SAVVY Wiki: A Context-oriented Collaborative Knowledge Management System

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ABSTRACT

This paper presents a new Wiki called SAVVY Wiki that realizes context-oriented, collective and collaborative knowledge management environments that are able to reflect users' intentions and recognitions. Users can collaboratively organize fragmentary knowledge with the help of the SAVVY Wiki. Fragmentary knowledge, in this case, implies existing Wiki content, multimedia content on the web, and so on. Users select and allocate fragmentary knowledge in different contexts onto the SAVVY Wiki. Owing to this operation, it is ensured that related pages belong to the same contexts. That is, users can find correlations among the pages in a Wiki. The SAVVY Wiki provides new collective knowledge created from fragmentary knowledge, depending on contexts, in accordance with the users' collaborative operations. Various collaborative working environments have been developed for the sharing of collective knowledge. Most current Wikis have a collaborative editing mode to every page, as a platform to enable a collaborative working environment. In order to understand an arbitrary concept thoroughly, it is necessary to find correlations among the various threads of content, depending on the users' purpose, task or interest. In a Wiki system, it is important to realize a collaborative editing environment with correlation among pages depending on the contexts. In this paper, we present a method to realize the SAVVY Wiki, and describe its developing prototype system.

Categories and Subject Descriptors

H.5.3 [**Group and Organization Interfaces**]: Collaborative computing, Computer-supported cooperative work, Web-based interaction.

General Terms

Design, Human Factors

Keywords

Wikis, collaborative working environment, context-oriented, collective knowledge.

1. INTRODUCTION

In recent times, the number of users who employ search engines and applications on the web to retrieve and browse content as well as to understand or learn about arbitrary concepts has been on the rise. However, most of the current search engines and applications are not amenable to the discovery and learning of arbitrary concepts. In order to understand an arbitrary concept, it is necessary to be able to easily organize and represent the various relationships between the parts of such content. It is important to develop an organization and representation system among the various content categories in order to improve the user's understanding of arbitrary concepts.

On the other hand, various collaborative working environments such as the WikiWikiWeb (Wiki) [1] have been developed for sharing collective knowledge. When someone creates content on these environments, others can collaboratively revise and extend it. As a result, the use of these environments in each community is creating various collective knowledge bases. Most users use Wiki not only to share knowledge resources but also to organize their ideas. The volume of knowledge resources available on various fields has been increasing rapidly; it has, however, been difficult for users to understand the relationships between the concepts encountered in widely distributed knowledge resources on the basis of their purpose, task, or interest.

In the case of most current Wikis, each page in a Wiki is strongly connected by using static hyperlinks. The links in a Wiki are important because they assist in navigation to other related pages. When a user clicks on such a link, the system navigates to the purported page or redirects to a fresh view and creates a new page. A user may find related pages and content by pursuing this operation. However, users are not able to understand why these pages are linked with each other; moreover, it is impossible to visually edit such relationships among the content by using this system. To understand an arbitrary concept thoroughly, it is necessary to find correlations among threads of the content, depending on the user's purpose, task or interest. In a Wiki system, it is important to realize a collaborative editing environment while designing and maintaining correlation among the pages in order to facilitate the users' purposes, tasks and interests.

On the basis of this background, we focus in this paper on the context-oriented collective and collaborative knowledge management environments in a Wiki. Most current Wikis have only the editing mode of a page as the collaborative working

environment. Pages are written in simple syntax. Current Wikis only provide some links written in the syntax as the relationships between the pages. It is not enough to represent and edit relationships among pages. From the viewpoint of the users, the various pages in a Wiki are purveyors of fragments of knowledge. It is important for users to organize pages depending on their visual contexts inside a Wiki. That is, it is important that users can collaboratively create new collective knowledge from fragmentary knowledge, depending on the contexts, and can understand the correlations between the various contexts.

We propose a new Wiki system called "SAVVY Wiki." This system realizes context-oriented collective and collaborative knowledge management environments that can reflect users' intentions and recognitions. Users can collaboratively organize fragmentary knowledge by using the SAVVY Wiki. Fragmentary knowledge implies existing Wiki content, multimedia content on the web, etc. Users pick up and allocate fragmentary knowledge in each context onto the SAVVY Wiki. As a result of this operation, related pages belong to the same contexts. That is, users can find correlations among the pages in a Wiki. The SAVVY Wiki provides new collective knowledge created from fragmentary knowledge depending on the contexts, in accordance with the users' collaborative operations.

In this paper, in order to realize the proposed method, we introduce two types of pages—an object page and a subject page—in a SAVVY Wiki. The proposed system realizes an organization and presentation environment of correlation among pages in the Wiki by using the two types of pages.

The contributions of this paper are as follows:

- This paper proposes a context-based collaborative knowledge management Wiki called the SAVVY Wiki.
- This paper defines two types of pages on the way to realizing the SAVVY Wiki.
- The paper shows the first prototype system of the SAVVY Wiki.

Our paper is organized as follows. In section 2, we provide a brief introduction to related work. In section 3, we present details of our subject-based collaborative knowledge management system, the SAVVY Wiki. In section 4, we present details on the current implementation of the proposed method and the usage scenarios. Finally, in section 5, we provide our conclusions.

2. RELATED WORK

The idea of the WikiWikiWeb (Wiki) comes from Cunningham. Generally, Wiki systems have become exceedingly popular as collaborative working environments for the sharing of knowledge within a community. In fact, most Wiki engines are open-source, and many sites run Wikis as a community venue for discussing and writing on issues and topics. Therefore, most collective knowledge on Wiki is profitable, instantaneous, specialist, and dependent on the community. In particular, Wikipedia [2] is one of the applications of Wiki that has been created by an open community of volunteers. Wikipedia is a collaboratively edited encyclopedia that utilizes Mediawiki [3], which is one of the Wikis. Most Wiki pages are written in a simple syntax that allows even novice users to easily edit such pages. Each page in a Wiki is strongly connected owing to the static hyperlinks in the syntax. The links in a Wiki are important to navigate to other related pages. When a user clicks on such a link, the system navigates to the new page or redirects to a view that creates a new page.

Several new kinds of Wikis and Wiki clones have emerged recently: There is now the qwikWeb [4] that integrates the Wikis to mailing lists; the LBWiki [5], which is a location-based Wiki that allows users with mobile devices to create Wiki pages via GPS co-ordinates; the DistriWiki [6], which is a P2P Wiki for a distributed environment; the AniAniWeb [7], which is a personal home page Wiki; the SmallWiki [8], which is a fully object-oriented implementation of the Wiki; and the ThinkSpace [9], which is a Wiki for specific educational tools.

Some researches describe structuring information inside the Wiki system. Most Wikis are strongly connected by using static hyperlinks. The links in a Wiki are important to navigate to other related pages. However, to represent the relationship between pages, a static link alone is insufficient. WikiTrails [10] provides tracking and trail generation for the augmentation of the Wiki structure and navigation. ShyWiki [11] is a spatial hypertext Wiki for the representation of the relationships between Wiki pages.

Furthermore, there are a lot of works related to the semantic Wiki. The Semantic Wiki is a Wiki improved with Semantic Web [12] technologies. These works provide semantic annotation functions. The users express the relationships between the pages in detail for the benefit of the systems. They enable users to structure and annotate the Wiki pages for better navigation. One of the first semantic Wikis was the Platypus Wiki [13]. This had only a simple interface. Semper Wiki [14] is a semantic personal Wiki that employs a similar approach. IkeWiki [15] supports a richer semantic Wiki for knowledge workers and assists in the collaborative formalization of knowledge. Sweet Wiki [16] supports semantic annotation following "social tagging." Semantic MediaWiki [17] is a semantic wiki that is an extension of the MediaWiki. AceWiki [18] is an expressive semantic Wiki for novice users that allow them to use controlled natural languages. These semantic Wiki systems are formalizations of knowledge relationships in systems, developed by extending some markup languages. That is, these representations of relationships are only machine-readable. Users have to input additional markup languages or commands that are meant for systems and not for humans.

Comparing these systems, we focus on the organization environment for users under a collaborative system like the Wikis. The current web environments provide only browsing and jumping actions. In order to understand and extend knowledge, it is important to browse, edit and organize knowledge for users. In other words, it is necessary to realize a collaborative organization of pages carrying fragmentary knowledge for the benefit of users of the Wiki systems. The proposed Wiki system, SAVVY Wiki, provides a human-understandable and editable correlation-representation environment.

The term "SAVVY" refers to our Semantic Association Various Viewpoint sYstem. This meaning is nearly expressed by the phrase, "visualization for various relationships" [19].

The main features of our proposed Wiki system, the SAVVY Wiki, are as follows:

- The system provides a mechanism for the collaborative organization of fragmentary knowledge.

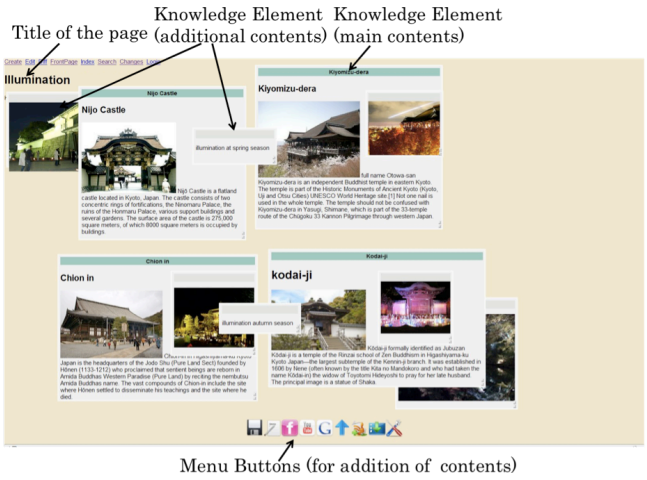

Figure 1. An example of the arrangement view in the SAVVY Wiki in the case of the "Illumination" page. This view consists of the title and knowledge elements. There are two types of knowledge elements – main contents and additional contents. You can also see some menu buttons.

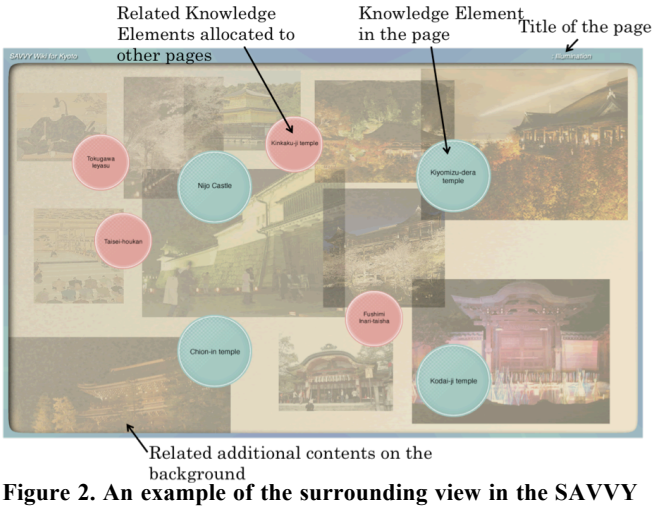

Figure 2. An example of the surrounding view in the SAVVY Wiki in the case of the "Illumination" page. This view consists of a title and some nodes. Blue nodes indicate knowledge elements that belong to the "Illumination" page. Red nodes indicate related knowledge elements that belong to other pages

- The system provides a mechanism for the assimilation and creation of new knowledge from various units of fragmentary knowledge, depending on their contexts, in accordance with the users' collaborative operations.
- The system represents various correlations depending on their contexts while organizing. In the SAVVY Wiki, users select and allocate fragmentary knowledge in different contexts onto the SAVVY Wiki. As a result, related pages belong to the same contexts; that is, users can find correlation among the pages in a Wiki.

3. SAVVY Wiki

In this section, we show a context-oriented knowledge management Wiki named as the SAVVY Wiki. The SAVVY Wiki provides for a collective and collaborative correlation editing environment among its pages, depending on their context. In order to facilitate these correlations in the SAVVY Wiki, the system provides two original types of pages–an object page and a subject page.

In section 3.1, we present an overview and a report on the user interface. In section 3.2, we present the data structure inside the SAVVY Wiki, including the two types of pages. In section 3.3, we present basic user operations using the SAVVY Wiki.

3.1 Overview

This section presents some screenshots of the SAVVY Wiki.

The SAVVY Wiki provides two modes of visualization—the "arrangement view" and the "surrounding view." The arrangement view represents elements of pages designed to expedite users' operations in a given context. The surrounding view represents other contexts and pages that relate to a current page for the user's overview. The Wiki provides two modes of visualization by using two displays or by switching screens. These two modes are dynamically synchronized with each other. By using these modes, users can understand the overview around a current page while editing it.

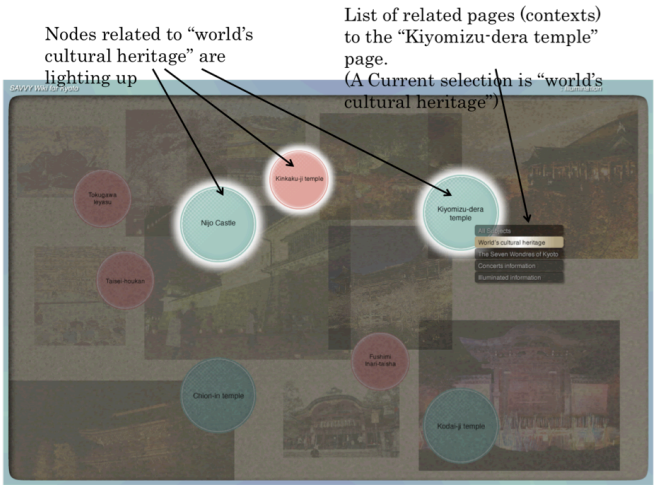

Figure 3. A surrounding view presents the pages (contexts) that a node belongs to. For example, when users right-click the "Kiyomizu-dera temple" node, the surrounding view provides a list of pages (contexts). When users select a page in the list, the related nodes light up.

First, Figure 1 illustrates a screenshot exemplifying an arrangement view. The arrangement view consists of a title and knowledge elements. You can also see some menu buttons. In this example, the page is entitled "Illumination". Note that a title represents a context. In traditional Wikis, a title usually represents the name of an object, such as the "Kinkaku-ji temple," the "Kyoto station," etc. In the SAVVY Wiki, you can create not only pages that have the names of objects as titles but also pages that have contexts as titles. In this page on "Illumination," you can select and allocate fragmentary knowledge, including existing pages, as knowledge elements. In Figure 1, "Nijo castle," "Kiyomizu dera," "Chion in," and "Kodai-ji temple" have their pages are allocated to the "Illumination" page as knowledge

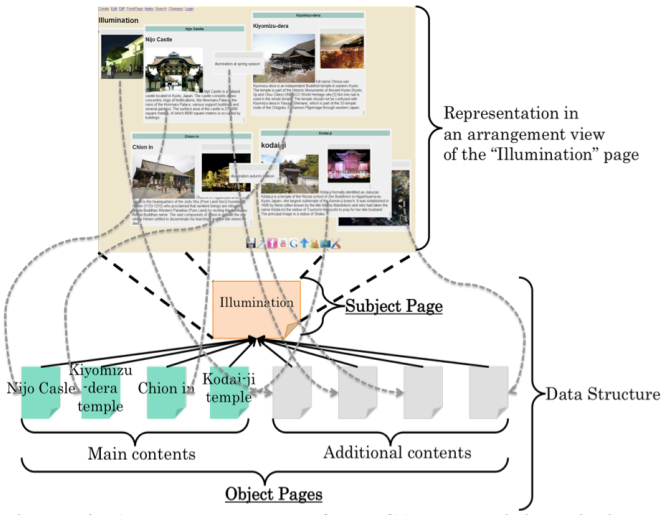

Figure 4. A data structure of the SAVVY Wiki. This is an example of the "Illumination" page. All the knowledge elements are defined as pages in the SAVVY Wiki. There are two types of pages – an object page and a subject page.

elements. These elements are the main contents. This means that each of the main contents is related to the context. In this example, "Nijo castle," "Kiyomizu-dera temple," "Chion in," and "Kodai-ji temple," are related to the contexts inherent in "illumination." Each knowledge element is represented in a window like a sticky note that has a blue bar. Furthermore, you can create some new fragmentary knowledge as knowledge elements in these pages. These are represented in windows that have a gray bar. These bars are annotations of correlation among the primary sections of the content. The arrangement view represents context-oriented, collective and collaborative knowledge on the page and provides an editing environment by allocating existing pages and creating new fragmentary knowledge items.

Next, Figure 2 illustrates a screenshot, exemplifying a surrounding view. The surrounding view consists of a title and some nodes. There are blue nodes and red nodes. Blue nodes refer to knowledge elements that belong to the page. In Figure 2, "Nijo castle," "Kiyomizu dera," "Chion in," and "Kodai-ji temple" nodes are blue. In the surrounding view of the "Illumination" page, as shown in Figure 1, the "Nijo castle," "Kiyomizu-dera temple," "Chion in" and "Kodai-ji temple" pages are allocated as knowledge elements to the list of main contents. The red nodes refer to related knowledge elements that belong to other pages. In this case, the "Kinkaku-ji temple," "Taise-houkan," "Tokugawa Ieyasu," and "Fushimi Inari-taisha" nodes are red. That is, red nodes imply knowledge that is related to other contexts. The surrounding view provides an overview around the current page (that is, a context). In addition, you can also see some images in the background. These have been added as knowledge elements to each page and have been termed as additional content. From this representation, users can intuitively know the content based around a given context.

The surrounding view presents the pages (contexts) that a given node belongs to. For example, in Figure 3, the surrounding view provides a list that represents the pages that the "Kiyomizu-dera temple" belongs to. When users select a page in the list, the related nodes light up. Thus, users are informed of other relationships around a given page.

By employing these two modes of visualization, users can collectively and collaboratively organize fragmentary knowledge, including existing Wiki pages, web content, etc., while they discover and learn about arbitrary concepts.

3.2 Data Structure of the SAVVY Wiki

In this section, we introduce the data structure of the SAVVY Wiki. Figure 4 shows the data structure in the case of the page on "Illumination," depicted in Figure 1. A page in the SAVVY Wiki consists of various knowledge elements as described in section 3.1. All the knowledge elements are defined as pages in the SAVVY Wiki. That is, the SAVVY Wiki represents all descriptions and correlations by its pages. There are two types of pages—object pages and subject pages.

In section 3.2.1, we define the two types of pages. In section 3.2.2, we present the correlations among the knowledge elements (that is, object pages) in a subject page.

3.2.1 Two types of pages in the SAVVY Wiki

Next, we define the two types of pages in a SAVVY Wiki, as shown in Figure 4. By these definitions, the SAVVY Wiki realizes the concept of page-based knowledge management.

A) Subject Page

A subject page has some object pages as knowledge elements. The title usually represents a context. Users allocate object pages as knowledge elements to a subject page according to the title, which stands for a particular context. A subject page can be used recursively as an object page of other subject pages.

B) Object Page

An object page acts as a knowledge element of the subject pages. There are two kinds of object pages. One contains the main content. The main content is an existing piece of fragmentary knowledge that includes existing Wiki pages, existing web content, etc. This usually shows a concept with its explanation in the SAVVY Wiki. The other kind of object page contains additional content. Additional content is created directly in a subject page. This becomes more fragmentary than the main contents. This usually shows an annotation for the correlation among main contents in the subject page or shows an annotation for the subject page directly.

3.2.2 Correlation among object pages

Pages in the SAVVY Wiki are formed in a hierarchy, as shown in Figure 4, owing to the policy of having subject pages and object pages. Users may want to define correlations among object pages that belong to the same subject page.

Users edit collaboratively in the arrangement view of SAVVY Wiki. The arrangement view allows users to freely allocate various object pages depending on the title (the context). We assume that users deliberately distance non-related object pages from each other; similarly, we assume that closely-related object pages are arranged close together in the arrangement view. In the SAVVY Wiki, correlations among object pages in the same subject page depend on visual distances. Note that the visual distance depends on a subject page's title, which depicts a context

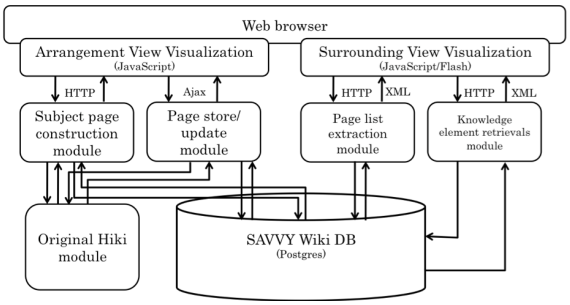

Figure 5. SAVVY Wiki implementation. A prototype SAVVY Wiki is implemented in Ruby, based on a Hiki. The system can present two modes of visualizations – an "arrangement view" and a "surrounding view" – on a browser.

such as semantic correlation, geographical distance, time scale, etc. We should define various measures depending on the context. A current version of SAVVY Wiki only tracks distances among object pages in each subject page. The various context-dependent measures would be the subject of future work in this field.

3.3 Basic Operations

This section presents several basic operations in a SAVVY Wiki. In order to realize the context-oriented collective and collaborative knowledge management system, new user operations that are not included in the current Wiki are necessary. We show the new operations as follows:

A) Create a new subject page in the arrangement view

First, users create a new subject page like the ones in the current Wikis. Users define a new context for allocating an object page.

B) Select and allocate object pages onto a subject page in the arrangement view

Users select related object pages from existing Wiki pages, web content, etc. as knowledge elements for a subject page. Next, these pages are freely allocated to the subject page. This operation allocates the main content.

C) Create and allocate a new object page in the subject page in the arrangement view

Users create new object pages in the subject page directly. This operation mainly creates additional content. After that, users freely allocate the new object pages to the subject pages in a manner similar to operation B.

D) Browse overview in and around the subject page in the surrounding view

Users browse the surrounding view in order to check for correlations among the object pages in and around the subject page. Users can then intuitively form an idea about the content designed around a given context.

Users collaboratively and recursively operate these processes. By these operations, users can collaboratively create new collective knowledge from fragmentary knowledge, depending on the contexts, and can understand the correlations around a context.

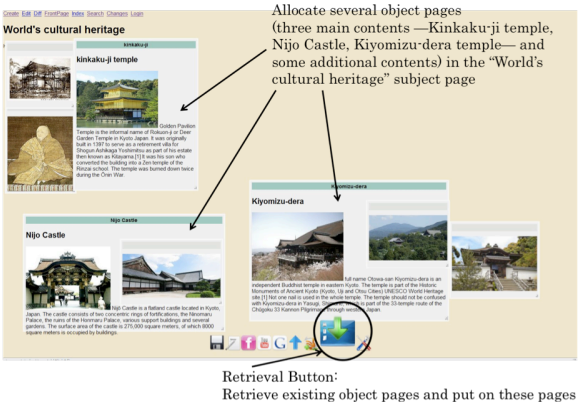

Figure 6. An arrangement view of the "World's cultural heritage" subject page before user operations. The "World cultural heritage" page already has several object pages.

Figure 7. A surrounding view of the "World's cultural heritage" subject page before user operations. This represents not only the object pages shown in Figure 6 but also other related object pages.

4. IMPLEMENTATION AND USAGE SCENARIOS

In this section, we demonstrate the prototype system of the SAVVY Wiki in detail. In section 4.1, we present the implementation environment of this version. In section 4.2, we demonstrate the effectiveness of the prototype SAVVY Wiki system with several scenarios as examples. Finally, in section 4.3, we discuss our proposed Wiki system.

4.1 Implementation Environment

Figure 5 shows the current implementation architecture of a prototype SAVVY Wiki. The system provides two modes of visualization—the "arrangement view" and the "surrounding view." A subject page construction module constructs a subject page from several object pages in each case for the arrangement view. A page store/update module asynchronously stores edited pages from the arrangement view. A page list extraction module retrieves and organizes related pages in XML for the surrounding view. This module allows for correlation measurement depending on the visual distance, as described in section 3.2.2. A knowledge

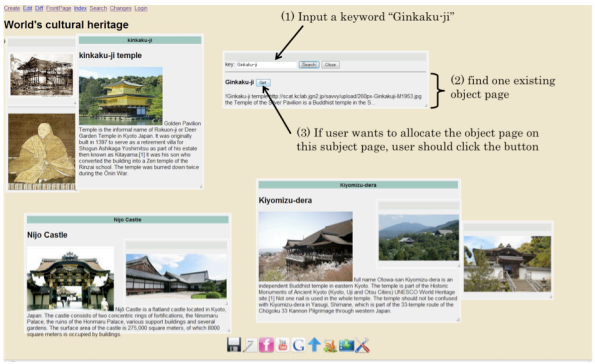

Figure 8. Retrieving the "Ginkaku-ji temple" page for putting onto the "World's cultural heritage" page.

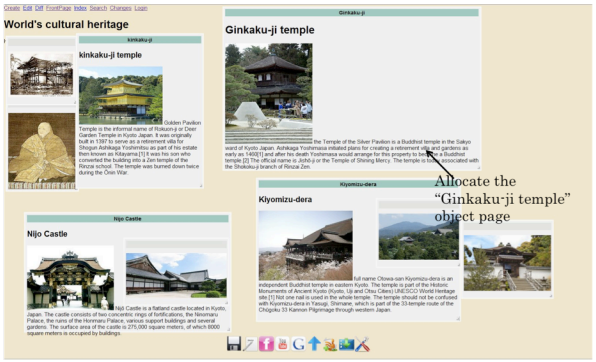

Figure 9. Allocating the retrieved "Ginkaku-ji temple" page onto the "World's cultural heritage" page in the arrangement view. Users can freely allocate this "Ginkaku-ji temple" page onto the arrangement view of the"World cultural heritage" page.

element retrieval module retrieves related additional content for the background of the surrounding view.

A prototype SAVVY Wiki is implemented in Ruby, based on a Hiki [20]. The Hiki is one of the Wiki clones written in Ruby. It is customizable and mobile confirmative. In particular, the Hiki enables us to enhance functions via plugins. We also developed some plugins for multimedia pages for uploading images and sounds.

Data in the SAVVY Wiki is stored in a Postgres database. The SAVVY Wiki uses a browser-based interface with Ajax and Flash.

4.2 Examples Scenarios

In this section, we demonstrate the effectiveness of the SAVVY Wiki. As an example, we consider a scenario wherein a user allocates the "Ginkaku-ji temple" object page to the existing "World cultural heritage" subject page. We present these processes by utilizing the SAVVY Wiki as shown in Figures 6, 7, 8, 9 and 10.

Figures 6 and 7 show the subject page on "World cultural heritage" before user operation. Figure 6 depicts the arrangement view and Figure 7, the surrounding view. By such representation, users can intuitively know about the content available on a given context. The "World cultural heritage" page already has several object pages. There are pages on the "Kinkaku-ji temple," the "Nijo Castle" and the "Kiyomizu-dera temple." That is, these

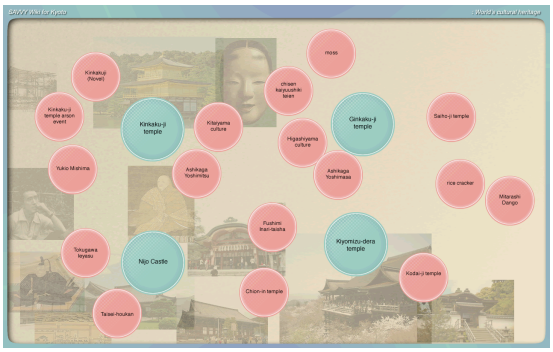

Figure 10. Allocating the retrieved "Ginkaku-ji temple" page onto the "World's cultural heritage" page in the surrounding view. Note that not only the "Ginkaku-ji temple" node but also several red nodes appear newly. Red nodes in the surrounding view are related object pages that belong to other subject pages.

views show related content on the context "World cultural heritage."

When a user wants to allocate a "Ginkaku-ji temple" object page as main content onto the subject page, he/she can click on the retrieve button on the menu in the arrangement view, as shown in Figure 6. The arrangement view provides a retrieval window (See Figure 8). First, the user inputs the keyword "Ginkaku-ji." The system then provides a list of object pages. In the case shown in Figure 8, the system finds one object page. If the user wants to allocate the returned object page onto this subject page, he/she clicks on the "Get" button on the object page. The system then updates the new "World cultural heritage" pages, as shown in Figures 9 and 10.

Figure 9 shows the arrangement view of the "World cultural heritage" page after user operations. In this view, the "Ginkaku-ji temple" object page appears. Users can freely allocate this page to the arrangement view of the "World cultural heritage" page. Figure 10 shows the surrounding view of the "World cultural heritage" page after the user operations. Note that in addition to the "Ginkaku-ji temple" node several other red nodes appear newly. Red nodes in the surrounding view depict related object pages that belong to other subject pages. That is, users can understand the influence of the correlations on the contexts by having edited them. From the two modes of visualization, users can collectively and collaboratively organize object pages as fragmentary knowledge while learning about arbitrary concepts.

This process collaboratively creates new knowledge that consists of fragmentary knowledge. The pages in most Wikis comprise fragmentary knowledge. Each page connects only static hyperlinks. Most Wikis address the issues of co-editing and analyzing each page and their links. The SAVVY Wiki provides a collaborative and collective knowledge creation environment. This helps in the effective utilization of fragmentary knowledge.

4.3 Discussion

This SAVVY Wiki realizes context-oriented collective and collaborative knowledge management environments that reflect user intentions and recognitions. The SAVVY Wiki realizes a collaborative organizational environment that can propagate fragmentary knowledge by representing it in subject and object pages. As described in section 3.3, the SAVVY Wiki provides

easy user operations for organization of knowledge. By using these operations, users can collaboratively organize fragmentary knowledge items and create new context-oriented knowledge, while learning about arbitrary concepts.

We have a wide range of options for providing fragmentary knowledge by using various tools such as blog, Wiki, etc. The amount of knowledge resources available in various fields has been increasing rapidly; however, users continue to find it difficult to retrieve even widely distributed knowledge resources in accordance with their purposes, tasks, or interests. One of the reasons for this is that collaborative and collective knowledge creation environments for scattered fragmentary knowledge items have not yet been realized. Some are of the opinion that the current Wikis help users to create collective knowledge. That, however, is not enough to solve these problems. In the current environment, anyone can provide knowledge resources; however, not everyone can organize them.

On the other hand, in recent times, the number of users who employ applications on the web not only for retrieving and browsing content but also for discovering and learning about arbitrary concepts has been on the rise. However, the current web environments do not support this requirement adequately. Users can obtain related knowledge resources by using a search engine. It is hard for users to organize these resources with the view to developing an understanding of new concepts. It is therefore important to realize such collective and collaborative knowledge management environments.

The SAVVY Wiki provides an organization environment for fragmentary knowledge by allowing for easy user operations. In the scenarios described in section 4.2, users allocate the "Ginkaku-ji temple" pages onto the "World's cultural heritage" page. The "World's cultural heritage" page is created from several fragmentary knowledge items—the "Kinkaku-ji temple," the "Nijo Castle," the "Kiyomizu-dera temple" and the "Ginkaku-ji temple." That is, users organize fragmentary knowledge in the context of the "World's cultural heritage." This realizes context-oriented collective and collaborative knowledge management, which helps in the effective utilization of fragmentary knowledge.

In order to achieve cooperation, communities are required to share the same sense of values, interest and purpose. In order to ensure cooperation, first, people who have the same sense of values, interest and purpose gather together. Next, people collect fragmentary resources from around them and from each other with the view to utilizing the same. Finally, by these processes, cooperation is achieved. In the SAVVY Wiki, the title of a subject page represents the sense of shared values, interests and purposes. People having the same sense of values, interests and purpose come to the same subject page. These people bring several fragmentary knowledge items corresponding to the subject page and allocate them onto subject page. These processes create new collective knowledge, and this is how the SAVVY Wiki engenders a cooperative environment.

We posit that the SAVVY Wiki not only changes the collaborative environment but also the Web-content structure. The current Web structure is a network that connects information resources via static links. In the current Web environment, a user's action involves only browsing the resource and jumping to other resources by using the static links. The SAVVY Wiki, on the other hand, provides correlations among pages by organizing them. When we construct an analysis system for data on the SAVVY Wiki, the system allows for new navigation on the basis of the users' collective intentions and recognitions. That is, it changes the Web structure on the basis of the users' collective intentions and recognitions. Thus, the SAVVY Wiki can reconfigure Web resources and legacy databases.

We will apply this system to enhance, analyze, share, and reuse knowledge, carrying it beyond time, places, and fields on the Web.

5. CONCLUSIONS

In this paper, we presented a new Wiki called the SAVVY Wiki. This system realizes context-oriented collective and collaborative knowledge management environments and is able to reflect users' intentions and recognitions. Users can collaboratively organize fragmentary knowledge using the SAVVY Wiki. The SAVVY Wiki provides new collective knowledge created from fragmentary knowledge, depending on the contexts of the users' collaborative operations. In addition, users can find correlation among the pages in a Wiki.

In recent times, the number of users who employ applications on the web for the purpose of retrieving and browsing content, and for discovering and learning about arbitrary concepts has been on the rise. Various collaborative working environments like Wiki have been developed for sharing collective knowledge.

However, it is difficult for users to understand relationships among between concepts present in the widely distributed knowledge resources, according to their purpose, task, or interest. To understand an arbitrary concept thoroughly, it is necessary to find correlations depending on the user's purpose, task or interest. It is important to build a collaborative organizational environment among pages carrying fragmentary knowledge items in a Wiki system, depending on users' purposes, tasks or interests.

Currently, we are developing a knowledge cluster system for knowledge sharing, analysis, and delivery among remote knowledge sites [21]. We have proposed, in particular, the interconnection method for heterogeneous knowledge bases [22] [23]. The proposed SAVVY Wiki will be applied to this method as a management system for the interconnection of knowledge.

As a subject for future study, we shall install an analysis function on our Wiki's collective knowledge for the sake of more effective knowledge elicitation. We will also apply our system to various fields and applications, including various communication tools. Furthermore, we will apply our method to form a P2P Wiki network.

6. REFERENCES

[1] Leuf, B., and Cunningham, W. 2001. The Wiki Way: Quick Collaboration on the Web, Addison-Wesley.

[2] Wikipedia, http://en.wikipedia.org

[3] MediaWiki, http://www.mediawiki.org

[4] Eto, K., Takabayashi, S., and Masui, T. 2005. qwikWeb: integrating mailing list and WikiWikiWeb for group communication. In proceedings of the 2005 international symposium on Wikis (San Diego, California, October 16 - 18, 2005). WikiSym'05. ACM Press, New York, NY, 17-23.

[5] Millard, D., Lewis, R., and Howard, Y. 2008. LBWiki: A Location-Based Wiki. In proceedings of the 2008 International Symposium on Wikis (Porto, Portugal,

September 8-10, 2008). WikiSym'08. ACM Press, New York, NY.

[6] Morris, J. 2007. DistriWiki: A Distributed Peer-to-peer Wiki Network. In proceedings of the 2007 international symposium on Wikis (Montreal, Quebec, Canada, October 21-25, 2007). WikiSym'07. ACM Press, New York, NY, 69-74.

[7] Rick, J. 2007. AniAniWeb: A wiki approach to personal home pages. In proceedings of the 2007 international symposium on Wikis (Montreal, Quebec, Canada, October 21 - 25, 2007). WikiSym'07. ACM Press, New York, NY, 99-118.

[8] Ducasse, S., Renggli, L., and Wuyts R. 2005. SmallWiki: A meta-described collaborative content management system. In Proceedings of the 2005 international symposium on Wikis (San Diego, California, October 16-18, 2005). WikiSym'05. ACM Press, New York, NY, 75-82.

[9] Shuyska, J., and Davies, C. 2008. ThinkSpace: The collaborative process of designing new technologies for the classroom. In proceedings of the 2008 International Symposium on Wikis (Porto, Portugal, September 8-10, 2008). WikiSym'08. ACM Press, New York, NY.

[10] Reinhold, S. 2006. WikiTrails: Augmenting Wiki structure for collaborative, interdisciplinary learning. In Proceedings of the 2006 international symposium on Wikis (Odense, Denmark,August 21-23, 2006). WikiSym'06. ACM Press, New York, NY, 47-58.

[11] Solís, C., and Ali, N. 2008. ShyWiki: A Spatial Hypertext Wiki. In proceedings of the 2008 International Symposium on Wikis (Porto, Portugal, September 8-10, 2008). WikiSym'08. ACM Press, New York, NY.

[12] Berners-Lee, T., and Fischetti, M. 1999. Weaving the Web: The original design and ultimate destiny of the World Wide Web by its inventor, Harper San Francisco.

[13] Campanini, S.E., Castagna, P. and Tazzoli, R. 2004. Platypus Wiki: A Semantic Wiki Wiki Web. In proceeding of 1st Italian Semantic Web Workshop (Ancona, Italy, December 10, 2004) Semantic Web Applications and Perspectives (SWAP), http://semanticweb.deit.univpm.it/swap2004/camerarready/castagna.pdf.

[14] Oren, E. 2005. SemperWiki: A semantic personal Wiki. In proceedings of the 1st Workshop on The Semantic Desktop - Next Generation Personal Information Management and Collaboration Infrastructure (Galway, Ireland, November 6, 2005).

[15] Schaffert, S. 2006. IkeWiki: A semantic wiki for collaborative knowledge management. In proceedings of the 1st International Workshop on Semantic Technologies in Collaborative Applications (Manchester, U.K. June 26-28, 2006) STICA 06. 388-396.

[16] Buffa, M., and Gandon, F. 2006. SweetWiki: Semantic web enabled technologies in Wiki. In proceedings of the 2006 international symposium on Wikis (Odense, Denmark,August 21-23, 2006). WikiSym'06. ACM Press, New York, NY, 69-78.

[17] Krötzsch, M., Vrandečić, D., and Völkel, M. 2006. Semantic MediaWiki. In proceedings of the 5th International Semantic Web Conference (Athens, GA, USA, November 5-9, 2006). ISWC 2006. Springer Berlin, Heidelberg, 935-942.

[18] Kuhn, T. 2008. AceWiki: A Natural and Expressive Semantic Wiki. In proceedings of the Semantic Web User Interaction at CHI 2008 (Florence, Italy, April 5, 2008). SWUI2008. http://swui.webscience.org/SWUI2008CHI/Kuhn.pdf.

[19] Nakanishi, T., Zettsu, K., Kidawara, K., and Kiyoki, Y. 2009. SAVVY: A Semantic Associative Browsing System for Heterogeneous Knowledge Resources. In proceedings of the 42nd Hawaii International Conference on Systems Science (Waikoloa, Big Island, HI, USA, January 5-8, 2009). DOI http://doi.ieeecomputersociety.org/10.1109/HICSS.2009.891

[20] Hiki, http://hikiwiki.org/en/.

[21] Zettsu, K., Nakanishi, T., Iwazume, M, Kidawara ,Y., and Kiyoki, Y. 2008. Knowledge cluster systems for knowledge sharing, analysis and delivery among remote sites. Information Modeling and Knowledge Bases, vol. 19, 282-289.

[22] Nakanishi, T., Zettsu, K., Kidawara, Y., and Kiyoki, Y. 2007. Towards Interconnective Knowledge Sharing and Provision for Disaster Information Systems-Approaching to Sidoarjo Mudflow Disaster in Indonesia. In proceedings of the 3rd Information and Communication Technology Seminar (Surabaya, Indonesia, 2007). ICTS 2007. 332-339.

[23] Nakanishi, T., Zettsu, K., Kidawara, Y., and Kiyoki, Y. 2008. Approaching to Interconnection of Heterogeneous Knowledge Bases on a Knowledge Grid. In proceedings of the International Conference on Semantics, Knowledge and Grid (Beijing, China, December 3-5, 2008). SKG 2008. 71-78. DOI http://doi.ieeecomputersociety.org/10.1109/SKG.2008.64