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Design and Development of Library and Information Science Learning Object (LISLO) Retrieval System

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Abstract

The paper outlines the opportunities that Learning object has put forward for teaching and learning. Focusing on a particular aspect of learning object retrieval system i.e., design and develop the mechanism of learning object on library and information science learning object (LISLO) using open source software (Greenstone) and open standards (IEEE LOM), the paper discusses about the online and offline CD ROM product and services of LISLO. It enhance modified IEEE LOM metadata incorporation for digital archiving and retrieval system using Greenstone Metadata schema (GEMS).

Keywords: Digital Library; Learning Object; Learning Object Metadata; Learning Object Metadata Standards; IEEE LOM Standard.

Introduction

Internet and Web provide us a comprehensive multimedia-driven platform for knowledge communication. Digital libraries are major application entities of Internet and Web technologies. These are considered as next generation library services. In simple words, Digital libraries are managed collections of digital objects. These entities enable the creation, organization, maintenance, management, access to, sharing and preservation of digital knowledge bearing objects or document collections. Learning objects are the entities of digital learning system. Digital learning objects are accessible from anywhere, by anyone, at anytime, in any format and in any language. The term "digital library" has been culled from the literature by (Fox,1998), and their spirit is captured in the following brief characterization: A collection of digital objects, including text, video, and audio, along with methods for access and retrieval, and for selection, organization and maintenance of the collection. According to the Digital Library Federation (DLF, 2009) definition, "Digital libraries are organizations that provide the resources, including the specialized staff, to select, structure, offer intellectual access to, interpret, distribute, preserve the integrity of, and ensure the persistence over time of collections of digital works so that they are readily and economically available for use by a defined community or set of communities". The DELOS Digital Library Reference Model (Candela...[et al.], 2009) defines a digital library as: An organization, which might be virtual, that comprehensively collects, manages and preserves for the long term rich digital content, and offers to its user communities specialized functionality on that content, of measurable quality and according to codified policies. Akscyn and Witten, (Akscyn and Witten, 1998), views digital libraries as "organized collections of digital information," and wisely recommends that they articulate the principles governing what is included and how the collection is organized. The digital libraries, digital archives, institutional repositories and learning objects repositories are also products of advanced research in the areas of ICT and information storage and retrieval system (ISARS). With the advent of Information and Communication Technologies (ICT), libraries are increasingly attempting to digitize learning object for perpetual access (long time preservation as well as access) and thereby make digital learning object more productive to the LIS

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community. In India, a number of institutions already have initiated digitization projects and programmes that will later integrate into digital library or digital repository systems.

Learning Object

With the growing number of e-resources, it has become imperative for information professional to redefine their role in disseminating information to the users due to information explosion on library and information centers. (IEEE 1484.12.1–2002) In this Standard, learning object is any entity, digital or non-digital, that may be used for learning, education, or training Learning objects are also known as digital objects, knowledge objects, educational objects, instructional objects, intelligent objects, reusable learning objects, data objects. The learning objects, like, self-learning study materials, tutorials, exercises, assignments, case studies, project reports, dissertations, theses, articles, seminar presentations, conference papers, audio-visual materials, etc. are essentially used by the open and distance learners in their learning process.

The advantages of digitizing learning objects are as follows (Deegan and Tanner, 2002):

- The qualitative learning objects can be shared by learners of different programmes within open and distance learning (ODL) institution;
- The qualitative learning objects can be shared by learners of different ODL institutions within or outside the country;
- The learning objects would be made available to the cross sections of the learners;
- The learning objects would be made available to learners of different ODL institutions;
- Duplication of efforts of preparing self-learning study materials can be minimized;
- Duplication of final projects, dissertations, theses of learners can be restrained;
- Creativity and innovation of the learners can be ignited when they see others' works; and
- Visibility and prestige of the ODL institutions, which initiate learning objects repositories, would be increased.

Learning Object Metadata

Learning Object Metadata is a data model, usually encoded in XML, used to describe a learning object and similar digital resources used to support learning. The purpose of learning object metadata is to support the reusability of learning objects, to aid discoverability, and to facilitate their interoperability, usually in the context of online learning management systems (LMS) as well as learning object digital repository / library. The IEEE 1484.12.1 – 2002 Standard for Learning Object Metadata is an internationally-recognized open standard (published by the Institute of Electrical and Electronics Engineers Standards Association, New York) for the description of "learning objects". The drafting of the IEEE Learning Object Metadata is contributed by (an international consortium) IMS Global Learning Consortium.

- Learning Object Metadata (LOM) is a metadata standard to describe educational resources
- The IEEE Learning Object Metadata (LOM) standard specifies the syntax and semantics of Learning Object Metadata, defined as the attributes required to fully / adequately describing a Learning Object. Learning objects are defined here as any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning.

The features of Learning Object Metadata are

- In web based learning, the trend is to encode learning materials with meaningful and machine understandable metadata in order to facilitate modular and reusable content repositories.
- Learning object metadata is usually represented in XML or RDF format.
- Metadata is used not only in searching and acce ss to the learning object repositories but also in reusing learning object materials and learning objects aggregation.
- Learning object metadata is the base of most operations on learning objects.
- Learning object repository stores both learning objects and their metadata in two different ways
- Storing them physically together
- Learning Objects and their metadata stored separately
- Most Learning Object Repositories are actually learning object metadata repository in which every metadata includes the link to the learning object resource (content is somewhere else).

The standards of Learning Object Metadata are

Instructional Management Systems Project (IMS), Advanced Distributed Learning Initiative (ADL) and SCORM, Alliance of Remote Instructional Authoring and Distribution Networks for Europe (ARIADNE), Dublin Core Metadata Initiative, IEEE Learning Technology Standards Committee (LTSC) Learning Object Metadata- IEEE 1484, Canadian Core Learning Object Metadata (CanCore), World Wide Web Consortium (W3C), METADATA. The available LO metadata standards application profiles are ADL SCORM, ARIADNE, SingCore, UK Curriculum online, Australian Learning Federation, Standard (IEEE / ISO) and others. In this context, the existing Learning Object Repositories are CAREO (Campus Alberta Repository of Educational Object), GEM (Gateway to Educational Materials), JA-SIG (Java in Administration Special Interest Group), and MERLOT (Multimedia Educational Resource for Learning and Online Teaching).

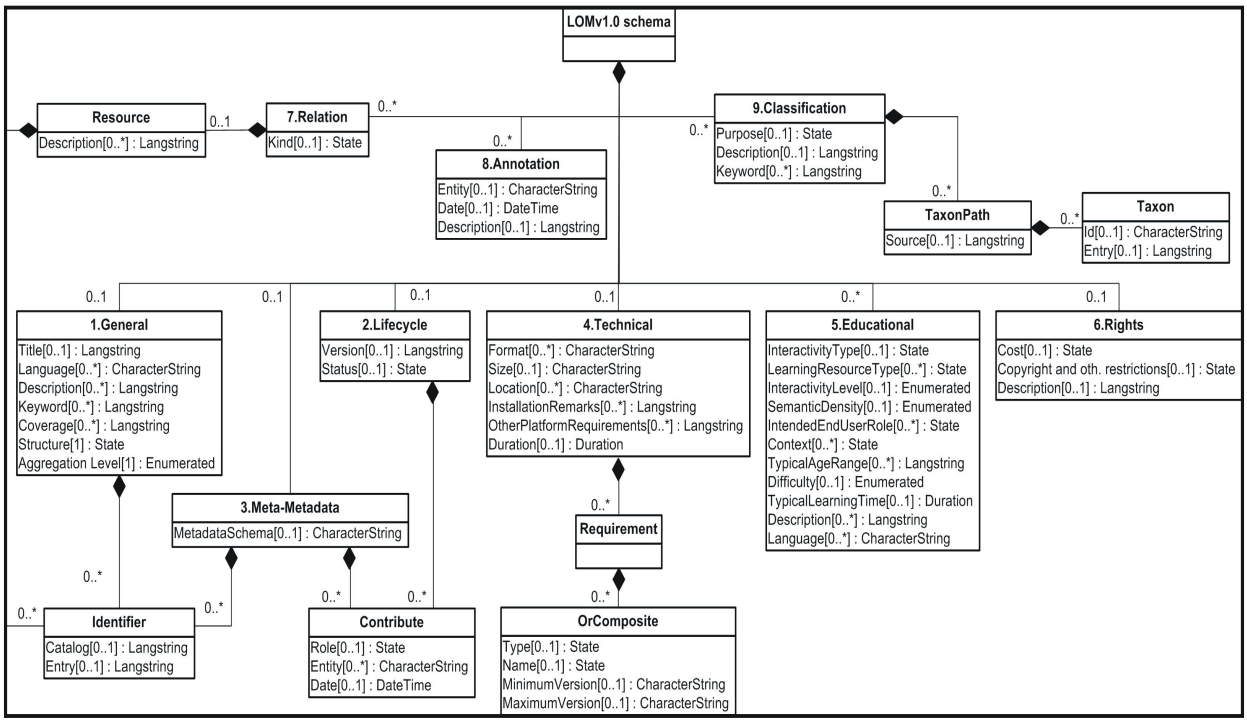

Chart 1: Elements of IEEE LOM (source-IEEE LOM)

All the data elements of IEEE 1484.12.1 – 2002 LOM Standard (IEEE LOM, 2002)) are represented here in chart 1. A detail description of each IEEE LOM element is available in the project website.

IEEE LOM Standard consists 65 simple data elements with additional container elements. The IEEE LOM standards divided into 9 categories. These are general, lifecycle, meta-metadata, technical, educational, rights, annotation, classification. The schematic representation of the hierarchy of elements in the LOM data model () is represented in Figure-1.

The IEEE LOM Application Profile needs to be modified to suit the requirements of this project. A simple but robust set of data elements has been created by using GSDL metadata element set (GEMS) tool. The modified elements set given below (Table-1)

This project deals with the Design and Development of web integrated services dealing with Learning Object (LO) in Library and Information Science (LIS) entitled LISLO. The main purpose of this work is to provide offline information (CD - ROM) to the Community of LIS to solve their availability of course material. This work is to be useful to students, library professionals, research scholars and information scientists.

Greenstone is a suite of software for centralized building and distributing digital library collections. It provides a new way of organizing information and publishing it on the Internet or on CD-ROM. Greenstone is produced by the New Zealand Digital Library Project at the University of Waikato, and

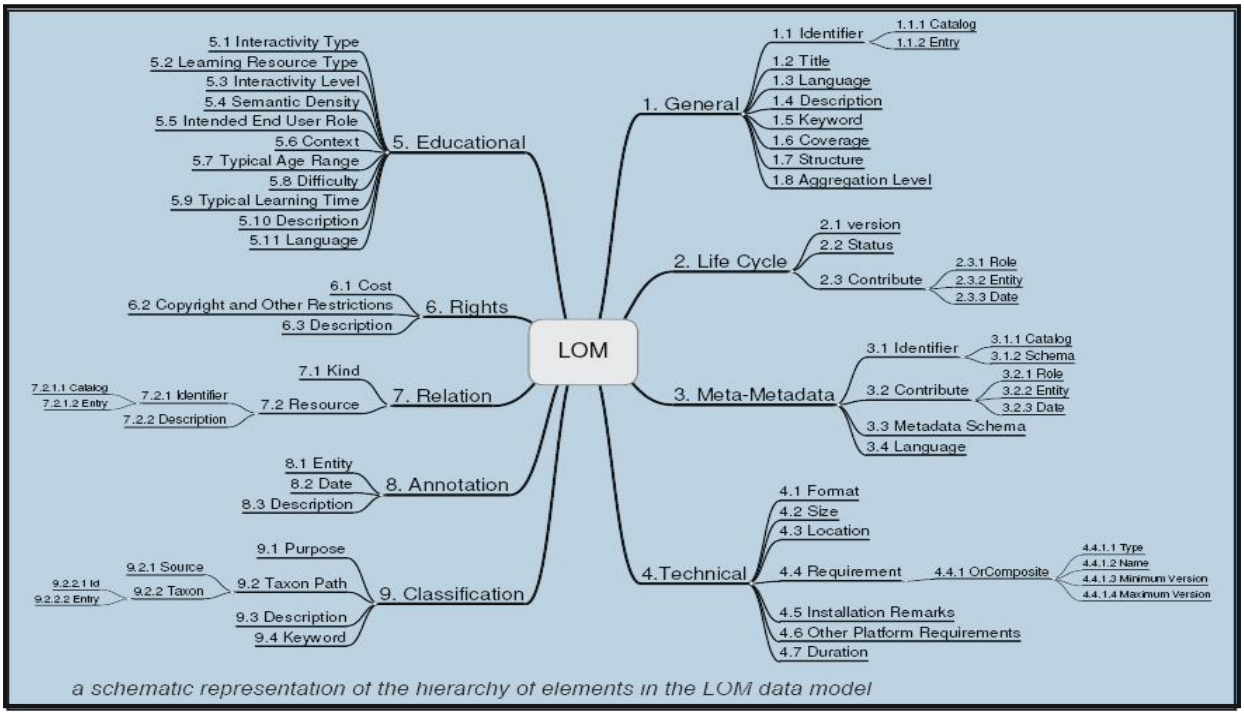

Fig.1: Schematic representation of the hierarchy of elements in the IEEE LOM data model (Source-IEEE LOM)

Table 1: Modified Elements of IEEE LOM

Element Name	Description	Source	Mandatory?	Searchable?
Contributor	Right of the LO	lo.Contributor	Mandatory	No
Course Title	Course title of a paper	lo.CourseTitle	Mandatory	Yes
Course Number	Number of a paper	lo.CourseNumber	Mandatory	No
Block Title	Block title of LOs	lo.BlockTitle	Mandatory	Yes
Block Number	Number of a block of a paper	lo.BlockNumber	Mandatory	No
Unit Title	Unit title of LO	lo.UnitTitle	Mandatory	Yes
Unit Number	Number of a unit title	lo.UnitNumber	Mandatory	No
Keywords	Subject & Keywords of LO	lo.Keywords	Mandatory	Yes
Language	Language of LO	lo.Language	Mandatory	No

developed and distributed in cooperation with UNESCO and the Human Info NGO. It is open-source software, available from http://greenstone.org under the terms of the GNU General Public License.

Objective

The objectives of this project work are as follows:—

- To design and develop the mechanism for LISLO through the application of open sources software (GSDL) and open standard.
- To export the LISLO Products on CD-ROM for offline access.

Hypothesis

To design and development of LISLO in CD-ROM compatible format is user-friendly access mode for digitized LO Information resources through the integrated use of—

- Greenstone Digital Library Software (GSDL) as Digital Media Archive (DMA) software ;
- Apache as Web server ;
- Browsers as client software ; and
- Locally modified IEEE LOM as metadata elements sets.

Research Design and Methodology

To enhance the accessibility of knowledge, Indira Gandhi National Open University (IGNOU) has initiated a Digital Repository named e-Gyankosh to share its valuable resources with educational institutions and learners internationally. eGyanKosh is a National Digital Repository to store, index, preserve, distribute and share the digital learning resources developed by the Open and Distance Learning Institutions of IGNOU in India and powered by DSpace. Items in eGyanKosh are protected by copyright, with all rights reserved by IGNOU, unless otherwise indicated. To access the items in repository registration is required (Figure-2).

Registration is free. In, (IGNOU) have deposited total number of 30515 digital learning resources till 23rd June, 2012. In, e-gyankosh, Bachelor of Library and Information Science (BLIS) [163], Certificate in ICT Applications in Library (CICTAL) [44], Master's Degree in Library and Information Science (MLIS) [184] from three learning object (Total=391) (excluding theses, streaming video) are downloaded. The total number is 352. But few LO of e-gyankosh are not available at the present time. These non available course materials are MLI002 (Block1, 2, 3), MLI005 (Internet Resources), MLI006 (Content Development, Content analysis), Library Classification Theory (Approaches to Library Classification, unit9.pdf), Current Awareness Services, MLI007 (Block2, Programming in specific languages), MLIE105 (Informetrics & Scientometrics), MLIE106 (Public Library Systems and Services), Library Management (Block3- Human Resource Management, Block4- Managerial Quality & Leadership, Block5- Organisational Behaviour). e-gyankosh is searchable by search including advance search facilities, browsing by titles and authors. For conducting this study, the search facilities of LO used extensively by search (including advanced search), browse by course title, block title, a-z lists (unit title) and the CDROM product will install necessary

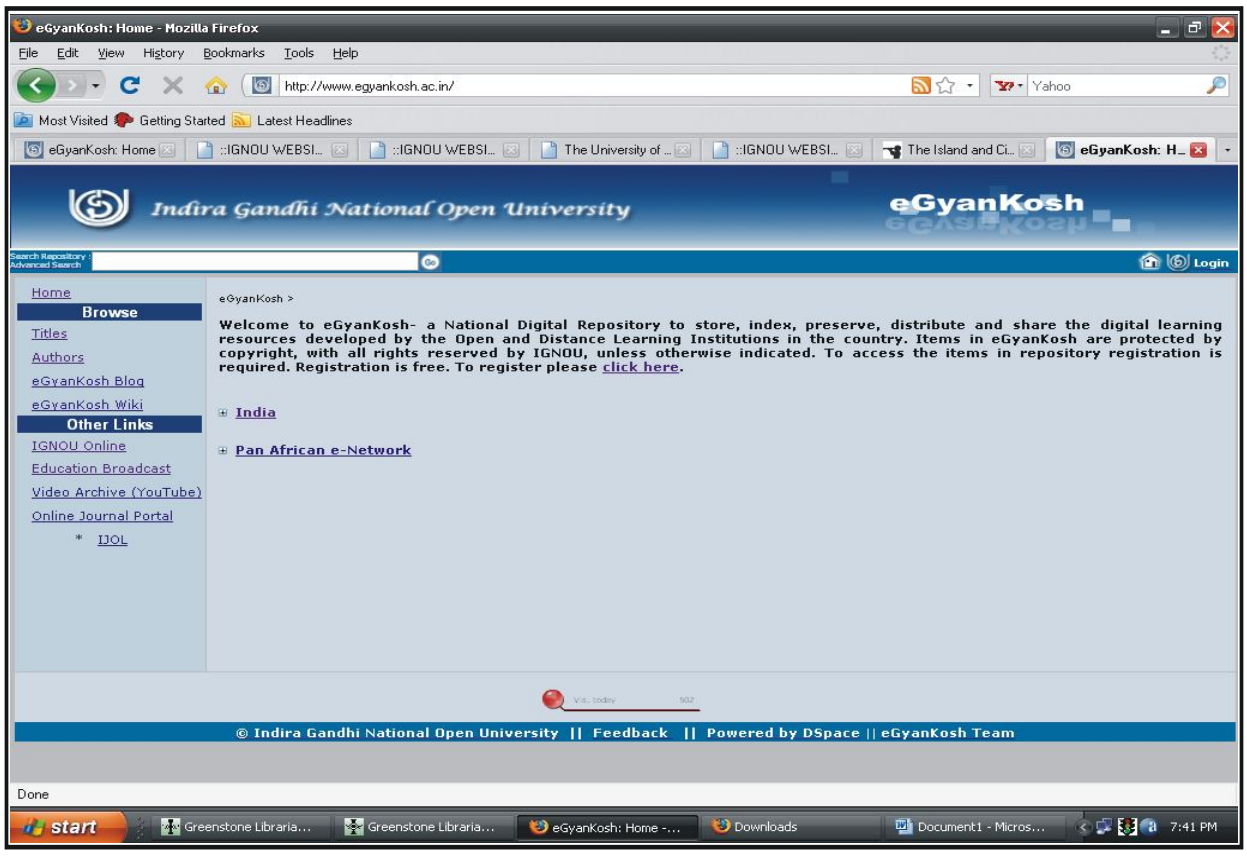

Fig.2: Homepage of e-gyankosh

retrieval programs and web browser (Open source web browser) into the standalone PC accessing by any user. The retrieval program of GSDL will seek data from the CDROM against user queries. To design of this project, IEEE LOM Application profile (locally modified) is applied as metadata elements sets using Greenstone Editor Metadata Set (GEMS). This research project utilizes Greenstone Digital Library software (GSDL), as DMA software, and Greenstone Librarian Interface (GLI), as a tool for designing a searchable and browsable information product available on optical storage media. The five basic tasks that are involved for building the product are as follows-

- ★ Gather Storage of LO resources in LIS
- ★ Enrich Encoding each object through modified IEEE LOM schema
- ★ Design Controlled indexing of DLO resources
- ★ Create Building of the collection on LO in LIS
- ★ Format Designing user interface for searching and browsing

The methodology for successful implementation of the above mentioned design issues will be as follows—

Group I: Installation and Configuration of the System

- ★ Installation of Apache webserver;
- ★ Installation of Java runtime Environment;
- ★ Installation of Greenstone Digital Library softw are; and
- ★ Linking of Apache and GSDL for web based access.

In this step, GSDL and its prerequisites software are already existed in LAMP (Linux, Apache,

Mysql, Perl which is already included in GSDL) architecture machine.

Group II: Creation of Metadata

- ★ Creation of modified IEEE LOM metadata using Greenstone Element Metadata Set (GEMS)

Group III: Collection Development

- ★ Decision on scope and coverage (Includes LO (BLIS, CICTAL, MLIS) of IGNOU learning materials from egyankosh);
- ★ collect and storage of PDF formatted LO in LIS from egyankosh into a folder on local drive

Group III: Collection Organization

- ★ creation of a digital learning database entitled "LISLO"
- ★ Uploading the pdf formatted LIS LO in Local storage space through GLI;
- ★ Incorporation of metadata (modified IEEE LOM) in GSDL through GLI using Enrich tab;
- ★ Design of the user interface by search (Course Title, Block Title, Unit Title, Key Word, Full Text) and browser (Course Title, Block Title, A-Z lists of Unit Title);
- ★ Designing of display format;
- ★ Testing and debugging;
- ★ Checking and verification of the product;
- ★ Exporting to CDROM.

Snapshots of Group II

Creation of modified IEEE LOM element set:

In this process, the following steps are:

1. creation of modified IEEE LOM metadata eleme nts set using Greenstone Editor for Metadata Sets (GEMS);
2. adding the element by right clicking on modified IEEE LOM metadata schema;
3. shows the addition of element entitled "Contribute";
4. element additions in modified IEEE LOM schema;
5. saving the modified IEEE LOM Schema

Group III: Collection Organization

The following steps are as follows:

1. creation of a new collection entitled "LISLO" and the descri ption about Library and Information Science Learning Object;
2. gathers the three folders (BLIS, CICTAL, and MLIS) from local drive;
3. data incorporation of modified IEEE LOM metadata;
4. designing step, MGPP is selected as advance search engine within Green stone LISLO digital collection;

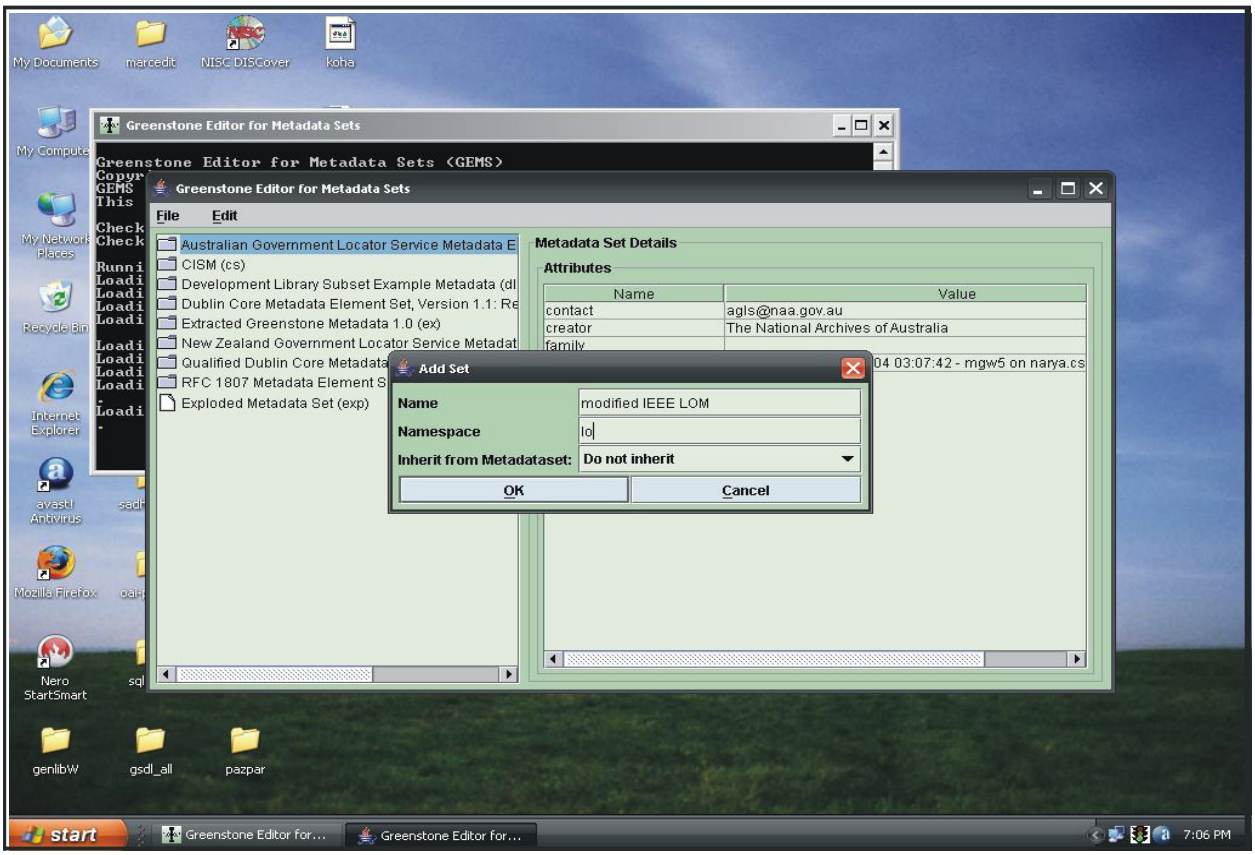

Fig. 3: creation of modified IEEE LOM metadata elements set using Greenstone Editor for Metadata Sets (GEMS)

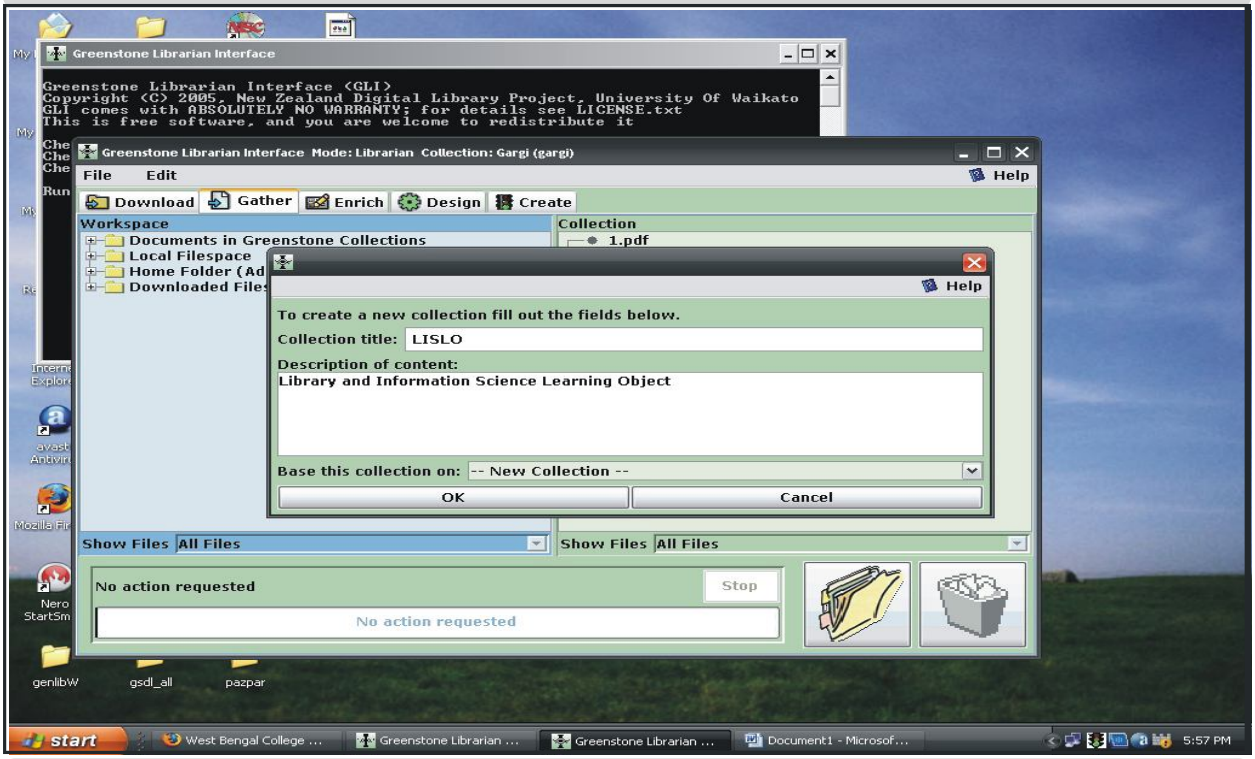

Fig. 4: creating a new collection entitled LISLO and the description about Library and Information Science Learning Object

5. managing the search indexes by lo.BlockTitle "Block Title", lo.CourseTitle "Course Title", lo.Keyword "Keyword", lo.UnitTitle "Unit Title", text "Full Text";
6. creation of browsing classifier by classify AZCompactList -metadata lo.CourseTitle, classify Hierarchy -metadata lo.BlockTitle -sort lo.UnitTitle - buttonname "Block Title", and classify AZList -metadata lo.UnitTitle - buttonname "A_Z Lists";
7. display format creation;
8. selection of modified IEEE LOM metadata;
9. testing the various search results from LISLO collection and modification.

Various steps are showed in snapshots as follows:-

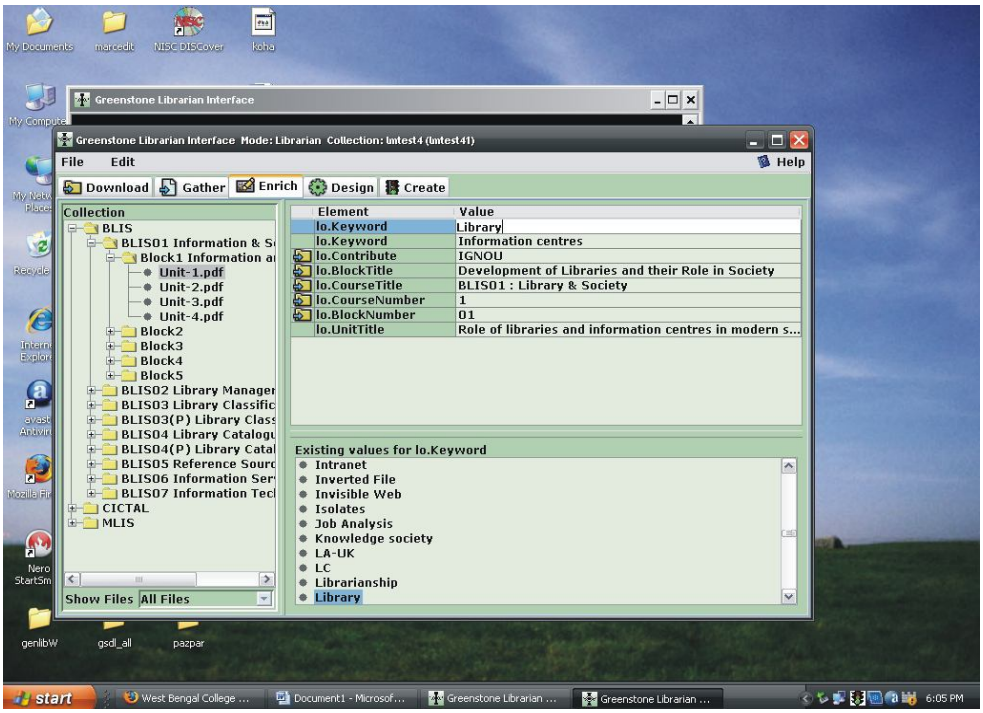

Fig. 5: Data incorporation in modified IEEE LOM metadata

Database Design

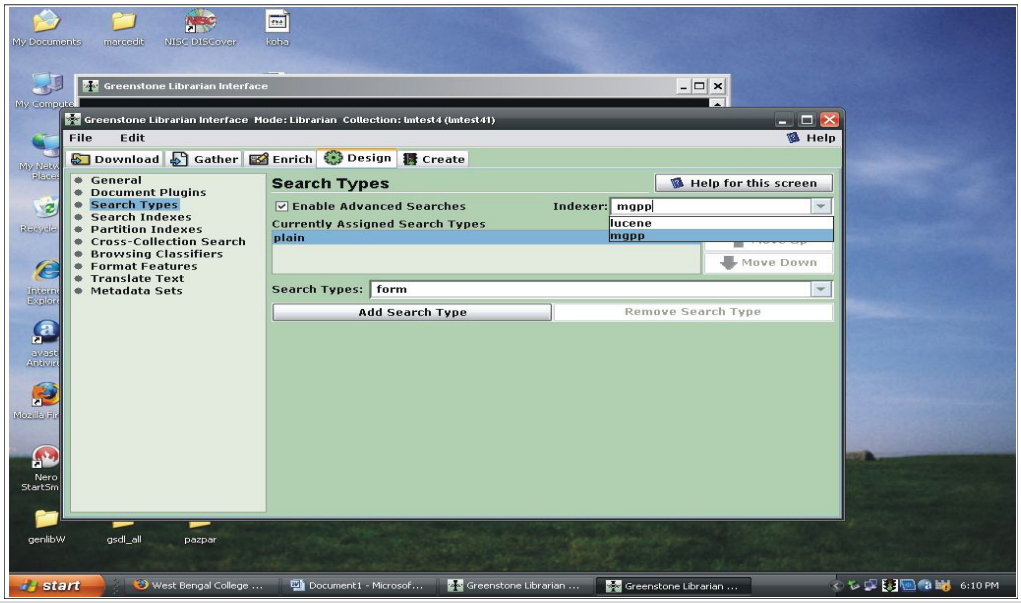

Fig. 6: MGPP is selected as advance search engine within Green stone LISLO digital collection

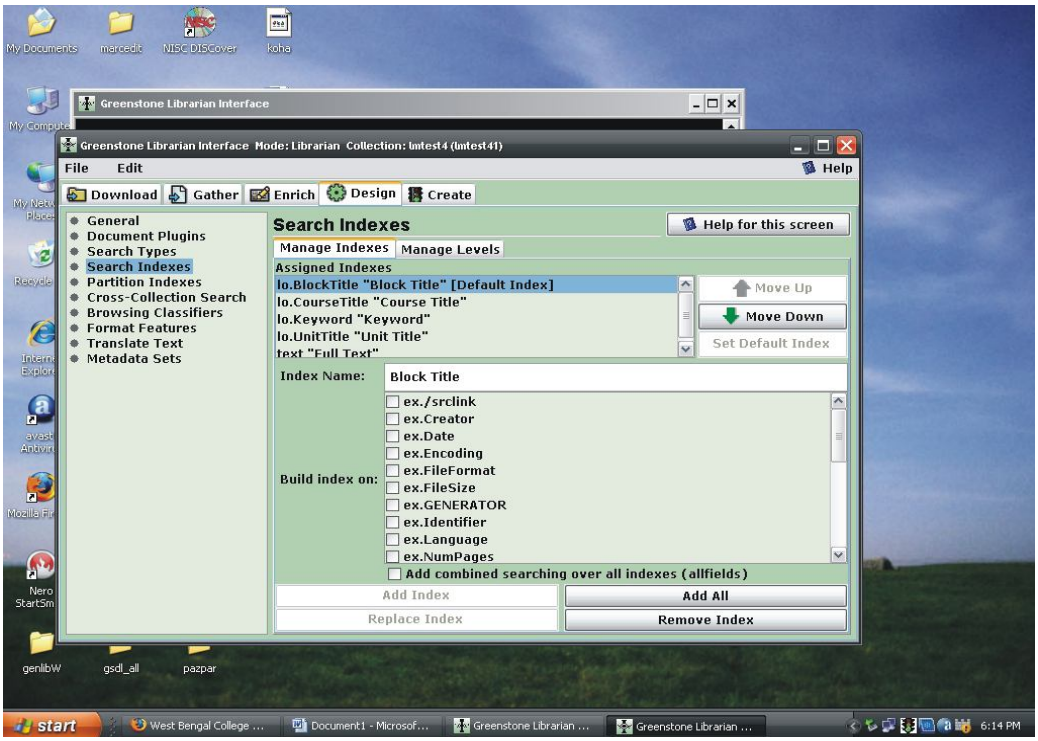

Fig. 7: Ddesign of search indexes by lo.BlockTitle “Block Title”, lo.CourseTitle “Course Title”, lo.Keyword “Keyword”, lo.UnitTitle “Unit Title”, text “Full Text”

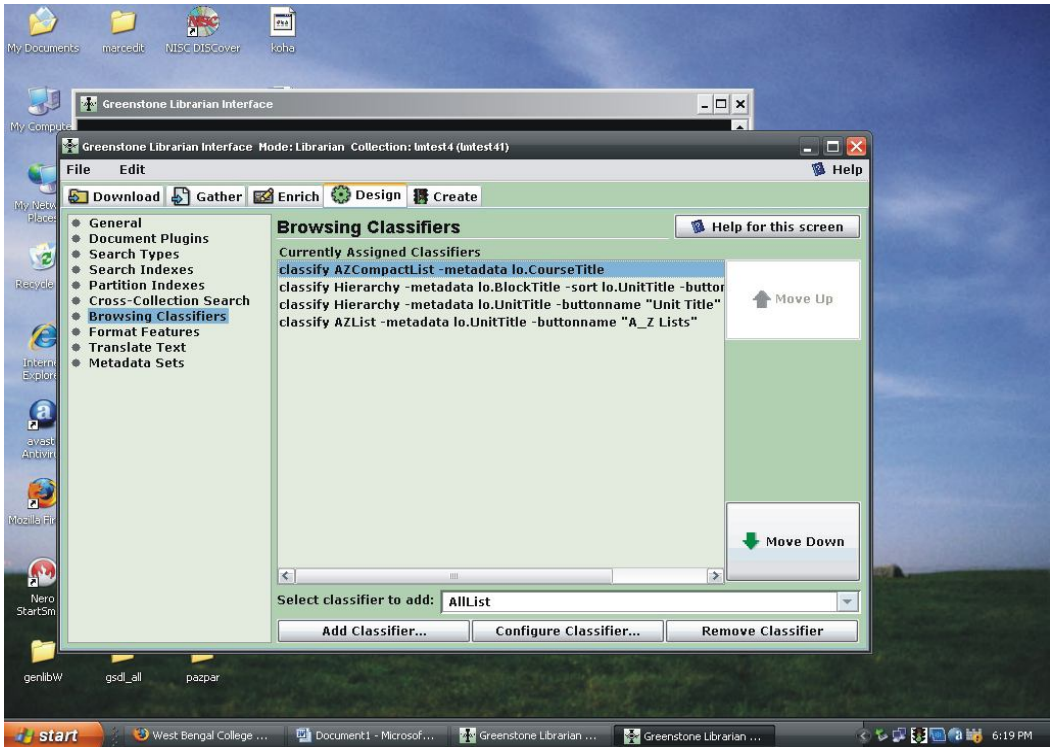

Fig. 8: Design of browsing classifier by classify AZCompactList -metadata lo.CourseTitle, classify Hierarchy -metadata lo.BlockTitle -sort lo.UnitTitle - buttonname “Block Title”, and classify AZList - metadata lo.UnitTitle -buttonname “A_Z Lists”

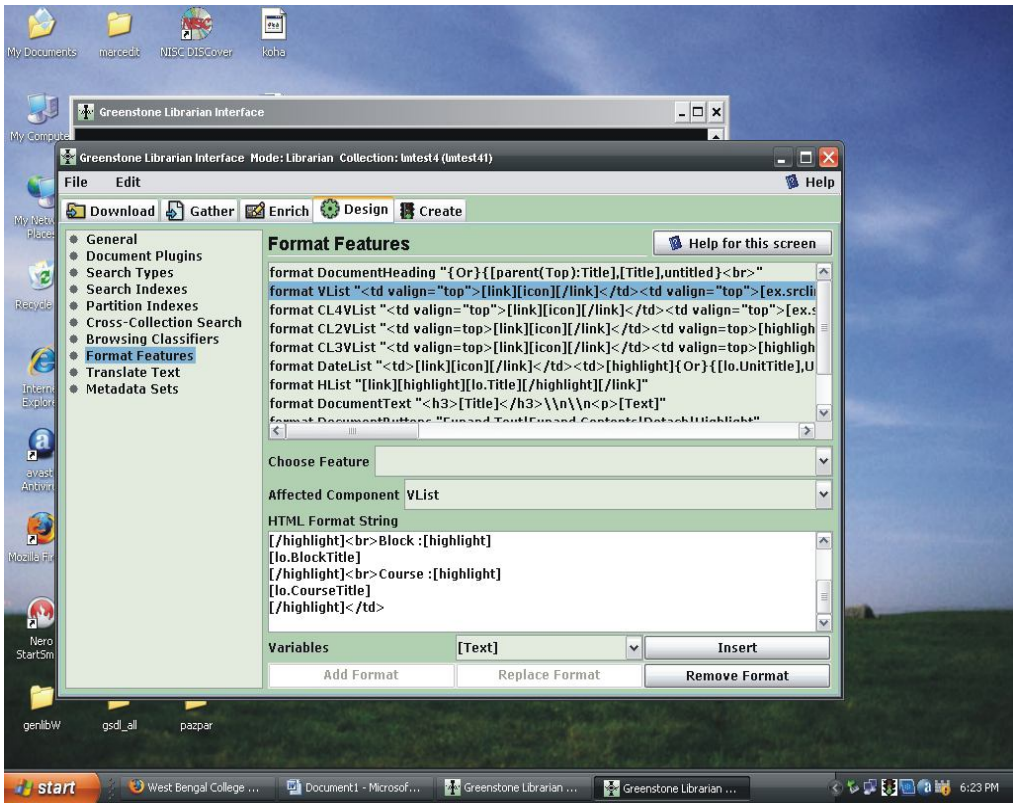

Fig. 9: Design of display format

Fig. 10: Search results of LISLO collections

Conclusion

Digital libraries are very important sources of structured well-organized and well-stored information. Next generation digital libraries will supply a comprehensive range of services on network. The information professional has to keep constant watch for new developments and noticeable changes in the field of their concern. Greenstone is a comprehensive software system for creating digital library collections. It builds data structures for searching and browsing from the material provided, rather than relying on any hand-crafting. Browsing is based on modified IEEE LOM metadata. Browsing is controlled by "classifiers" that process metadata into browsing structures (by course title, block title, a-z list by unit title). Further research on multilingual digital learning object, multimedia based learning object, interoperability and crosswalk of learning object standards is essential for the establishment of successful digital learning object library system.

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