

The Implementation of Wiki-based Knowledge Management Systems for Small Research Groups

Chia-Han Yang, Ming-Ying Wu, Chien-Min Lin, Don-Lin Yang

Department of Information Engineering and Computer Science, Feng Chia University, Taiwan

chyang531@gmail.com, printfxd@gmail.com, cm1098@gmail.com, dlyang@fcu.edu.tw

Abstract

Due to the soaring of knowledge-based economy and the blooming growth of e-business, more effective approaches to accumulate and manage valuable knowledge become an important issue for both of the academic and the industry fields. There are many knowledge management systems built for large corporate companies. However, not many open source systems are available for small research communities. Currently, wiki has not only changed the conception of building knowledge in an on-going process, but also become a popular tool of sharing knowledge worldwide. In this paper, we adopt wiki tools, TiddlyWiki and MediaWiki, to build two useful platforms as knowledge management systems for small research groups less than twenty members. Our prototype intends to help students quickly grasp the expertise of their specific domain knowledge as new comers and become experienced researchers at the end of their learning process. We try to make this project as a continuous effort to accumulate more useful knowledge in a collaborative manner as required by most of the researchers.

Keyword – *Domain knowledge, wiki, TiddlyWiki, MediaWiki, knowledge management system*

1. Introduction

With the rapid development of knowledge-based economy and e-business, effective knowledge acquisition and management have become a popular issue. Numerous software systems of knowledge management have been built and used extensively. However, not many open source systems are available for small research communities. Using knowledge management systems can not only help accumulate personal and group knowledge, but also support research groups to share their domain knowledge and useful feedbacks. Exchanging knowledge between personal and research groups consists of knowledge update, coherence editing, knowledge revision, and knowledge sharing, so that we can learn useful knowledge in an effective way.

Currently, wiki is a popular knowledge sharing tool well-known to most Web users. We use this platform to achieve the goal of knowledge sharing between personal and research groups. Using our system, the research group members can make use of knowledge more efficiently and the novice can build up the fundamental knowledge more quickly.

2. Related work

Wiki is a Web system which provides a collaborative environment [4]. Everyone can contribute or modify the information on the Web page without any permission. It allows users to build and connect to Web pages using a simple markup language [5]. As a result, it helps users to

share knowledge and experiences with each other more easily. There are three major problems in the traditional publish of Web pages:

A. Information classification and redundancy

As in a Bulletin Board System (BBS), the problem of exhibiting information and knowledge for such systems is the difficulty of putting the information for the same topic together and in an easy way for access. It is very easy for wiki to set up a topic to allow users publish their opinions in the same set of pages. This will cut down the amount of multiple information post in various places of the system.

B. Making the final conclusion

Knowledge sharing platforms usually are confronted with the problem that the owner of the system has a final say on the topic being discussed. Everyone has his/her own opinion on the controversial issues. However, in the wiki system every member can edit the Web page until no more updates. This way every voice can be heard and any subjective opinion won't totally dominate the real issues to be discussed.

C. The wrong information

It is hard to modify or remove the content on the Web page right away when we find the wrong information or duplicated information without any permission. Through wiki we can modify the content and revise the knowledge with the latest information much faster.

There are many kinds of wiki systems being used as the knowledge management system. The popular wiki systems are MediaWiki [8], Moinmoin, Oddmuse, Pmwiki, Phwiki, Tikiwiki, TWiki, and Usemod. However, these system platforms are targeted for different users, programming languages, database systems, and user interfaces. We adopt MediaWiki to build our system which consists of namespace, watch list, templates, and other functions. Furthermore, MediaWiki uses MySQL as the database system. With these characteristics, it helps us categorize and manage the Web page more easily.

Compared to other wiki systems, MediaWiki has five advantages:

- (1). MediaWiki is more popular such that users are familiar with this system. Wikipedia [7] is the most well-known system using the framework of MediaWiki.
- (2). It can support different operating systems such as Windows and Linux. High compatibility is a major concern in constructing a system.
- (3). Setting up MediaWiki is easier than the other wiki systems. It takes very little time to build the system by following the installation guideline.
- (4). It allows incremental addition of extra functions. With the advantage of high flexibility, it can fulfill the requirements of different users.
- (5). It supports many languages, Chinese, English, and others to design the interface. The default is UTF-8.

Through the comparisons and the evaluations listed above, we decided to adopt MediaWiki as the platform that helps the members of research group to accumulate and share knowledge with others.

TiddlyWiki [2] is one of the personal knowledge management systems developed by using the wiki platform. TiddlyWiki is a kind of Web page combined with the use of JavaScript. If one would like to expand any particular function that is not included in the system, just add the functional module to satisfy the requirement. It is also convenient to carry TiddlyWiki with us because the system is just a file. We can put it in a USB flash drive and use the Web browser to open and edit the content to manage personal knowledge.

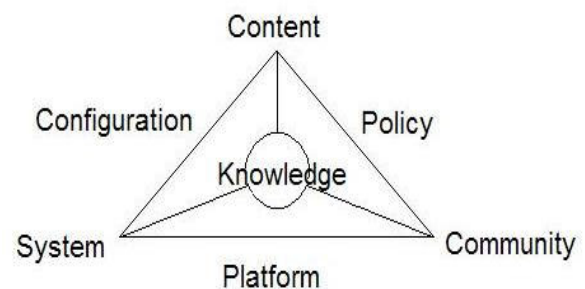


Figure 1 The triangle relationship of the wiki construction

According to the model of the triangle relationship of the wiki construction, as shown in Figure 1, knowledge sharing and creation mainly consists of three elements: system, content, and community. These elements are connected with each other by configuration, platform, and policy to form the triangle relationship.

System

The system comprises three factors, web server, server-side script program, and database management system, which is called wiki web software.

Content

The content is edited by the members of the research group. Besides the expertise in the field, the knowledge base also includes: the progress of the project, the achievement of the course, the schedule of the research group, personal notes and files, the activity of research group, the proposition for research group, and others related to the research group.

Community

The members of the community in the laboratory consist of graduate students, professors, and the system manager. The users in the community can use the edit function to modify the content and they can support some issues in which they are interested. As we accumulate knowledge by the system, professor is an expert in the field, who can help us to verify the correctness of the knowledge and then increase the confidence of knowledge acquired. Moreover, the system manager must maintain the system and make sure that the system works well, and therefore the manager needs more authority than the other users, such like verify the user accounts, delete web pages, restore web pages, block web pages, open up web pages, and operate other particular functions.

These three primary elements of system, content, and community, must connect to each other by configuration, platform, and policy. We discuss these essential components as follows.

Configuration

Between the system and the content, we adopt knowledge

management tools to organize knowledge. However, the configuration of exhibiting knowledge might influence users on searching related information.

Platform

The platform built up by system manager connects the system to the community. The members of the community can communicate, interact, and share their knowledge via the platform.

Policy

In order to keep the coherence, as the members of the community provide some information, they must follow some rules. We institute some management policies like the format of the web pages, the font and the size of words, the coherence of the terms to order the content and make sure the quality of the information, and then it helps to search and modify the information more easily.

3. System framework

Using Wiki, our system architecture is very simple and clean. It only contains two modules, personal knowledge base and research group knowledge base.

3.1. Personal knowledge base

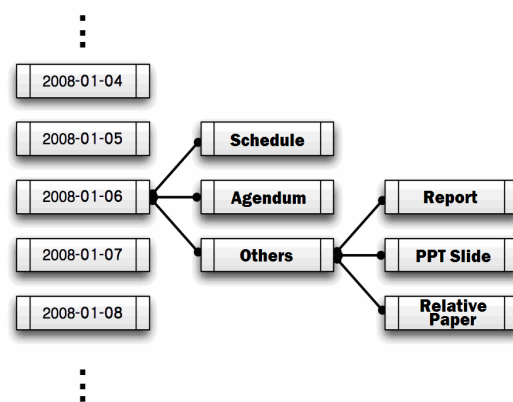


Figure 2 The framework of the personal knowledge base

The content in the personal knowledge base is maintained by each user. They can record their own schedule and what

they have learned in the classes by days, weeks, or any categories they prefer. Figure 2 shows the framework of the personal knowledge base.

3.2. Research group knowledge base

After analyzing work items performed by most graduate students in the research groups like department labs, we divide them into four parts: research, project, tutorial, and schedule. The framework is shown in Figure 3.

Research

The research part records the related issues and research results that are reported in weekly group meetings. It includes the personal research progress of each graduate student and their theses. After each weekly meeting, the content of discussion and the presentation report are kept in the system. In addition to record the progress report of each individual, the system also keep the publications and theses of the previous group members.

Project

The on-going projects and the projects that have been completed are recorded in the section of the project. For the closed projects, it consists of the tracking information and corresponding final reports. For the on-going project, it comprises the information on the team members who are responsible for the project and the progress reports so that the project leader (i.e., Professor) can monitor the progress of the projects more effectively and efficiently.

Tutorial

The tutorial part mainly is divided into expertise tutorial, software tutorial, and course tutorial. The expertise tutorial helps the novice and the people who are interested in this field to quickly build up the fundamental knowledge. The software tutorial introduces the procedure of setting the systems and the software which we usually use in the laboratory to prevent the novice wasting their time on fumbling. The course tutorial not only stores the course documents and announces the related information, but also provides a platform for discussion and interaction.

Schedule

The members of the research group can publish their own schedule in this section. It helps the group leader and the other group members to arrange their schedule and organize meetings.

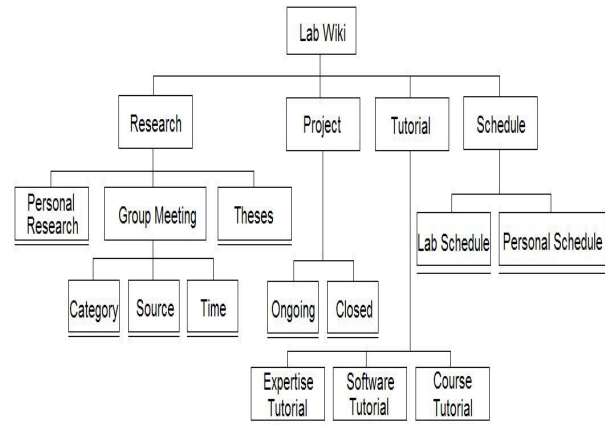


Figure 3 The framework of the research group knowledge base

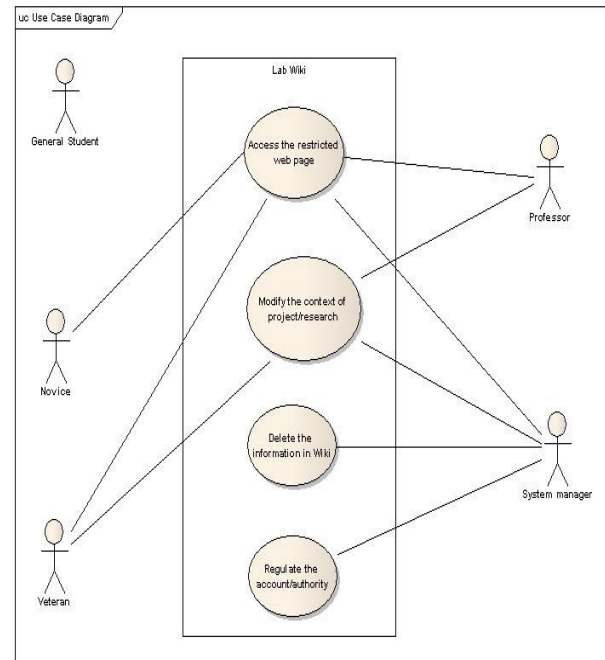


Figure 4 Use case diagram

In the use case diagram of Figure 4, users can be divided into guest, novice, veteran, professor, and system manager. The Lab Wiki system provides four functions for users to (1)

read the restricted Web page, (2) add or modify project information and personal research data, (3) delete the content in wiki system and (4) manage the account. Users must use the wiki system based on their authorization.

The general users that include the professors and the members of the research group can access the nonrestrictive pages such as adding or modifying the Web pages. The sequence diagram of using research group knowledge base, which we call the Lab Wiki system, is shown in Figure 5.

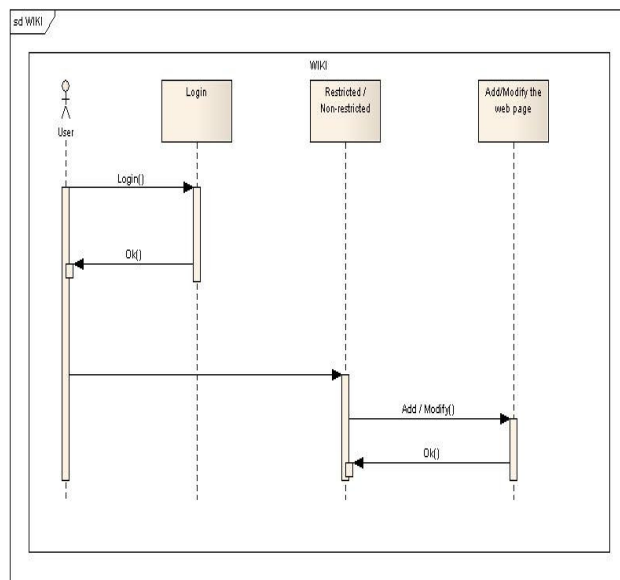


Figure 5 The sequence diagram of using research group knowledge base

The system manager not only can modify the Web pages, but also can classify, protect, delete or restore the Web pages and perform other operations which need higher authority. The sequence diagram of the Web pages management is shown in Figure 6. Besides the Web pages management, the system manager is also capable of modifying the authorities of the accounts to satisfy all of the requirements. The system manager can group the users and then give each group suitable authorities. The sequence diagram of account management is shown in Figure 7.

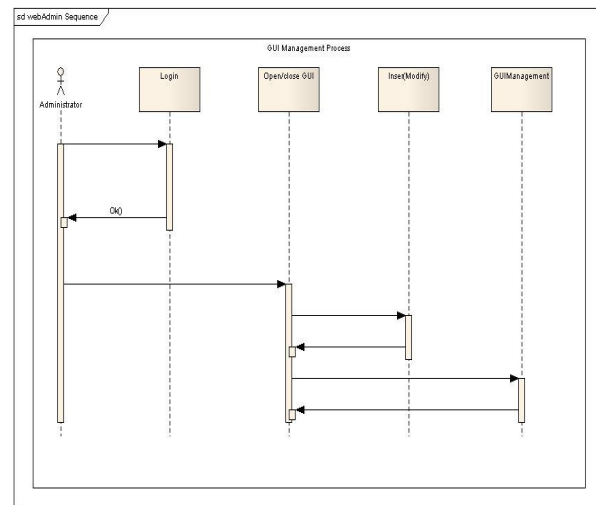


Figure 6 The sequence diagram of the Web pages management

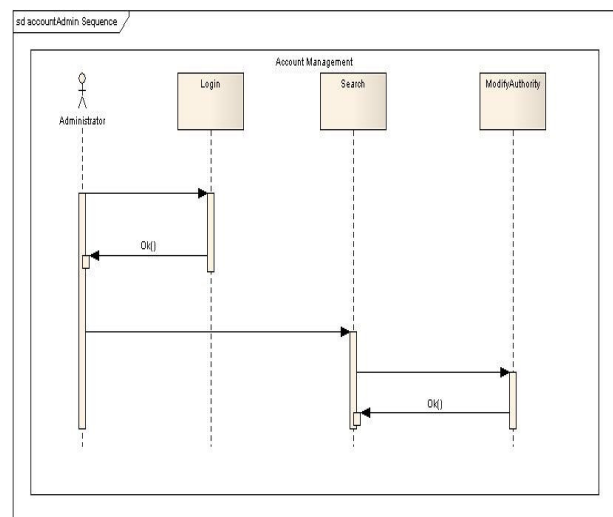


Figure 7 The sequence diagram of account management

3.3. Integration of personal and research group knowledge base

We adopt Web-based application program to build the update server and use the integration platform to integrate the personal knowledge base and the research group knowledge base as shown in Figure 8. Users can upload their content of the personal knowledge base to the update server, and then the update server will modify the research group knowledge base according to the user's requests. Moreover, the update server also allows the users to download new knowledge information from the research

group knowledge base.

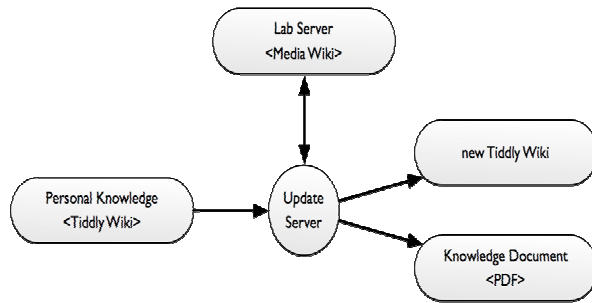


Figure 8 The framework of the integration platform

4. Function design and implementation

In this section, we will discuss system design and implementation of the personal knowledge base and the research group knowledge base in the laboratory.

4.1. Personal knowledge base

We use the TiddlyWiki platform to design the personal knowledge base. With its characteristic of the small file, the members of the research group can store the knowledge content into the flash drive or other mobile devices. In addition to easy to carry, we can edit the content with Web browser any time. Furthermore, we can use JavaScript to add the function we need as shown in Figure 9.

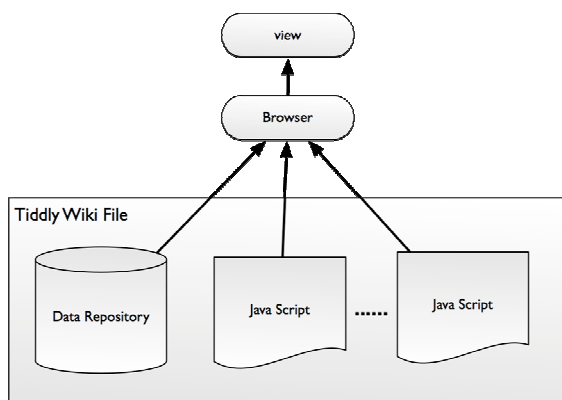


Figure 9 The function of data addition in TiddlyWiki

Besides of the basic functions, we add the following additional modules to fulfill our requirements.

WikiBar

WikiBar is the same as the toolbar of OpenOffice. This function can help users edit the content without remembering the grammar of wiki, thus it alleviates the problem of adapting the new system.

ListTagsMacro

In addition to the basic search engine, the ListTagsMacro function can list all related hyper-links whose content is marked by the same tag. With this function, users are easy to search what they want.

4.2. Research group knowledge base

In the research group knowledge base, we use MediaWiki to build the platform of knowledge management. The author can publish new knowledge or any issue to discuss with the other members. After making a conclusion which is then verified by the group leader, the final result is a creditable knowledge to all the members.

Although MediaWiki has many useful functions by itself, we would like to expand more appropriate functions in order to fulfill the requirements of the entire research group. The extra functions we added are as follows.

Authorization of accessing the restricted Web page

We divide users into different groups where each group is assigned with different authorization of access. A research group can determine whether a Web page is public or non-public. The public Web pages make the content available to the non-group members whereas the non-public Web pages only allow the research group members to share the pages. Since the MediaWiki only provides unrestricted access to the users, we not only make it a policy to regulate the private Web pages, but also add extra functions to authorize users to access the restricted Web pages.

FCKeditor

MediaWiki only provides the basic editor for users. Since it cannot satisfy our editing requirements, we extend the function by adding the OpenOffice toolbar to provide a better service of text editing.

ImageMap

In MediaWiki we can only edit the content of Web pages. When reading the content, users usually need to illustrate some information with the graph functions. To improve the wiki interface, we use ImageMap to enhance the function of graphic illustration.

Schedule

The members of the research group can record their own schedules in the *schedule*. It helps the group leader and members to schedule their activities and organize meetings. To exhibit the schedule with better visualization, we also add the function of calendar. It helps the research groups monitor the progress of projects and research activities more effectively.

4.3. Integration of personal and research group knowledge base

The update server is designed by using JSP language and its graphic user interfaces. Users can upload the content from their personal knowledge base to the update server. Similarly, the content in the research group knowledge base can be downloaded to the personal knowledge base in TiddlyWiki.

5. Conclusion and future research

Due to the blooming growth of the Internet and the soaring knowledge-based economy, wiki has become more and more popular. With the interests of a wide variety of users, the development of wiki systems becomes much faster. In the personal knowledge base, TiddlyWiki has the characteristics of easy to carry and flexibility, such that it is convenient for users to collect information and accumulate knowledge.

Moreover, MediaWiki can be used to build the research group knowledge base. It is the advantage of MediaWiki that fulfills the requirement of knowledge update, collaboration editing, knowledge correction, and knowledge sharing. Not only does it help us to learn new knowledge

much faster, but also let us make use of the knowledge more efficiently. Especially, the novices can build up the fundamental knowledge faster and easier.

It has been shown that our wiki-based knowledge management system satisfies the requirements of most small group users. However, with the advance of information technologies and explosive growth of digital data, the knowledge management system must become more easy-to-use with better knowledge discovery and efficient management for various group sizes of users. In the future, we will try to involve more people to evaluate our system and provide more suggestions for further improvements.

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Computer Science. His research interests include data mining, software engineering, and computer networks.

Author biographies

Chia-Han Yang received his M.S. degree from the Department of Information Engineering and Computer Science at Feng Chia University, Taiwan, in 2009. His research interests include data mining, database systems, and software engineering.

Ming-Ying Wu received his M.S. degree from the Department of Information Engineering and Computer Science at Feng Chia University, Taiwan, in 2009. His research interests include data mining, knowledge management systems, and software engineering.

Chien-Min Lin received his M.S. degree from the Department of Information Engineering and Computer Science at Feng Chia University, Taiwan, in 2009. His research interests include data mining, database systems, and software engineering.

Don-Lin Yang received his B.E. degree in Computer Science from Feng Chia University, Taiwan, in 1973, an M.S. degree in Applied Science from the College of William and Mary in 1979, and a Ph.D. degree in Computer Science from the University of Virginia in 1985. He worked at IBM Santa Teresa Laboratory from 1985 to 1987 and at AT&T Bell Laboratories from 1987 to 1991. Since then, he joined the faculty of Feng Chia University and is currently a professor in the Department of Information Engineering and