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# Supporting Field Study with Personalized Project Spaces in a Geographical Digital Library

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**Abstract.** Digital libraries have been rather successful in supporting learning activities by providing learners with access to information and knowledge. However, this level of support is passive to learners and interactive and collaborative learning cannot be easily achieved. In this paper, we study how digital libraries could be extended to serve a more active role in collaborative learning activities. We focus on developing new services to support a common type of learning activity, field study, in a geospatial context. We propose the concept of personal project space that allows individuals to work in their personalized environment with a mix of private and public data and at the same time to share part of the data with team members. To support the portability of the resources in our digital library, the selected resources can be exported in an organized manner.

## 1 Introduction

### 1.1 Motivation

Compared to traditional libraries, information stored in digital libraries can be easily accessed without time and location restrictions. With the rapid growth of information in digital form, digital libraries are playing more and more important roles in our daily activities including study and research. On one hand, digital libraries have been rather successful in supporting these activities by providing users the desired information. On the other hand, the level of the support is passive to the users in many ways as illustrated below:

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- Digital library accesses is a standalone task separate from other applications or systems that support the remaining learning tasks. Often times, digital libraries provide very little or no interface mechanism to share services and content with the other applications and systems. The only exceptions are those that support some query and data dissemination services over the internet through the various protocols, e.g., Z39.50[7] and OAI[5]. Even when these services and content are available, they are usually made available only to other digital library systems instead of an integrated e-learning environment.
- Digital libraries are not designed to cater to the needs of the different learning activities. Unlike e-learning environments where different learning activities such as lectures, laboratory experiments, field studies, etc., provide structured experiences for student learning, digital libraries usually focus on a narrow set of generic tasks, i.e., cataloging/classifying content and metadata, searching and browsing. They are clearly inadequate to independently support the various learning activities.
- Digital libraries are less personalized to meet the learning needs of different users. A user centric or user group centric view to create, organize and deliver content and metadata is lacking in the existing digital library designs. This leaves an impression that digital libraries are created for a mass public and are not friendly to learning individuals and groups.
- Single-directional delivery of information in digital libraries prevents collaborative learning. In most digital libraries, information is delivered to the user upon users' queries including both browsing and searching. However most of the users are unable to share their findings with other users. One reason is that the information to be shared may not match the format requirement of the digital library. Another reason is that information needs to be carefully evaluated before it can be made available to other users.

### 1.2 Research Objectives and Contributions

In this paper, we adopt a holistic approach to design a digital library portal for supporting interactive and collaborative learning activities to address the above shortcomings of digital libraries. We introduce the concept of **personalized project space** to the design of G-Portal, a digital library portal providing both map-based and classification-based interfaces to geography metadata resources. We specifically describe the use of personalized project and its services in the field study learning activity. Within a user-owned personalized project, a specialized collection of metadata resources can be assembled from existing projects and freshly created to meet the needs of a field study project. The G-Portal services that are useful for field study include:

- Metadata resource gathering and creation for personalized projects;
- Classification and visualization of both geographical and non-geographical resources;
- Annotation of resources; and
- Exportation of project resources for report writing;

To justify the use of personalized project space in G-Portal, we examine a field study exercise that involves students studying beach erosion at the East Coast of Singapore. We will show that G-Portal personalized project services can support the various learning tasks in the field study, integrating them in a flexible manner.

### 1.3 Paper Outline

The remaining portions of the paper are structured as follows. Section 2 gives an overview of the G-Portal project as a whole. We introduce field study as a general learning activity in Section 3 . This is followed by a description of a personalized project and its services in Section 4 . In Section 5, a working field study example is given. Before the paper concludes in Section 7 , the work related to our project is surveyed (see Section 6 ).

## 2 G-Portal Overview

G-Portal is a Web-based digital library that collects and manages metadata of geospatial and geo-referenced resources on the Web and provides digital library services to access them [6]. The information maintained by G-Portal are mainly metadata records that describe raw resources, such as Web pages, images and other objects that are accessible on the Web. Other types of information managed by G-Portal include semi-structured data records and annotations. These metadata records, data records and annotations are known as *resources* in G-Portal.

Every resource contains among other attributes, a location attribute storing its geospatial shape and position, and a link to the corresponding raw resource if it is a metadata resource. For non-geospatial resources, the location attribute is left unused. Similarly, G-Portal leaves the link attribute unused for the semi-structured data and annotation records that do not have their corresponding Web-based raw resources.

All resources are stored as XML records, and we adopt a common basic resource schema specifying the set of basic attributes to be used for all resources. Other extended resource schemas can be derived from the basic schema to allow some controlled heterogeneities among resources by having each type of resources to include attributes in addition to the basic ones.

Annotations are special types of resources that store useful remarks or supplementary information about some other resources. Besides having all characteristics of ordinary resources, each annotation record contains the id(s) of the annotated resource(s). In other words, annotations provide a flexible mechanism to let users actively augment the existing resources within the digital library.

G-Portal organizes resources into projects where each project contains a collection of resources that are relevant to a specific topic or learning activity. Within each project, resources are further grouped into layers for finer grained organization. Each layer serves as a *category* to hold logically related resources. For example, a project for field study might include rivers, mountains and targeted objects of the study; the rivers and mountains can be grouped into *map* layer and other objects into another.

G-Portal provides a map-based interface that visualizes resources with geographical attributes on a map (see Figure 3). This interface makes resources with known geographical locations easily and intuitively accessible and helps users discover the spatial relationships between resources. Other user interfaces used to access resources in G-Portal include a classification-based interface that classifies and organizes resources into taxonomies and a query interface that permits queries on resources based on keywords and spatial operators.

## 3 Field Study Activity

In this section, we describe the tasks to be performed in a field study for the geography domain. The purpose is to examine the tasks before we present the G-Portal services supporting them in Section 5.

Field study refers to research conducted in the real environment where data are collected from live situations. Often times, field study is preferred over laboratory work because of the realism the former provides for learning of topics such as geography, history, business, etc..

Consider a field study for secondary school geography students. Before the field study is conducted, a teacher is responsible for:

- Defining clearly the field study objectives and tasks;
- Providing reading materials including reference books, maps, photos, etc.;
- Equipping the students with devices necessary for taking measurements in the field study task, and instructions of using these devices; and
- Briefing on the requirement of a field study report for final assessment.

Nowadays with much of the reading materials digitized, a digital library can host this information organizing it in a way convenient for searching and browsing throughout the field study. Since G-Portal can accommodate different projects, each representing an organized collection of resources, the reading materials for field study can be placed in a G-Portal project and thus be visualized, browsed and queried. While in a G-Portal project, the resources can be easily updated and probably be reused in other field study projects.

From the student's perspective, it is possible to:

- Read the materials and understand what to do in the field study;
- Learn to use the device(s);
- Make trips to the designated areas;
- Document the necessary measurements and notes;
- Analyze the data obtained; and
- Write a report with supporting materials.

Starting from accessing reading materials, students need to plan for the field study by knowing the designated field trip areas. A digital library providing a map view of the field trip areas and related geographical objects is essential. G-Portal clearly meets this requirement.

A field trip usually involves teams of students. Students in a team are expected to collaborate in data collection, data analysis, and report writing. To facilitate collaborative learning, a digital library should allow a new collection of resources to be constructed and maintained by each team of students, along with the one defined by the teacher. Services that facilitate resource creation, annotations, and customized resource organization will be extremely important. For example, a student team may need to compile a large list of references related to the field study task. The references include textbooks, reading materials given by the teacher, online information sources and others arranged in a topic hierarchy.

Furthermore, to prepare a good report, the selected resources including map and other geographical objects will need to be made available in an online report which can be a set of inter-linked Web pages documenting the field study findings. Such an online report can be made publicly available for general consumption.

A G-Portal project provides the excellent space for students to manage information. However, there are several limitations. The previous version of G-Portal assumes that project is created by experienced information experts. The project services are therefore not geared towards supporting individual or group learners.

In the following section, we will present the *personalized project management* module in G-Portal which offers hopefully most if not all answers to the requirements of a field study activity.

## 4 Personalized Project Management

The personalized project management module is a new extension to the project services of earlier version of G-Portal to provide better support to learning activities such as field study.

In G-Portal, a personal workspace is provided to each user (or group of users) to build his/her (or their) own collections of resources and annotations in form of personalized projects. A personalized project has the same basic attributes as any project in G-Portal including *name* and *description*. The unique attribute of a personalized project is the *accessibility*, which can be *private* or *public*. A private project is visible and accessible to the creator only and a public project is accessible to all the users.

Personalized project management module in G-Portal enables the users to create, manipulate, export and delete their own projects. Functions of the personalized project management module can be further classified into five groups:

– **Project Management**

To create a new project, user specifies the basic attributes of the project including *name*, *description*, and whether the project is *private*. The creator can also alter these attributes or delete a personalized project.

– **Layer Management**

Within a project, layers can be defined to maintain resources in different logical groupings. Properties including *name*, *description* and *type* (resource layer or annotation layer) are specified for each layer. Within a personalized project,

appropriate layers can be defined to group resources logically. Note that the layers and the assignment of resources to layers can only updated by the corresponding project owners.

– **Schema and Resource Management**

Every resource in G-Portal is created using a resource schema that serves as a template. In a personalized project, schemas can be user-defined to meet the needs of a learning activity for a user (or team of users). In a personalized project, resources are either entirely created by the user or copied from the other public projects, e.g. the master project created by a teacher for students' reference. In a collaborative learning setting, it is also quite likely to have multiple users exchanging resources among their personalized projects.

– **Resource Classification**

The resource classification function gives users the freedom to define the classification criteria to group resources under different categories deem relevant to the field study. In other words, the same resources could well be classified differently when they appear in different personalized projects.

– **Resource Presentation**

The resource presentation function allows users to configure the HTML representation of the resources when they are displayed within a personalized project. Note that the resources are stored as XML records in G-Portal. By customizing the resource presentation, users of the personalized project can decide to format the resource content appropriately.

– **Personalized Project Export**

By providing each user a personalized workspace in G-Portal, the management of the resources (information) becomes much easier for each learning activity. Nevertheless, if the access to personalized project is always confined to the G-Portal server, there will be several serious shortcomings. Firstly, G-Portal server will always be the bottleneck for data access especially in cases where high speed network access to the server is not available. Secondly, users will find it extremely difficult to extract the personalized project content for report writing. To make the resources much more portable, G-Portal provides a project export module, which can: (i) export all resources in the project to one or more Web pages that can be easily saved to a local storage device; (ii) export the resource organization information, i.e., the layers and the schemas; and (iii) export an Applet as the map-based interface and for accessing the resources. All these Web pages exported are stored in a zip file downloadable from the G-Portal Web server.

## 5 A Working Example

In this section, we discuss the field study support in G-Portal using a working example. We consider a field study of beach erosion at the East Coast Park (ECP) area in Singapore. East Coast beach is a popular recreation spot for Singapore residents as it has a long swimming area, well located eating places, and several other water sports facilities. Nevertheless, this beach has been prone to erosion as sea waves

wash away large amounts of the beach sand which must be regularly replenished with new sand.

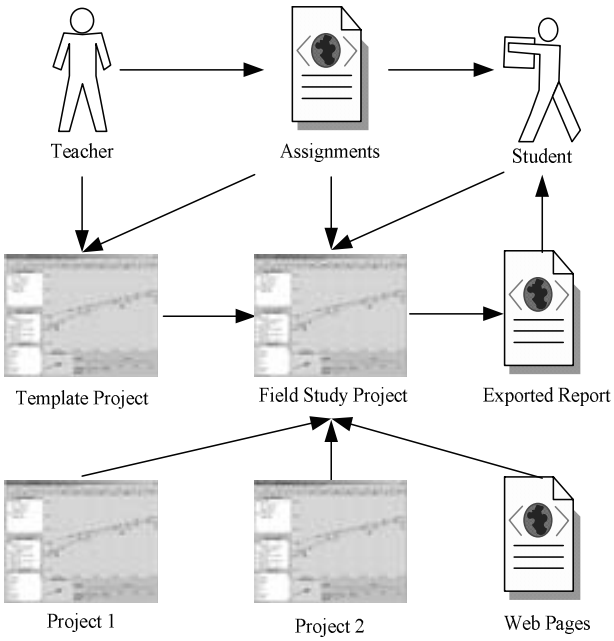


**Fig. 1.** Sample Field Study Process

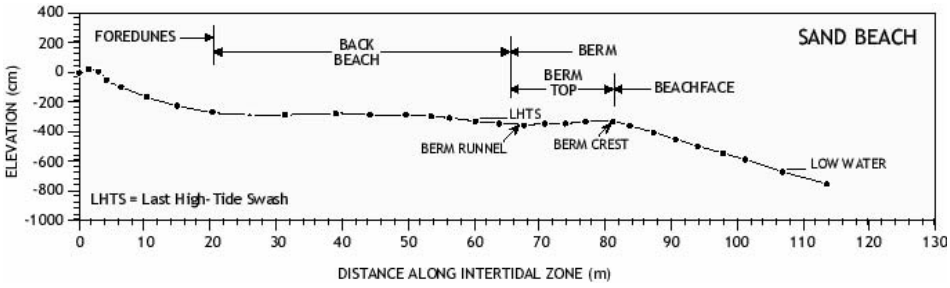


**Fig. 2.** A Sample Beach Profile

The objectives of the beach erosion study are: (i) to understand what beach erosion is and what causes beach erosion; (ii) to assess current state of the beach; (iii) to compute a rough rate of erosion based on historical records; and (iv) to document the process of field study and findings. The devices used in beach erosion study are: transit rods; line; sight marker; GPS device; and a digital camera [8]. The GPS device is used to locate the beach profiles[1] where the previous measures have been taken. The digital camera is to visually document the current state of the beach that is being assessed. A sample beach profile is reproduced[2] in Figure 2.

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[1] A beach profile is a cross-section taken perpendicular to a given beach contour; the profile may include the face of a dune or sea wall; extend over the backshore, across the foreshore, and seaward underwater into the near shore zone.

[2] Available [online] http: //response.restoration.noaa.gov/shor_aid/profile.html

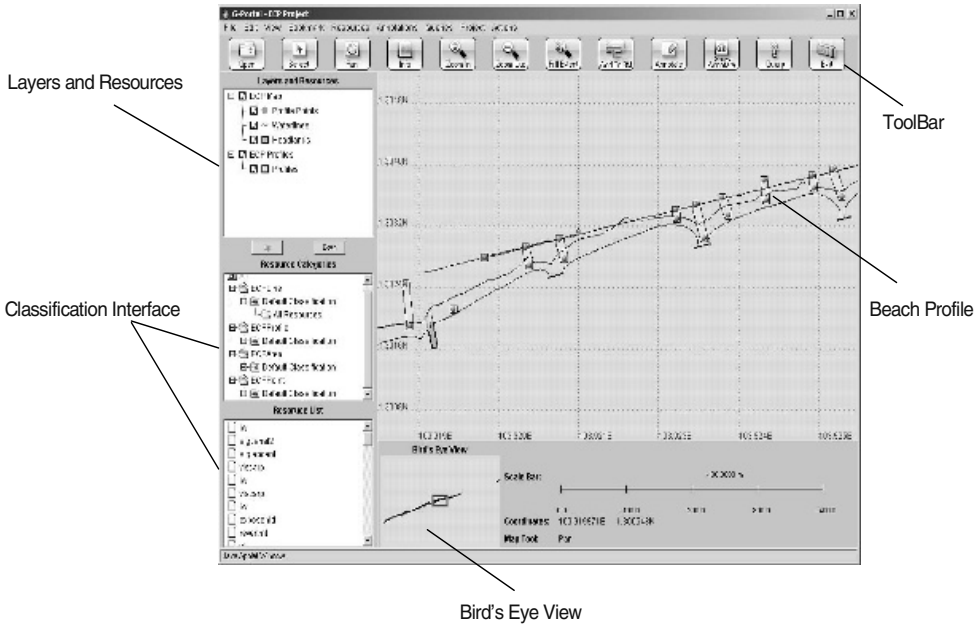


**Fig. 3.** G-Portal coastline study master project

As discussed in Section 3, essential information including instructions for measuring beach profiles, instructions for using the GPS device, report format, etc., can be defined in an "assignment" Web page (see Figure 1). This assignment serves as a raw resource in the *master project*. The master project, shown in Figure 3, provides the students the map of the beach to be accessed, the GPS positions of the beach profiles and so on. Each of the beach profiles is associated with a Web page known as a profile description. A profile description provides photos taken at the point to help the student locate the point, historical records, and other supporting information. This master project is accessible by all the students.

Students create their own field study projects in G-Portal as their personalized project workspaces. Recall that in G-Portal, layers and resources from existing projects can be easily added to a personalized project. Students may selectively add resources from the master project or other relevant projects (e.g., similar field study projects done by another group of students) in G-Portal. These resources could be map objects and profile descriptions. The assignment Web page can be added to the personalized project for easy reference.

When all measurements are collected, the newly collected data can be added to the field study personalized project as resources or annotation to existing resources. For example, a student can create a Web page to contain each photograph taken at the beach, define the corresponding metadata resource in the personalized project describing the photograph, and provide a link from the metadata resource to the Web page. This Web page then serves as a raw resource in the field study project.

To prepare a field study report, the resources in the field study project can be exported to Web pages for easy analysis and reference. This is done by using the resource presentation and project export functions of personalized project. In the report, different map-based and classification-based visualization of the resources will

be needed in the different report sections. G-Portal allows these different visualizations to be exported. On the other hand, a completed field study report may be also added to the field study project for future reference.

Due to the large number of beach profiles, each student (or each group of students) may be required to assess only a small number of beach profiles. By sharing the field study projects, the report and the findings of each student (student group) are accessible by the teachers and all the other students.

## 6 Related Work

Despite the great success of personalization systems in many areas (e.g., Amazon.com), personalization in digital library has yet been well supported.

Giacomo *et al.* proposed a personalized service for digital libraries named MyLibrary [3]. It provides digital library users (as individuals or groups) with personalized shared Web environment, recommender system integration, Web link checking mechanism and tools that extend the functionality of Web browsers. However, it has been commented that MyLibrary focuses on applying basic personalization and rudimentary recommender systems in a reasonably straightforward way and does not really add much value to the digital library [2].

A personalized information environment (PIE) for the digital library is proposed in [4] and the personalization is considered in two stages: material personalization and collection personalization. Material personalization is to provide facilities to use the digital library materials according to the user's personal requirements such as active reading and information gathering. Collection personalization is designed to provide facilities such as personalized retrieving and filtering based on both the user's interest and the user's working context. Nevertheless, interactive and collaborative learning are not supported in PIE.

CYCLADES envisages a digital library not only as an information space in which individual users may search for and organize the information, but also as a collaborative meeting place of people sharing common interests [1]. It provides personalized services such as notification and recommendations, which are lacking in G-Portal. However, G-Portal is also unique in that it has an exporting function and other standard DL services such as annotation and classification that can be seamlessly applied to personalized projects.

## 7 Conclusions

Digital libraries have been successful as information sources for learners. Nevertheless, the support of interactive and collaborative learning has not yet been achieved. In this paper, we show that learning activities can be supported in the G-Portal digital library using the concept of personalized project space. We first give an overview of G-Portal and its key concepts followed by a detailed discussion on the personalized project functions in G-Portal. We show that a common type of learning activity, field study, in a geospatial context, can be supported using the personalized

project management. The process is illustrated with a working example. We believe that one of the most interesting functions in personalized project management is exportation. Exporting resources from a project to a set of Web pages while preserving the resource organization gives the users great flexibility in using the resource independent of the G-Portal digital library. The development of this exportation function is currently ongoing. As a part of future work, we would like to examine other types of learning activities and extend the G-Portal functions to meet the corresponding requirements. We would also like to evaluate the personalized project management and its usefulness in supporting field study.

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## References

[1] H.Avancini and U.Straccia. Personalization, collaboration, and recommendation in the digital library environment CYCLADES. In *Proceedings of IADIS Conference on Applied Computing*, Lisbon, Portugal, March 2004.

[2] J.Callan, A. Smeaton, M. Beaulieu, B., P.Borlund, P. Brusilovsky, M.Chalmers, C.Lynch, J.Riedl, B.Smyth, U.Straccia, and E.Toms. Personalisation and recommender systems in digital libraries, May 2003. Joint NSF-EU DELOS Working Group Report Available[online]: http: //www.ercim.org/publication/ws-proceedings/Delos-NSF/ Personalisation.pdf.

[3] M.Di Giacomo, D.Mahoney, J.Bollen, A.Monroy-Hernandez, and C.M.Ruiz Meraz. Mylibrary, a personalization service for digital library environments. In *In Proceedings of Joint DELOS-NSF Workshop on Personalisation and Recommender Systems in Digital Libraries*, Dublin, Ireland, June 2001.

[4] C.Jayawardana, K.P. Hewagamage, and M.Hirakawa. A personalized information environment for digital libraries. *Journal of Information Technology and Libraries*, 20(4), December 2001.

[5] C.Lagoze and H.Van de Sompel. The Open Archives Initiative: Building a Low-Barrier Interoperability Framework. In *Proceedings of the First ACM+IEEE Joint Conference on Digital Libraries (JCDL 2001)*, Roanoke, VA, USA, 2001.

[6] Ee-Peng Lim, Dion Hoe-Lian Goh, Zehua Liu, Wee-Keong Ng, Christopher Soo-Guan Khoo, and Susan Ellen Higgins. G-Portal: A Map-based Digital Library for Distributed Geospatial and Georeferenced Resources. In *Proceedings of the Second ACM+IEEE Joint Conference on Digital Libraries (JCDL 2002)*, Portland, Oregon, USA, July 14–18 2002.

[7] C.A. Lynch. The Z39.50 Information Retrieval Standard. *DLib Magazine*, April 1997.

[8] Phyllis E. Rumpp and George W. Rumpp. Measuring beach profiles. Available[onine]: http: //mciunix.mciu.k12.pa.us/~seastar/beachdir.html.