

A Collaborative Content Publisher

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Abstract—We propose a web application called Collaborative Content Publisher (CCPublisher), which enables users to publish content and post their work on blogs or elsewhere. Users can participate in collaborative writing of the content posted on different web pages and synchronize each content version. A web annotation function is also provided for users to annotate multimedia content on the web pages. Users can integrate the annotated multimedia content with their collaborative work and update the annotation after the original annotation has been modified. Annotations of multimedia content in different versions of the collaborative work will be consistent if the same multimedia is used. With the CCPublisher, users can provide feedback on any web page, exchange ideas, and enrich the shared collaborative content as well as the web content. It therefore facilitates collaborative learning and the efficient accumulation of knowledge.

Keywords—Collaborative learning; Web annotation; Multimedia annotation; sharing annotation; Publisher

I. INTRODUCTION

The concept of collaborative learning, a popular topic in E-learning 2.0 [1], refers to a group of learners working together to achieve a common goal [2]. In the collaborative learning process, learners share ideas or modify each other's work. Thus, learners are no longer just information receivers; instead, through contributing, sharing and collaborating, they can also become information providers. As a result, collaborative learning increases a learner's sense of achievement and motivation to learn, and also facilitates the development of critical thinking [3].

An increasing number of educationalists are exploring the possibility that online services could be used to enhance collaborative learning. For example, the State University of New York used Flickr's tagging feature [4] in an online history course to enable students to annotate and discuss a series of paintings [5]; while SUNY Geneseo launched a collaborative writing project using Mediawiki [6]. The above services may not have been designed for educational purposes initially, but they have accelerated online collaboration among learners and created new educational opportunities.

Existing online collaborative learning applications, such as Wikipedia [7] and Flickr, have certain limitations. For

example, most of them require users to work collaboratively on a centralized platform. Although users can share their collaborative content or post it on web pages, they cannot provide feedback or exchange ideas on the shared content. This limited one-way sharing also prevents synchronizing changes with the original content. If the original content has been modified, the authors have to re-share it, which may take a great deal of time; otherwise, the shared content will be inconsistent with the latest version.

To resolve the above problems, we have developed a web application called Collaborative Content Publisher (CCPublisher), which enables users to publish content that can be embedded in web pages. Editing tools are provided so that users can edit and give feedback directly on the published content. New feedback is transferred to copies of the published collaborative content automatically so that all versions are synchronized. We also provide a web annotation function for users to annotate multimedia in web pages and transform it with the annotations into collaborative content. The annotations of the multimedia in the collaborative content will be consistent with the original annotations. Through the content embedded in blogs or elsewhere, users can easily exchange comments, co-edit the content and expand the current version. CCPublisher increases the opportunities for interaction between users and facilitates the efficient accumulation of information.

The remainder of this paper is organized as follows. Section 2 examines existing online services related to collaborative learning; Section 3 presents the features of CCPublisher; and Section 4 describes the synchronization mechanism. Section 5 contains some concluding remarks.

II. RELATED WORK

In this section, we discuss existing online services for collaborative learning, with the focus on those that provide collaborative writing platforms and web annotation tools. We also consider online services for sharing collaborative content.

Collaborative writing platforms, such as Wikipedia, Moodle wiki [8] and Google doc [9], can be used for collaborative learning. Wikipedia allows users to contribute content and collaborate with other users to modify the

content; thus, most articles have multiple authors. An article will change dynamically after modification, and anyone can track who made a particular change. Moodle wiki, a component of the Moodle system, is also a collaborative writing platform. It enables students to participate in collaborative writing with peers and instructors. Teachers can see when each student writes a new article and view the records of the student’s previous online work. Meanwhile, students can view and modify each other’s work. Moodle wiki supports group projects and can be used to develop group reports and maintain class records of activities on given topics. Google also provides a writing platform called Google Docs, which allows users to edit a document online and collaborate with other users to edit their contributions.

Collaborative learning can also be achieved by using a web annotation feature, such as Tagtoo [10], Diigo [11], or Reframe It [12], to construct a collaborative environment. Tagtoo allows the user to tag images on any web pages. The tag, which can be a Facebook account or a link, will be shown on the image and shared via Facebook. Diigo enables users to annotate, archive and organize web pages. It is easy for students to participate in collaborative research projects, and ask questions while reading web pages. Meanwhile, Reframe It puts users’ comments in a sidebar that changes for any page. Users can comment on any page, even if it does not have a comment function.

However, none of the above collaborative learning services provide a convenient sharing function, such as the capability to update shared collaborative content. Moreover, users cannot participate in collaborative writing on the shared collaborative content. For example, after sharing collaborative content via the embedded functionality of Google Docs, users cannot update the new version of embedded content as the original content changes, or provide feedback, such as comments or annotations. Tagtoo allows users to embed tags in web pages, but a tagged image cannot be shared with other web pages.

Using other services to share collaborative content also has some limitations. For example, Calameo [13] enables

users to upload PDF or PowerPoint files and convert them into embeddable Flash files, which can then be used to embed collaborative content in web pages. Although users can comment on shared content, they cannot transfer their comments to the original collaborative work or show the comments on the same content embedded in other web pages. Another platform called Apture [14] allows publishers and bloggers to link and integrate multimedia or web pages in a dynamic layer above their own pages. Users can view the latest version of the content, but they cannot give feedback on it.

To update web annotations, we exploit the annotation functions presented in our previous work [15]. The functions described in this paper allow users to add annotations to multimedia on web pages. They also enable users to interact with one another and maintain the consistency of annotations of the same multimedia on different web pages. Furthermore, we introduce a function that synchronizes the annotations of multimedia in the collaborative content with the annotations of the original web multimedia.

III. THE FEATURES OF CCPUBLISHER

CCPublisher is comprised of three components: the Collaborative Multimedia Web Annotator (called the “Web Annotator” hereafter), the Collaborative Content Editor (CCEditor), and the Collaborative Content Reader (CCReader).

Fig. 1 shows the process for publishing content with the CCPublisher. First, the web page loaded by a user is embedded by the Web Annotator (step 1). The Web Annotator enables users to annotate web multimedia content that lacks an annotation capability and transfers the annotated multimedia content to the CCEditor for editing (step 2). On completion of the editing, the user can publish his/her collaborative content via the CCReader (step 3), which can be embedded in the web pages with an embedded code (step 4). We describe each component in detail below.

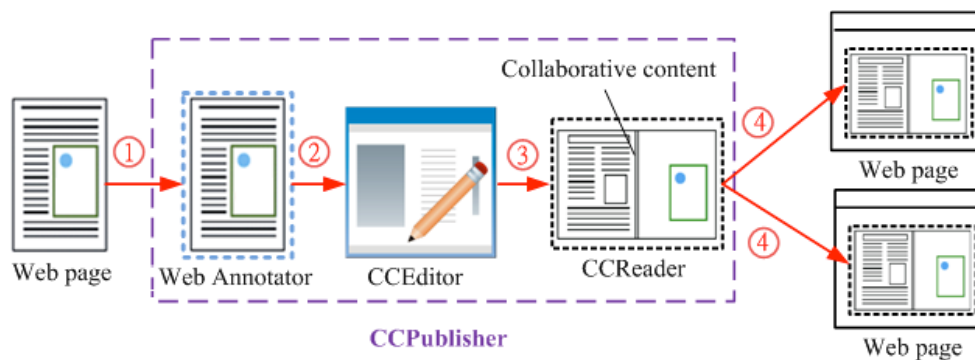


Figure 1. The Publishing Process of CCPublisher.

A. Collaborative Multimedia Web Annotator

To annotate multimedia content on web pages that lack an annotation capability, the Web Annotator uses a parser to embed the annotation function in the web multimedia content. Fig. 2 shows an example of an image on a web page embedded with the annotation function. The annotation tool allows users to draw lines or type text on existing web content. After completing the annotation process the author can select the public mode for other users to view or re-edit the annotations, or select the private mode so that only he/she can change the annotation. Any annotations are displayed with the multimedia and recorded on the Multimedia Annotation Record so that users can track who made a particular change. The annotations made by a user will be loaded into the CCEditor for further editing.

B. Collaborative Content Editor

The CCEditor is used to publish collaborative content with the CCReader. The interface of the CCEditor is shown in Fig. 3. The editing tools on the left-hand side of the interface are: add lines/figures and text, or adjust the thickness, transparency, and color. The author can import materials from other web pages or local computer. The multimedia that was annotated by the Web Annotator will also be loaded into the CCEditor.

If the author wants to import the annotations added to the multimedia by the Web Annotator, CCEditor or CCReader, he/she can click on the multimedia. The CCEditor will then display a pop-up window that shows the Multimedia Annotation Record (Fig. 4). The author can import and edit the annotations.



Figure 2. An image embedded by the Web Annotator.

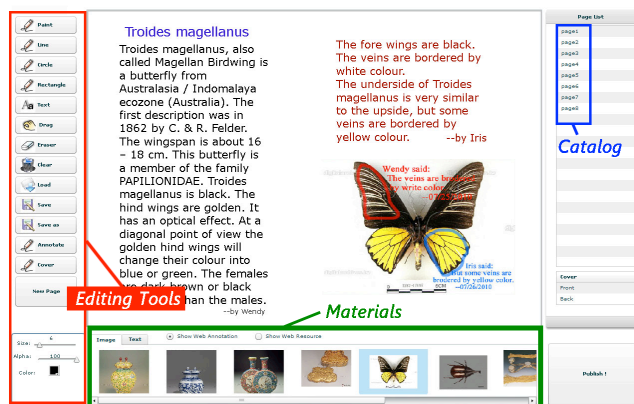


Figure 3. The Interface of the Collaborative Content Editor.

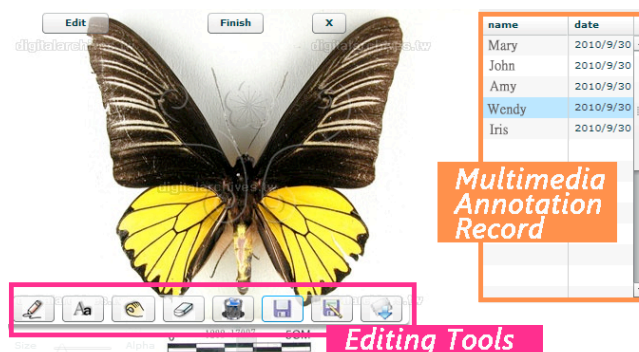


Figure 4. An example of a pop-up window that shows the Multimedia Annotation Record.

The CCEditor allows the author to store changes as he/she complete each page, as well as sort the pages in the catalog and review the work. On completion of the editing, the CCEditor generates the collaborative content with the CCReader, which then creates an embedded code and a URL for the author to post the collaborative content on blogs or elsewhere. The CCPublisher will also store the collaborative content so that the author can go back to the CCEditor to re-edit it.

The CCEditor provides three types of sharing mechanism. First, the author can select the public mode, which allows anyone on the Internet to modify and republish any part of the content. Second, the author can set content as “read-only” so that others can only view the material. Third, the author can restrict access so that only nominated members of a group can modify and republish the content. In addition, to prevent other users making inappropriate modifications of the collaborative content, the author can vet changes and decide which ones to accept.

C. Collaborative Content Reader

The CCReader enables users to view and make feedback on the collaborative content that the CCEditor generates

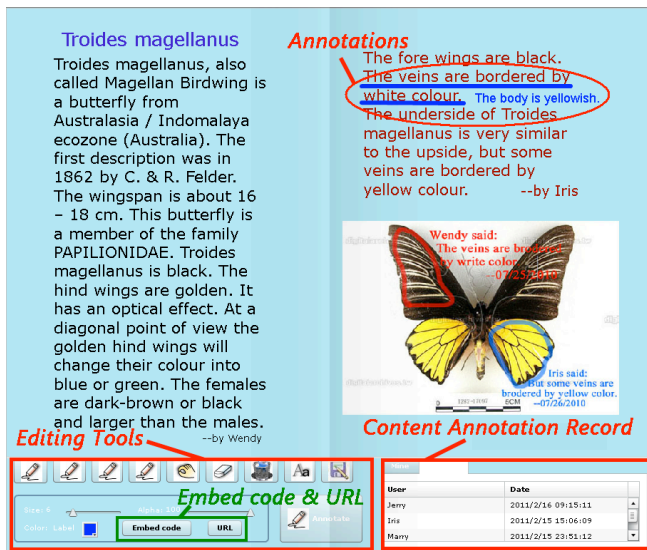


Figure 5. The Interface of Collaborative Content Reader.

and embeds on web pages. Fig. 5 shows an example of the CCRReader interface that authors can use to add annotations with the editing tools. If users want to share the collaborative content via the CCRReader, the embedded code and URL are provided.

Any part of the collaborative content can be modified and republished if the author has given permission. The changes will be recorded on the Content Annotation Record so that everyone can track who made a particular change, and the author can decide which version to accept.

In addition, users can import annotations added to the multimedia by the Web Annotator, CCEditor or CCRReader. When a user clicks on the multimedia, the CCRReader will display a pop-up window that shows the Multimedia Annotation Record for users to import annotations. The interface of the pop-up window is the same as that in Fig. 4. It also provides editing tools for users to edit existing annotations or add new ones. The changes will be displayed on the multimedia in the collaborative content and transferred to the original multimedia resource embedded by the Web Annotator. (We describe this mechanism in Section 4).

CCPublisher is implemented with PHP and Adobe FLEX. PHP is used to implement the web applications, transfer the annotation record and access the database; and Adobe FLEX is used to implement the interfaces that communicate between the web browser and the web server. We use the Apache HTTP Server 2.0 as the web server and MySQL as the database.

IV. THE SYNCHRONIZATION MECHANISM OF CCPUBLISHER

The synchronization mechanism ensures that all versions of shared collaborative content are consistent. As collaborative content may be posted on two or more web pages for users to access, CCPublisher uses a

synchronization mechanism to maintain the consistency of all shared content. Users can choose to synchronize all copies of the collaborative content or synchronize the multimedia annotations in the collaborative content and the Web Annotator.

A. Synchronizing copies of collaborative content

Fig. 6 shows an example of synchronizing copies of collaborative content. The content and copies are posted on web pages A, B and C. After one of the pages has been modified, the change is sent to CCPublisher (step 1), which stores the modification and transfers it to copies of the collaborative content posted on other web pages when users access the CCRReader (step 2). After users update their copies, the modification will appear in the collaborative content (step 3).

B. Synchronizing multimedia annotations in collaborative content and the Web Annotator

Annotations of multimedia in different versions of the collaborative content and the Web Annotator will be consistent if the authors utilize the same multimedia resource. Fig. 7 shows an example of synchronizing multimedia annotations in collaborative content and the Web Annotator.

Content A and content B contain the same image obtained from the same web page. When reading content A, the user annotates the image, and the new annotation is transferred to the CCPublisher (step 1). When other users access content B, the annotation will be transferred to content B by the CCPublisher (step 2). After users update this annotation, it will be displayed in the image (step 3). The annotation will also be transferred to the original image resource embedded by the Web Annotator (step 4), and appear on the Web Annotator after users update the annotation (step 5). Similarly, when authors use the Web Annotator to annotate multimedia on web pages, the annotations are loaded to the multimedia in the embedded collaborative content by the CCPublisher.

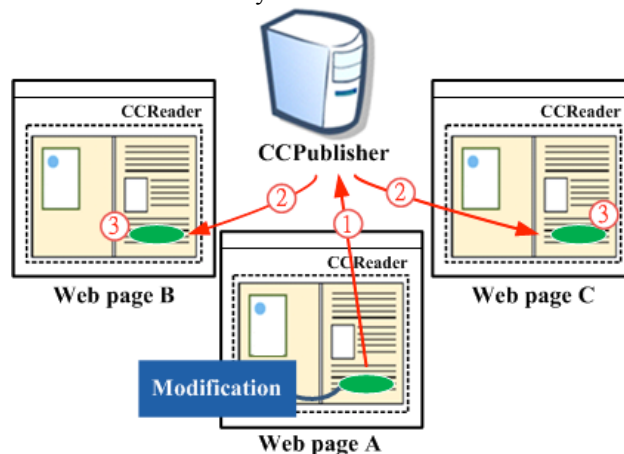


Figure 6. Synchronizing copies of collaborative content

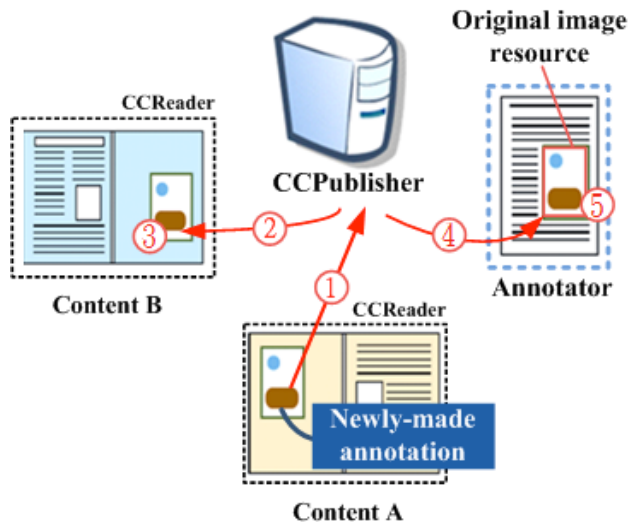


Figure 7. Synchronizing multimedia annotations in collaborative content and the Web Annotator.

In summary, the CCPublisher synchronizes all shared versions of the collaborative content. It also synchronizes the multimedia annotations in the collaborative content and the Web Annotator. The synchronization mechanism allows users to exchange ideas and participate in collaborative writing more efficiently by providing immediate feedback and more communication opportunities.

V. CONCLUSION

We have presented a web application called CCPublisher, which enables users to participate in collaborative writing of the content posted on web pages and helps authors synchronize different versions of the content. CCPublisher also solves the problem of one-way knowledge sharing and the inconvenience of updating different versions of shared content. In addition, we provide a web annotation function for users to collaborate with each other on web content that lacks an annotation capability. The annotations added to the web content can be integrated into the collaborative content. They will also be consistent with their original multimedia annotations. CCPublisher allows users to provide feedback, exchange ideas on any web page, and enrich the shared collaborative content as well as the web content. It therefore facilitates the accumulation of knowledge and provides more opportunities for collaboration.

In our future work, we will expand the functionality of collaborative learning, e.g., by developing the annotation capability to include video annotation. We also hope to

implement CCPublisher on portable readers, thereby providing users with more mobility. Moreover, we hope that, in the near future, all users will be able to access the source code to expand the functionality of collaborative learning or implement our application on other e-learning platforms. Adding these functions would increase the convenience and utility of CCPublisher and enhance the concept of collaborative learning.

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REFERENCES

- [1] S. Downes, "E-Learning 2.0," ACM eLearn Magazine: Education and Technology in perspective, Oct. 2005. <http://elearnmag.acm.org/featured.cfm?aid=1104968>.
- [2] P. Dillenbourg, "What do you mean by 'collaborative learning'?" In Collaborative-learning: Cognitive and Computational Approaches, P. Dillenbourg (Ed), Oxford: Elsevier, 1999, pp.1-19.
- [3] A. A. Gokhale. "Collaborative Learning Enhances Critical Thinking," Journal of Technology Education, vol. 7, 1995, pp.22-30.
- [4] R. Giles, How to Use Flickr: The Digital Photography, 1rd ed., Course Technology PTR, 2006.
- [5] S. O'Hear, "e-learning 2.0 - how Web technologies are shaping education," ReadWriteWeb, Aug. 8, 2006, http://www.readwriteweb.com/archives/e-learning_20.php.
- [6] P. Schacht, "The Collaborative Writing Project," in Using Wiki in Education, sec. 2, S. Mader Eds. 2007, pp.12-23.
- [7] P. Ayers, C. Matthews and B. Yates, How Wikipedia Works: And How You Can Be a Part of It, 1rd ed., No Starch Press, 2008.
- [8] K. Brandle, "Are you ready to 'MOODLE'?" In Proc. of Language Learning & Technology, vol.9(2), 2005, pp. 16-23.
- [9] Google Doc, <http://www.google.com/google-d-s/b1.html>.
- [10] Tagtoo, <http://www.tagtoo.org>, 07.18.2011.
- [11] B. Yuan, and B. Tan. "Explore Diigo for the First Time Applying to Learning Hitting the Target," In Proc. of the Second International Symposium on Networking and Network Security, 2010, pp. 133-135.
- [12] Reframe It, <http://reframeit.com>, 07.18.2011.
- [13] Calameo, Publish and share documents, <http://www.calameo.com>, 07.18.2011.
- [14] Aapture, <http://www.aapture.com>, 07.18.2011.
- [15] C. Lin, F. P. Chu, H. A. Wang, and J. C. Ko, "An Interactive Multimedia Web Editor," In Proc. of 8th IEEE Fourth International Conference, IEEE Press, 2008, pp. 341-342.