WEBSITE DESIGN FOR AN ONLINE SWAP SOCIAL NETWORK FORUM

Liu Binger
Li Jiaying

Bachelor's Thesis
School of Business and Culture
Degree Programme in Business Information Technology
Bachelor of Business Administration

2016

Currently, the swap and donation activities are unheeded in China with multiple reasons. Similar activities and operation methods exist but goals are not achieved well. Additionally, there is a notable gap between the wealthy people and the poor in the mainland of China, and negative impacts grow strong. Therefore, this research work sought possible resolutions for solving these problems.

The objective of this thesis is to understand the background of the above described issues and concepts and analysis of their resolutions. To define the concept and solve these issues, the constructive research method and combination of qualitative and quantitative research method were used in this research work. Literature review and a questionnaire were also included for supporting this research work process successfully. To achieve the objective of the thesis research, several features were studied and analyzed.

By studying literature, exploring online sources, and analyzing the questionnaire data we found out that people cannot find the information that they search for on the existing websites for swap and donation activities. Ignorance of these activities because of insufficient relevant information causes heavy negative impacts.

By further developing the prototype that we designed during our thesis project, people could find information easily and quickly. Graduate students, people who work out of their hometowns and especially the people of limited means in the mainland of China could benefit from the website.

Key words   Responsive website design, online swap social network forum, internal site search engine, search data analysis

CONTENTS

SYMBOLS AND ABBREVIATIONS

HTML   HyperText Markup Language

CSS   Cascading Style Sheets

SDLC   Systems Development Life Cycle

HTTP   Hypertext Transfer Protocol

1   INTRODUCTION

In this chapter, the motivation, the background, scope of the research including objectives and limits of the thesis project, and the structure of the thesis are presented. Furthermore, the objectives of the thesis research are described.

1.1   Background and Motivation

The huge demand for electronic consumptions in China causes individual product becoming unused and decreased in their value. Goods swap, which means exchange of these sorts of products with other people for non-profit purpose, is a meaningful and useful activity. In the current Chinese electronic business market, websites for goods swap exist and these are profitable websites. These websites do not have enough spaces to display information for swap and donation and online shopping still plays the main role on these websites. The transaction form of these websites is similar with online shopping and a third party might make profit from these websites.

There is a notable gap between the wealthy and poor in China. "China's widening income inequality is largely a reflection of faster income growth among the rich, rather than stagnant living standards among the poor" (Cevik & Correa-Caro 2015, 3). Online shopping develops rapidly at present, and preferential price and timesaving methods are the major causes. The wealthy people spend extravagantly on the Internet, and they frequently buy household products, which they do not need and discard them even though they are brand-new, while the poor cannot pay for these products because of the high prices. Moreover, the popularization level of computer science is not high among the poor, and they have no conditions and experience in using the Internet. According to Wu (2015), the wealthy also look down on the poor, which gives negative impact in China.

Personal computers are the main terminals for online shopping. The amount of people shopping on smart electronic devices has grown fast. A total of 69% people do online shopping via desktop computers and 53% via smart mobile phones (Mehra 2014, 14, 24-31). To narrow down the gap and soften the impact, a website for both non-profit goods swap and highly organized donation

activities is needed for an individual local city, especially for a small area in the mainland of China. In order to organize these activities conveniently, a specific website can be constructed to gather information concerning the products.

Smart electronic devices provide useful information for human beings on the Internet. Environmental pollution can be controlled by decreasing the need for paper products and electronic information recycling. Today, recent social network communities mainly consist of the youth. Young generation become a major user group of social media. They have advantages over the older generation in learning how to use electronic products, software and mobile applications (Lee 2014, 15). People who study and work far away from home are one part of the main user group of the swap and donation website. After graduation, students have lots of used household products which are not able to flit to a new place. Placing furniture without large expense is also a problem for people who come to a new city for studying and working. Since discarding is not a good way to deal with these products, and finding satisfying furniture is not easy to do, the website with swap and donation features can be constructed.

We are students from degree the programme in Business Information Technology. Courses of website development orientation, system testing and business marketing orientation were studied and these study experiences are relevant to our research project. These specific knowledge and interest in China swap market allow us to develop a social network community website for swap and donation.

1.2   Scope and Objectives

The scope of this research includes an overview of a website development process. Firstly, the website requirements and website function planning are discussed. In addition, the framework and sitemap of the website are determined based on the requirements. Secondly, a flexible website design approach also known as RWD and programming skills are used to develop the website for all types of devices, such as a mobile phone and personal computers. Thirdly, website functional testing is included in this research. Key terms and concepts such as internal site search engine, search data analysis

system and other concepts relevant to the topic of this research are also discussed.

The features of swap website system include information browse, comment, and users account management. The features exclude online commerce system, logistics management and inventory management. The website is only able to provide information and services for registered users. Non-registered users cannot browse detailed information about the website.

The main objective of this thesis project is to design a responsive website with the PHP scripting language and HTML language for personal computer operation system and mobile devices. Additionally, a particular explanation of the process for website analyses, design and implementation was provided. The website function planning, usability and layout are determined in the research. Today, people are living with electronic devices and the website designed in this thesis work can be used for swap and donation. Furthermore, the goal of the website is to reduce discard, increase goods' value, save unnecessary expenses and improve living standards of the people who need household products but without enough economic capability.

1.3   Structure of Thesis

The thesis consists of six chapters. An introduction is included in Chapter 1. In the Chapter 2, the research questions, the research methods and techniques are described. In Chapter 3, a detailed description of the first phase of the swap website development is provided. Chapter 4 presents the development environment and implementation processes. Chapter 5 introduces the website testing process and the testing result are analysed. Finally, Chapter 6 draws conclusions and presents discussions about the whole thesis work.

2 RESEARCH QUESTIONS AND METHODOLOGY

Research questions and research methodology are the main focuses of this chapter. The questions are logically connected. Both of the questions and the methodologies supported the thesis work development.

2.1 Research Questions

The following research questions are addressed.

1. What are the user requirements for the swap website?

This question enables us to gain an understanding of the goal of the swap website and what features should be included in it. The main users are college students, people who work far away from home, e.g. study and live in a foreign country and the wealthy and the poor in China. The requirements for the website were defined by a questionnaire among foreign students of Lapin AMK and people who surf the Internet in China. We are also foreign students in Lapin UAS, and our study background and personal knowledge in our home country swap website field enable us to identify suitable features for the website.

According to the main users' characteristics, the online swap social network forum was constructed as a responsive website. An informative and interactive user interface, which includes understandable navigation, was designed and implemented based on an open source website template.

2. What are the technical requirements for the swap website?

The second research question describes what operation system, programming language and software are selected for the website design and implementation.

Our thesis project was implemented without any expense since the website was built based on an open source code and free template. The database server is free and easy to understand. The website had to be manageable at all time, which means programmers and administrators can adjust the content of the website and modify user groups during the constructing phase, testing phase and maintenance phase.

3. How can the swap website be designed, implemented and tested?

The third research question introduces what practical phases are included in the website design, implementation and testing process. Figure 1 displays the Software/System Development Life Cycle.
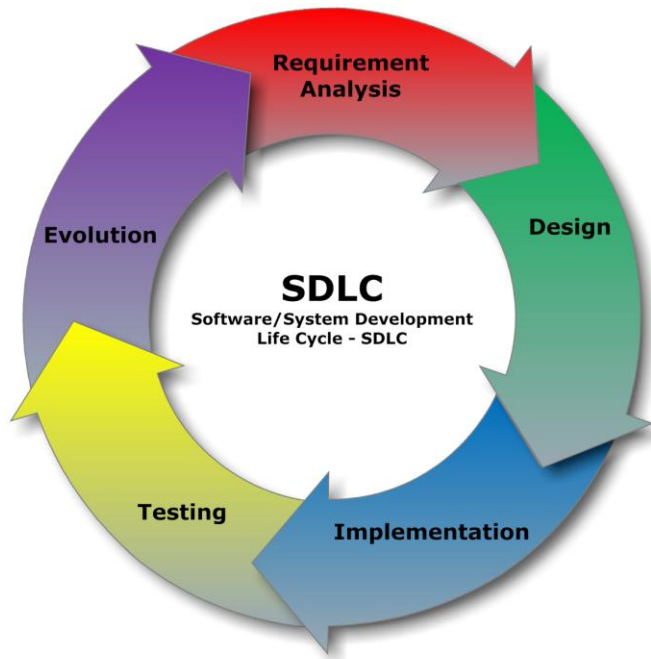

Figure 1. Software/System Development Life Cycle – SDLC (Hi-Tech ITO 2013)

According to the SDLC diagram, the design of the swap website includes four phases except evolution. Evolution includes maintenance and user feedback which are out of our capability.

The first phase was to define the main user and analyse user requirements. Based on these user requirements and our personal experiences, the features of the website were determined. The second phase was to design the framework of website user interface and system. Layout, content, security, database, website architecture and programming language were determined and designed in detail. Next phase was development and implementation. The website was built based on all requirements and analysis. The goal of the website was also achieved at this phase. Testing was the final phase of the whole process that the website should not have any runtime errors and the test level of usability should be high.

4. Why should the swap website be designed and developed? What are the differences between our swap website with other similar websites?

The fourth research question provides the reasons for why the swap website should exist and introduces the unique features which other websites do not have.

The swap website provides features not only for the people who study and work far away from home but also both the wealthy and the poor in China. People go to the website and publish swap posts after register. Then every register could view these posts and apply for swap.

Donation Unit is a special feature of our swap website. The goal of this unit is to improve living standards of the poor, shorten the gap between the wealthy and the poor and soften the negative impact in China. The unit will hold activities in a regular period and the people who want to donate can be gathering at a specific location. Then the donated products will be arranged and sent to the poor by the swap website staff and activity's volunteers. Benefit for people who donated a lot is commending their positive activities on the Chinese biggest blog Weibo.

2.2   Research Methods and Techniques

The constructive research method and combination of qualitative and quantitative research method were used in this research work. Literature review and questionnaires were also included in the methods for research. The objective of our thesis work was to design a website, integrating a practical orientation and development work. This work was based on empirical data collected by a questionnaire. The necessary information such as the website features, layout, structure, programming environment, and software platform were all collected trough these methods for our website design.

The constructive research method is relevant to our research topic since the research was conducted to design a website with specific features. "Constructive research method implies building of an artifact (practical, theoretical or both) that solves a domain specific problem in order to create

knowledge about how the problem can be solved (or understood, explained or modeled) in principle. Constructive research gives results which can have both practical and theoretical relevance" (Crnkovic 2010, 4). Based on the existing knowledge with practical and theoretical studying, the problems in the computer science field can be solved with an appropriate result.

For designing our website Online Swap Social Network Forum (henceforth OSSNF), collection and analysis of the website content, user requirements and technique requirements were the primary and essential sections for our website design, implementation and testing. With our understanding of the existing website development knowledge and online open source code, OSSNF was designed as a website with specific features, which can be used to increase its marketing effect once it is used publicly.

The combination of qualitative and quantitative research methods was selected since our research work was based on existing background information about website design and user requirements. "Constructive research takes off from the existing well understood ground and that is why research in Software Engineering often starts with empirical investigations where quantitative (Controlled experiment, Survey) or qualitative (Grounded Theory, Case studies) methods are used prior to the constructive work" (Crnkovic 2010, 5). The questionnaire was one approach to provide detail user requirements for OSSNF development in this work.

The questionnaire was necessary for the website development. It is a cheap and time-saving method for information collection. The questions with limited choices of answers could be understood easily by the respondents. The result of the questionnaires is clear and understandable, displayed in charts, graphs and diagrams. "They are especially useful in surveying people who are dispersed over a wide geographical area, where the travelling demands on an interviewer would be excessive" (Phellas, Bloch & Seale 2011, 183). Considering that user groups of OSSNF are separated in different regions, online self-completion questionnaire was chosen for this thesis work.

The respondents for our questionnaires were cyber citizens from China and foreign students from Lapland UAS because OSSNF is designed for Chinese

culture. Cyber citizens come from different age groups and types, and they surf the Internet regularly. With the computer technology experience of these respondents, suitable answers were provided. Through the questionnaire and analysis of our study background and interests, user requirements were appropriately determined in detail and the website was developed with useful features successfully.

Literature review was one part of our website development process which could also be seen as a start of OSSNF design and analysis. "Literature reviews are designed to provide an overview of sources you have explored while researching a particular topic and to demonstrate to your readers how your research fits within a larger field of study" (Labaree 2016, 5). Website blogs and scholarly articles which provided us with the sources relevant to online swap were reviewed and analysed. On the basis of the literature review, we decided to design OSSNF.

Through exploring the existing websites, which have similar content to our proposed website, OSSNF with its suggested features achieves better layout and useful value than those websites. Furthermore, with these better layout and value, OSSNF would be useful and bring benefits for the main user group once it used publicly.

Additionally, in order to understand the keywords of our research to design and develop OSSNF, literature review and literature analysis of the keywords were utilized as the methods to collect data. The data and theoretical information were collected from secondary sources such as established articles, books, online blogs and websites.

3 OSSNF DESIGN AND ANALYSIS

This chapter describes how OSSNF started to be constructed. The first phase of our swap website development process was to define user requirements. Designing architecture for the swap website system and user interface was the second phase. Both phases are introduced in detail below.

3.1 User Requirements

Our thesis project OSSNF was started with thinking about website features, contents, structure and layout. Parts of the features of OSSNF were analyzed and determined from the questionnaire which answers were collected from the cyber citizens and foreign students from Lapin UAS. The questionnaire gave us well-defined information about how OSSNF should be. Our study background and interest were also used to determine the requirements, and the goal of OSSNF was clearly defined.

In order to collect information from OSSNF target users in different regions in a fast and cheap way, a questionnaire was adapted to our situation.

The questionnaire contains eight questions and it collected answers from the respondents, 72.22% of which were between 18 to 25 years old. The question "Do you have any experiences in swap?" shows 69.44% of the respondents do not have any experiences in swap relevant activities. Swap activities are not organized well in the mainland of China. People do not have enough information and effective methods about how to achieve their will, therefore, the rate of discard increased and the value of household materials decreased.

Figure 2 shows the clear result about the question "Do you have any experiences in swap?"

Do you have any experiences in swap?
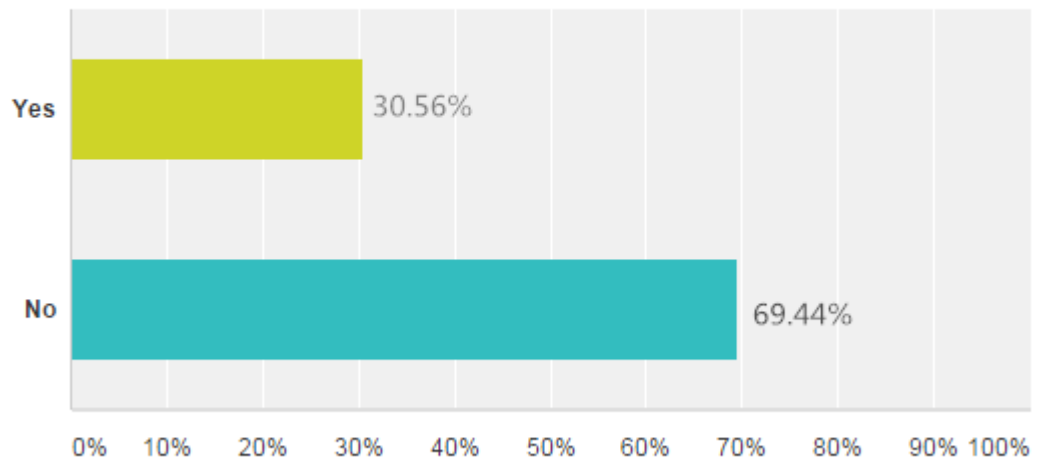
Figure 2. Questionnaire result 1

Figure 3 shows the result in the question "If there is an online swap website, what functions would you like it to be?" Most of the respondents want information on a swap website is sorted by the same local area or the same category. As the Chapter 1.1 described, the websites for household materials swap exist but these websites do not have a large space for displaying the swap information, even their main role is not swap and donation. Without understandable and clear information, the will for swap and donation of people will be reduced.

If there is an online swap website, what functions would you like it be?

Figure 3. Questionnaire result 2
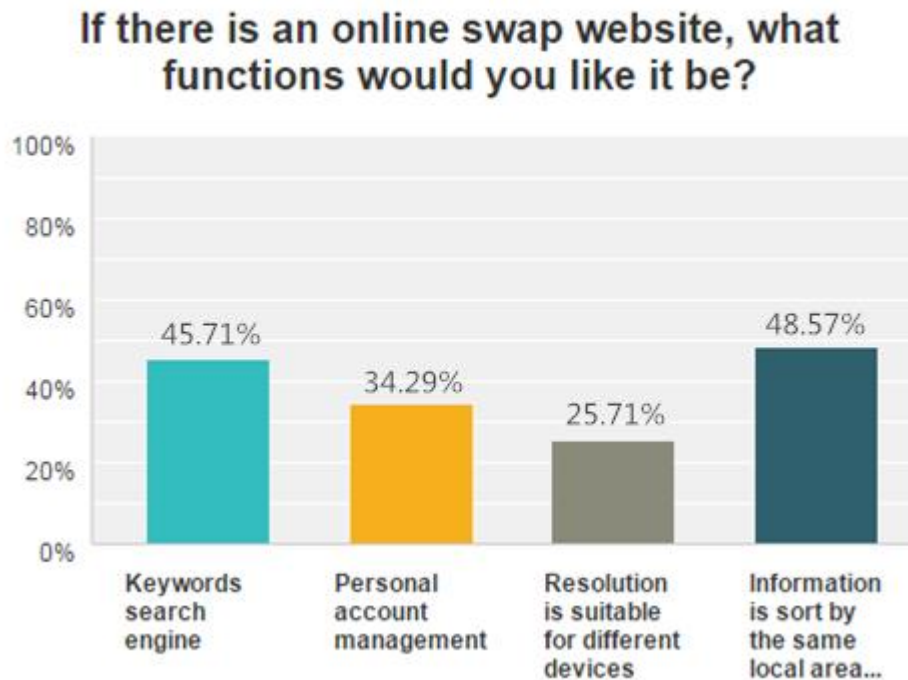
At this situation, the goal of our swap website could be achieved. According to all highly selected answers in the questionnaire, the features of the swap website were determined. Therefore, OSSNF will be a website focuses on providing non-profit swap service and donation information. Target users can register at OSSNF to browse any information they want, manage their personal account for others' convenient contact, post and reply the swap information with other users, and view the donation activities information to participate.

3.2   Development Environment and Technologies

To satisfy and achieve the user requirements, specific tools, development environment and programming languages were selected to build the swap website.

3.2.1   Development Environment

This subchapter describes OSSNF development environment in detail and provides the basic understanding of HTTP, XAMPP, Apache, MySQL, Bootstrap and phpMyAdmin. The purpose and reasons for developing in these environments is also discussed.

Hyper Text Transfer Protocol (henceforth HTTP) is a communication standard of dealing with the requests and responses on users' browser and web server. The web server waits for the requests from users' computers and responds it through HTTP. (Nixon 2009, 2.) Our swap website development server is also seen as a local host. It saved time and strengthened security during the website development process. The local host can load webpage faster than a public host does. One can modify the code directly in the local host and save it. There is no need to update the code to a public host and time is saved. (Nixon 2009, 13.) Time of our website functional test was also saved by using this local host instead of broadband connection. The swap website is secured by firewall in our personal computers and it is not easier to be attacked than it in a public server.

To find a suitable web server and database for our swap website, XAMPP was chosen. It is a free and small size cross-platform tool for students developing and testing website in PHP and MySQL. It contains the most common web development technologies such as Apache HTTP Server, PHP, MySQL, phpMyAdmin, Openssl, and SQLite. All these technologies are gathering in a single package. (Dvorski 2007, 1.)

Apache is the most popular web server in the HTTP Server market which we used as our local host. A survey by Netcraft in March 2016 received responses from over 1 billion sites informing that 32% of websites run on the Apache server. For database management, MySQL and phpMyAdmin run well in our local host.

MySQL is a popular multi-user and multi-threaded Structured Query Language (SQL) database system (Kirilenko 2009, 26). It is extremely powerful, exceptionally fast, and highly scalable (Nixon 2009, 157). "phpMyAdmin is a web-based interface to a MySQL server. phpMyAdmin translates what you

enter into the web browser, sends queries to the MySQL database, and translates the returned information back to web format" (Polly 2012, 1.)

OSSNF development is based on an existing template which already has a basic layout and functions. The most popular web development framework Bootstrap provides a lot of source code for us to write OSSNF even the responsive web feature. "Bootstrap significantly speeds up the undertaking of building a frontend web interface because of its ready-made, thoroughly tested blend of HTML markup, CSS styles, and JavaScript behaviour. With these essential foundations rapidly set up, we can confidently modify the UI on top of a solid basis." (Armel 2014, 17.) This method saved our time on OSSNF development. For these reasons, OSSNF can run smoothly on users' different types of devices.

3.2.2   Programming Techniques

This subchapter discusses all used programming techniques in OSSNF design and development. Detail introduction of PHP, HTML, MySQL, CSS and JavaScript is provided.

A practical way to produce dynamic web content is developing it by using PHP, MySQL, and JavaScript together. "PHP handles all the main work on the web server, MySQL manages all the data, and JavaScript looks after web page presentation. JavaScript can also talk with your PHP code on the web server whenever it needs to update something (either on the server or on the web page)" (Nixon 2009, 9.)

To display results for users' keywords search requests on OSSNF, PHP takes the main role in our local host. PHP is a free server side script language that is used to create server output page which users requested. One PHP file can include several types of programming languages such as PHP, HTML, CSS, JavaScript and some MySQL commands that provided a thorough interface and functions for OSSNF. (Nixon 2009, 33.) PHP can also use MySQL commands to call MySQL directly without running MySQL (Nixon 2009, 7).

Hyper Text Markup Language which (henceforth HTML) was used to structure and make contents for our web page. CSS, which is known as Cascading Style Sheets, sets the formatting and appearance of the swap website (Kolowich 2014). HTML and CSS are essential parts for a website development. "JavaScript is a programming language is used to make web pages interactive. It runs on your visitor's computer and it does not require constant downloads from your website. JavaScript is often used to create polls and quizzes." (Chapman 2016.) For achieving specific features, JavaScript was used to structure it and these features could be called later.

3.3 OSSNF's Sitemap and Features

Sitemap is an essential part of a website design. To help designers and programmers understand well the content and objectives of a website and build a balanced website, a sitemap should be created. (ANR Technology Services 2014). The user requirement analysis was followed by the sitemap creation. A clear and understandable sitemap was created for website development. By following the sitemap below, OSSNF achieved all proposed features successfully. The proposed features were determined based on the user requirements. The questionnaire provided us detail information about how the swap website should be.
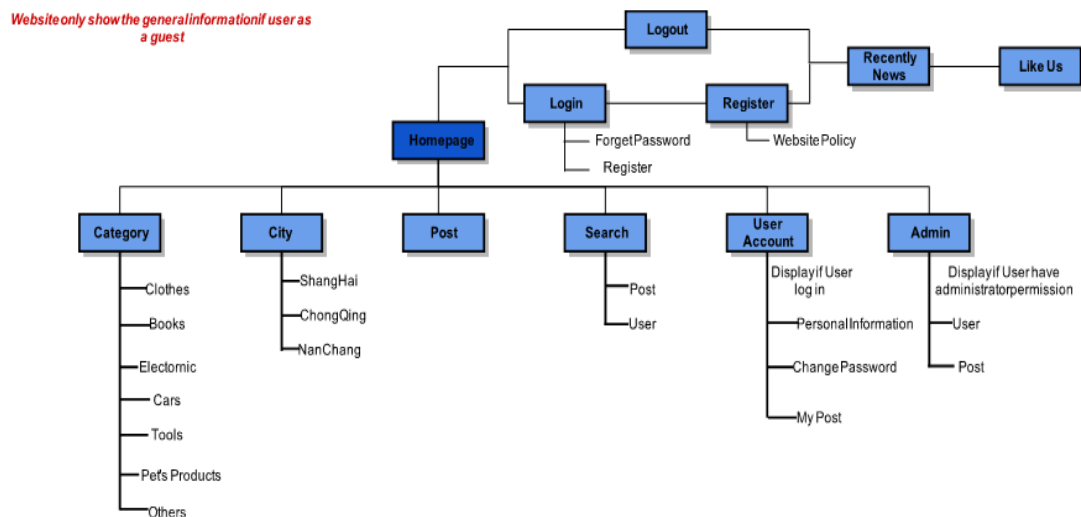
Figure 4 shows the content of OSSNF.

Figure 4. OSSNF sitemap

Registered users can browse the swap information from all pages on OSSNF by following the main menu which sorts information in specific orders. Different city areas and swap products categories lead users to the correct pages that they want to browse. Except following the menu, users can also use the internal site search engine of OSSNF to search information.

Internal site search engine is one of the proposed features. It enables users to browse specific products by searching keywords with filters. Usually, the internal search engine is only required for those large websites which have thousands of pages. However, it is also needed for a small website if it relates to e-commerce. (Clay 2015, 33.) Since OSSNF focuses on the swap and users have demand for different household products, internal search engine doing well on finding answers and saving time. Both non-registered and registered users could find information among thousands of pages by keywords searching. They could search household products' name or other users' name to search information. Through the data analysis, relevant information will be sort in chronological order and display the result for users. However, only registered users could read detail information about these results.

Except browsing the web pages, registered users could also post swap information, reply other users who had a comment below their posts and

manage their personal account. They could edit their profile photo, nickname, contact information, view and delete their posts. Password change is available when users forget their login key to OSSNF.

The swap website only shows the general information to a user while he/she has not registered yet. Non-registered users can only browse the homepage of the website, donation activities announcements and a brief introduction of registered users' swap posts by following the navigation and search engine. To browse detailed information and post swap information, those users who have no admission to using these features need to register and login at OSSNF.

3.4   System Design

OSSNF consists of two systems, the website architecture system and the swap and donation system. Both systems support OSSNF development and progress successfully.

3.4.1   OSSNF Website Architecture

The following diagram shows the whole structure of OSSNF. It also led us to a successful website development.
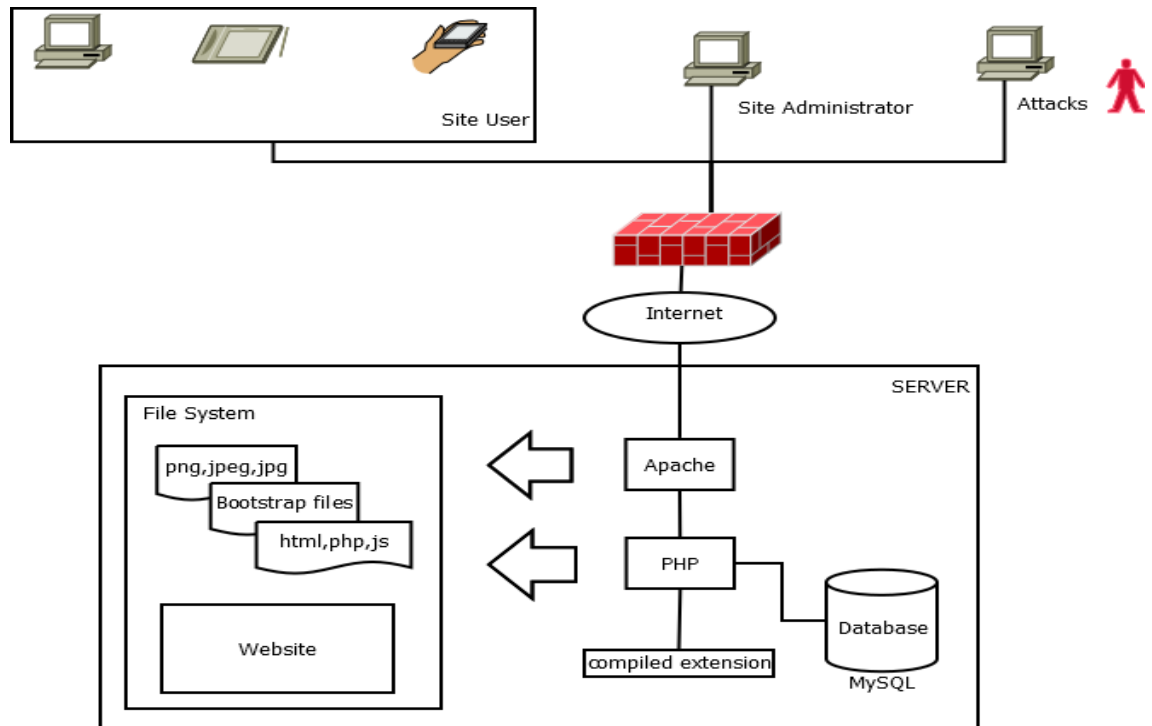
Figure 5. OSSNF website system architecture

There are three types of people who can interact with OSSNF. These people could be OSSNF users, administrators, and attackers. The swap website users can be registered users and unregistered users who browse the website through their own workstations, tablets, and other smart mobile devices. The OSSNF administrators could be the people who administrate the swap website through their workstations. The attackers of OSSNF could be the hackers who attack the swap website through their workstations.

The website is a part of the Internet because usually a website is published through the Internet with a server. As the diagram above describes, inside SERVER, there are file system and database. Outside the website system, a firewall was set between the website and visitors to protect the website from attack by hackers.

There are two types of the attackers. Generally, they could be the people who use various techniques to discover and exploit a weakness in a website. One type of the attackers is white hat hacker. Usually, they belong to a security test team which tries to attack a website for this website's security test (Krehel &

Andersen 2015). However, another type of the attackers is the crackers, also named as black hat hacker (Agnew 2012). The most common reasons for crackers attack a website is for fun and making benefit (Cienfuegos 2014). This type hacker is the main object for detection and prevention. They might steal swap and donation resources and violate OSSNF users' privacy.

Since the OSSNF is a prototype of swap website, the Internet connection was replaced by the local host connection. The Server displays on the above figure means XAMPP local server and the Firewall means the local computer firewall which provides by Windows operating system default set (Microsoft 2016). Inside the XAMPP server, Apache was used as a server which links to OSSNF file system. The OSSNF file system includes code files, template code files, and image files. The code files include HTML files, PHP files, and JavaScript files. The code template file means the bootstrap template code files. The image files include several types of images such as png, jpg, and jpeg. The detail of the OSSNF file system was list as a table and explained in the next chapter.

Additionally, the OSSNF used PHP to connect MySQL database with the code file which means data is stored in the database and it could be read in specific web pages by calling PHP code file. These data can be a user name, user password, user information, published time and images' path.

3.4.2 The Swap and Donation System

The swap and donation system was constructed at the second phase of OSSNF development. It was figured out with the sitemap creation and it shows how the swap and donation features of OSSNF work.

As chapter 3.1 described, OSSNF is a website focused on providing non-profit swap service and donation information. Through browsing the swap posts about any types' household products on OSSNF, registered users could find satisfactory answers for their demands. Cheap, convenient and timesaving local meeting method is the reason for OSSNF sorting swap posts in geographical order. By getting in touch with the posters' contact information, users can have a conversation with the posters to discuss where they could meet for swap. After the successful swap, the poster can remove his/her swap information from

OSSNF or just leave a comment saying that the swap is completed. Non-profit is always the main idea during OSSNF development and future evolution.

For donation activities, both registered and unregistered users can view the activities announcements. The announcements are displayed at the center banner of the homepage which means everyone can notice it immediately. The OSSNF will organize donation activities in a regular period. For example, the location for holding the activity is determined by current weather and other conditions. One donation activity could be held in every half year. These activities' masterminds and organisers could come from OSSNF. They could be the managers, OSSNF developers, and administrators. Before the activity is held, there will have an announcement for volunteers' application which is displayed at the same banner as the origin donation information. The volunteers are people who are willing to support OSSNF donation activity. They help the organisers gather all donated products, package and transfer it to the target beneficiary. The target beneficiary is already defined with the motivation of OSSNF development.

3.4.3 OSSNF User Use Case

Use case is a description of system reaction in software engineering which is created by software developers and the software terminal users. To identify and make OSSNF's objective clear, understand what could happen to the OSSNF system, support chapter 3.4.2 and provide more clear understanding for readers, the OSSNF user use case was figured out by this website researchers and users. (Visual Paradigm 2016, 1-2.)

The following diagram describes how the OSSNF system reacts with its users and how the OSSNF internal system works. "Normally, a dashed line with an open-ended arrow in UML indicates a dependency – the source relies on the target in some way" (O'Docherty 2005,154). The dashed lines in the below diagram show the relationships between each feature. The feature at the tail of an arrow is subordinate to the feature at the head. The subordinate features are available once users had interacted with the superior features.
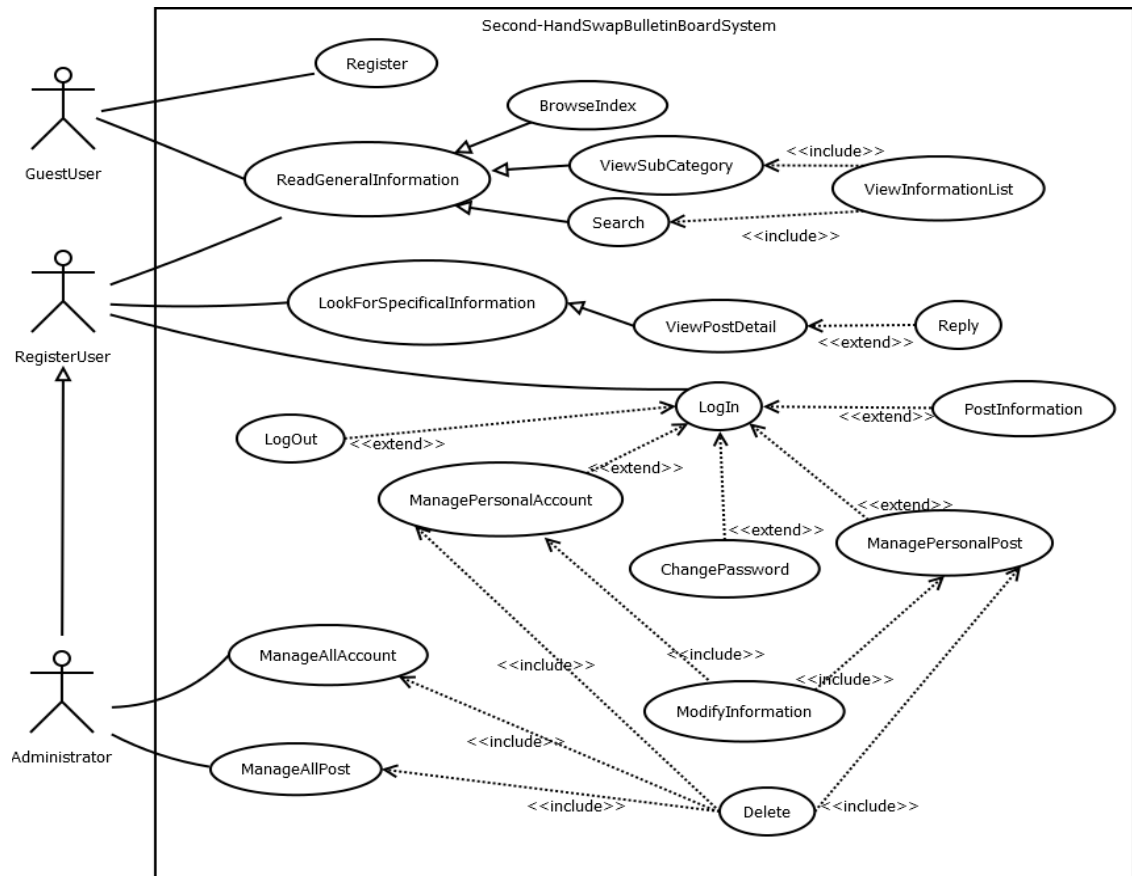
Figure 6. OSSNF user use case

There are three types of users of OSSNF, non-registered users, registered users and website administrators. Any type's users can read the general information by browsing the index, menu's subcategories and search engine. However, only registered users and administrators can view detail information. The non-registered users also known as the guest user can own the same access rights as those two types' users after register. Registered users have rights to use the following features after login: view swap posts detail information, comment other users' posts, edit personal account, modify account password and manage personal swap posts.

The objectives of administrators are keeping OSSNF secure and well-organized. They manage all registered users' accounts and their swap posts. They can delete and add new users into OSSNF. However, they could not modify any users' information and posts' content.

3.5   User Interface

This subchapter focuses on OSSNF user interface. Detail visual information about the layout and features are described. Through this subchapter, readers will gain understandings about how to interact with OSSNF.

Figure 7 shows the homepage of OSSNF. All three types' users of OSSNF could view the navigation which is also called as the menu and turn to subcategories pages. At the center of this page, there is a photo gallery which can switch different images to display several the newest swap and donation announcements.
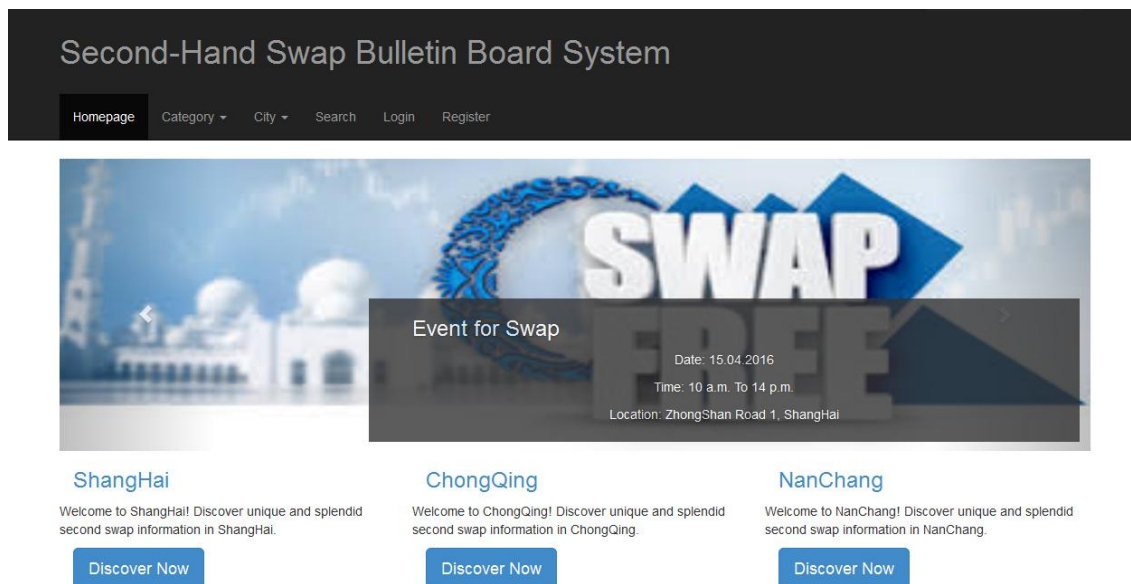
Figure 7. OSSNF homepage

Figure 8 shows the detailed content in the menu area. The menu has five options for users: Category, City, Search, Login and Register, and all types' users could interact with. Under the Category, all swap posts sort in specific orders: Clothes, Books, Electronics, Cars, Tools, Pet's products and others. The posts are sort in different regions under the City navigation. Users could use OSSNF internal search engine to find their interests in Search. And Register button will lead users to register page. This user-friendly menu provides

understandable and clear information to users and the users will not be confused and lost.
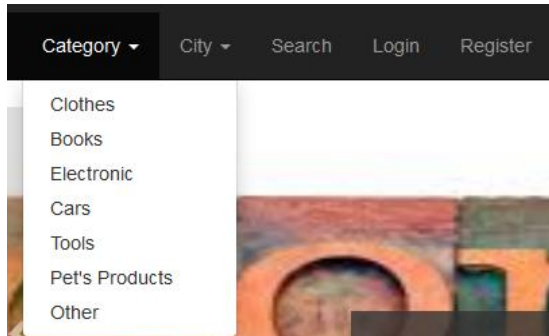
Figure 8. Navigation

Figure 9 shows the interface of users' account management. After login, registered users could manage their personal account on OSSNF. They could edit email address, their real name and contact information for others easily having conversations with. They could also change the password and modify their past swap posts. Delete the account is always available for them if something happened.

Figure 9. User account management

Figure 10 shows the form for swap post. Registered users have the right to post any household products on OSSNF. This post form will lead them to share information successfully.

Figure 10. Swap post form

Figure 11 shows the post result. The swap information will be displayed in its specific category once users have posted it successfully.
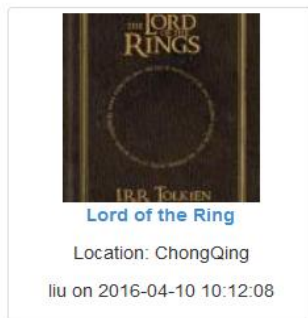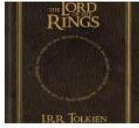
Figure 11. Post result example

By clicking the title in the colour blue of the above example swap post, details of this post will be displayed as Figure 12 and other registered users could view and comment it.

Figure 12. Detail swap post example

The OSSNF internal search engine allows both non-registered and registered users to search their interests keywords. However, only registered users could go further which means browsing details.

At the Search page that Figure 13 shows, users can select categories and cities which are the same as the menu provides. They could also enter their interests keywords and click the search button, then the specific results will be displayed.
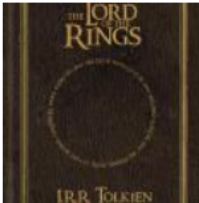
SEARCH

POST   USER

Board   --Select Category-- ▾

City   ○ShangHai ○ChongQing ○NanChang

Search   [Search   ]   [Search]

Lord of the Ring

Location: ChongQing

liu on 2016-04-10 10:31:37

Figure 13. OSSNF internal search engine

It is different between normal users and OSSNF administrators. "In order to make access distinctions and track user activity, security systems must know who is making each request. The primary purpose of user administration is to provide information that helps systems make this determination" (SAS Institute). Figure 14 shows OSSNF administrator privileges.

User Administration

Nick Name	Post Number	Reply Number	Manage
xoxoli	0	1	Delete
liu	1	1	Delete

Figure 14. OSSNF administrator privileges

Administrators have access to view registered users' posts and delete their account if any troubles happened. The users who post unhealthy and relevant content will be removed from OSSNF by administrators.

4 DEVELOPMENT AND IMPLEMENTATION

This chapter describes the third phase of OSSNF development, and it includes the development environment installation, database connection, and proposed features' achievement.

4.1 Development Enviorment Setting

The primary stage of develop website is set the development environment. The steps of set development environment include deploy web development server, MySQL database, Bootstrap template, and image files. The first step of set development environment is downloading the XAMPP installation suit from the official website https://www.apachefriends.org/download.html. In official website, researchers can choose download package based on operating system and XAMPP version. In this case, researchers can download the latest version for Windows operating system.

After downloading, researchers who run the installation package can choose between default installation and custom installation. However, researchers can just accept the default installation by only clicking the *Next* button. When clicking the *Next* button the installation is complete and researchers need to click the *Finish* button to exit the installation. Further, researchers can run the XAMPP Control Panel and start Apache and MySQL. The status of active XAMPP Control Pannel is shown below in Figure 15.
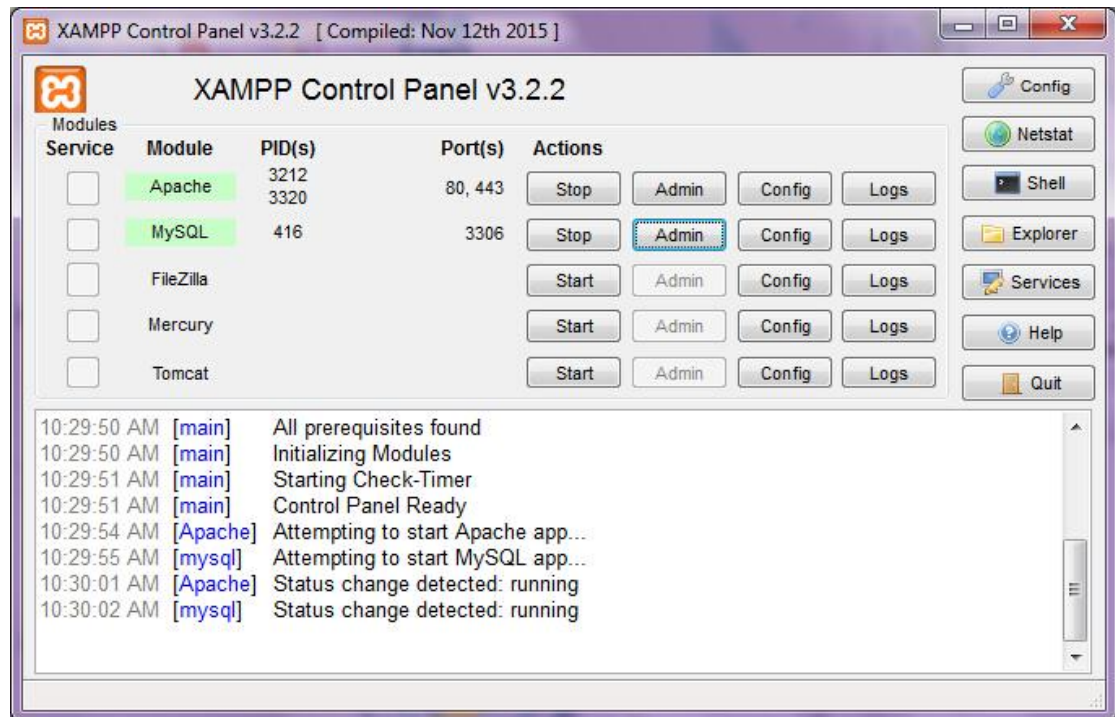
Figure 15. XAMPP Control Panel

The second step of set development environment is creates database and connect with web server. Researchers can simply use phpMyAdmin to create database by clicking the *Admin* button after started MySQL. Firstly, researchers need to create a user account with the same name database in phpMyAdmin. The researchers set user name and password by themselves and let host be local host during account create process. The status of using phpMyAdmin adds user account is shown below in Figure 16.
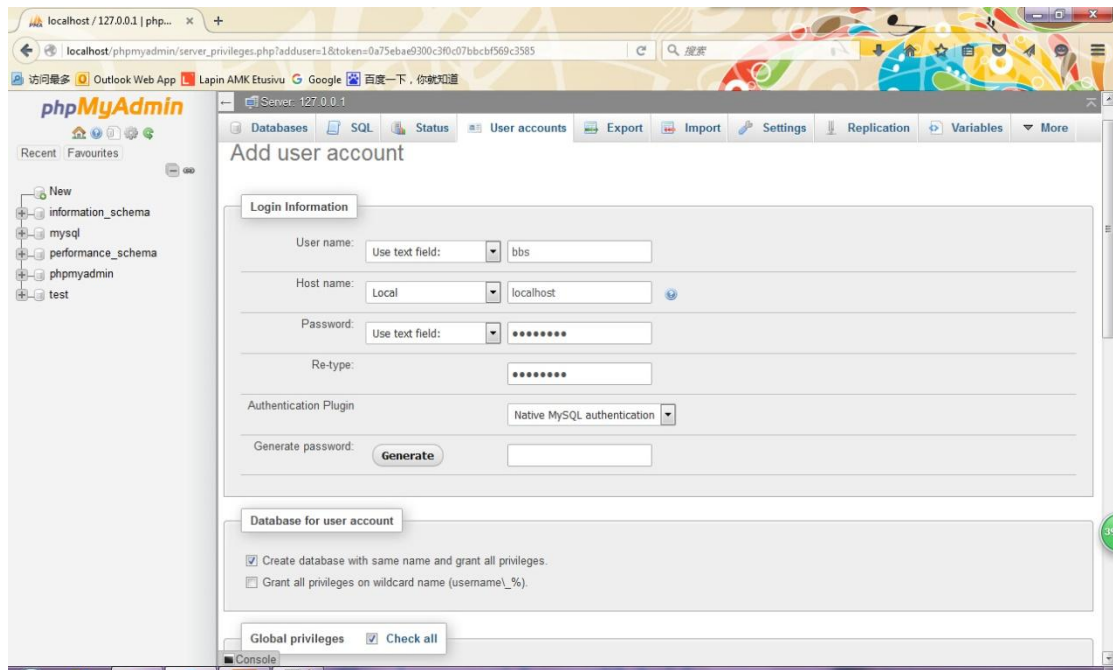
Figure 16. Add User Account

When researchers create user account with the same name database, a create table page will display. Researchers just need to enter name of database table and number of table columns. The status of create table is shown below in Figure 17.

Figure 17. Create Table

Researchers need to go next page of create table by click the *Go* button in the page. In next page, Researchers can set the name, type, length and attribute of each column. Some of the columns can be set as *NULL* or *CURRENT_TIMESTAMP* by default. In addition, researchers also need to set a primary key for the table for connecting with other tables later. Normally, the columns named as id is the primary key. The final result of post table will display. The setting of post table is shown below in Figure 18.

	#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
☐	1	id 🔑	int(11)			No	None	AUTO_INCREMENT	🖉 Change ⊖ Drop 🔑 Primary ⓤ Unique ▾ More
☐	2	name	char(40)			No	None		🖉 Change ⊖ Drop 🔑 Primary ⓤ Unique ▾ More
☐	3	content	longtext			No	None		🖉 Change ⊖ Drop 🔑 Primary ⓤ Unique ▾ More
☐	4	publishTime	datetime			No	CURRENT_TIMESTAMP		🖉 Change ⊖ Drop 🔑 Primary ⓤ Unique ▾ More
☐	5	registerId	int(11)			No	None		🖉 Change ⊖ Drop 🔑 Primary ⓤ Unique ▾ More
☐	6	board	char(30)			No	None		🖉 Change ⊖ Drop 🔑 Primary ⓤ Unique ▾ More
☐	7	city	varchar(20)			No	None		🖉 Change ⊖ Drop 🔑 Primary ⓤ Unique ▾ More
☐	8	photoPath	varchar(100)			No	None		🖉 Change ⊖ Drop 🔑 Primary ⓤ Unique ▾ More

Figure 18. Post Table

Researchers can simply use PHP codes to connect to database. The database.php is a PHP file which used for connecting to database. In PHP researchers set variables as database name, database server type, user account name and user password. Then create connection with user account by use variables of username, password and server type. Finally select the database by defining the database name and connected user account. The codes for connecting PHP to database are shown below in Figure 19.

```php
<?php
/*        file: database.php
    description: Connects to the database (contact to local MYSQL-server)
*/
$database='bbs';
$username='bbs';
$password='12345679';
$server='localhost';
//create the connection
$conn=mysql_connect($server,$username,$password) or die('No connection to database-server available');
//selet the database to be used
mysql_select_db($database,$conn) or die('Cannot select database');
?>
```

Figure 19. Database

Finally researchers apply Bootstrap template by downloading Bootstrap source folders and saving Bootstrap source folders under *xampp/htdocs/BBS* directory. Researchers also create a folder named posting under same directory for saving user upload image later.

In addition, under the *images* folder there is a subfolder named as *thumbs*. The *pager* folder under *xampp/htdocs/BBS* directory is stored PHP files to achieve

pager function. Table 1 shows the elements for achieving development environment.

Table 1. Development environment

Name	Type	Description
css	File folder	Bootstrap's css folder
fonts	File folder	Bootstrap's fonts folder
images	File folder	Store website layout images
js	File folder	Bootstrap's JavaScript folder
pager	File folder	Function for separate page
postimg	File folder	Store original post images and resize post images in thumbs as sub file folder
bbs	SQL file	Export code from XAMPP MySQL for create database
database	PHP file	Connect to database bbs

4.2   Homepage

For achieving the homepage, researchers create two PHP files, i.e. index.php and read.php. The index.php is used for showing the homepage, which includes the page header, navigation bar, image gallery, Information link, and page footer. The image gallery displays in the homepage was achieved by using the

carousel function in the Bootstrap template. The responsive website design was also achieved by using the grid system in the Bootstrap template. The read.php is used for achieving the homepage can link to the subpages in OSSNF. The read.php used the command *include* for making other PHP files have the same layout as the homepage.

Table 2 displays the elements for achieving homepage.

Table 2. The elements of Homepage

Name	Type	Description
index	PHP file	Display the Homepage for website
read	PHP file	Help website link homepage to other subpages with common layout

For achieving a common layout for the website in index.php and read.php researchers call the Bootstrap template files which include CSS and JavaScript. It helps with other included PHP files in index.php can show in the specify position on subpage with the same layout for each page. The codes for linking to CSS and JavaScript are shown below in Figure 20.

```php
<?php
/*  file:   index.php
    desc:   Displays the starting page of the website
*/
session_start();  //starts the session (used for example in login)
header('Cache-control: no-store,no-cache,must-revalidate');
include('database.php');
?>
<DOCTYPE html>
<html>
  <head>

    <meta http-equiv="X-UA-Compatible" content="IE=Edge">

    <title>Second-Hand Swap BBS</title>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <link href = "css/bootstrap.min.css" rel = "stylesheet">
    <link href = "css/styles.css" rel = "stylesheet">

<style type="text/css">

  </head>

<script src="//ajax.googleapis.com/ajax/libs/jquery/1.10.2/jquery.min.js"></script>
<script src = "js/bootstrap.js"></script>
<script src = "js/tooltip.js"></script>
<script src = "js/popover.js"></script>

<script>
    $(function(){
        $('#example').popover();
});
</script>
```

Figure 20. Homepage2

In addition, in these two PHP files researchers also need to start the session and connect to database. Once users login users' account a session will start and their user id, user name and user permission will record in the session until logout. The *session_start()* command written in the PHP files allows the relevant webpage to read the session for judging the login users' identity and permission. The database connection can be done by including database.php.

4.3   Account System

The account system includes the functions of register, login, logout, and forget password. The register, login, and forget password functions in account system display with a form in webpage. Once the users click the button used for submitting the form, the website will run PHP file at the system background, read the form information, and process verification test. If the information

passes verification test, then the operation can be run, otherwise; a window will pop up with the error message.

Independent of the fact that the information passes verification test or not, the website needs to display a webpage to respond to the operation. Based on different situations, the codes in the system background must include some codes which are linked to different webpage.

Table 3 displays the elements for achieving account system.

Table 3. The elements of Account System

Name	Type	Description
login	PHP file	Display a login form.
checklogin	PHP file	Verification test of login form which fill by user. If yes login and go back to previous read page before login form. When login the SESSION is start. Else go back to log in form.
register	PHP file	Display a form for guest user register.
saveregister	PHP file	Verification test of register form which fill by user. If yes save user information to database table reply and go account management page. Else show error information and reload previous page.
authentication	PHP file	Display a form for forget password.
checkid	PHP file	Verification test of forget password form which fill by user. Check new password and confirm password is correct format and match. If both match then password change and save into database with login. Else back to previous page.
checkEmail	INC file	Check the format is email address
code	PHP file	A JavaScript function to create verification code
logout	PHP file	End SESSION to make user log out

In login.php file a special function use verification to make sure the user is a person. The verification image is created by code.php file which randomly create image with background colour interference and random number. The random number will store in the session as in checklogin.php file and need to done the verification test. It means that the verification code which get from

login form by using *$_POST["frmVerification"]* is not empty and equal to *$_SESSION["Auth_code"]*. The verification tests of other information work in the similar theory as the above function does. Once information pass the verification test checklogin.php file will check the users identify by compare with the data store in database. After confirming user identifies with database, the login session starts and goes to other page according to user's previous browsing webpage. The codes for achieving verification code image are shown below in Figure 21.

```php
<?php
/*
    file:   code.php
    desc:   Create an code for Verification.
*/
            session_start();
            function rand_create()
            {
            Header("Content-type: image/PNG");
            srand((double)microtime()*1000000);
            $im = imagecreate(62,22);
            $black = ImageColorAllocate($im, 0,0,0);
            $white = ImageColorAllocate($im, 255,255,255);
            $gray = ImageColorAllocate($im, 200,200,200);
            imagefill($im,0,0,$gray);
            while(($randval=rand()%100000)<10000);{
            $_SESSION["Auth_code"] = $randval;
            imagestring($im, 5, 10, 3, $randval, $black);
            }
                for($i=0;$i<200;$i++){
                $randcolor = ImageColorallocate($im,rand(0,255),rand(0,255),rand(0,255));
                imagesetpixel($im, rand()%70 , rand()%30 , $randcolor);}
            ImagePNG($im);
            ImageDestroy($im);
            }
            rand_create();
?>
```

Figure 21. verification code

The forget password function is quiet same as login function. The only different is requires different information in the form. The register function is a little bit different from the login function at the background operation part. The verification test will check that do not have any same data existed in database. After passing the verification test the new account information will be inserted into database. The email address which required in forget password and register function will verification through the checkEmail.inc to make it sure uses correct email format. The codes for achieving logout function are shown below in Figure 22.

```php
<?php
/*          file: logout.php
    description: Destroys the session. Redirects to the main page
*/
session_start();
session_unset('u_pass');
header('location:index.php?page');
?>
```

Figure 22. Logout

The logout function is a background function which can destroy the session which starts after user login. The code *session_unset('u_pass')* can destroy the session. After the background operation done the website will go to the homepage of website by using code *header('location: index.php?page').* The code can display required webpage which written after location.

4.4   Post System

The post system allows register user post swap information by filling a form and uploading image. The post.php file show the post form in front webpage and checkpost.php file do the background operations. The smallerimage.php and class_squareimage.php files are used for resize the image which uploaded from user.

Table 4 displays the elements for achieving post function.

Table 4. The elements of Post

Name	Type	Description
Post	PHP file	Display a post form for register to post.
checkpost	PHP file	Check user fill post form as require if not give error information and reload previous page; if yes rename the image and include php for resize image and then save post to database table post
smallerimage	PHP file	Resize the post image and save to sub folder named thumbs under postimg
class_squareimage	PHP file	A code example from internet which help resize image to square

A JavaScript function in post.php file enables users to view the image before upload it. The size of previous view image is the same as the size of resized image which will be displayed in website after post. The JavaScript uses the *FileReader()* to display the resized image by reading the Uniform Resource Locator (henceforth URL) of image file. The codes for achieving previous view

upload   image   function   are   shown   below   in   figure   23.

```
<script type="text/javascript">
function readURL(input) {
        if (input.files && input.files[0]) {
            var reader = new FileReader();

            reader.onload = function (e) {
                $('#blah')
                    .attr('src', e.target.result)
                    .width(150)
                    .height(150);
            };

            reader.readAsDataURL(input.files[0]);
        }
    }
</script>
```

Figure 23. Upload image previous view

For showing the previous view of uploading image in post form researchers need to call the JavaScript function. Therefore, researchers display image with the same id and src which set in the JavaScript function. The alt is used for shown message before a previous view of uploading image. The codes for using previous view upload image function are shown below in Figure 24

```
<div class="form-group">
    <label for="Image" class="col-sm-5 control-label">Image</label>
    <div class="col-sm-3">
        <input type='hidden' name='MAX_FILE_SIZE' value='2000000' />
        <input id="Image" onchange="readURL(this);" name='selected_image' type='file' />
    </div>
</div>
<div class="form-group">
    <label class="col-sm-5 control-label">Image Preview</label>
    <div class="col-sm-3">
        <img id="blah" src="#" alt="You not upload image yet"/>
    </div>
</div>
```

Figure 24. Show preview image

The JavaScript function of random new image name in checkpost.php file is used for avoiding same image names. The random function will make a new image name start with CR- and then characters from numbers, capital letters and small letters. For calling the function later just set the variable of filename

equal to *random(10)*. The *random(10)* function only random 10 characters by setting the *$length* as 10. The codes for creating a new randomly image name are shown below in Figure 25.

```php
function random($length)
{
    $hash = 'CR-';
    $chars = 'ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789abcdefghijklmnopqrstuvwxyz';
    $max = strlen($chars) - 1;
    mt_srand((double)microtime() * 1000000);
        for($i = 0; $i < $length; $i++)
        {
            $hash .= $chars[mt_rand(0, $max)];
        }
    return $hash;
}
```

Figure 25. Random image name

There are many operations needed to be done in checkpost.php. The background operation will run verification test for information which send by post form. If the information passes the verification test, it will randomly generate a new name for image, resize the image and store all information include image path to database and then display the user account manager webpage. If the information did not pass the verification test, it will pop up a window shows the error message and goes back to the webpage of post form. The main codes involved with post background operation are shown in Figure 26 and Figure 27.

```php
session_start();
include('database.php');
$result1 = mysql_query("SELECT * FROM register WHERE nickName='$_SESSION[nickName]'");
while($row = mysql_fetch_array($result1))
  {
    $e = $row['email'];
    $n = $row['nickName'];
    $r = $row['realName'];
    $m = $row['mobilePhone'];
    $q = $row['qq'];
    $c = $row['city'];
    $i = $row['id'];
  }

    if($_FILES && isset($_POST["submit"]) && $_POST["submit"] == "Post")
    {
      $name = $_POST["name"];
      $board = $_POST["board"];
      $content = $_POST["content"];
      date_default_timezone_set("Etc/GMT-2");
      //$date=date("Y-m-d H:i:s",time());
      $imagefile=$_FILES['selected_image']['name'];
      $filetype = strtolower(substr($imagefile,strrpos($imagefile,'.')+1));
      $type = array("jpg","jpeg","pjpeg","png");
      if(empty($imagefile) || $name=="" || $board=="" || $content=="" || empty($_POST["city"]))
      {
        echo "<script>alert('Please fulfill the form!'); history.go(-1);</script>";
      }
      else if(!in_array($filetype, $type))
      {
        echo "<script>alert('Not correct image format! Only accept png, jpg, jpeg!'); history.go(-1);</script>";
      }
```

Figure 26. Checkpost1

The PHP can use command to get the file's type of uploaded file by using *strtolower(substr($imagefile,strrpos($imagefile,'.')+1))*. As it requires uploading an image file, the file's type is limit in jpg, jpeg, pjpeg and png. Therefore, researchers created a variable equal to the uploaded image file and an array included variables as limit image types. Judge the variable with all variables included in array. If can be match means that the uploaded file is an image file.

```php
else
{
    $path=addslashes(dirname($_SERVER['DOCUMENT_ROOT']));
    $path.="/htdocs/BBS/postimg/";
    $filename=explode(".",$_FILES['selected_image']['name']);
    do
    {
        $filename[0]=random(10);
        $imagefile=implode(".",$filename);
    }
    while(file_exists($imagefile));
    if(move_uploaded_file($_FILES['selected_image']['tmp_name'],$path.$imagefile))
        {
            include('smallerimage.php'); //saves thumbnail images/thumbs/-folder
            include('database.php') ;
            mysql_query("set names 'gbk'");
            $sql_insert = "insert into post (name,content,publishTime,registerId,board,city,photoPath)
                            values ('$_POST[name]','$_POST[content]',now(),'$i','$_POST[board]','$_POST[city]','postimg/thumbs/$imagefile')";
            $res_insert = mysql_query($sql_insert);
            //$num_insert = mysql_num_rows($res_insert);
            if($res_insert)
            {
                mysql_close($conn);
                header('location:read.php?page=password');
            }
            else
            {
                echo "<script>alert('System busy,please wait!'); history.go(-1);</script>";
            }
        }
}
```

Figure 27. checkpost2

The image is resized by using command include to run the smallerimage.php. The database is not store the image but store the image path. The path is the relative path of image in website's folder.

4.5   Display Post and Comment System

The post display and comment system is achieved through show.php, detail.php, savecomment.php, and pager.php files. The show.php and detail.php are the front webpage files, the savecomment.php is the background operation file, and pager.php set the page separate function for webpage. In show.php, information will be displayed according to the selected category in webpage. The posts can show 3 per row according to layout set through Bootstrap template and 24 per page according to pager set through pager.php. The detail.php displays a specific post with comments which is selected by the registered users.

The comment information is also limited by pager.php, and it can only show 24 comments per page. The show.php and detail.php include pager.php and use code *$pager->links* for separate page. The savecomment.php is the background operation for saving the new comment and reloading the detail.php. Table 5 displays the elements for achieving post display and comment system.

Table 5. The elements of display post and comment system

Name	Type	Description
Show	PHP file	Show a posts list according to selected category. Including page setting.
Detail	PHP file	Display detail information of selected post as well as reply of post for register. Include reply form. If not a log in user will show login form first.
savecomment	PHP file	Check comment form information is not empty. If not empty save comment to database table reply and reload previous page. Else show error information and reload previous page.
Pager	PHP file	Page setting. Set each page only can show 24 elements.

The show.php can judge selected category of posts by reading the id in URL. The id which used for identify the category of show page is set just as the same as the category name or city name. The code *$_GET['id']* can get the id from

URL. The codes for getting correct category to linking subpage id shown in Figure 28.

```
if(!empty($_GET['id'])) {$id=$_GET['id'];}
else {$id=''; echo "<script>alert('Page not find!'); history.go(-1);</script>"; }
include('database.php'); //database connection for the application
//select all the rows from the contact-table and run the query
//run the query and create resultset
```

Figure 28. Get the id

The id needs to be checked whether it is the type of category or the name of city. Then use the id to get relevant posts data in database and show general information in webpage. If register user click the post name the page will shows detail and comment of post. Otherwise the webpage will show login page for guest user who click post name. The main codes involved with displaying post general information and comment of post are shown Figure 29 and Figure 30.

```
if(mysql_num_rows($resultcount)>0){
//echo the results in a table inside a loop
    while($row=mysql_fetch_array($result)){
        //as long as there are rows in the result-set, they will be echoed
        $i=$row['id'];
        $p=$row['photoPath'];
        $name=$row['name'];
        $c=$row['content'];
        $t=$row['publishTime'];
        $city=$row['city'];
        $n=$row['registerId'];
        $result2=mysql_query("Select nickName from register where id='$n'") or die('Could not get information');
        while($row=mysql_fetch_array($result2)){$nickname=$row['nickName'];}
        echo <<<END
            <div class="col-sm-4" >
            <div class="thumbnail"><img src='$p' class="img-responsive" width="150" height="150"/>
            <p><strong><a href="read.php?page=detail&id=$i">$name</a></strong></p>
            <p>Location: $city</p>
            <p>$nickname on $t</p>
            </div>
        </div>
END;
    }

    echo <<<END
    <div class="col-sm-12" > $pager->links </div>
END;

    //pager definitions in separate file
    mysql_free_result($result);//removes the $result from the webserver memory
    mysql_free_result($result2);
    mysql_close($conn); //close the database connection
}else echo '<h3>No Result</h3>';
```

Figure 29. Show general information of post

The general information includes the post image, post name, post content, city, and user's name and publishes time. The result of post show by show.php is

displayed according to the recently publish time because add command *order by publishTime* DESC at the end of database command.

```php
$resultcount=mysql_query("select * from reply where postId=$id order by publishTime") or die('Could not get information');
include('pager.php');
$sql2="select * from reply where postId=$id limit $from,$rowsperpage";
$result3=mysql_query($sql2,$conn) or die('Could not retrieve data from database');
if(mysql_num_rows($resultcount)>0){
 //if the row was found in database table contact, display the form
 $count=0;
 while($row=mysql_fetch_array($result3)){
        //as long as there are rows in the result-set, they will be echoed
        $reply=$row['id'];
        $content=$row['content'];
        $time=$row['publishTime'];
        $ni=$row['registerId'];
        $count=$count+1;
        $result4=mysql_query("Select * from register where id='$ni'") or die('Could not get information');
        while($row=mysql_fetch_array($result4))
        {
            $nickname2=$row['nickName'];
        }
        echo <<<END
            <div class="panel panel-default">
            <div class="panel-heading text-left"># $count</div>
            <div class="panel-body">
            <div class="col-xs-12"  >
                <p class="text-left">$content</p>
                <p class="text-right">$nickname2 pubilshed on $time</p>
            </div>
        </div>
        </div>
END;
    }
        echo <<<END
        <div class="col-sm-12" > $pager->links </div>
END;
```

Figure 30. Display comment

The comment information includes the comment number, comment, and user's name and publishes time. The code of display comment is quiet similar to display general information of post. Only the comment is read from the reply table in database.

4.6 Search

The website search engine is achieved by use search.php file. In the search page the user can choose search by user or by post through selecting different tab. The tab is a function which supported by Bootstrap template. It helps with separating long webpage and be friendly with mobile user by switching the page to two tabs.

The search can be done by selecting category, entering keyword, and both. Once user click button for submitting the search information the background

operation in the same PHP file will be done and result will be listed after search form. Table 6 displays the elements for achieving search function.

Table 6. Element of search system

Name	Type	Description
Search	PHP file	Show search form for search post or user according to selected tab. Once user use search will search in database and show the result.

The search function done through search data in database. The background operations need to check the information in database. The user search is checking relevant data in the register table and the post search is checking the relevant data in the post table. The type of category and the name of city which get from search form is use command *where* to search in database. If not select type of category and name of city then set variable of city as *city IS NOT NULL* and set variable of category as *board IS NOT NULL*. The keyword search is to use command *LIKE '%%$searchword%%'* to search from each columns in table. The codes for achieving the search in database function are shown in Figure 31.

```php
include('database.php');
if((isset($_POST["submit1"]) && $_POST["submit1"] == "Search")||(isset($_POST["submit2"]) && $_POST["submit2"] == "Search")){
if(isset($_POST["submit1"]) && $_POST["submit1"] == "Search")
    {
        if(empty($_POST['searchword'])) {$_POST['searchword']='';}
        if(empty($_POST['city'])) {$c='city IS NOT NULL';}
        else {$c = "city='$_POST[city]'"; }
        if(empty($_POST['board'])) {$b='board IS NOT NULL';}
        else {$b = "board='$_POST[board]'"; }
        $searchword=$_POST["searchword"];
        //echo "<br>$searchword<br>$c<br>$b<br>";
        $resultcount=mysql_query("Select * from post where $c and $b and
        (name LIKE '%%$searchword%%' or content LIKE '%%$searchword%%' or city LIKE '%%$searchword%%' or board LIKE '%%$searchword%%')
        order by publishTime DESC") or die('Could not get information');
        include('pager.php');
        $result=mysql_query("Select * from post where $c and $b and
        (name LIKE '%%$searchword%%' or content LIKE '%%$searchword%%' or city LIKE '%%$searchword%%' or board LIKE '%%$searchword%%')
        order by publishTime DESC limit $from,$rowsperpage") or die('Could not get information');
```

Figure 31. Search through database

The way to show search result is the same way as to show general information in show.php. If search result is user when click user name, the webpage will link to new webpage show all general information of the post which post by the user.

4.7   Account Management

The account management system is separated as personal account manager and administrator account manager. These two are similar with each other. One different between administrator manager and personal manager is that administrator manager can show and manage all account information in website but require the user have administrator's permission. The other different between administrator manager and personal manager is that administrator manager can only delete information in website but cannot modify users' information.

The website should list detail of information which require delete and ask for confirmation. The deleteuser.php and deletepost.php files are used for listing information and asking confirmation. Once user confirms the delete command, the delete background operation will run and go back to other webpage. The delete operation can be removeuser.php and removepost.php. Table 7 displays the elements for achieving account manage system.

Table 7. Elements of account manage system

Name	Type	Description
adminpost	PHP file	Display all post in website with page setting. Allow administrator delete post.
adminuser	PHP file	Display all users in website with page setting. Allow administrator delete user.
checkpassword	PHP file	Check the form is return as requirement. According to form to done update user information or change password.
deletepost	PHP file	Display selected post information and ask for confirmation for delete.
deleteuser	PHP file	Display selected user information and ask for confirmation for delete.
modify	PHP file	Check modified post information for modify post. If fulfil requirement then save to database and go back to account management page. Else back to previous page.
modifypost	PHP file	Display a form to register for modifying their post
password	PHP file	Three tabs for register Information management form.
postdetail	PHP file	Display post detail by selected user
removepost	PHP file	Read id of selected post. Delete selected post and reply of this post.
removeuser	PHP file	Read user id and id of selected user. Check if user delete own account will log out first, if administrator delete other user will not log out. Then delete all related data of selected user in database and go to homepage.

The personal account information modify is done by changing the information in the form that shows the user personal information in personal account webpage. Once the user changes the information and clicks button for submitting the background operation will run. The personal account information modify is done by clicking the modify link in each post general information. Once user clicks the link the new webpage of modify post form will show. The code for modifying post in post form is similar with modify user account information. The codes for achieving remove user function are shown in Figure 32.

```php
<?php
/*
    file:   removeuser.php
    desc:   Reads the id of the register, post, reply table record to be removed and runs
            the query to remove it from database
*/
session_start();
if($id==$_SESSION['id'])
{
    session_unset('u_pass');
}
if(isset($_POST["submit"]) && $_POST["submit"] == "Delete"){
$id = $_POST["id"];
include('database.php');
$sql="delete from register where id='$id'";
mysql_query($sql,$conn) or die('Could not remove register from database');
$sql2="delete from reply where registerId='$id'";
mysql_query($sql2,$conn) or die('Could not remove reply from database');
$sql3="delete from reply where readerId='$id'";
mysql_query($sql3,$conn) or die('Could not remove related reply from database');
$sql4="delete from post where registerId='$id'";
mysql_query($sql4,$conn) or die('Could not remove post from database');
header('location:index.php?page');
}
?>
```

Figure 32. Remove user

Website should make user logout first when removing a user. Otherwise the website will remain in status and keep some user's information in session. After destroying the session researchers should delete all relevant data in database. It means that all of user's personal information stored in register table, all users' post information stored in post table, all users' comment information stored in reply table, and all comment information for the user's post stored in reply table.

5 USABILITY TESTING

This chapter presents the final phase of OSSNF development – usability testing. Similar websites as OSSNF exist. People might leave this swap website and go to the next similar site immediately if the navigation confused them and they could not find their interests. To achieve the specific goals of OSSNF which is described in chapter 1.1 and chapter 1.2, usability testing is necessary.

Usability testing is an essential part of software and website development. According to Travis 2012, there are two kinds of usability tests: formative testing and summative testing. Summative testing aims to test how easy a system can be used and OSSNF usability testing belongs to this type. The testing consists of learnability, memorability, efficiency, satisfaction, and errors. These elements in the testing mainly show how easy the software and website can be used, how successful specific goals achieved for terminal users, how quickly the users can find information, and how satisfied the users can enjoy the website. (Churm 2012.) Without the testing, SDLC might be interrupted because of the occurrence of unexpected errors such as script damage, incorrect variables in the database, mixed and disorderly user interface and others. All these errors could be the reasons for OSSNF unsuccessful operation. User amount will be decreased and the goals could not be reached.

Participants for OSSNF usability testing were selected among the respondents who had answered the questionnaire. Based on the questionnaire experience, these respondents could provide better testing result than others. Due to the fact that OSSNF is a prototype of a swap website at the current situation, before the usability testing the swap website researchers, which means us, did the test for technique debugging.

The technique debugging received two errors. The first one was the posted swap information could not be displayed on OSSNF after submitting this post by following the correct form. However, this posted information could be found in the database. Additionally, the second error occurred after the first one was rearranged. Usually, the website will turn to the detail information page after clicking the title of a post, but the error was described as retrieve not found.

After the debugging, OSSNF headed to the usability testing without technique errors. All the testers could find their interests immediately, the colour and layout of the website are balanced, the navigation is understandable, and the information provided from OSSNF was clear. However, the big problem of OSSNF was that users could not reply others behind their comments. They could only send one comment in a separate line each time which makes the information page disorderly. Additionally, the images design of donation activity announcement is not good.

The testing was successful, all discovered technique errors were rearranged, requirements and suggestions from testers were taken into consideration for OSSNF further development.

6   CONCLUSIONS

The objective of this thesis was to design a prototype of swap website for a personal computer operation system and mobile devices. All defined objectives of our project were achieved and the research questions were answered. Through the user requirements analysis and literature studies, we accomplished the swap website OSSNF development and testing. OSSNF achieved all proposed features and the errors detected in the testing phase were corrected well.

During OSSNF development phase we learnt how to use Bootstrap template and skills for website building were practiced. The skills include development environment analysis and operation, database connection, and programming languages writing. The prototype was designed with RWD technology by integrating our study knowledge and experiences.

The most challenging phase was technique debugging. Technique debugging means finding the incorrect code line during the testing phase. Occasionally, the webpage displayed unexpected contents without showing any error messages and therefore the debugging was challenging. It was hard to find where the errors were as these codes were relevant to several PHP files and even database commands. Another challenge was posting image. It was not the same as the error debugging. The features of posting image consist of previous view, image file type checking, image storage, and its path storage in database. Moreover, for the possible situation that the user uploads a larger size image or different images with the same name, it was necessary to rename and resize users' uploaded image. All requirements of this uploading image were complex and challenging. However, online sources gave many tutorials on how to achieve the features required by OSSNF. Additionally, the supervisors and other programming teachers helped us overcome the challenges.

Currently, OSSNF is a prototype of a swap website. It is not available for public use. However, there are various opportunities for OSSNF's further development. Moreover, the market of OSSNF looks promising since the swap and donation activities are still unheeded in China. The gap between the wealthy and the

poor is still increasing. However, OSSNF has its specific advantages for achieving its goals: reduce discard, increase goods' value, save unnecessary expenses and improve living standards of the people who need household products but without enough economic capability.

BIBLIOGRAPHY

Agnew, A. 2012. Why Do Hackers Hack Websites?? Accessed 9 April 2016
http://www.website-guardian.com/why-do-hackers-hack-websites-va-5.html.

Armel, J. 2014. Web application development with Laravel PHP Framework
Version 4. Helsinki Metropolia University of Applied Sciences. Faculty of
Engineering. Bachelor Thesis. Accessed 9 April 2016
https://www.theseus.fi/bitstream/handle/10024/74052/Author.pdf?sequence=1.

Cienfuegos, C. 2014. Why would hackers be after your network? Accessed 9
April 2016
https://blog.kaspersky.com/why-hackers-attack-you/5983/.

Chapman, S. 2016. What Is JavaScript. Accessed 13 March 2016
http://javascript.about.com/od/reference/p/javascript.htm.

Churm, T. 2012. An Introduction To Website Usability Testing. Accessed 10
April 2016
http://usabilitygeek.com/an-introduction-to-website-usability-testing/.

Clay, B. 2015. Search Engine Optimization All-in-One For Dummies. Accessed
13 February 2016
https://books.google.com.hk/books?id=nf12BgAAQBAJ&pg=PA33&lpg=PA33&
dq=internal+site+search+engine&source=bl&ots=1XaqlC_Bbc&sig=ZuNTr3P2
M-a9XdxO1dWnSDfpaV0&hl=zh-
CN&sa=X&ved=0ahUKEwiq3cjUovrLAhVDMJoKHXikD0g4ChDoAQhgMAg#v=
onepage&q=internal%20site%20search%20engine&f=false.

Crnkovic, G.D. 2010. Constructive Research and Info-Computational
Knowledge Generation. Accessed 13 February 2016
http://www.mrtc.mdh.se/~gdc/work/MBR09ConstructiveResearch.pdf.

Dvorski, D.D. 2007. Installing, Configuring, and Developing with XAMPP.
Accessed 13 March 2016
http://dalibor.dvorski.net/downloads/docs/InstallingConfiguringDevelopingWithX
AMPP.pdf.

Kolowich, L. 2014. Web Design 101: How HTML, CSS, and JavaScript Work.
Accessed 13 March 2016
http://blog.hubspot.com/marketing/web-design-html-css-javascript.

Krehel, O. & Andersen, D. 2015. At what point do white hat hackers cross the
ethical line? Accessed 9 April 2016
http://www.networkworld.com/article/2971524/cloud-security/at-what-point-do-
white-hat-hackers-cross-the-ethical-line.html.

Lee, I. 2014. Integrating Social Media into Business Practice, Applications,
Management, and Models. Accessed 10 February 2016
https://books.google.com.hk/books?id=cKB_BAAAQBAJ&pg=PA15&dq=young
+generation+and+social+networking&hl=zh-

CN&sa=X&ved=0ahUKEwju4q_a0dbKAhWr_HlKHVrfCGAQ6AEIITAB#v=onep
age&q=young%20generation%20and%20social%20networking&f=false .

Mehra, N. 2014. Online shopping consumers in China. KPGM, 13 - 28.
Accessed 13 February 2016
https://www.kpmg.com/CN/zh/IssuesAndInsights/ArticlesPublications/Document
s/China-Connected-Consumers-201403-c.pdf

Michigan State University ANR Technology Services 2016. Creating a Website.
Sitemap Document. Accessed 3 March 2016
http://support.anr.msu.edu/uploads/files/45/ANRTS%20How%20to%20Create%
20a%20Sitemap.pdf.

Microsoft.com 2016. Safety & Security Center. What is a firewall? Accessed 9
April 2016
https://www.microsoft.com/en-us/security/pc-security/firewalls-whatis.aspx.

Mike O'Docherty 2005. Object-Oriented Analysis and Design. Understanding
System Development with UML 2.0

Netcraft Ltd 2016. March 2016 Web Server Survey. Accessed 13 March 2016
http://news.netcraft.com/archives/category/web-server-survey/.

Nixon, R. 2009. Learning PHP, MySQL, and JavaScript. 1st edition. Sebastopol:
O'Reilly Media Inc.

Phellas, N.C. & Bloch A. & Seale C. 2011. Structured Methods: Interviews,
Questionnaires And Observation. Accessed 13 February 2016
http://www.sagepub.in/upm-data/47370_Seale_Chapter_11.pdf.

Polly, P.D. 2012. Introduction to MySQL and phpMyAdmin. G563 Quantitative
Paleontology. Department of Geological Sciences. Accessed 13 March 2016
http://www.indiana.edu/~g563/Handouts/Intro%20to%20MySQL.pdf.

SAS Institute Inc. SAS(R) 9.3 Management Console: Guide to Users and
Permissions. Introduction to User Administration. Accessed 10 April 2016
http://support.sas.com/documentation/cdl/en/mcsecug/63190/HTML/default/vie
wer.htm#aboutum.htm.

Serhan, C. & Carolina, C.C. 2015. Growing (Un)equal: Fiscal Policy and Income
Inequality in China and BRIC+. Internation Monetary Fund Working Paper 15/68.
Accessed 13 February 2016
http://www.imf.org/external/pubs/ft/wp/2015/wp1568.pdf.

Sitemap Document. Accessed 13 February 2016
http://support.anr.msu.edu/uploads/files/45/ANRTS%20How%20to%20Create%
20a%20Sitemap.pdf.

Travis, D. 2012. 2 Kinds of Usability Test. Accessed 10 April 2016
http://www.userfocus.co.uk/articles/2-kinds-of-usability-test.html.

USC Libraries 2016. Organizing Your Social Sciences Research Paper: 5. The Literature Review. Accessed 13 February 2016 http://libguides.usc.edu/writingguide/literaturereview.

WordPress.com 2013. Web Software and Mobile Application development. What are the Software Development Phases? Accessed 13 February 2016 https://customwebsoftwaredevelopmentservices.wordpress.com/2013/05/31/what-are-the-software-development-phases/.

Writing Effective Use Case 2016. Visual Paradigm. Accessed 13 February 2016 https://www.visual-paradigm.com/tutorials/writingeffectiveusecase.jsp.

Wu, S.S. 2010. Chinese 'Rich Second Generation' Extravagantly Shelling Out Millions. Accessed 13 February 2016 http://www.theepochtimes.com/n3/1510736-rich-second-generation-chinese-spend-extravagantly/.

APPENDICES

Appendix 1.   Questionnaire

Appendix 1. Questionnaire   Appendix 1 1(3)

Q1: What is your gender?

○ Male

○ Female

Q2: Which age group you belong to?

○ <18

○ 18-25

○ 25-35

○ 35-45

○ >45

Q3: How often do you surf internet?

○ Everyday

○ 3-5 times a week

○ 1-2 times a week

○ No internet

Q4: How do you familiar with e-commerce?

○ Big fan of online shopping

○ Related career

○ Know it but not a fan

○ What is e-commerce?

Q5: If there is an online swap website, what functions would you like it be?

☐ Keywords search engine

☐ Personal account management

☐ Resolution suitable for different devices

☐ Information sort by the same local area/the same category

☐ Others:

Q6: Do you have any experiences in swap?

○ Yes

○ No

Q7: If the website can provide you swap services, what kind of goods would you like to swap?

☐ Clothes/bags/toys/etc.

☐ Life tools (home/garden/sports/outdoors/etc.)

☐ Homemade food/local food

☐ Books/CDs

☐ Electronics/Computers

☐ Second-hand vehicle

☐ Others: [   ]