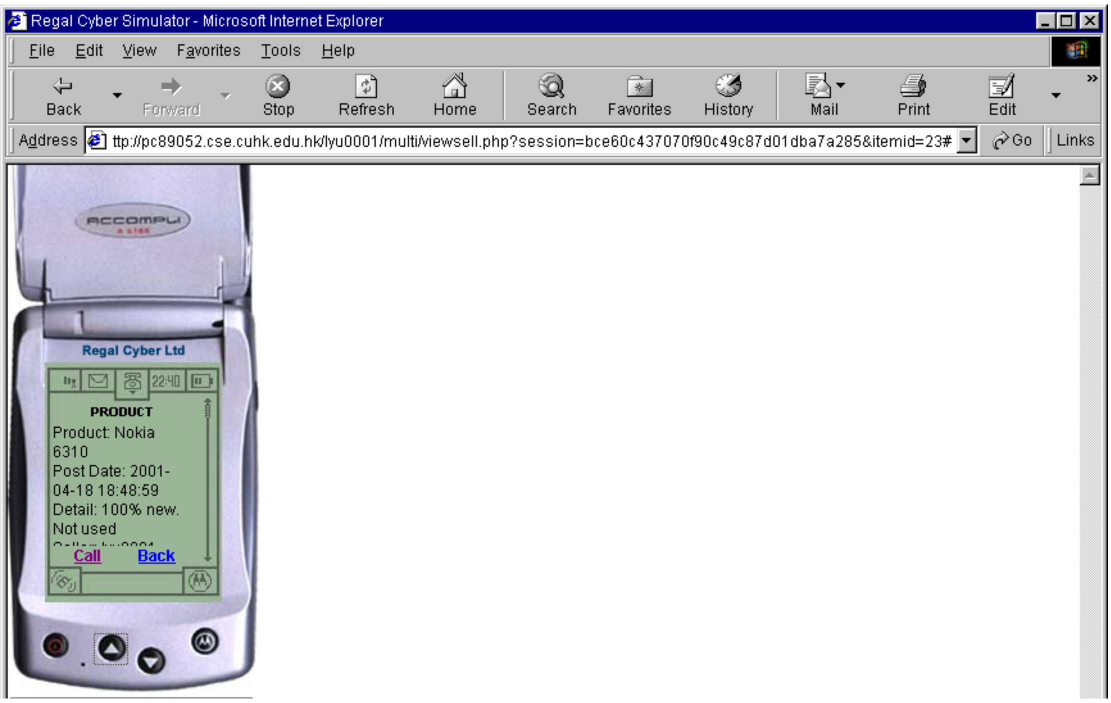
If we are to support HTML and WML, only two set of XSL documents is required and the data to be presented is the same XML file.


Lyu0001: Second Hand Marketplace - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit
Address http://pc89052.cse.cuhk.edu.hk/lyu0001/multi/viewsell.php?session=bce60c437070f90c49c87d01dba7a285&itemid=23
Go Links
Internet Second Hand Retail Store
DEMO
View Item Status
View Histroy
Send Message
View/Edit Info
Change Password
Logout
Category for Sell
Category for buy
Post New Item
Register
Done
intranet

Product

Product Title:	Nokia 6310
description:	100% new. Not used
Price:	2000
District:	Shatin
Payment Method:	cash
Pick up method:	In person
Image:	

Figure 28 HTML output using XML data and a XSL document for HTML


Regal Cyber Simulator - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit
Address ttp://pc89052.cse.cuhk.edu.hk/lyu0001/multi/viewsell.php?session=bce60c437070f90c49c87d01dba7a285&itemid=23#
Go Links
ACCOMPLI
Regal Cyber Ltd
22:40
Call
Back

PRODUCT
Product: Nokia 6310
Post Date: 2001-04-18 18:48:59
Detail: 100% new. Not used

Figure 29 WML output using the same XML data and a XSL document for WML

5.4 Producing Animation in WAP

Aim:

Animation can attract users' attention in a web site. Animation is to be included in the web site.

Limitation:

Unlike the animation GIF file format in web, the wbmp image format can only display static image. Therefore we need to find alternative way to simulate animation.

Our approach:

WML provides a timer which can be used to specify a time to load another page. With this, we can simulate the animation effect by putting a number of images in different wml pages and set a timer in page 1 to load page 2 after two second, and set a timer in page 2 to load page 3 after two second, etc.

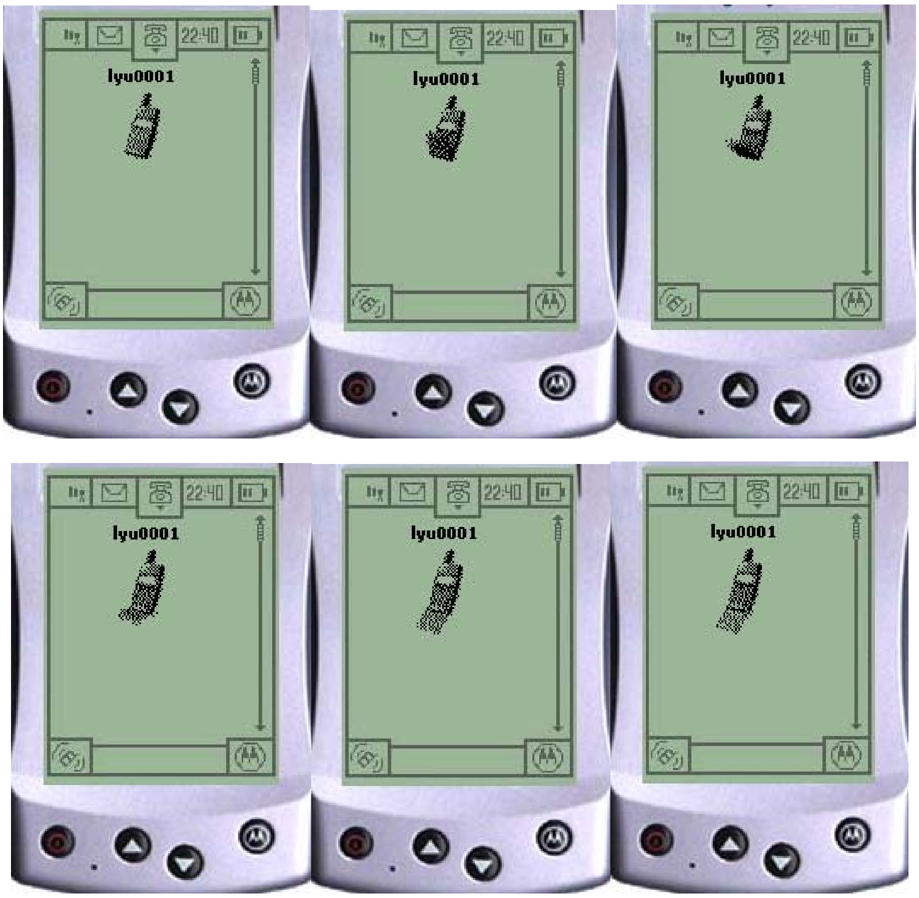


Figure 30 Animation from left to right, from top to bottom

5.5 Maintain User Session Data Across Page Navigation

Aim:

Since HTTP does not maintain user session information, many ways are introduced in traditional web system to enable the user login capability that requires passing user session information across pages. Two of the most common way is to use cookies to store data related to user session, and to pass the data along with the URL.

Limitation:

Cookies are believed to be a better way to store session data, as it will not make the URL unnecessarily long. However, current implementation of WAP specification (WAP 1.0) does not support cookies. Although new version of the specification (WAP 1.2) has cookies support, public WAP enabled phone network and the WAP phones on that market still not yet able to support that.

Our approach:

As a result, we have to stick to pass session data with URL in order to maintain user login in WAP version of the system. In order to simplify implementation, we used URL to pass session data in both web and WAP version.

5.6 Interaction with Voice Call

Aim:

Interaction is a vital part of a system that involves many people. People generally want to interact with people, but not machines. So we are to provide ways to enable interaction between people.

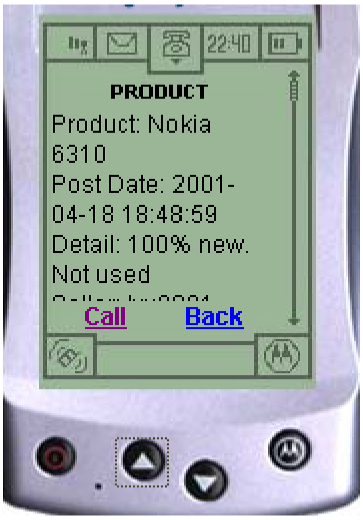
Limitation:

As the mobile user is using a phone to visit the system, and the phone has a primary function of making a phone call, it is a reasonable thinking of providing a phone number of another person to let to user make a phone call to chat with others.

In a traditional way, when the user gets a phone number on the screen and wants to call that person, the user has to copy down the phone, terminate the WAP connection and dial the number, which sounds not convenient.

Our approach:

Wireless Telephony Applications Interface (WTAI) enables applications to perform typical functions of a mobile telephone with WML. One of the function is to make phone call to a specified number. With this method and when the phone supports, the user can dial the given number with a press of a button, which eliminates the need of the user to copy down the number temporarily. However, a side effect of this application is that the WAP connection will be disconnected once the user choose to make a phone call by this method. In view of the future implementation of phone, such as GPRS, (Nokia 6310) which enable simultaneous connection to voice and data calls, the problem of disconnection of the WAP application will be eliminated.



PRODUCT

Product: Nokia 6310

Post Date: 2001-04-18 18:48:59

Detail: 100% new. Not used

Figure 31 The CALL button will dial the number stored in the page

5.7 Instant Messaging

Aim:

Apart from making phone calls, another way to enable interaction is to include instant messaging capability. This allows interaction with people who does not want to store their phone number at the server.

Limitation:

The traditional way to implement the instant message capability is to have an application sitting there listening any incoming message. However, mobile user, unlike PC/workstation user, cannot run multiple programs or multiple browsers at the same time so that if we are to have the main program to be our web site application, another program cannot exist at the same time to listen to messages. An alternative way is to use push, which is not supported in current WAP specification. Although WAP 1.2 has support for push, current network and phone does not supported yet. Another way is to refresh the page at time interval to periodically check for new message. This method is also not feasible as it will interrupt the normal page navigation as user may be in process of typing something while the timer fires to reload the page, which cause nuisance to users.

Our approach:

Our implementation is to modify the refresh method a little bit to avoid the automatic refresh. We do a checking every time only when user request a page from our system. So they will get notified for new message when they access a page in our system.

6. System Architecture

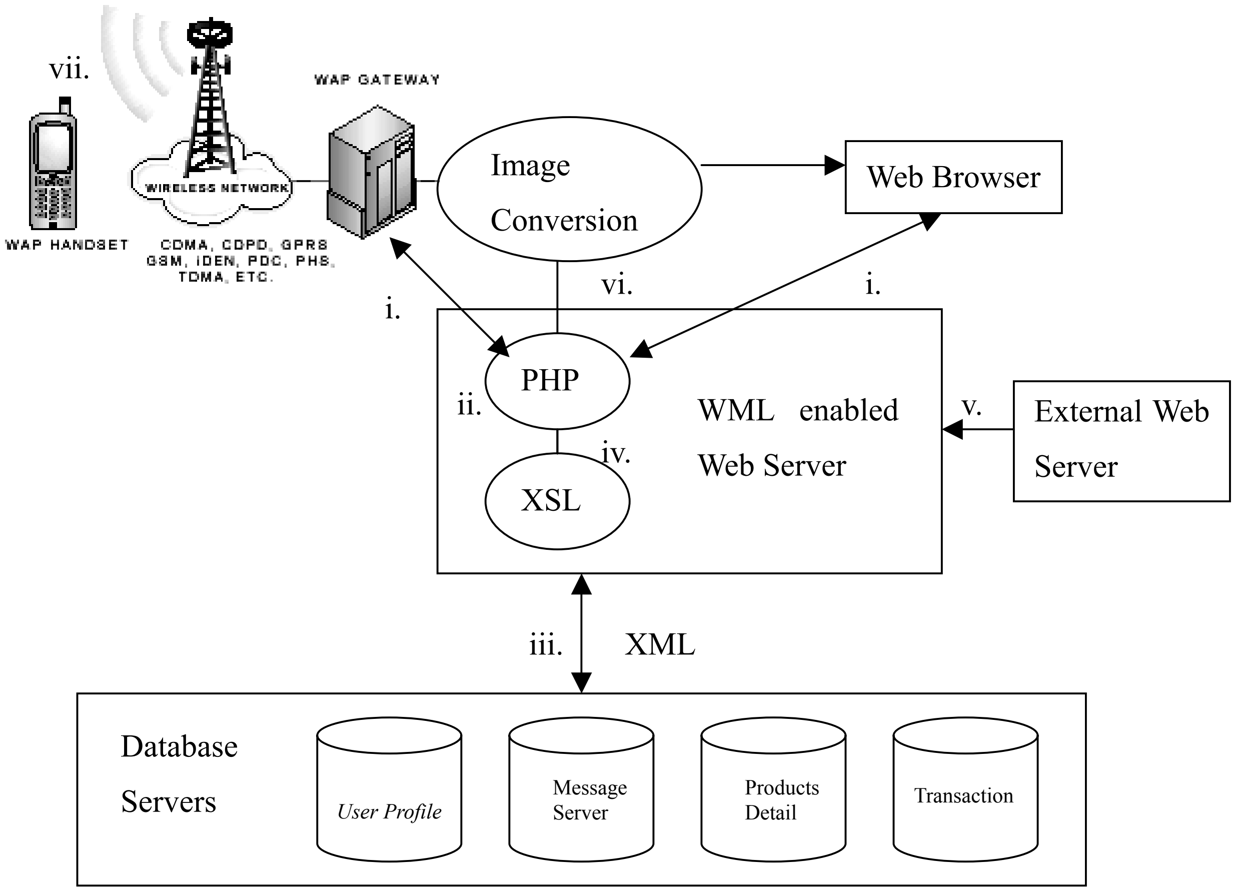


Figure 32 System architecture

6.1 Component description

1. Client Web Browser: Standard web browser that support HTML with HTTP request/response for web version of Second Hand Retail Store.
2. Client WAP Browser: WAP browser that support WML with HTTP request/response for WAP version of Second Hand Retail Store.
3. Web Server: a Linux web server configured to support WML that is capable of running PHP, with library for XML and XSLT support. The WAP pages should be accessible by WAP gateways.
4. Database server: It consists of a collection of database tables. They include User Profile, Item Details, Product Response, Simple message, and Transaction databases.

6.2 Dataflow description

i. The client web/WAP browser retrieves information and generates a HTTP request to the web server. The web server detects the HTTP request and determines which version of client browser and redirect to suitable web/WAP page.

ii. PHP scripts handle all the application logics and process functions to provide services for the client request. Information input by the clients is passed to the web server that connects with the database engine.

iii. All process related to browsing items will consult the Item Detail Database. With PHP script at web server, XML document that contain information user requested for is dynamically generated. When there are other client request, PHP handle the request and connect to the corresponding database servers, data is retrieved from the servers and separate from the layout design.

iv. Together with the XSL, which is written for different browser to display, XSLT will transform the XML document to suitable HTML/WML pages and output to the client.

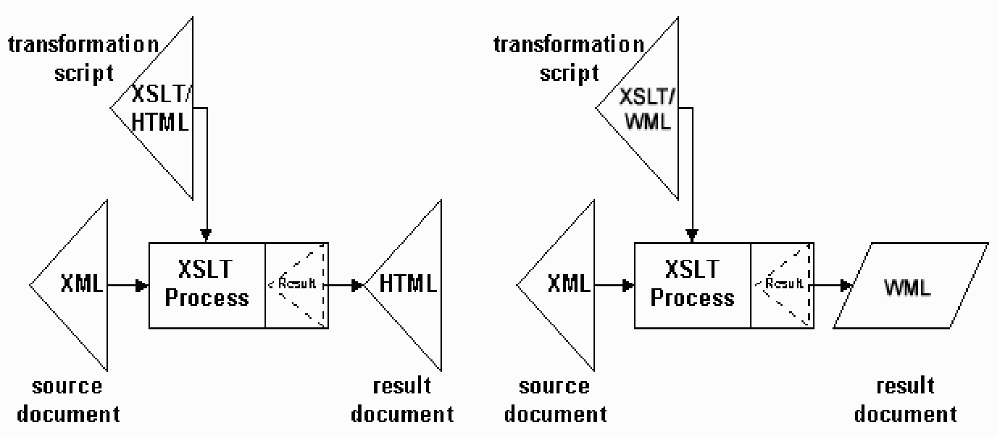


Figure 33 Workflow of XSL

v. If there is an image located at other web server outside our system, HTTP requests is sent from our web server to retrieve the image.

vi. When the client browsers support HTML pages, the image is to be displayed directly to the client. If WML enabled browsers detected, an image conversion script is used to transform the incoming image to WBMP image for WAP display.

vii. Once the client, using WAP phone, retrieved the products information and selected to dial to another client directly, the WAP browser will exit and switch to traditional telephone network for making voice call.

7. System Design

7.1 Overview

In our system, there is a database storing users information and product information post by users. A set of server scripts are generating web pages for users using web browser to access our system, and there is another server scripts generating WML pages for users using WAP phones (or WAP enabled device) to access our system. The two set of scripts both interact with the database and generate appropriate pages to users.

7.2 Site Map

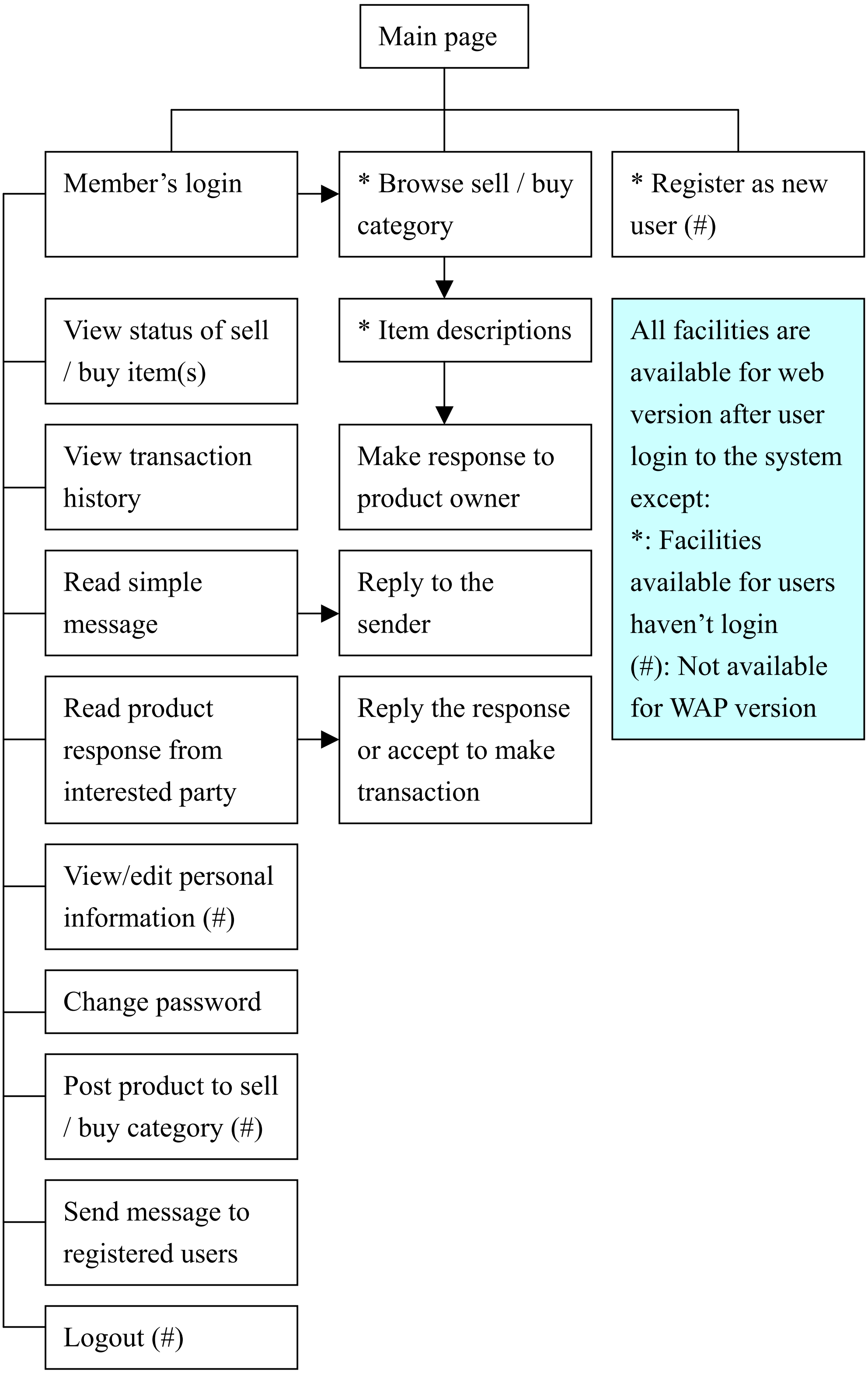

Main page
Member's login
* Browse sell / buy category
* Register as new user (#)
View status of sell / buy item(s)
* Item descriptions
All facilities are available for web version after user login to the system except:
*: Facilities available for users haven't login
(#): Not available for WAP version
View transaction history
Make response to product owner
Read simple message
Reply to the sender
Read product response from interested party
Reply the response or accept to make transaction
View/edit personal information (#)
Change password
Post product to sell / buy category (#)
Send message to registered users
Logout (#)

Figure 34 Sitemap of the system

7.3 Database

List of tables:

Table	Description
sechand_action	Indicate the product is either for sale or buying
sechand_cat	Contain the category for products which belongs to
sechand_item	Store details of a product for sell/buy posted by registered users
sechand_message	Store the general message and the users involved for retrieval purpose
sechand_payment	Payment method for the transaction of a product
sechand_pickup	Pickup method for the transaction of a product
sechand_reply	Store the response message of a product between the owner and the respondent
sechand_session	User session information for passing data through navigating the system
sechand_status	Status of the product when a transaction is being made
sechand_transaction	When a product is accepted and a transaction is made, record related to that transaction is made for later reference
sechand_user	All user information is stored after registration

Table: sechand_action

Field	Type	Null	Key	Extra
id	int(11)		Primary	auto_increment
description	varchar(60)			

Table: sechand_cat

Field	Type	Null	Key	Extra
id	int(11)		Primary	auto_increment
description	varchar(60)			
parent	int(11)			

Table: sechand_item

Field	Type	Null	Key	Extra
Id	int(11)		Primary	auto_increment
owner	varchar(60)			
category	int(11)			
action	int(11)	Yes		
pickup	int(11)	Yes		
payment	int(11)	Yes		
title	varchar(60)	Yes		
description	text	Yes		
district	varchar(20)	Yes		
price	int(11)	Yes		
image	varchar(255)	Yes		
postdate	datetime			

Table: sechand_message

Field	Type	Null	Key	Extra
id	int(11)		Primary	auto_increment
fromid	int(11)			
toid	int(11)			
postdate	datetime			
message	text	Yes		

Table: sechand_payment

Field	Type	Null	Key	Extra
id	int(11)		Primary	auto_increment
method	varchar(20)			

Table: sechand_pickup

Field	Type	Null	Key	Extra
id	int(11)		Primary	auto_increment
description	varchar(60)			

Table: sechand_reply

Field	Type	Null	Key	Extra
itemid	int(11)			
fromid	int(11)			
toid	int(11)			
replydate	datetime			
price	int(11)	Yes		
reason	text	Yes		

Table: sechand_session

Field	Type	Null	Key	Extra
id	char(32)		Primary	
userid	int(11)			
expire	datetime			

Table: sechand_status

Field	Type	Null	Key	Extra
id	int(11)		Primary	auto_increment
status	varchar(20)			

Table: sechand_transaction

Field	Type	Null	Key	Extra
invoicenum	int(11)		Primary	auto_increment
itemid	int(11)			
fromid	int(11)			
toid	int(11)			
date	datetime			
price	int(11)			
statusid	int(11)	Yes		

Table: sechand_user

Field	Type	Null	Key	Extra
id	int(11)		Primary	auto_increment
username	varchar(60)			
password	varchar(32)	Yes		
fullname	varchar(255)	Yes		
contactnumber	varchar(60)	Yes		
address	varchar(255)	Yes		
email	varchar(255)	Yes		
bankacct	varchar(60)	Yes		
visaname	varchar(60)	Yes		
visanum	varchar(127)	Yes		
visadate	varchar(10)	Yes		
mastername	varchar(60)	Yes		
masternum	varchar(127)	Yes		
masterdate	varchar(10)	Yes		

8. System Implementation

8.1 Hardware Platform

A PC machine installed with Redhat linux 7.0 and Apache 1.3.19 is used to host server scripts of our system. And throughout our implementation, platform independence is also considered so that our implementation is made as platform independent as possible.

8.2 Server Configuration

The next step for us is to configure our server to comply with wml files, thus making us wap enabled.

We can serve wml documents from any normal (UNIX or NT) server (all NCSA types and most of the others). This means it is easy to make our own wap hosting system using any regular server (eg. Apache, the most commonly used server in the world today). Basically, all it involves is changing our MIME types file so that it involves wap related file extensions with the appropriate type. For example, the server should hand out all *.wml files with the MIME type text/vnd.wap.wml.

Here are the full MIME types:

Doc. type	Official MIME type	Extension
WML document	**text/vnd.wap.wml**	**.wml**
Wireless Bitmap Image	**image/vnd.wap.wbmp**	**.wbmp**
WMLScript	**text/vnd.wap.wmlscript**	**.wmls**
Compiled WML document	**application/vnd.wap.wmlc**	**.wmlc**
Compiled WML Script	**application/vnd.wap.wmlscriptc**	**.wmlsc**

The way we install these MIME types is different for differing servers, but here's how we do it in Apache:

First, locate the srm.conf file (in /etc/httpd/conf), or .htaccess files in the directory/ies that we require. Then type the following in:

```
# WAP MIME Types
AddType text/vnd.wap.wml .wml
AddType image/vnd.wap.wbmp .wbmp
AddType text/vnd.wap.wmlscript .wmls
AddType application/vnd.wap.wmlc .wmlc
AddType application/vnd.wap.wmlscriptc .wmlsc
```

Then, save the file and restart Apache.

To add the MIME types to a Microsoft IIS server, we need to do the following:

On the server console, open the management console; from here we can define the MIME types to either be valid for the entire server or to be valid for separate directories. To add a MIME type to a directory all we need to do is right click on the directory in which we want to add the MIME type, select the HTTP headers tag and click the file types button at the lower right. Click 'new type' and supply the extension and the content type as listed above. Just as simple as for Apache.

To add a MIME type to an entire server; right click on the server, click the 'file types' button and follow the instructions above.

8.3 Programming Language

We have chosen PHP as the server scripting language. With the current distribution of PHP, there are both windows version and unix/linux version available, so that our programs are able to port to other platforms with ease.

8.4 External Libraries

A number of external libraries is used for the implementation, these includes Sablotron 0.51 for XSLT processing, GD-1.8.4 for image I/O and generation, expat-1.95 and libxml2-2.3.2 for XML processing.

8.5 Database System

A MySQL database system is installed to serve as a database backend. MySQL system also have windows version and unix/linux version so that our implementation will not be limited to a single platform.

8.6 Program Testing

Since current web browser is not able to render WML pages, so in addition to using web browsers to test our system, WAP simulators are used to test our WAP version of our system. Since different simulators have different behaviors, and simulators are more ‘forgiving’ than actual WAP phones, so WAP phones and WAP service of mobile network providers are occasionally required to test our system for errors.

9. Project Experience and Comments

9.1 E-commerce Models

During our study of current e-commerce situation, we have a better idea of the current e-commerce market, how they work, and how the system are designed. This allow us to have a hand-on experience on designing and implementing an e-commerce system.

9.2 Wireless Internet Access

As we are implementing a WAP enabled system, we need to get familiar with the Wireless Application Protocol (WAP), which is a relatively new protocol. We need to get into details on what the current protocol allows us to do, and what it can’t do, and have to get expectations and prediction on the future of this protocol so that we can have better planning of our project. Since the computer and Internet world is changing every minute, experience and skills on adapting and expecting changes are valuable.

9.3 Limitations on Using WAP

Since the client device used to surf the internet through WAP is a little bit different to the original web browser, WAP is designed with following constraints:

1.Small Display

As long as the mobile phones are tiny, practical and easy to carry in our pocket, the WAP screen has to be small. We can`t read through the same amount of information as on our computer. And, the screen quality is not as good. We can send pictures with WAP, but if they are too complicated they will merely appear as blurs.

2. Limited Input Facilities

It is much harder to write an e-mail on our phone than on our PC. When people start to use their mobile phone to read and write e-mails, the need for a better keyboard will force the producers to develop a better system

3. Narrow bandwidth of network connection

Telecom-developers are constantly working on a better and faster way of sending information to our mobile phone. The GSM network implemented in most of Europe today, is a slow way of sending information, proximately 9.6 Kbps. New network technologies are called HSCD (high-speed circuit switch data) and GPRS (General Packet Radio Service). They will give we a faster connection. In a few years most of the European countries will build a new broadband network, called UMTS.

4. Limited Memory

The WAP phones we get today have little memory capacity. The total size of a standard WAP page should not exceed 1.4 Kbytes. The development of new WAP services will probably press the hardware producers to come up with better memory systems for mobile terminals in the near future.

5. Insufficient Computational Resources

Since the recent cellular phones are made for mobile telephony service in the first place, the size of such devices is to be made as tiny as possible. Moreover, limited battery supply is also a great concern in design a phone. Thus, the WAP phones now available do not have much computational power to process complex data sent through the network.

9.4 Security Considerations

In view of the insufficient support of public wap gateway in secure connection, and in addition that wireless transmission can be easily tapped (easier than tapping wired network). We have to make a compromise on avoiding to request user to input sensitive information, such as credit card number, through mobile network. And force users to input sensitive information through the web interface which a more secure channel, such as SSL, can be available.

9.5 Use of XML and XSL

XML allows users to:

- bring multiple files together to form compound documents
- identify where illustrations are to be incorporated into text files, and the format used to encode each illustration
- provide processing control information to supporting programs, such as document validators and browsers
- add editorial comments to a file

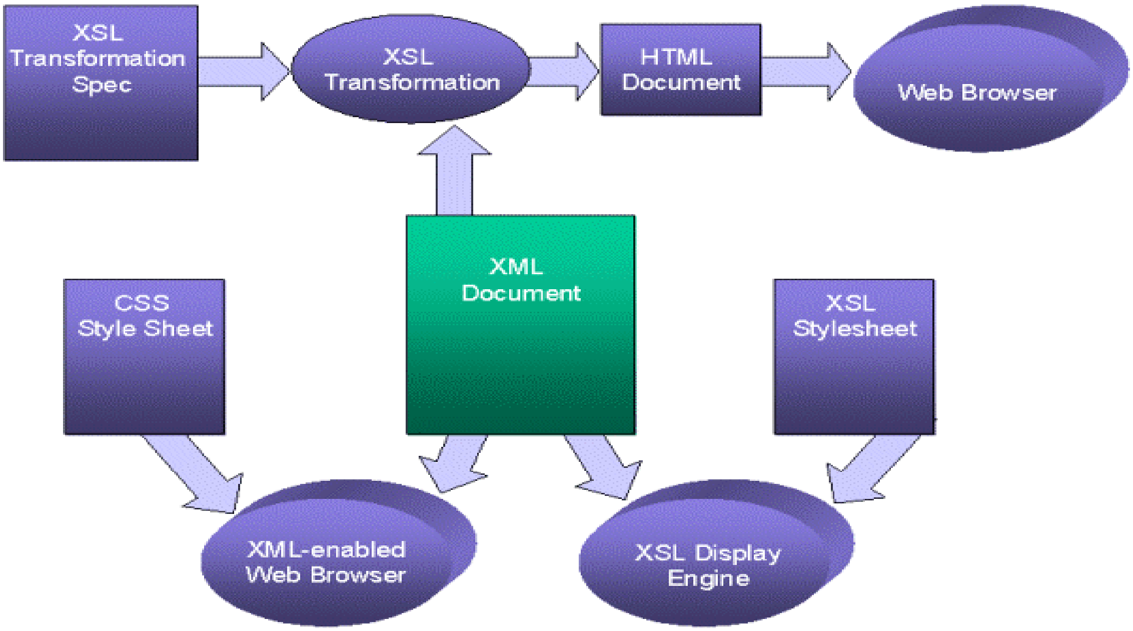
However, that XML is not:

- a predefined set of tags, of the type defined for HTML, that can be used to markup documents
- a standardized template for producing particular types of documents.

XML was not designed to be a standardized way of coding text: in fact it is impossible to devise a single coding scheme that would be suit all languages and all applications. Instead XML is formal language that can be used to pass information about the component parts of a document to another computer system. XML is flexible enough to be able to describe any logical text structure, whether it is a form, memo, letter, report, book, encyclopedia, dictionary or database.

9.6 Transformation from XML to non-XML using XSL

An XSLT processor may choose to recognize the stylesheet writer's desire to serialize a non-XML representation of the result tree:



The XSLT Recommendation documents two non-XML tree serialization methods that can be requested by the stylesheet writer. When the processor offers serialization, it is only obliged to reify the result using XML lexical and syntax rules, and may support producing output following either HTML or WML lexical and syntax rules.

9.7 Key to build an WAP application on E-Commerce

The transactions to be invoked or the information to be captured may stay the same, however the way in which these things happen may well change. Consider, for example, purchasing a flight ticket using a Web browser compared to using a mobile phone with limited input capabilities. In the former, a more complex sequence of user interactions would be possible such as search for flights, construction of an itinerary, selection of dietary requirements and so on. In the latter (mobile phone) case, such a sequence would be too complex to be usable; hence the process might well be restricted to booking return fares across a limited selection of routes.

The key to building applications that work both on Web browsers and on mobile devices is to build the applications using component-based development techniques. This boils down to defining application building blocks (components) that clearly bound the different elements of the application. Such applications are likely to be written using the Object Management Group's Common Object Request Broker Architecture (CORBA), or Microsoft's Common Object Model (COM) architecture. These approaches are nothing new for applications that have been written explicitly to support Web functionality such as E-Commerce.

Use of components will only help if the right sorts of components are used. They need to be of the right granularity, too big and they will be unwieldy, too small and the resulting application will be too complex. What is more, a success is dependent on the existence of a certain sort of component, known as a Controller. Correctly structured applications will use Controller components to separate device-specific functionality from generic functionality, hence migrating an E-Commerce application to a WAP environment becomes a task of writing new Controller components supporting the mobile devices.

9.8 Usage and potential of WAP

Using mobile phone to surf the net is better than what we can have in desktop computer in some way. If we have a mobile phone we will probably have noticed that our phone is a more “private” device than our computer. Our phone is always within reach, we can get hold of all our friends using it and we have a lot of personal information in store. People that have had to leave their homes in a hurry, often tell the press that the items they grabbed on their way out were the wallet and the mobile phone. The latter has almost become a part of their personalities, and people like to express their identities through the design and the price of their phones. Leading phone producers will tell us that they use great amounts of time and money to find out what segment of mobile users prefer what kind of phones when it comes to size, colour and functionality.

As opposed to our PC, the WAP phone will always be within range. It invites us to order something wherever we are, and we can search for information in the middle of a discussion around the café table. We can check our e-mail on the run, and we can be in touch with the Intranet in our office anytime.

In a few months, everybody will buy a WAP phone when their old phone collapse. Nowadays, it is the coolest guys and the business people who buy them. Young people will buy a WAP phone to keep in touch with their friends. We can pop our mail by our phone, and we can chat with strangers if we like that. Teenagers will love keeping themselves updated on the fashion and culture arena by WAP, and they can buy movie tickets and other items by phone. Business people will buy a WAP in order to buy stocks on their way to the airport. They will check the destination weather before they buy some new clothes for the trip, and they will be logged on to the company WAP pages whenever and wherever they want to. Our neighbour will buy a WAP phone because we already have one, and because he thinks it is practical to have access to the latest Wall Street news.

We will buy a WAP phone because we never remember to buy a TV guide, and we need to know if our favourite TV program is on TVB today. Besides, it is nice to be able to read about we favourite band when we are stuck on the train and everybody is starring at the chewing gums on the floor.

9.9 The future of WAP

The tremendous surge of interest and development in the area of wireless data in recent times has caused worldwide operators, infrastructure and terminal manufacturers, and content developers to collaborate on an unprecedented scale, in an area notorious for the diversity of standards and protocols. The collaborative efforts of the WAP Forum have devised and continue to develop a set of protocols that provide a common environment for the development of advanced telephony services and Internet access for the wireless market. If the WAP protocols were to be as successful as transmission control protocol (TCP)/Internet protocol (IP), the boom in mobile communications would be phenomenal. Indeed, the WAP browser should do for mobile Internet what Netscape did for the Internet.

As mentioned earlier, industry players from content developers to operators can explore the vast opportunity that WAP presents. As a fixed-line technology, the Internet has proved highly successful in reaching the homes of millions worldwide. However, mobile users until now have been forced to accept relatively basic levels of functionality, over and above voice communications and are beginning to demand the industry to move from a fixed to a mobile environment, carrying the functionality of a fixed environment with it.

Initially, services are expected to run over the well-established SMS bearer, which will dictate the nature and speed of early applications. Indeed, GSM currently does not offer the data rates that would allow mobile multimedia and Web browsing. With the advent of GPRS, which aimed at increasing the data rate to 115 kbps, as well as other emerging high-bandwidth bearers, the reality of access speeds equivalent or higher to that of a fixed-line scenario become evermore believable. GPRS is seen by many as the perfect partner for WAP, with its distinct time slots serving to manage data packets in a way that prevents users from being penalized for holding standard circuit-switched connections.

10. Conclusion

Our system of Internet Second Hand Retail Store has been implemented for most common second hand service. We allow the browsing, posting of product buy/sell request. With the product information, we allow user to input an URL of an image, and we do image conversion to display appropriate image format on different type of browsers. Animation is simulated by loading a different image at pre-defined time interval. We also looked into the aspect of separating data manipulation from layout design, which can substantially reduce the complexity of maintaining data with layout.

Throughout the project implementation, we have read though many materials on e-commerce and the WAP, and have hands-on experience to set-up a web site, and have written a simple site of an e-commerce application, second hand market. As we are to make a web site to be accessible by both web and WAP, we gain skills on parallel implementation of both web and WAP, and learn the importance of separating data manipulation and layout design. Throughout the problem we have faced, we have learned and have experience on the workflow of how an e-commerce on the wireless network works.

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Appendix 1. WAP

A1.1 Definition

The Wireless Application Protocol (WAP) is an open, global specification, which is optimized for mobile users with wireless devices the opportunity to easily access, interact with information and services, and more importantly, surfing the internet. The protocol is developed by WAP Forum (http://www.wapforum.org/), an organization of some of the most powerful Internet and telecom companies.

A1.2 History

Phone.com, Ericsson, Nokia and many others began developing standards independently of each other, but soon they realized that it would make more sense to focus development around a common standard. They all wanted to establish a common format for Internet transfers to mobile telephones, without having to customize the Internet pages for the particular display on every different mobile telephone or personal organizer. With WAP Forum they were able to find such a protocol.

A1.3 Background Statistics

Forrester is one of the leading independent research firms which analyses the future of technological change and its impact on businesses, consumers, and society. This research institute has conducted a research on WAP, and presumes that by 2004, one-third of all Europeans -- more than 219 million consumers -- will regularly use their mobile phones to access Internet services. According to a recent report from Forrester, ninety percent of the e-commerce executives interviewed plan to launch Internet sites designed for mobile phones with tiny displays and thin connections.

Forrester-analysts stress the fact that the only thing which can slow down this development is restricted user access.

In other words, smart cell phones will become the dominant means of accessing the Internet in some years, when Web-capable phones will make up 79 percent of the unit volume of Internet appliances, according to a report by Semico Research.

A1.4 WAP Architecture

The WAP protocols are analogous to many of those used in existing Internet technology, yet are optimized for the challenges raised by small, narrowband client devices (such as mobile phones) and limited over-the-air bandwidth.

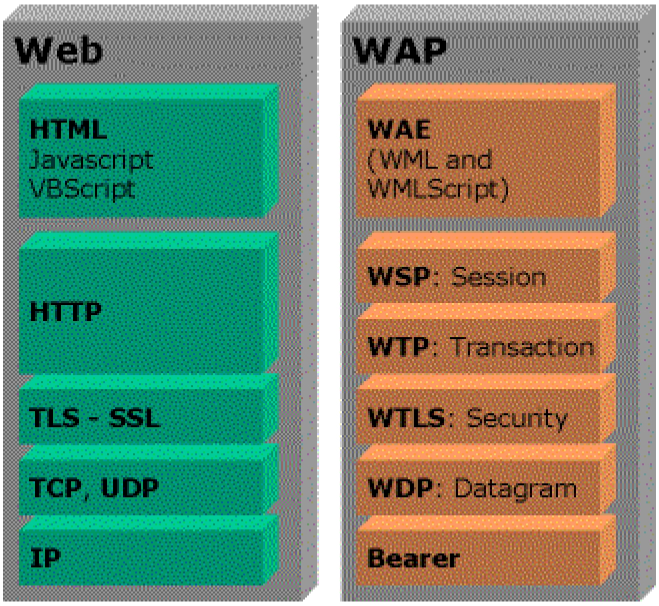
As WAP is an extension of the Internet onto wireless devices, it makes sense that it should share the same architecture. In its most simplified form, this is referred to as the three-layer model, as shown in the diagram below.

USER
BUSINESS
DATA

Internet applications work as follows:

The User layer exists to present information to end-users; the business layer is where the bulk of application execution takes place. Finally the Data layer consists of databases, legacy systems, external information feeds and other resources that the application might need to access. In general, Internet applications extend this model to support the thin-client model of the Web browser - an additional layer, known as the presentation layer, is added between the user layer and the business layer. In physical terms, the presentation layer maps onto the Web server just as the user layer maps onto the Web browser. The common language of the Internet, TCP/IP, separates the user layer and the presentation layer. It is this boundary, between user and presentation layers, that is the most important in the WAP-based wireless application architecture.

An essential principle of WAP is that it adds wireless proxy technology to the model above - rather than having a web server communicating directly with a browser on a wireless device, additional facilities are added to overcome the difficulties caused by today's wireless communications. These facilities include a protocol stack designed to minimize bandwidth requirements and to preserve the security and integrity of transactions, together with client and server extensions to execute the WAP-specific elements of the application.



The WAP Protocols cover both the application level (WML and WMLScript; collectively known as WAE, the Wireless Application Environment), and the underlying transport layers (WSP and WTP, WTLS, and WDP). The fact that the WAP Forum defines all these levels of the communications stack means that everything should hang together quite nicely. (In the web world, the application layers and the transport layers are specified by different organizations, but actually it still hangs together quite nicely).

HTTP Interface

The HTTP interface serves to retrieve WAP content from the Internet requested by the mobile device.

WAP content (WML and WMLScript) is converted into a compact binary form for transmission over the air

WSP

The WAP session protocol (WSP) layer provides a lightweight session layer to allow efficient exchange of data between applications.

WTP

The WAP transaction protocol (WTP) layer provides transaction support, adding reliability to the datagram service provided by WDP.

WTLS

Wireless transport layer security (WTLS), an optional security layer, has encryption facilities that provide the secure transport service required by many applications, such as e-commerce.

WDP

The WAP datagram protocol (WDP) is the transport layer that sends and receives messages via any available bearer network, including SMS, USSD, CSD, CDPD, IS–136 packet data, and GPRS.

Bearer

The 'bearer' level of WAP depends on the type of mobile network. It could be CSD, SMS, CDMA, or any of a large number of possible data carriers. Whichever our target client is using, the development above remains the same.

Note that the WAP application architecture is not about the languages or data structures that are used. In theory, WAP could support the transmission of any data format. In practice, formats are currently limited to the Wireless Markup Language, WML and the scripting language, WMLscript. In physical terms, each of the layers in our model is affected by WAP, as follows:

User Layer. In the WAP architecture, the client device is currently a mobile phone or a PDA running a WAP-compliant micro-browser. This part of the WAP specification is known as the Wireless Application Environment, or WAE.

Presentation Layer. A WAP proxy is added to the Web server in order to manage and serve WML pages. In addition, a filter can be included between the Web server and the WAP proxy, which converts HTML pages to WML on the fly.

Business layer. Application servers are available that have been designed or extended specifically to take into account the needs of wireless applications. These are covered in more detail in a coming article.

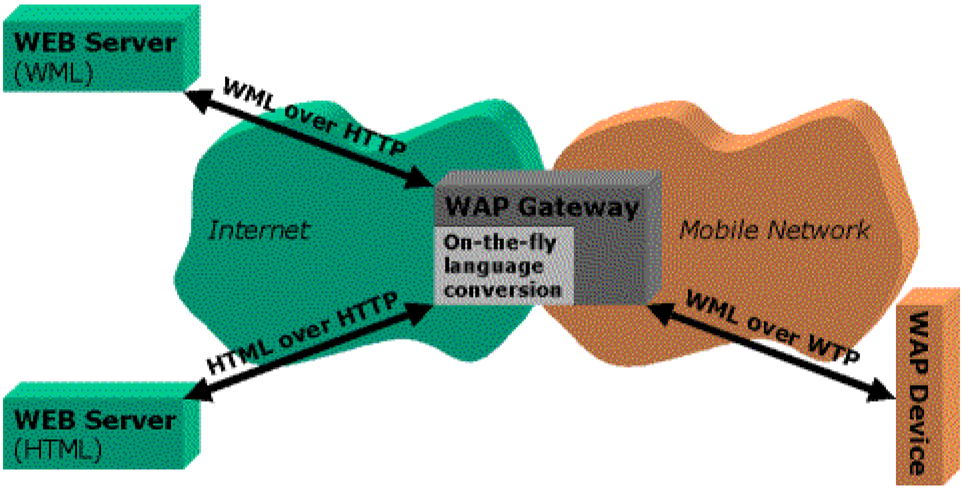
The Internet comprises clients (browsers) and servers which actually host the pages that we view - or the applications that produce the pages on-the-fly.

WAP is no different. Our clients are now the mobile devices, and the servers are still hosting static pages and applications.

The only consideration we have to now make is that we will have to connect the mobile network to the Internet - so that the phone can make a request for the page and it will be able to reach the server. (And of course the response has to make it back).

To connect these two mega-networks, the WAP Specification assumes there will be a

WAP Gateway. At its simplest level, this is a 'stack converter'. It converts the 'WAP' request into a 'Web' request and the 'Web' response into a 'WAP' response.



In theory, the gateway could also be made to convert the HTML page content itself on-the-fly as well. For example, if a phone makes a request to a HTML page, the gateway might feel it is capable of converting the HTML response into WML - so that the phone can understand it.

However, we need to bear in mind that WML is designed for small screens, and is therefore not as visually rich as HTML. Any such conversion will compromise a great deal of the HTML content and formatting - as well as any in-line scripting.

Some of the WAP Gateway products that are now coming on to the market (such as Nokia's WAP Server) also provide hosting capabilities themselves. There are no advantages to hosting static content on a WAP Gateway (other than perhaps performance), but if we are running dynamic web applications on a WAP Gateway, we may be able to determine more about our target client's request. In theory, and in the future, we might be able to integrate our WAP Server into the mobile network to gain information about the subscriber's location, for example.

Hosting on our own WAP Gateway-type server will require us to maintain connections into the mobile network somehow. For example, we might dial into the network's SMS engine, or provide dial-in modems for CSD access (that is, the mobile will dial our server as though it was a regular point of presence, like an ISP).

Although the impact of WAP upon the Internet application architecture is relatively low, there are nonetheless a number of factors that affect the way that applications are constructed. Perhaps most clearly, the user interface will change - it must be designed to be usable on small-screen, limited-input devices. Also, it needs to be written in WML and WMLscript rather than HTML and JavaScript or DHTML.

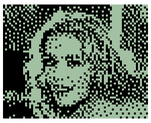
An additional element of the WAP architecture differs from the Internet model, as its origins lie in telecommunications rather than IT. This is the WTA server (Wireless Telephony API). WTA enables WMLscript applets to access telephony functionality such as call control, phone book access and messaging. Hence This could be used in a number of ways. Perhaps the simplest application is that of being able to dial a number directly from a WMLscript-based address book application. More advanced would be the capability to forward a call by selecting options from a menu. Finally, fully-fledged WTA is envisaged to be used in "click-to-talk" applications. For example, if a user is booking a flight ticket and needs to consult with an agent, the user could click a button to dial directly into the customer service department responsible. This could spell the end of voice mail prompts, to nobody's chagrin.

A1.5 WML Basic

Let's go right back to basics for one moment. On the web, we have the very ubiquitous HTML (HyperText Markup Language) for describing the look and text of pages that are seen by web browsers. These pages also tell the browser about the locations of the graphics to put on the page, and the links to be made to other pages.

It's quite simple in WAP: WML is the equivalent of HTML - and WBMP graphics are the monochromatic graphics a WAP phone should be able to view.

GIF format



WBMP format

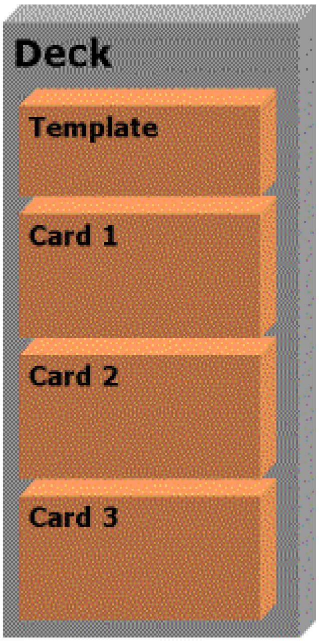
HTML these days is used to encapsulate both the exact form *and* the content of a page. Modern web pages are pixel-perfect and often works of graphic art. Combined with knowledge of the quirks of Internet Explorer or Netscape Navigator, an experienced web author can dictate exactly what the page will look like.

Unfortunately, WML doesn't quite offer that power of design; and if we're expecting pixel-perfect WAP pages, then we're in for a big surprise.

WAP devices and their characteristics are very varied - from tiny phone screens to a respectable PDA display. With this in mind, WML (which is the language used to write WAP pages) makes very few assumptions about how the page will be rendered on the final device.

In other words, we can be fairly sure that although the WML page will contain the content we want to display, we should leave any dreams of dictating form at the door! Once the market is full of WAP phones, testing pages across all potential devices will be impossible - it's therefore worth getting used to this new philosophy now.

Many web designers will find that writing in WML is actually fairly straightforward. It's been designed with knowledge of how HTML has evolved, and as a result is very pragmatic.



There are well-defined rules for WML structure, which we will find are well documented by the WML Standards (at http://www.wapforum.com) - and we can be fairly sure that if our content meets the rules, it should be rendered sensibly by all compatible phone devices.

However, we can realize that these rules are *very* strict compared to those of HTML. (Or, to be more precise, the HTML standards are treated quite loosely these days). For example, we can't get away with nesting tags incorrectly, and the encoding of special characters like the ampersand (&) is very important.

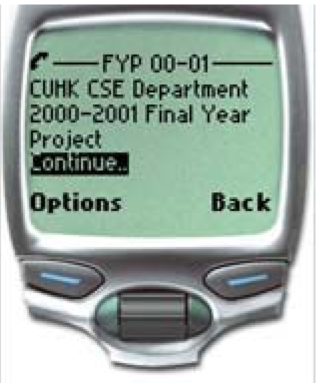
A WML document is composed of a deck, and a deck contains multiple cards. In practice, we can think of a deck as an HTML document comprising many individually addressed parts. The #label syntax is used to refer to a card in a deck.

The mobile device downloads a complete deck, but only displays one card at the time.

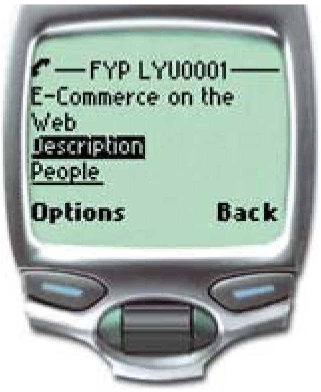
User can navigate through the links inside the document by tasks associated with the soft keys.

Here is a simple WML document:

```
File name:- index.wml
Location:- http://www.cse.cuhk.edu.hk/~lyu0001/index.wml
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML
1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml><!-- This is a comment. -->
<template><!-- Provide characteristics which are
common to cards across the whole of a deck. -->
<do type='prev' label='Back'><prev/>
</do>
</template>
<card title="FYP 00-01" id="main">
<p>CUHK CSE Department 2000-2001 Final Year
Project<br/>
<a href='#subject'>Continue..</a>
<!-- When the link is selected, next card in the
same deck with id="subject" will be displayed. -->
</p>
</card>
<card title="FYP LYU0001" id="subject">
<p>LYU0001 Wireless-based Mobile E-Commerce on the Web<br/>
<a href='description.wml'>Description</a><br/>
<!-- Go to another deck with file named "description.wml" in relative path.
-->
<a href='http//www.cse.cuhk.edu.hk/~lyu0001/people.wml'>People</a>
<!-- The link can also be specified by absolute path. -->
</p>
</card>
</wml>
```



FYP 00-01
CUHK CSE Department
2000-2001 Final Year
Project
Continue..



FYP LYU0001
E-Commerce on the
Web
Description
People

**Note: WML is much stricter than HTML, every tags must have its end tag. All the tags and attibutes should be in lower case. Otherwise, it will result in errrors!!*

Since WML is simply a specific type of e**X**tensible **M**arkup **L**anguage (XML) language. The second line describes the type of WML that we are using, and where the client device could go to look up the instructions for how to deal with this file.
A deck has to be a valid XML document, and this implies that a WML document should start with the standard XML header and the reference to the **D**ocument **T**ype **D**efinition (DTD).

Once our mobile device receives a deck, it will display the text of the first card. If we press the link, we will be able to navigate to the next card or another deck.

Here are the functional areas that recent WML support:

1. Text presentation and layout
2. Deck/card organizational metaphor,
3. Inter-card navigation and linking
4. String parameterization and state management (WML variables)
5. Interface to phone features

A1.6 Advantages

We cannot get access to the WAP services without a WAP phone. They are not too expensive, and the telecom experts predict that WAP phones will be better, faster and cheaper in the next few months. This is a technology that develops fast, and the newest WAP phones are much better compared to yesterday's phones which we can buy in our local telecom shop for a nice price.

Internet is still the best when it comes to exchange of information. But if our only interest is to be kept updated on the stock market or the latest sport reviews, WAP is the fastest and easiest way to be online. The e-commerce business' WAP is even better than shopping on the Internet. We don't need a big screen to order the last Smashing Pumpkins CD. All we need to make the order is a WAP-phone, click a few times, wherever we are - whenever we choose.

Appendix 2. Overview of XML and XSL

A2.1 Definition of XML

XML (extensible Markup Language) is a markup language for documents containing structured information.

Structured information contains both content (words, pictures, etc.) and some indication of what role that content plays (for example, content in a section heading has a different meaning from content in a footnote, which means something different than content in a figure caption or content in a database table, etc.). Almost all documents have some structure.

A markup language is a mechanism to identify structures in a document. The XML specification defines a standard way to add markup to documents.

A2.2 Component of XML

The number of applications currently being developed that is based on, or make use of, XML documents is truly amazing. For our purposes, the word "document" refers not only to traditional documents, like this one, but also to the myriad of other XML "data formats". These include vector graphics, e-commerce transactions, mathematical equations, object meta-data, server APIs, and a thousand other kinds of structured information.

XML is based on the concept of *documents* composed of a series of *entities*. (`Entity' is the English spelling of the French word `entité', the Teutonic equivalent of which is `thing'. Those familiar with modern programming techniques will probably be more comfortable using the word `object'. All these terms are synonymous.) Each entity can contain one or more logical *elements*. Each of these elements can have certain *attributes* (properties) that describe the way in which it is to be processed. XML provides a formal syntax for describing the relationships between the entities, elements and attributes that make up an XML document, which can be used to tell the computer how it can recognize the component parts of each document.

XML differs from other markup languages in that it does not simply indicate where a change of appearance occurs, or where a new element starts. XML sets out to clearly identify the boundaries of every part of a document, whether it be a new chapter, a piece of boilerplate text, or a reference to another publication.

To allow the computer to check the structure of a document users must provide it with a document type definition that declares each of the permitted entities, elements and attributes, and the relationships between them.

Document Type Definition (DTD), which is a formal model that users of XML can check that each component of document occurs in a valid place within the interchanged data stream. An XML DTD allows computers to check, for example, that users do not accidentally enter a third-level heading without first having entered a second-level heading, something that cannot be checked using the HyperText Markup Language (HTML) previously used to code documents that form part of the World Wide Web (WWW) of documents accessible through the Internet.

A2.3 Advantage of using XML

XML was created so that richly structured documents could be used over the web in a flexible way. The only viable alternatives, HTML is not practical for this purpose. HTML comes bound with a set of semantics and does not provide arbitrary structure.

While XML is being designed to deliver structured content over the web, some of the very features it lacks to make this practical, a more satisfactory solution for the creation and long-time storage of complex documents. XML will be the standard procedure for web delivery. However, the database system still exists. We dump out the resultant queries as XML formatted. That is, the database gets back to its original job of just storing data and keeping indexing information. Then on top of that we layer some APIs to extract the raw information and format it into XML. The main advantage is that we can define one format and then have different "views" of it, such as HTML and WML pages.

Because XML is ASCII-based, it promises to make deploying Internet-based distributed applications easier than is possible with binary-based messaging technologies like DCOM (Distributed Component Object Model) or CORBA (Common Object Request Broker Architecture). But, this doesn't mean that binary-based architectures should be tossed in favor of XML - they often work very well together. XML is a means of providing more efficient data exchange. The ultimate goal is to eliminate data redundancy and foster data reuse.

A2.4 XML Development Goals

It shall be straightforward to use XML over the Internet. Users must be able to view XML documents as quickly and easily as HTML documents. In practice, this will only be possible when XML browsers are as robust and widely available as HTML browsers, but the principle remains.

1. XML shall support a wide variety of applications. XML should be beneficial to a wide variety of diverse applications: authoring, browsing, content analysis, etc. Although the initial focus is on serving structured documents over the web, it is not meant to narrowly define XML.
2. It shall be easy to write programs that process XML documents. The colloquial way of expressing this goal while the spec was being developed was that it ought to take about two weeks for a competent computer science graduate student to build a program that can process XML documents.
3. The number of optional features in XML is to be kept to an absolute minimum, ideally zero. Optional features inevitably raise compatibility problems when users want to share documents and sometimes lead to confusion and frustration.
4. XML documents should be human-legible and reasonably clear. If we don't have an XML browser and we've received a hunk of XML from somewhere, we ought to be able to look at it in our favorite text editor and actually figure out what the content means.
5. The XML design should be prepared quickly. Standards efforts are notoriously slow. XML was needed immediately and was developed as quickly as possible.

6. The design of XML shall be formal and concise.
7. XML documents shall be easy to create. Although there will eventually be sophisticated editors to create and edit XML content, they won't appear immediately. In the interim, it must be possible to create XML documents in other ways: directly in a text editor, with simple shell and Perl scripts, etc.

A2.5 XSLT

The Extensible Stylesheet Language Transformations (XSLT) W3C recommendation describes a transformation vocabulary used to specify how to create new structured information from existing XML documents.

Unlike with a programming language, we don't need to be a programmer to successfully describe how to transform our information. XSLT implements transformation "by example", not just "by program logic", and builds in support for the kinds of transformation typically needed to present information.

Our objective, as an XSLT stylesheet writer, is to give an XSLT engine examples of how each of the constructs in our information is supposed to be structured once it has been transformed. We create these examples as "templates" of the result and we tell the engine when these templates get added to the resulting tree our transformation is creating. Our stylesheet templates can include our instructions to the XSLT engine to hunt down information anywhere in our input XML file, or many XML input files, to fill in holes in our template where our own information belongs.

When using the Extensible Stylesheet Language (XSL) formatting objects to present our information, our stylesheet objective is to transform our information into a hierarchy exclusively comprised of the XSL formatting object vocabulary. A rendering engine then takes this result hierarchy and interprets the semantics of the XSL vocabulary to produce our desired rendition, all without using a single construct of our own vocabulary, because we've transformed our own information into rendering information.

With XSLT we are not restricted to present our information in the same order we created it, nor are we required to present all of our information. Also, we can traverse our source XML multiple times if we need to reuse our information more than once in a single result, perhaps to simultaneously create tables of content and internal cross references described abstractly in our raw structured content.

The XSLT recommendation describes how XSLT engines can choose to support different ways to serialize the templates we have added, in combination with the information we glean from our source tree, to the result tree. Our result can be realized using XML syntax conventions, HTML syntax conventions (with or without CSS) or WML syntax conventions.

Think of the possibilities: with XSLT we can take our structured XML information and synthesize new instances for our colleagues and customers to use, or build HTML/CSS web pages from data stores, or feed other systems with flat text representations of our data, or create operating system scripts, etc.

This gives us the freedom to organize the information the way we want from the beginning, to best meet our own business requirements, and still fulfill our obligations and desires to utilize our information in a myriad of ways downstream.

A2.6 Example of using XSLT:

Here is an example showing that we use one XML, two XSL together with a PHP script to make use of XSLT that can generate the HTML and WML files separately according to the user's request. Clients only need to request the URL of test.php file for both web and WAP browsers.

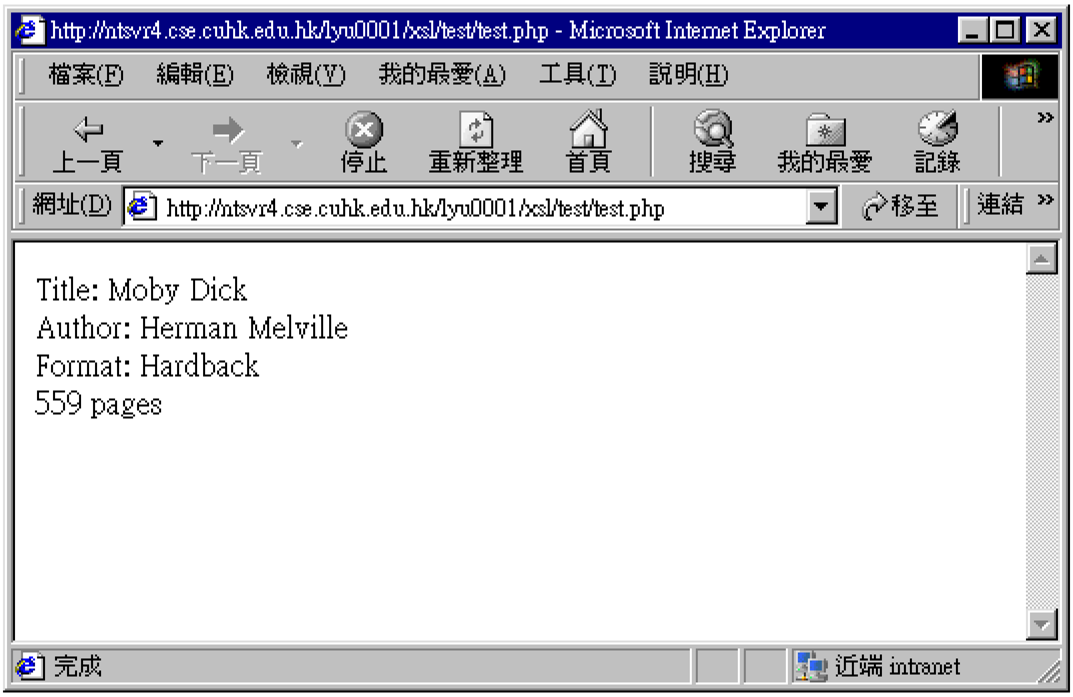
A simple XML document (test.xml)

```
<?xml version="1.0"?>
<book>
  <title>Moby Dick</title>
  <author>Herman Melville</author>
  <format>
    <spine>Hardback</spine>
    <pages number="559" />
  </format>
</book>
```

A simple PHP script (test.php)

```
<?php
  if (ereg("wml",$HTTP_ACCEPT))
  {
   $xslfile = "wml.xsl";
  }
  else
  {
    $xslfile = "html.xsl";
  }
$xslt = xslt_create();
$result="";
```

```
$xsldoc=join("",file($xslfile));
$xmldoc=join("",file("test.xml"));
xslt_process($xsldoc,$xmldoc,$result);
echo $result;
@xslt_free($xslt);
?>
```


http://ntsvr4.cse.cuhk.edu.hk/lyu0001/xsl/test/test.php - Microsoft Internet Explorer
檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)
上一頁 下一頁 停止 重新整理 首頁 搜尋 我的最愛 記錄
網址(D) http://ntsvr4.cse.cuhk.edu.hk/lyu0001/xsl/test/test.php
移至 連結
完成
近端 intranet

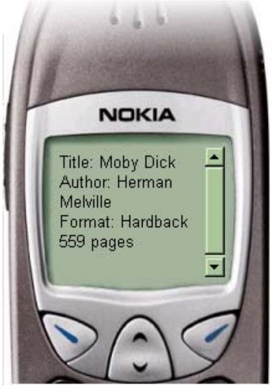
Title: Moby Dick
Author: Herman Melville
Format: Hardback
559 pages

A simple XSL document for HTML output (html.xsl)

```
<?xml version="1.0"?>
<xsl:stylesheet                                         version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
  <xsl:template match="/">
    <html>
      <body>
        Title: <xsl:value-of select="book/title"/>
        <br/>
        Author: <xsl:value-of select="book/author"/>
        <br/>
        Format: <xsl:value-of select="book/format/spine"/>
        <br/>
        <xsl:value-of select="book/format/pages/@number"/> pages
      </body>
    </html>
  </xsl:template>
```

```
</xsl:stylesheet>
```

A simple XSL document for WML output (wml.xsl)



Title: Moby Dick
Author: Herman
Melville
Format: Hardback
559 pages

```
<?xml version="1.0"?>
<xsl:stylesheet                    version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/Transform">

  <xsl:output
    method="xml"
    doctype-public="-//WAPFORUM//DTD WML 1.1//EN"

doctype-system="http://www.wapforum.org/DTD/wml_1.1.xml"/>

  <xsl:template match="/">
    <wml>
      <card>
        <p>
          Title: <xsl:value-of select="book/title"/>
        </p>
        <p>
          Author: <xsl:value-of select="book/author"/>
        </p>
        <p>
          Format: <xsl:value-of select="book/format/spine"/>
        </p>
        <p>
          <xsl:value-of select="book/format/pages/@number"/> pages
        </p>
      </card>
    </wml>
  </xsl:template>
</xsl:stylesheet>
```