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Development of Domain Specific Cluster : An Integrated Framework for College Libraries under the University of Burdwan

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Abstract

The paper discusses the development of six domain specific cluster software in the college libraries under the University of Burdwan. Library is the heart of educational institutions. So, as to select the open source relevant with comprehensive software and global parameters on the basis of global recommendations like IFLA-Working Group, Integrated Library System for Discovery Interface (ILS-DI), Request for Proposals (RFP), Request for Comments (RFC), Service Oriented Architecture (SOA) and Open Library Environment Projects (OLE) including the areas like integrated library system cluster, digital media archiving cluster, content management system cluster, learning content management system cluster, federated search system cluster and college communication interaction cluster for designing and developing the college libraries under the University of Burdwan. Also develop the single window based interface in six domain specific cluster for the college librarians and the users to access their necessary resources through open source software and open standards. These six domain specific cluster softwares are to be selected for easily managed the digital and library resources in the college libraries affiliated to the University of Burdwan. This integrated framework can easily managed the housekeeping operations and information retrieval systems like acquisition, cataloguing, circulation, member generation, authority control, report generation and online public access catalogue for the users as well as library professionals also.

Keywords : Domain Specific Cluster ; Integrated Framework ; Single Window base Interface ; Integrated Library System

1.0 Introduction

College libraries of any type or size are now struggling with the processes of organizing, storing and dissemination of digital and print resources in an integrated environment (Morgan, 2002). Moreover, the advent of digital resources and Web 2.0 technologies recently raised a new challenge for college libraries which are generally characterized by limited resources and inadequate technical manpower (Mukhopadhyay, 2008). In short, a typical college library under UGC system is now expected to manage library automation, portal for e-journals (mainly available through N-LIST programme of INFLIBNET (UGC) (Tseng, Poulter & Hiom, 1996) and open access journals), digital asset management (curricula, question papers, digital learning objects, digital scholarly resources produced by institute, institutional reports etc.), learning content management system (as a platform for learner-teacher interaction through a digital teaching-learning-evaluation system); and interactive communication and interaction setup for institutional members (Blogs, Wikis, Discussion forum etc.) (Mukhopadhyay, 2006). All these resources and services require to be integrated in a single-window user interface for efficient retrieval through content management system (Weber, 2004). Apart from these requirements, college libraries need to handle regional language based information retrieval system for managing multilingual information resources (Henley, 1970).

As a whole, rules of the game are changing rapidly and fundamentally. Automation of college libraries cannot alone handle growing user expectations and demands of the authority (Open Library Environment, 2009). In fact, the concept of information management and retrieval system in academic setup is changing more rapidly than the college libraries are changing to meet it. For example, recently, DLF-ILS Discovery Internet Task Group (ILS-DI) developed a set of Technical Recommendation for library software (Digital Library Federation, 2008). This set of recommendation is playing a pivotal role in setting up modern academic libraries. The recommendations are framed in view of the variations in user demands and developments in ICT. As per these recommendations library software systems should – i) improve discovery and use of library resources; ii) support a clear set of expectations (framed systematically) for users (end users and power users) and developers; iii) be open and extensible for recommendations applicable to existing and future system requirements; iv) support interoperability, inter-operation and cooperation; and vi) be responsive to the user and developer community. In other words, college libraries of this country are trying to balance with growing user demands, increasing expectations from authority, new recommendations from global agencies, new tools/services on one hand and limited resources, inadequate technical manpower, highly priced software, non-standard application tools on the other hand. Obviously, this is a kind of uneven battle for college libraries. The only chance of fight it back is to use judiciously open contents, open source software and open standards in designing and developing college library systems for integrated management of dissemination of information resources (Stueart & Morgan, 1998).

Under such circumstances, this research study aims to develop an integrated information management and retrieval system for college libraries affiliating to the University of Burdwan on the basis of demand survey for requirements. The integrated framework will be based on global set of recommendations as far as standards; workflows and users services are concerned. Although, the integrated information management and retrieval system will be designed primarily on the basis of requirements of college libraries under the University of Burdwan, but the design architecture will be crafted carefully so that the integrated system framework can be extended to college libraries in general.

1.1 Review of Literature

The next generation integrated library management and retrieval system is one of the important elements for the college libraries. The next complete persons living time complete list connections attempting to turn quality example got mixed together library systems (ILSs) into more quick and strong look for flat structures that offer more user-friendly 2.0 things giving greater value to for users. One of the ways of use prudently an investigation is to review the related literature and work done by the previous researchers to build upon a solid foundation of the concerned topic has been taken up for investigation. In recent drastical change of World technology for automated and digital library system, but these can't predict the next biggest development. In order to study the said topic critically and to make the clear idea, it is highly indispensable to review literature to place the undertaken research in proper perspective. A literature review surveys scholarly articles, academic journals, conference proceedings, reports, books, Internet resources, global recommendations, request for proposal, request for comment, open library environment project, digital library federation, ILS-DI recommendation, IFLA-Working Group recommendation and dissertations and also thesis etc. relevant to a particular issue, area of research, theory providing descriptions, summary, and critical evaluation of each work. The objectives is to give an overview of significant relevant literature published on the nature of the problem.

Archana, Padmakumar & Beena (2014) observed that since 2000, the Central Library of Cochin University of Science and Technology (CUSAT) has been changed their library operation from manual system to automated library system by some closed source software i.e. Adlib library. After 11 years, in 2011, the authority of the university resolved to change to an open source software (OSS), for integrated library management system (ILMS) and thus they selected the Koha which is the best open source software for automating the library housekeeping operations and information retrieval. Traditional models of libraries offering information services are not working for current generation of students. The current generation of library users can be termed as 'digital natives'. These digital natives have grown up in an environment surrounded by rapidly evolving technologies. This means that today's academic library users think about technology and information differently than previous (Musangi, 2015). India has over 500 University Libraries and over 26,000 College Libraries. "Only 35% of the Universities and Colleges located in the urban cities, seems to have completed the computerization of their libraries. Lack of budget, infrastructure and skilled manpower, traditional attitude, bureaucracy, etc. are some of the reasons for non-computerization of libraries" (Chandrakar & Arora, 2009).

"Academic libraries include school, college, university and research libraries. All these cater to the needs of academic community for supplementing the study and research programmes of the institution and help conserve and disseminate knowledge. Although these academic libraries share certain common features and characteristics, they differ enormously in the value and content from one another" (Sahai). Academic libraries do not exist by themselves; they exist to serve the objectives of the education system of which they form a part."

Mondao & Sinha (2011) reflects the modern college library is conceived as a genuine service unit. It supplies materials for developing and expanding interests. Though its reference tools, indexes, bibliographies and catalogues both manual and computerized, the realm of knowledge may be explored. The library cooperate with other agencies or

institutions of instruction in helping students learn to use books and libraries, to find information, and to study. By its bulletin exhibits, posters and atmospheres, the library teaches informally. Mukhopadhyay (2000) discusses the software up-gradation is a continuous process. A critical study of development of LMS over the years suggests that LMSs may be divided into four generations on the basis of their facilities for integration and interconnectivity. Hopkinson (2009) discussed the library automation has developed in the industrialized world over the last 25 years and progress in developing countries cannot be separated from trends worldwide. However there are different criteria for success in developing countries which are brought out in this review. Pandey & Singh (2011) Koha is an open source software in integrated library system with comprehensive functionality including fundamental or advanced options. Koha includes modules for acquisition, cataloguing, serials control, patron management and more. Biswas (2008) discussed the NewGenLib is the open source integrative library management web enabled architecture. Rai & Kumar (2011) discussed in the year 1994, libraries commenced to show their presence in the cyber world by establishing their own web sites, and later on, the web became a component of LMS systems but this magnification was very slow and steady in developing countries. The ILS also provides a discovery interface (commonly known as the Online Public Access Catalog or "OPAC") that enables patrons to probe for resources (ILS-DI, 2011). Haravu (2009) reflect the SOA is an architecture philosophy into several generic accommodations. Workflows, an accommodation utilization model and protocols and schemas are defined. Hodgson (NISO 2012) Librarians have apperceived and fortified, long afore the dawn of computers, the desideratum for standards to avail in accumulation management, share resources with other libraries, and ameliorate access for library patrons. Sudhamaniks (2010) discuss about the two softwares such as Koha and NewGenLib. These software provides advanced modules like cataloguing, acquisition, circulation, serial control and OPAC in alibrary automation. Zico (2009) this paper implement a puissant and flexible integrated library system, fortifying the academic, research and administrative desiderata of all academic members including students & faculty and to utilize Koha, which is an open source software. Morshed (2008) discusses the BRAC University's Ayesha Abed Library is not equipped with adequate software, which can access books from different branched, and procedures within BRAC University itself. This proves to be a problem for students and people within BRAC who could benefit within BRAC University.

Mukhopadhyay (2008) discussed the automation of library housekeeping operations is considered as an especially critical area from which future benefits will emerge. ICT is an invention of direct pertinence to libraries prime concern – the acquisition, storage and exploitation of cognizance as recorded in documents of all kinds. Guy (2000) identifies the key roles of national libraries in terms of acquisition, retention, preservation and providing access to materials are considered, first of all in terms of printed materials and then in terms of electronic materials. Omekwu (2007) this paper aims to explore the traditional and emerging roles of cataloguing professionals in a global network information environment. That exploration becomes even more critical in view of migration of information resources into digital, electronic and virtual domains. Cataloguers have key roles in knowledge segmentation, identification, organization and authentication. Vaglio & D'Urso (2008) discusses the fundamental staffing changes in libraries have become possible as a result of technical developments. Lubetzky redefined the objectives of catalogue as proposed by Charles Cutter in 1876 and as modified by Paris Principles in 1961 (Svenonius, 2000). Therefore, these two groups of function in library catalogue require control over access points. Authority control is an umbrella term for the technical processes related with authority works and aims to achieve control over the variant forms of access points. The purport of

ascendancy control in an automated library setup is to achieve consistency and uniformity in bibliographic files and to reduce divergence and diversity. Ascendancy control is an extravagant and time-consuming process in libraries of any type or size. Veve (2009) discusses proliferation of articles in different multidisciplinary journals on the theory and application of the FRBR conceptual model, but little has been indited about its obverse for ascendant entities: the Functional Requisites for Ascendancy Data conceptual model (FRAD). The usefulness of this FRAD-predicated ascendancy file in cataloging manuscripts is evaluated and presented.

Willson & Given (2010) technology can often correct spelling errors, the involute tasks of information probing and retrieval in an online public access catalog (OPAC) are made more arduous by these errors in users' input and bibliographic records. The work focuses only on those open source LMS packages which are available on the web for download freely and still releasing their updated versions and aims to discuss the OPAC module in those packages to trace the features and characteristics with special reference to searching and online services provided through web interface of the said packages. The comparative study is made from the review of earlier studies, information from the web-pages of the LMS packages and hands-on practice in local installation done (Sarma, 2016). Ahmad (2014) reveals the objective of this study is to highlight the library software awareness with special focus on OPAC Vs card catalogue among the users of Indian Institute of Technology (IIT) Delhi, IIT Kanpur, and Kashmir University. The study also highlights the features of LibSys and Virtua software used by the select libraries. Web 2.0 thrives on network effects: databases that get richer the more people interact with them, applications that are smarter the more people use them, marketing that is driven by user stories and experiences, and applications that interact with each other to form a broader computing platform. According to O'Reilly's (2006) about web 2.0:

"Web 2.0 is a set of economic, social, and technology trends that collectively form the basis for the next generation of the Internet—a more mature, distinctive medium characterized by user participation, openness, and network effects".

Colleges are also using Web 2.0 outside of the instructional context. Campus administrators and police harvest information from online discussions and postings to monitor possible illegal activities and to keep a finger on the pulse of the campus. Tufts University combined Google's mapping technology with institution of higher education (IHE) information to create a mashup complete with "satellite images, informative links, [and] category searches" in order to provide "a resource that enables prospective and current students, staff, faculty, campus visitors, community members, and others to explore the campus online and locate buildings and services" (Campus Technology 2006). At Penn State University, cellphone text messaging services now quickly and easily send announcement to students according to their own preferences (Carnevale 2006). Meanwhile, the dining services at other institutions such as Marywood University, Purdue University, and Berkeley College employ Web 2.0 platforms in Web-based kiosks where "students can use a touch screen and check their meal plan balances, see the day's menus, or even send a special dietary request or feedback to the dining director. A password and log-in system lets them create nutritional charts for themselves and track nutritional intake throughout the day" (Esposito 2006). Baladrón...[et.al] (2010) discussed the Internet world, the tags Web 2.0 and utilizer centricity have been utilized in recent times to reflect the democratization about the Web for the end users are no longer passive entities and have postulated a key role in which they used the content management system for the users in library. This study explored the impact of Web 2.0 on the effectiveness of service delivery in academic libraries in Kenya. Data for the

study were collected through an analytical survey of the web platforms of nine academic libraries in Kenya (Gichora & Kwanya, 2015). This article traces the development of subject gateways from 1999 till 2013 and critically studies the longest surviving subject gateways. It shows that the most critical feature expected of a subject gateway, i.e., evaluation of resources prior to selection, is missing in majority of the subject gateways (Kanetkar, 2014). Moreover, most of the library software use Z39.50 client to get information from Library of Congress and withal Iranian National Library. Consequently, none of them could exchange data between each other because of not utilizing server side accommodation. The proposed model endeavors to introduce harvesting metadata by OAI accommodation provider and withal probing the metadata records by SRU client-server architecture (Hafezi, 2008). Cousins & Sanders (2005) middle ware is one of the important tool to provide access by information retrieval protocol Z39.50 server and it also support the virtual online cataloguing both for users as well as librarian. To consider issues arising from the cross-database search process and the quandary of interoperability between systems. Middle ware was acclimated to establish a Z39.50 server for a subsisting virtual cumulation catalogue, InforM25. The Copac physical amalgamation catalogue was habituated in different cross-database searching tests, investigating the value of query transformation by the middleware and interoperability in cross-database searching in multiple database. Hakala (2003) this paper analyses the impact these changes have, or should have, on the roles of national bibliography databases. As regards the Internet access, support for Z39.50 is seen as essential in order to enable copy cataloguing. Cataloguing of Web resources is analysed from the point of view of traditional library systems, information retrieval portals and digital object management systems. Gatenby (2002) discusses the deficiencies of search engines and the importance of metadata before examining three models of metadata retrieval: distributed; distributed data with a centralized index; and centralized union catalogues. In listing of advantages and disadvantages of the distributed model, the Z 39.50 protocol is used as an example. Daniel & Dominic (2011) explains about the intrusion detection operating system and its prevention for Linux environment, the host base intrusion detection ; intrusion prevention system, design and implementation of the system and its components etc., the common process of scanning attack in the process of monitoring the system and its methods; sniffing attack with the network interface; spoofing attack- prevention module and its sub modules with Dataflow diagram and graphical representation etc.

Dunsire & Willer (2010) this paper describes the recent initiatives to make standard library metadata models and structures available to the Semantic Web, including IFLA standards such as Functional Requirements for Bibliographic Records (FRBR), Functional Requirements for Authority Data (FRAD), and International Standard Bibliographic Description (ISBD) along with the infrastructure that supports them. The FRBR Review Group is currently developing representations of FRAD and the entityrelationship model of FRBR in resource description framework (RDF) applications, using a combination of RDF, RDF Schema (RDFS), Simple Knowledge Organization System (SKOS) and Web Ontology Language (OWL), cross-relating both models where appropriate. Vastrad...[et.al] (2011) describes how federated search avails the users to find resources across library accumulations. Federated search is essentially for utilizing the parallel search and advanced search, as far as possible, the search facilities already offered by each library resource. Federated probing, withal kenneed as meta probing, broadcast probing, cross probing, and a variety of other denominations, is the competency to probe multiple information resources from a single interface and return an integrated set of results. McDonald & Thomas (2006) describes in 1990 the concept of World Wide Web is an important and essential for enabled architecture in the research libraries and discussed the two content management system

software like Drupal and Joomla reference the developmental history of ILSs to discuss the limitations of the current ILSs, the unavoidable transformation these systems are facing, and some aspects or features that the next-generation ILSs are expected to contain (Li, 2014). The revolutionary change which took place in Information and Communication Technologies (ICTs) has dramatic effects on modern education system and the way universities carry out their functions of teaching, learning and research, particularly on the creation, storage and dissemination of knowledge (Mane & Panage, 2015).

Learning management system can preserve to minimize by reducing learning administration costs. “The value proposition of a LMS is cost-efficient training administration” (Brennan, Funke & Anderson, 2001, p. 9). The LMS cannot, however, support content sharing and the attendant savings realized through the utilization of learning objects nor can it provide the same level of learning control of cognition. Bhat & Mahesh (2014) discussed the fifth generation is based on computer oriented informations are involved electronic information through Internet tools and techniques. There are several forms and types of electronic resources which are available in the cyber world. Some of the well known ones that are gaining ground are the electronic journals, standards, technical designations, reports, patents, article (fulltext and browsing), trade reports, and hosts of other document sources. This paper presents the findings of a survey about the cognizance and utilization of electronic resources by medicos available in the medical institute libraries. Boss & Nelson (2005) discussed the emergence of federated search implements for the library market represents a consequential step toward the longstanding goal of a prevalent probing interface in the reference environment. These systems aim to provide integrated access to library documents and searching the indexing part of a particular resources. Leong & Chennupati (2014) discussed the Online exhibitions are web-based multimedia information systems, which were came into existence with technological advances in computer processes, communications, multimedia, and the introduction of internet.

The obtainment to literature review was the browse method where print and electronic sources were visually examined, read and digested, probing for some pertinency, congruousness and usefulness of the topic at hand. Browsing the printed materials such as journals, periodicals, books, conference papers, annual reports, newsletter, newspapers and theses, would reinforce and reinforce the researchers substratum of the subject matter. The used of information retrieval implements such as OPAC, abstracts, indexes and bibliographies sanctioned more preponderant insight of the subject in a effective and efficient way to managed the documents in a library. Among the online databases and e-journals probed were LISA, Emerald, Ebsco Host, D-Lib Magazine, Libri, Ariadne and the websites/homepages of many peregrine digital libraries. Predetermined keywords used during the search were digital library, virtual library, e-library, hybrid library, digital library initiatives, digital library quandaries, digital library research, digital accommodations, digital reference, resource sharing, distributed information resources, Astute Property Rights, digitization, online databases, dematerialization, born digital materials, information surrogates, digital objects, information revolution, library automation, library systems, hybrid library, cyberian, information professionals, digital librarian, ecumenical access, repositories and interoperability.

1.2 Background of the Study

A library plays a crucial role in confirming the success of higher education. Indian higher education is now considered as one of the largest in the world. The challenge is to

make our higher education system as the finest one. This challenge cannot be met without the help of libraries as information support entities. In the domain of undergraduate studies, college libraries are responsible to support teaching-learning-evaluation activities. The library services need to change in view of the increasing use of ICT in disseminating education (such as Virtual classroom project, development of SWAYAM as MOOCs platform in India, services of Consortium for Educational Communication under UGC, e-Pathshala programme of NCERT, e-PG pathshala of INFLIBNET, NPTEL etc) and changing needs of the learners and teachers.

The 25th Five-year Plan (2012-2017) document (chapter on Higher Education) proposed a set of innovative and revolutionary recommendations to strengthen higher education in India. Some of the relevant recommendations may be reported here to support theoretical foundation of this paper (see http://planningcommission.gov.in/plans/planrel/12thplan/pdf/12fyp_vol1.pdf):

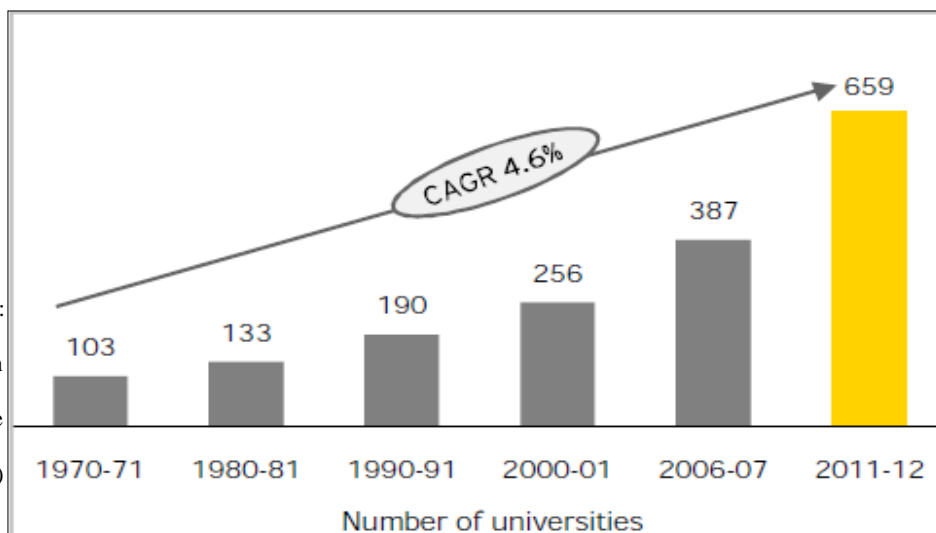
- To establish meta university framework to promote inter-institutional collaboration and designing of innovative interdisciplinary programs. This framework would encourage the use of Massively Open Online Courses (MOOCs) and access to content, teaching and research support for all the members of a network;
- To use ICT in education and to create open-access content repositories including interoperable institutional repositories for user content and networks; implementing single portal for all content and DTH channel initiatives;
- To encourage Indian college and universities to shift from the current annual examination system to semesters with choice-based credit system (CBCS), comprehensive and continuous evaluation and regular revision of curricula to ensure updated and relevant curricula; and
- To develop platform to create subject-specific curricula and re-usable digitized contents for students to create a knowledge repository.

These are only a few key recommendations of the Government for the current five year plan (2012-2017) but the shifting of focus is very much clear from the guidelines such as establishment of informal and umbrella educational institutes like meta university (it may be reported here that the first meta university in India is a distance educational institute called IGNOU), extensive use of ICT in teaching-learning-evaluation, establishment of national educational repository, utilization and development of open educational resources and research materials and making curricula more future friendly and realistic. All of these guidelines required a paradigm shift in college library systems and such a holistic approach cannot be supported by traditional library services operating in isolation. The need of the time is to design and develop integrated library services to support inclusive and joined-up educational systems.

1.2.1 Colleges under the University of Burdwan

There were only 20 Universities and 500 colleges in our country at the time of independence. Government of India earmarked a nine fold increase in funding on higher education during Eleventh Plan period. If we take into account the establishment of universities and colleges in the country, the picture is quite encouraging for the last decade (2000-01 to 2011-12) with Compound Annual Growth Rate (CAGR) 4.6% from the decade of seventy to 2011-12.

Fig. 1:
Growth of
universities
in India
Source:
FICCI
Higher
Education
Summit
2012 Report:
Higher
Education in
India -
Twelfth Five
Year Plan
(2012-2017)
and beyond



The affiliated colleges under universities are also increasing rapidly. The number of college libraries (each college has at least one library) under the university of Burdwan are also increasing and the latest datasets is given the table-1. These college libraries are divided into three sectors like government college libraries, government aided college libraries and private non aided college libraries. This research work has selected only government and government aided colleges under the University of Burdwan.

SL.	College Libraries Under the University of Burdwan	
	Nature of College libraries	No. of College libraries
1.	Government College Libraries	11
2.	Government Aided College Libraries	74
Total Number of Colleges libraries		85

Table-1: No. of College libraries under the University of Burdwan (as on 31.08.2016)

There are total 205 colleges have been enlisted in the Website of the University of Burdwan and in this research study only 85 colleges have been selected as in the said table 1.1. In this research work those 85 colleges belonging to both the Government and Government aided colleges under this University of Burdwan have been selected. A pre-defined questionnaire has been designed and circulated in the selected colleges. The questionnaire includes a set of questions related to expectations of library professionals in managing ICT-enabled library services and specific requirements in three major areas i.e. library automation, library digitization and supports for teaching-learning-evaluation. Although, the integrated information management and retrieval system framework has been designed primarily on the basis of requirements of college libraries under the University of Burdwan, but the design architecture is fine tuned on the basis of global recommendations (like ILS-DI project, OLE project and FOLIO project for SOA architecture for libraries). As college libraries in our state work in more or less similar environment, the results and products of this research study may easily be extended to cover college libraries working under other universities in the state.

1.2.2 Overview of Colleges in Districts

An analysis of college library locations shows that in Bankura district 2 Government

colleges and 21 Government aided colleges are operating under the University of Burdwan and in Birbhum district there is no Government colleges and only Government aided colleges are available in this district (16 in number). There are 23 colleges in the Burdwan District among them 3 colleges are Government and 20 colleges government aided. Hooghly district consists of 23 colleges among them 6 Government colleges and 17 colleges Government aided. Details of colleges under the university of Burdwan in different districts are given in the table – 2.

Sl.	District	Nature of Colleges	
		Government	Government aided
1.	Bankura	2	21
2.	Birbhum	---	16
3.	Burdwan	3	20
4.	Hooghly	6	17
Total number of colleges		11	74

Table – 2 : Overview of colleges district wise

1.3 Objectives of the study

In view of the background related to this research study and the context as represented through literature review, this research work centres on the following interlinked objectives:

(a) To study and analysis – i) requirements of college library systems under the University of Burdwan; ii) global set of recommendations related with the architecture and service requirements for academic libraries; and iii) global set of standards related with library automation, digitization and user services;

(b) To design an integrated software framework for accommodating different domain-specific software for performing basic as well as extended set of services as required for college libraries under the University of Burdwan and as recommended by relevant global agencies;

(c) To develop related service clusters for i) supporting essential library services (ILS cluster¹); ii) managing digital contents (DMA cluster²); iii) providing online teaching-learning-evaluation (LCMS cluster³); iv) facilitating institutional communication (CCI cluster⁴); v) extending federated search facilities (FSS cluster⁵); and vi) seamless integration of these service clusters in a content management system (CMS cluster⁶);

(d) To use open standards, open source software and open contents for designing the above-stated clusters and the integrated framework in Unicode-compliant environment (for

¹ ILS cluster: Integrated Library System cluster

² DMA cluster: Digital Media Archiving cluster

³ LCMS cluster: Learning Content Management System cluster

⁴ CCI cluster: College Communication and Interaction Cluster

⁵ FSS cluster: Federated Search System cluster

⁶ CMS cluster: Content Management System cluster

supporting multilingual document processing and retrieval with special reference to Bengali script) and to develop mechanisms for transferring the integrated framework as ISO image for easy implementation in target college libraries.

1.4 Statement of Research Problems

The research problem of this study is represented by a descriptive statement as below:

Designing and developing an integrated information management and retrieval system for college libraries under the University of Burdwan

A close examination of this descriptive statement shows that it is amenable to be converted into a set of interlinked questions and these are as follows:

- (i) What should be the mechanism to frame requirements for college libraries affiliating to the University of Burdwan? How to select sample libraries and to frame questionnaire for gathering required information? What should be the distribution and collection method? What global recommendations are to be considered for designing the framework? How to merge identified requirements and essential recommendations into a single list of design parameters?
- (ii) What should the method for design the basic cluster and domain-specific clusters on the basis of selected parameters? How components of the basic cluster can be selected and merged to provide platform for integrating domain-specific clusters? What should be the composition of clusters for different activities? How to select components of clusters in view of the recommended standards and required services? Is it possible to identify open source software and open standards for different domain-specific activities? What should be the mechanisms for grand unification of domain-specific clusters inside the basic cluster?
- (iii) How to develop mechanisms for federated searching to retrieve resources from different clusters through a single-window search interface? What should be the methodology for integrating federated search facility in user interface? How to enable Z 39.50 Client gateway and Server gateway including OAI/PMH based harvesting for developing interoperable library system? What should be the mechanisms for developing multilingual information retrieval in user interfaces, and multilingual data interoperability as subset of information management?
- (iv) In a post-development scenario, the most important question is how to port such a complex information entity into a product for easy use by target libraries. This research study aims to deliver a ready-to-use integrated software framework which can be utilized as-its-is basis by libraries that need it. In view of the foregoing the research questions are – i) how to develop a flexible open architecture to be useful for target libraries? ii) what mechanisms are required to transfer the integrated system as ISO image? and iii) how ISO file can be converted into a ready-to-install software system incorporating basic and domain-specific clusters?

1.5 Hypotheses

In view of the framed research questions in section 4, this research study banks on the following hypotheses –

(i) Request for Proposals (RFPs), Request for Comments (RFCs) and recommendations as proposed by DLF-ILS Discovery Internet Task Group (ILS-DI), Open Library project, FOLIO project etc. can be regarded as important input in setting up an integrated framework for college libraries in view of the ongoing and forthcoming changes; Moreover the demand survey for gathering requirements of college libraries working under the University of Burdwan may be helpful in fine tuning the parameters for designing and developing the integrated framework;

(ii) The basic cluster, which can accommodate six related domain-specific clusters (ILS cluster for managing basic library operations and Web 2.0-enabled OPAC services; DMA cluster for archiving/dissemination of digital resources; LCMS cluster for extending facilities for online teaching-learning-evaluation; CCI cluster for facilitating institutional communication and interaction; FSS cluster for developing single-window federated search interface; and CMS cluster for organizing and retrieval of resources available inside these five clusters), may be developed in an open platform and by using domain-specific open source software and related open standards;

(iii) Interoperability may be achieved through standards like Z 39.50, SRW (Search Retrieve Web), SRU (Search Retrieve URL), OpenSearch protocol, ZING (Z 39.50 for Next Generation) and open source software like YAZ toolkit; On the basis of these globally agreed upon interoperability standards including OAI/PMH and OAI/ORE, this research study may include Federated search mechanism to ensure single-window retrieval of resources organized on the basis of different data structure formats (e.g. MARC 21 for bibliographic materials, DCMES for digital resources, IEEE LOM for learning resources) and available inside different software layers (e.g. ILS cluster, DMA cluster, LCMS cluster);

(iv) Unicode-compliant standards, technologies and tools (like text-encoding standard, rendering engine and virtual keyboard) may be developed for multilingual data entry and retrieval (with special reference to Bengali script). The Unicode-compliant and Web 2.0-enabled integrated framework can be ported into an ISO image and finally ISO image can be converted into a ready-to-install product by using suitable algorithm and programs.

1.6 Methodology

The methodology of this research may be viewed as a five-step method in designing and developing an integrated information management and retrieval system framework for college libraries affiliated to the University of Burdwan. The major groups of method are as follows –

(i) Identification and selection of design parameters

This step includes following activities –

- (a) Study and analysis of global/national requirements in the forms of RFPs (Request for Proposals), RFCs (Request for Comments) and best practice guidelines;
- (b) Study and analysis of global/national recommendations prescribed by agencies like DLF-ILS Discovery Internet Task Group (ILS-DI), Open

Library project etc.;

- (c) Study and analysis of national and state level surveys conducted by researchers on the areas of this research study;
 - (d) Organizing demand survey in the target libraries for identifying the needs and requirements; and
 - (e) Framing a single list of design parameters from the results of the above stated activities for developing basic cluster and domain-specific clusters.
- (ii) Development of Basic Cluster

The activities of this group are –

- Selection of server side operating system;
- Selection of components of the basic cluster (e.g. Web server, Relational DBMSs, Programming environment);
- Selection of standards and tools for multilingual retrieval systems; and
- Development of Unicode-compliant basic cluster for seamless integration of domain-specific cluster

- (iii) Development of Domain-specific Clusters

This group includes activities require to develop different domain-specific cluster such as

- ILS cluster: Integrated Library System cluster
- DMA cluster: Digital Media Archiving cluster
- LCMS cluster: Learning Content Management System cluster
- CCI cluster: College Communication and Interaction Cluster
- FSS cluster: Federated Search System cluster
- CMS cluster: Content Management System cluster

- (iv) Testing and Debugging

(v) Development of mechanism to transfer the integrated framework into ISO image in view of easy use (installation/configuration/implementation) in target libraries.

1.7 Significance of the Study

In India, research in library and information science is dominated by survey research. Generally, these researches come out with a list of suggestions to be incorporated in developing library systems. In view of this fact, the novelty of this research work is to move one step further by developing an integrated framework for information management and retrieval system in college libraries on the basis of suggestions given by earlier research works, global recommendations and technical advices of RFPs and RFCs. As college libraries in our state work in more or less similar environment, the results and products of this research study may easily be extended to cover college libraries working under other universities in the state.

1.8 Analysis of existing college library system under the University of Burdwan

A. Analysis of Data and Discussion of college libraries

The survey is prepared on the basis of interviews and structured questionnaire in different aspects of this research study. The opinions of different college librarians regarding the integrated library system software were obtained by using a structured questionnaire and the interview is made on the basis of stated questionnaire which represent in the appendix-v. Opinions and observations of different aspects and issues related to the library operations including housekeeping operations and information retrieval system of the respondent librarians were taken. In this survey, private non aided colleges those were situated in the four districts such as Burdwan, Bankura, Birbhum and Hooghly districts have been ignored because of their lack of computer infrastructure as well as the B.Ed colleges of both Govt and Govt aided were also excluded from this study. Only the general colleges are taken into consideration in this study. There were 11 Government colleges and 74 Government aided colleges in the said four districts. The questionnaires were distributed among the college librarians of those 85 colleges affiliated under the University of Burdwan, Burdwan. Out of this 85 colleges, 11 colleges were Govt colleges and 74 colleges were Govt aided colleges. There were 85 college libraries affiliated under the University of Burdwan out of which 11 Govt colleges responded at 100% level and 60 Govt aided colleges responded out of 74, (i.e. 81.08%).

A1. The detail programme of the distribution of questionnaires among the Librarians of Government and Non-Government Colleges as well as the matter of responses as received from them is illustrated below:

The current study received 71 (11 Govt colleges and 60 Govt. Aided colleges) completed responses from librarians of colleges of the University of Burdwan, which constitutes the primary data for analysis and interpretation. The distribution of responses is shown in Table -3.

Sl. No.	District	Types of College exist		No. of questionnaires distributed		No. of questionnaires received		% of Responses	
		Govt.	Govt. Aided	Govt.	Govt. Aided	Govt.	Govt. Aided	Govt.	Govt. Aided
1.	Burdwan	3	20	3	20	3	15	100%	15/20*100 = 75%
2.	Bankura	2	21	2	21	2	17	100%	17/21*100= 80.95%
3.	Birbhum	0	16	0	16	0	13	---	13/16*100= 81.25%
4.	Hooghly	6	17	6	17	6	15	100%	15/17*100= 88.23%
Total		11	74	11	74	11	60	100%	60/74*100= 81.08%

Table – 3: Details of questionnaires distributed to librarians and responses received

Table -3 shows that 11 out of 11 are from Govt colleges, 100% questionnaires received and response 100% from the district of Burdwan, Bankura, Hooghly and no Govt colleges library in the Birbhum district. The responses of Govt aided colleges are 75% from Burdwan district, 80.95% from Bankura district, 81.25% from Birbhum district and 88.23% from the Hooghly district of the total respondents. It may be observed that the majority of the responses are from Govt aided college libraries under the University of Burdwan.

A 2. Size of the library collections

A 2.1 Collection size of the college libraries in Burdwan District

The table -4 reveals the collection size of the college libraries in Burdwan district . It is seen that four Govt aided college libraries possess their collection more than 40,000 and one Govt college library possesses its collection more than 40,000 and it is due to the earlier foundation of Govt aided college libraries. It is also seen from the table that majority of the Govt aided college libraries possess their collection upto 40,000. There are two Govt aided college libraries those have their collection less than 10000, it is because of the fact that these two libraries have been established few years back.

Library collections size	Govt		Govt aided	
	No.	%	No.	%
Upto 10,000 documents	--	--	2	13.33%
10000-20000 documents	--	--	1	6.67%
20000-30000 documents	1	33.33%	3	20%
30000-40000 documents	1	33.33%	5	33.33%
More than 40000 documents	1	33.33%	4	26.67%

Table – 4: Collection size of the college libraries in Burdwan District

A 2.2 Collection size of the college libraries in Bankura district

The table – 5 reveals that the collection size of the college libraries in Bankura district. One Govt college libraries possess upto 20000-30000 documents and another one Govt college library possess belongs to the slab of 30000 – 40000 documents, in both the cases having 50% . On the otherhand four Govt aided colleges possess upto 10,000 documents having 23.52%. It is also shows the five Govt aided college libraries possess the more than 40,000 documents having 29.41% and there are two college libraries in the district of Bankura having 17.65% with slab 20,000-30,000 documents. This table also highlight the three college libraries collection size is 10,000-20,000 documents in the district of Bankura Govt aided college libraries.

Library collections size	Govt		Govt aided	
	No.	%	No.	%
Upto 10,000 documents	--	--	4	23.52%
10000-20000 documents	--	--	3	17.64%
20000-30000 documents	1	50%	2	11.76%
30000-40000 documents	1	50%	3	17.65%
More that 40000 documents	--	--	5	29.41%

Table – 5: Collection size of the college libraries in Bankura district

A 2.3 Collection size of the College Libraries in Birbhum District

Table – 6 reveals that the collection size of the college libraries in the district of Birbhum. In this district all college libraries are belongs to the Govt aided colleges because no colleges affiliated to the Govt in the district of Birbhum. Five college libraries in this district the collection size slab is 30,000 – 40,000 and two college libraries are belongs to more than 40,000 documents possesses their collection. Only two colleges possess the collection size upto 10,000 documents having 15.38% and three college libraries collection size 10,000-20,000 documents having 23%. There are one college library possesses the 20,000-30,000 documents in the Birbhum district.

Library collections size	Govt		Govt aided	
	No.	%	No.	%
Upto 10,000 documents	--	--	2	15.38%
10000-20000 documents	--	--	3	23%
20000-30000 documents	--	--	1	7.69%
30000-40000 documents	--	--	5	38.46%
More than 40000 documents	--	--	2	15.38%

Table – 6: Collection size of the College Libraries in Birbhum District

A 2.4 Collection size of the College Libraries in Hooghly District

Table – 7 reveals that the collection size of the college libraries in the Hooghly district. Three Govt college libraries possess the more than 40,000 documents. One college library collection size 10,000-20,000 document possesses and the slab 20,000 – 30,000 it also belongs to one college libraries in the same district. Apart from this one Govt college library possesses the 30,000-40,000 documents having 16.67%. On the other hand the Govt aided college libraries are also affect the collection size in the Hooghly district. There are seven Govt aided college libraries collection size more than 40,000 documents having 46.67% and the slab 30,000 – 40,000 documents level belongs to three Govt aided college libraries having 20%. One college libraries collection size 20,000-30,000 documents having 6.67% and the slab 10,000-20,000 collection level belongs to two Govt aided college libraries in the district of Hooghly. The collection size upto 10,000 documents belongs to one Govt aided college libraries.

Library collections size	Govt		Govt aided	
	No.	%	No.	%
Upto 10,000 documents	--	--	2	13.33%
10000-20000 documents	1	16.67%	2	13.33%
20000-30000 documents	1	16.67%	1	6.67%
30000-40000 documents	1	16.67%	3	20%

More than 40000 documents	3	50%	7	46.67%
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Table – 7: Collection size of the College Libraries in Hooghly District

A 3. The present scenerio of automation in the Government College Libraries in the District of Burdwan

A 3.1 The present scenerio of automation in the Government College Libraries in Burdwan District

The table 8 reveals that 1 Govt college is fully motivated towards the promotion of library automation in its library system and it uses three computers for effective use both for administrative as well as library automation point of view and that is the Kalna Govt college. It is also seen that other two colleges use one computer and the governing body has taken interest towards implementing library automation for effective library service and modernisation in their libraries. But implementation of digital library system is to some extent complex phenomenon because it requires both technical knowledge on the part of the librarian and at the same time and the technicalities of the particular software are to be equally conducive and facilitative on the part of the producer. That is why the Govt colleges though they are exponent towards library automation but lack implementing fully digital library system for their own. Govt college education, Burdwan and General degree college Kalna are very nearer to Burdwan University and thus the librarians sometimes consult with the faculty members which facilitate the use of social networking for their own as well as they also allowing their students to go to the same system. Government General Degree College, Mangalkote is very Junior college and lacks much fund and thus the programme of automation is going very slowly in their college. It is a good sign that two colleges that is the librarians are very much interested to implement the open source software that is Koha, internationally reputed library management software in lieu of the commercial softwares. Here it can be said that there is a fair chance that librarians will be able to implement library automation in near future because they are ready to nurture open source library management automation software.

Sl. No.	Name of the Colleges	No. of Computers with internet facilities	Library OPAC	Library Software used	Use of barcode	Digital Library	Social networking
1.	Government College of Education, Burdwan	1	Processing stage	Koha	Processing stage	At the discussion stage in the Managing committee	Librarians personal blog
2.	Government General Degree College, Kalna	3	Fully supported library OPAC	Koha	Yes	In progress level	Facebook and blogs are used by librarian
3.	Government General Degree College,	1	Nil	Governing body	Governing body	Nil	Nil

	Mangalkote			discussed the matter in a meeting in the year 2015	discussed the matter in a meeting in the year 2015		
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Table – 8: Status of Automation in Government College Libraries in Burdwan District

A 3.2 Status of Automation in Government College Libraries in Bankura District

The table – 9 reveals that two Govt colleges in Bankura District have come forward to implement library automation technique in their college libraries. It is spectacular that each library has its one computer with Internet facilities; each library is using commercial library software; each library is interested to use the barcode system for organizing the documents as well as automated circulation procedures. It is also noted that the Governing bodies of the two Govt. Colleges are eager to implement digital library software in ensuing future. The librarians are also interested to go through various social networking programmes so as to collect information for their own as well as for rendering better library and information services to their user community.

Sl. No.	Name of the Colleges	No. of Computers with Internet facilities	Library OPAC	Library Software used	Use of barcode	Digital Library Software	Social networking
1.	Government General Degree College at Mejia (Gopalpur)	1	Processing stage	Libsys	Partially accepted	Managing committee thinking over the matter	Facebook and interest in other sites.
2.	Government General Degree College, Ranibandh	1	Processing stage	SOUL	Started using barcode	Librarian interested but lack of technical knowledge hampers	Twitter and blogging

Table – 9: Status of Automation in Government College Libraries in Bankura District

A 3.3 Status of Automation in Government College Libraries in Hooghly District

The table – 10 reveals that there are 6 Govt colleges out of which two colleges come forward with greater attention to implement the library automation procedure in their libraries. Hooghly Mohsin College is a heritage college and possess 6 computers for its library system followed by Chandannagar Govt college which utilizes 2 computers for its library activities. The other four colleges slowly introduces with one computer with Internet

facilities for managing the library activities. It is interesting to note that Hooghly Mohsin college is equally using two different kinds of software worth mentioning that libsys which is commercial and Koha which is open source software. Actually this college is comparing between the two softwares from their effective point of view and ultimately it will switch over only to any particular software as mentioned earlier.

Sl. No	Name of the Colleges	No. of Computers with Internet facilities	Library OPAC	Library Software used	Use of barcode	Digital Library Software	Social networking
1	Chandernagore Government College	02	No library OPAC	Koha	Processing stage	Managing committee discussed on digital library software	Facebook and Blogging
2	Government Physical Education College for Women	01	No library OPAC	No library management software	Machine generated barcode	They are not interested to digital media archiving software	Twitter and skype
3	Government Training College	01	Discuss the managing committee on library OPAC.	There is no library management software.	Discussion stage for implementing the barcode both manually and machine generated	No digital library software.	Facebook and twitter
4	Hooghly Mohsin College	06	Library OPAC	Koha and Libsys	Barcode generate through Koha software	Managing committee discussed on developing the digital library by the open source software.	Facebook and other social networking sites.
5	Institution of Education (PG) for Women	01	They are interested in library OPAC	No library management software.	No barcode generated tools	Not used on digital library software.	Not interested in social networking sites
6	Singur Govt. General Degree College	01	No library OPAC	No library management software	There is no barcode generation tools	No digital library software	Facebook and other social networking sites.

Table – 10: Status of Automation in Government College Libraries in Hooghly District

A 3.4 Status of Automation in Govt. Aided College Libraries in Burdwan District

The table – 11 reveals that the status of atomation in Govt aided college libraries in Burdwan district. There are only two Govt aided colleges are used SOUL and Libsys and all the colleges used Koha software because it is a open source software. Positive library OPAC available in the Koha software because it is mandatory. Some college libraries discussed the implementation of digital library software for the better management of digital resources for the users and most of the colleges are not to be discussed the said matter because library management committee is not interested about that factors. Moreover, most of the college libraries computers are connected to the Internet options and they have to be using the Social networking sites such as facebook, twitter and etc. For the community communication and interaction purpose. However, some of the college libraries using the barcode through Koha software and sometimes they have to be used the local software for the creation of Barcode in library housekeeping operations and information retrieval purposes for the users as well as library professionals.

Sl. No.	Name of the Colleges	No. of Computers with Internet facilities	Library OPAC	Library Software used	Use of barcode	Digital Library Software	Social networking
1.	Burdwan Raj College	04	No	Koha	No	Discussion stage	Facebook
2.	Dr. Bhupendra Nath Dutta Smriti Mahavidyalaya	03	Yes	Koha	Yes	No digital library software	Facebook and Twitter
3.	Dr. Gourmohan Roy College	02	Yes	Koha	Yes	No	Facebook and Twitter
4.	Gushkara Mahavidyalaya	04	Yes	Koha	Yes	No	Facebook and Twitter
5.	Kalna College	02	Yes	Koha (Windows Version)	No	No	Facebook
6.	Katwa College	04	Yes	Koha	Yes	No	Facebook
7.	M.U.C. Womens' College	02	Koha OPAC	Koha	Yes	Managing committee discussed on developing the digital library	Facebook and other social networking sites.
8.	Memari College	01	Koha OPAC	Koha	Yes	Managing committee discussed on developing the digital library	Facebook and other social networking sites.
9.	Shyamsundar College	02	Koha OPAC	Koha	Yes	Managing committee discussed on developing the digital library	Facebook and other social networking sites.
10.	Vivekananda Mahavidyalaya, Burdwan	02	Koha OPAC	Koha	Yes	No	Facebook, blog and twitter.
11.	Purbasthali	01	No	Libsys	No	No	Facebook and

	College						blogging
12.	Sir Rashbehari Ghosh Mahavidyalaya	02	No	No	No	No	Facebook
13.	Tehatta Sadananda Mahavidyalaya	01	No	No	No	No	Facebook
14.	Padmaja Naidu College of Music	01	No	No	No	Managing committee discussed on developing the digital library	Facebook
15.	Chandrapur College	03	Koha OPAC	Koha	Yes	No	Facebook

Table – 11: Status of Automation in Govt. Aided College Libraries in Burdwan District

A 3.5 Status of Automation in Govt. Aided College Libraries in Bankura District

The table 12 reveals that the status of automation in Govt aided college libraries in Bankura district. There are six govt aided college libraries using the SOUL software for the management of library housekeeping operation in this district. Four college libraries using the Koha open source software to managed their library resources and two colleges used the libsys software. But interesting is that the only one college used the local software like kalyani proprietary software. In case of library OPAC those colleges are using the Koha, it can fully OPAC enabled architectre and SOUL is the partial OPAC support for managed the library resources. There are two govt aided college libraries are using the digital library software. Mor or less all the colleges have been using the facebook social networking sites by the computer and Internet connectivity. In housekeeping operations barcode managed throuh library management software like Koha and SOUL.

Sl. No	Name of the Colleges	No. of Computers with Internet facilities	Library OPAC	Library Software used	Use of barcode	Digital Library Software	Social networking
1.	Bankura Christian College	03	Yes	SOUL	Yes	No	Facebook and twitter
2.	Bankura Sammilani College	02	Yes	SOUL	Yes	Yes	Facebook and twitter
3.	Bankura Zilla Saradamani Mahila Mahavidyapith	04	Yes	SOUL	Yes	Yes	Facebook
4.	Barjora College	01	Yes	Koha	No	No	Facebook
5.	Birsha Munda Memorial College	02	Nil	Koha	Yes	Nil	Nil
6.	Chatra Ramai Pandit	01	Yes	Kalyani	Yes	No	Facebook

	Mahavidyalaya						
7.	Chhatna Chandidas Mahavidyalaya	04	Yes	SOUL	Yes	No	Facebook
8.	Indas Mahavidyalaya	01	No	No	No	No	Facebook
9.	Jamini Roy College	02	No	SOUL	Yes	No	Facebook
10.	Khatra Adibasi Mahavidyalaya	01	No	Koha	Yes	No	Facebook
11.	Pandit Raghunath Murmu Smriti Mahavidyalaya	01	No	No	Yes	No	Facebook
12.	Raipur Block Mahavidyalaya	01	No	Libsys	Yes	No	Facebook
13.	Ramananda College	01	Yes	Koha	Yes	No	Facebook
14.	Saldiha College	03	No	SOUL	Yes	No	Facebook
15.	Saltora Netaji Centenary College	01	No	No	Yes	No	Facebook
16.	Sonamukhi College	03	No	Libsys	No	No	Twitter
17.	Swami Dhananjay Das Kathiababa Mahavidyalaya	02	No	No	Yes	No	Facebook

Table – 12: Status of Automation in Govt. Aided College Libraries in Bankura District

A 3.6 Status of Automation in Govt Aided College Libraries in Birbhum District

The table 13 reveals that the status of automation in Govt aided college libraries in Birbhum district. There are five govt aided college libraries have been using the Koha software whereas only one college used the SOUL software. Here also one college libraries using the libsys software for managing the library resources. Library OPAC only is available those colleges are using Koha software. In case of social networking facebook is the common to all the colleges and few college using the twitter and blogging software and this is possible through computer and internet connectivity. Most of the college libraries in this district have been using the barcode through Koha software and there is no digital library software for all the college libraries in the Birbhum district.

Sl. No.	Name of the Colleges	No. of Computers with Internet facilities	Library OPAC	Library Software used	Use of barcode	Digital Library Software	Social networking
1.	Abhedananda Mahavidyalaya	01	No	No	No	No	Yes
2.	Birbhum Mahavidyalaya	03	Yes	Koha	Yes	No	Yes
3.	Bolpur College	03	Yes	Koha	Yes	No	Facebook,

							Twitter, Blogging
4.	Chandidas Mahavidyalaya	02	Yes	No	Yes	No	Facebook, Twitter
5.	Hiralal Bhakat College	04	Yes	Koha	Yes	No	Facebook
6.	Kabi Joydeb Mahavidyalaya	01	No	No	No	No	No
7.	Kabi Nazrul College	01	No	No	Yes	No	No
8.	Krishna Chandra College	01	No	SOUL	Yes	No	No
9.	Rajnagar Mahavidyalaya	01	No	No	Yes	No	No
10.	Rampurhat College	02	No	Koha	Yes	No	No
11.	Sailajananda Falguni Smriti Mahavidyalaya	01	No	No	Yes	No	No
12.	Sambhunath College	01	No	Libsys	Yes	No	No
13.	Suri Vidyasagar College	03	Yes	Koha	Yes	No	Facebook

Table – 13: Status of Automation in Govt Aided College Libraries in Birbhum District

A 3.7 Status of Automation in Govt Aided College Libraries in Hooghly District

Table 14 reveals that the status of automation in Govt aided college libraries in Hooghly district. Netaji Mahavidyalaya is very much interesting in this district because they have to be using both Koha and Dspace for managing the library automation as well as digital resorces. Apart from this Koha software using the nine college libraries for managing their integrated library system and most of the cases they have also using the Barcode. Facebook have been using the users for the commnication and interaction because most of the college libraries computers and internet connectivity is available. There are 11 govt aided college libraries are OPAC enabled throug Koha software and local software.

Sl. No.	Name of the Colleges	No. of Computers with Internet facilties	Library OPAC	Library Software used	Use of barcode	Digital Library Software	Social networking
1.	Arambag Girls' College	04	Yes	Koha	Yes	No	Facebook
2.	Balagarh B.K. Mahavidyalaya	02	No	Local software	Yes	No	Facebook and Twitter
3.	Bejoy Narayan Mahavidyalaya	05	Fully automate d library OPAC	Koha	Yes	Yes (Single window based interface)	Facebook
4.	Hooghly	06	Yes	Libsys	Yes	No	Facebook

	Womens' College						
5.	Kabi Sukanta Mahavidyalaya	04	Yes	Koha	Yes	No	Facebook
6.	Khalisani Mahavidyalaya	03	Yes	Koha	Yes	No	Facebook
7.	Netaji Mahavidyalaya	08	Yes	Koha	Yes	DSpace	Facebook
8.	Polba Mahavidyalaya	04	No	Koha	Yes	Single window based interface	No
9.	Rabindra Mahavidyalaya	03	No	SOUL	Yes	No	Twitter
10.	Raja Rammohan Roy Mahavidyalaya	04	Yes	Koha	Yes	Discussion stage	Facebook
11.	Sarat Centenary College	01	Yes	Koha	Yes	Single window based interface	No
12.	Sree Gopal Banerjee College	04	Yes	Libsys	Yes	No	Facebook
13.	Sri Ramkrishna Sarada Vidyamahapith	05	No	No	Yes	No	Facebook
14.	Tarakeswar Degree College	06	Yes	Koha	Yes	Single window based interface	Facebook and Twitter
15.	Vivekananda Mahavidyalaya, Haripal	04	Yes	Koha	Yes	Single window based interface	Facebook

Table – 14: Status of Automation in Govt Aided College Libraries in Hooghly District

A 4. Influencing Factors for Selection of Library Software in the Govt Colleges of Burdwan District

A 4.1 Influencing Factors for Selection of Library Software in the Govt Colleges of Burdwan District

The table -15 reveals that librarians of the colleges are influenced by several relevant factors of selecting the library software. Most of the librarians pointed out that 66.67% affected by the reasons such as modules of library automation software, cost effectiveness of software, content management system and learning content management system. On the otherhand in two parameters or reasons are affected by 100% such as easy use and sophisticated and single window based interface. It is observe from the Govt. Colleges of the district of Burdwan for selecting the library automation software based on the factor as easy use and sophistication which invites the 100% attitude.

Sl. No.	Reasons and measures	No. of Librarians	Percentage
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1.	Modules of library automation software	2	66.67%
2.	Cost effectiveness of software	2	66.67%
3.	Easy use and sophistication	3	100%
4.	Content Management system	2	66.67%
5.	Learning content management system	2	66.67%
6.	Single window based interface	3	100%

Table – 15: Influence Factor for Selection of Library Software in the Govt Colleges of Burdwan District

A 4.2 Influencing Factors for Selection of Library Software in the Govt Colleges of Bankura District

The table 16 reveals that the librarians of the colleges are influenced by several factors of selecting the library software. In this case four (4) reasons and measures are highly conducive (100%) for selecting the library software in the colleges of Bankura District and these are as Easy use and sophistication, Content Management system, Single window based interface and Cost effectiveness of software. The other two (2) factors that is Modules of library automation software and Learning content management system are moderately conducive (50%). Thus, it is interesting to note that the librarians the Govt. Colleges of Bankura district have emphasized for selecting their library software based on the factor as **easy use and sophistication** which attains 100% attitude.

Sl. No.	Reasons and measures	No. of Librarians	Percentage
1.	Modules of library automation software	1	50%
2.	Cost effectiveness of software	2	100%
3.	Easy use and sophistication	2	100%
4.	Content Management system	2	100%
5.	Learning content management system	1	50%
6.	Single window based interface	2	100%

Table – 16: Influence Factor for Selection of Library Software in the Govt Colleges of Bankura District

A 4.3 Influencing Factors for Selection of Library Software in the Govt Colleges of Hooghly District

The table -17 reveals the influencing factors for selecting the library software in the Govt. Colleges of Hooghly District where it is seen that librarians are very much happy to select any software based on the two (2) factors such as Easy use and sophistication and Learning content management system having 100% coverage. All other factors such as Modules of library automation software, Cost effectiveness of software, Content Management system and Single window based interface having more than 60% coverage are also suitable for selecting the library automation software for their libraries. It is interesting to

note that **easy use and sophistication** attract 100% attitude of the librarian in selecting the library software.

Sl. No.	Reasons and measures	No. of Librarians	Percentage
1.	Modules of library automation software	5	83%
2.	Cost effectiveness of software	4	66.67%
3.	Easy use and sophistication	6	100%
4.	Content Management system	5	83%
5.	Learning content management system	6	100%
6.	Single window based interface	5	83%

Table – 17: Influence Factor for Selection of Library Software in the Govt Colleges of Hooghly District

A 4.4 Influencing Factors for Selection of Library Software in the Govt Aided Colleges of Burdwan District

The table 18 reveals that the librarians are influenced by the many factors and reasons 100% is affected in one parameters for the selection of library automation software of the Govt. Aided colleges under the Burdwan district and only the two colleges are affecting the 83% from the areas of Modules of library automation software and Learning content management system. Apart from these, other two factors such as cost effectiveness of software and content management system attract the attitude of the librarians upto 70%. In this district the librarians are also highly preferring the software having characteristics as easy use and sohplistication; and single window based interface.

Sl. No.	Reasons and measures	No. of Librarians	Percentage
1.	Modules of library automation software	12	80%
2.	Cost effectiveness of software	10	66.67%
3.	Easy use and sophistication	15	100%
4.	Content Management system	11	73%
5.	Learning content management system	12	80%
6.	Single window based interface	14	93%

Table – 18: Influence Factor for Selection of Library Software in the Govt Aided Colleges of Burdwan District

A 4.5 Influencing Factors for Selection of Library Software in the Govt Aided Colleges of Bankura District

The table 19 reveals that the librarians are influenced by the many factors and reasons. It is interesting to note that the librarians of the Govt. Aided colleges of Bankura district have sincerely argued to select the library software for their colleges based on the intrinsic

qualities of library software. Easy use and sophistication is nothing but the systematic and logical programming of both library activities and library services that to be prudentially incorporated in the software. And at the same scale, the single window based interface is nothing but the effective co-ordination and management of total library activities towards rendering best services and achieving highest satisfaction from the library users point of view. And thus these two factors are very keen to technical factors those are highly attractive and inviting the librarians attitude towards selecting the library factors. That is why in this case these two said factors covers almost 100% attitude of the librarians.

Sl. No.	Reasons and measures	No. of Librarians	Percentage
1.	Modules of library automation software	11	64.70%
2.	Cost effectiveness of software	13	76%
3.	Easy use and sophistication	17	100%
4.	Content Management system	12	70.58%
5.	Learning content management system	10	58.82%
6.	Single window based interface	14	82%

Table – 19: Influence Factor for Selection of Library Software in the Govt Aided Colleges of Bankura District

A 4.6 Influencing Factors for Selection of Library Software in the Govt Aided Colleges of Birbhum District

The table 20 reveals that the librarians are influenced in different factors such as single window based interface (92%), content management system (84.6%), modules of library automation software (76.92%) and learning content management system (69%). Apart from these there are also interesting one parameters easy use and sophistication (100%) which likes the most of the librarians for the library software in the Govt. Aided colleges of Birbhum District.

Sl. No.	Reasons and measures	No. of Librarians	Percentage
1.	Modules of library automation software	10	76.92%
2.	Cost effectiveness of software	8	61.53%
3.	Easy use and sophistication	13	100%
4.	Content Management system	11	84.6%
5.	Learning content management system	9	69%
6.	Single window based interface	12	92%

Table – 20: Influence Factor for Selection of Library Software in the Govt Aided Colleges of Birbhum District

A 4.7 Influencing Factors for Selection of Library Software in the Govt Aided Colleges of Hooghly District

The table 21 reveals that the librarians are influenced by the many factors and reasons 100% (easy use and sophistication) is affected in one parameters for the selection of library automation software of the Govt. Aided colleges under the Burdwan district and only the three colleges are affecting the 93%, 93% and 80% from the areas of Modules of library automation software, single window based interface and cost effectiveness of software. Apart from these, other two factors such as Learning content management system and content management system attract the attitude of the librarians upto 70%. In this district the librarians are also highly preferring the software having characteristics as easy use and sophistication; and single window based interface.

Sl. No.	Reasons and measures	No. of Librarians	Percentage
1.	Modules of library automation software	14	93%
2.	Cost effectiveness of software	12	80%
3.	Easy use and sophistication	15	100%
4.	Content Management system	11	73%
5.	Learning content management system	10	66.67%
6.	Single window based interface	14	93%

Table – 21: Influence Factor for Selection of Library Software in the Govt Aided Colleges of Hooghly District

A 5. Selection of library software in the Govt. Colleges of Burdwan District

A 5.1 Selection of library software in the Govt. Colleges of Burdwan District

Selection of library software is one of the important tasks of the Govt. Colleges of Burdwan district. The table 22 reveals that the two (2 i.e 66.67%) librarians are to be selecting the software and other two cases (1 i.e. 33%) software selected by the Principals and by the management.

Sl. No.	Selection of software	No. of Librarians	Percentage
1.	By the Librarians	2	66.67%
2.	By the Principals	1	33%
3.	By the Management	1	33%

Table – 22: Selection of library software in the Govt. Colleges of Burdwan District

A 5.2 Selection of library software in the Govt. Colleges of Bankura District

Table 23 reveals that the software selected in the Govt colleges of Bankura district by equally i.e 1 having 50% by the one librarian, one principal and one management.

Sl. No.	Selection of software	No. of Librarians	Percentage
1.	By the Librarians	1	50%
2.	By the Principals	1	50%
3.	By the Management	1	50%

Table – 23: Selection of library software in the Govt. Colleges of Bankura District

A 5.3 Selection of library software in the Govt. Colleges of Hooghly District

Table – 24 reveals that the Govt colleges in the district of Hooghly software selected by the librarians and here 4 college librarians having 66.67% software selected for their library requirement software for the better management of housekeeping operations and information retrieval for the users as well as advanced users. Apart from these 1 principal and 1management selected the library automation software in the Hooghly district.

Sl. No.	Selection of software	No. of Librarians	Percentage
1.	By the Librarians	4	66.67%
2.	By the Principals	1	16.67%
3.	By the Management	1	16.67%

Table – 24: Selection of library software in the Govt. Colleges of Hooghly District

A 5.4 Selection of library software in the Govt. Aided Colleges of Burdwan District

Table 25 reveals that the selection of library automation software in the Govt. Aided colleges of Burdwan district are very interesting because 8 librarians are to be selected the library automation software for the users as well as library professionals and also advanced users. This table also highlights the 5 college management are to be selected the library automation software having 33% for the users and advanced users of all the departments in the colleges. Two colleges software selected by the Principals having 13% for the better management of library housekeeping operation and information retrieval systems.

Sl. No.	Selection of software	No. of Librarians	Percentage
1.	By the Librarians	8	53%
2.	By the Principals	2	13%
3.	By the Management	5	33%

Table – 25: Selection of library software in the Govt. Aided Colleges of Burdwan District

A 5.5 Selection of library software in the Govt. Aided Colleges of Bankura District

Table 26 reveals that 7 (seven) librarians are to be selected the library automation software in the Govt. Aided colleges of Bankura district. In this district the college librarians are more interesting for the library software. Five colleges selected the library automation software having 29% by the college management and three colleges software selected by the college Principals in the Bankura district.

Sl. No.	Selection of software	No. of Librarians	Percentage
1.	By the Librarians	7	41%
2.	By the Principals	3	17.6%
3.	By the Management	5	29%

Table – 26: Selection of library software in the Govt. Aided Colleges of Bankura District

A 5.6 Selection of library software in the Govt. Aided Colleges of Birbhum District

The table 27 reveals that the six college librarians and five college management are to be selected the library software and three colleges softwares selected by the college Principals in the Govt. Aided colleges of Birbhum district.

Sl. No.	Selection of software	No. of Librarians	Percentage
1.	By the Librarians	6	46%
2.	By the Principals	3	23%
3.	By the Management	5	38%

Table – 27: Selection of library software in the Govt. Aided Colleges of Birbhum District

A 5.7 Selection of library software in the Govt. Aided Colleges of Hooghly District

Table 28 reveals that the selection of library software in the Govt. Aided colleges of Hooghly district is very much interesting because here ten college librarians having 66.67% are to be selected the library software and three college management selected the library software. On the otherhand only two colleges selected the library software by the college principals for the better management of library services for the users and adavanced level users.

Sl. No.	Selection of software	No. of Librarians	Percentage

1.	By the Librarians	10	66.67%
2.	By the Principals	2	13%
3.	By the Management	3	20%

Table – 28: Selection of library software in the Govt. Aided Colleges of Hooghly District

A 6. Details about Library Software used for Library Automation

Table 29 reveals that the details about library software used for library automation. Koha used 29 college libraries affiliated to the University of Burdwan having 40.84% and 7 colleges are using the Libsys having 9.85%. There are 10 colleges using the SOUL software having 14% and here interesting that the one college library using the Kalyani library management software. There are so many other open source softwares such as NewgenLib, Emilda, Openbiblio, WEBLIS, Libsoft, E-Granthalaya, SLIM++, EasyLib and Libsuite those softwares have not to be used of the college libraries under the University of Burdwan.

Sl. No.	Name of the software	No. of Libraries	Percentage
1.	Koha	29	40.84%
2.	NewGenLib	--	--
3.	Emilda	--	--
4.	Openbiblio	--	--
5.	WEBLIS	--	--
6.	Libsys	7	9.85%
7.	SOUL	10	14%
8.	Libsoft	--	--
9.	E-Granthalaya	--	--
10.	SLIM++	--	--
11.	EasyLib	--	--
12.	Libsuite	--	--
13.	Kalyani	1	1.4%

Table – 29: Details about Library Software used for Library Automation

A 7. Details about Library Software used for digital media archiving

Archivists are in high demand as society becomes more concerned with preserving our heritage. Our program helps students gain knowledge in collecting, appraising and preserving documents and materials found in manuscripts, moving images and photographs, oral-history recordings, multimedia, government records and literary correspondence. The most important softwares in the area of digital media archiving represents (Table -30) in this

research work for the college libraries. Here only one college library (7%) is used DSpace software as compared to other college libraries affiliated to the University of Burdwan.

Sl. No.	Name of the software	No. of Libraries	Percentage
1.	DSpace	1	7%
2.	E-Prints	--	--
3.	GSDL	--	--
4.	Invenio	--	--
5.	VuDL	--	--

Table – 30: Details about Library Software used for digital media archiving

A 8. Community communication and learning content management system

The table 31 reveals that Joomla is the only content management system known by the librarians of 3 (27%) Govt colleges and 4 (7%) Govt aided colleges. There are also so many content management system such as Drupal, concrete5 etc. are not used by the librarians there. It is also seen from the table that the wordpress is the very software having two characteristics i.e. equally content management system and community communication system which is used by 4 Govt college libraries and 7 Govt aided college libraries. There are so many other such type of software those are unfamiliar to the librarians. However, it is good to note that some libraries both from Govt and Govt aided college are slowly acquainted themselves with the modern techniques of learning content management system as well as community communication towards better information dissemination activities within the members of college community.

Sl. No.	Name of the software	No. of Libraries			
		Govt	%	Govt aided	%
1.	Joomla	3	27%	4	7%
2.	Drupal	--	--	--	--
3.	Concrete5	--	--	--	--
4.	Wordpress	4	36%	7	11%
5.	Moodle	--	--	--	--
6.	Atutor	--	--	--	--
7.	Squirelmail	--	--	--	--
8.	Mediawiki	--	--	--	--

Table – 31: Community communication and learning content management system

A 9. Status of Functioning Software Modules

The table 32 reveals the status of functioning software modules in the total 71 libraries of both Govt and Govt aided colleges. It is seen that cataloguing module is utilized by majority of college libraries, what is equally important function out of all other library housekeeping operations. The next important library housekeeping operation module is circulation and that is why it is seen from the table that 26 college libraries used this module and staff client module also. The table also reveals that some important modules those are require for implementing integrated library system are, however, being utilized and the rate of utilization of this module is highly dependent on the technical knowledge of the librarians and that is why these modules are utilized by few libraries of this study.

Sl. No.	Modules	No. of Colleges	Percentage
1.	Staff-client module	25	25/71 = 35%
2.	Acquisition	16	23%
3.	Cataloguing	32	45%
4.	Circulation	26	37%
5.	Authority control	15	21%
6.	Serials control	18	25%
7.	OPAC	20	28%
8.	Web-OPAC	12	17%
9.	Integrated Access	4	6%
10.	Add on modules	12	17%
11.	Offline circulation	--	---
12.	Patron management	14	20%

Table – 32: Status of Functioning Software Modules

A 10. Barriers to implementing the integrated library system in the Colleges of Burdwan district

A 10.1 Barriers to implementing the integrated library system in the Colleges of Burdwan district

Integrated library system brings great changes in the functioning of the college library and proving effective and efficient library services for the users as well as library professionals. But in spite of these great advantages, there are many barriers which occur at the time of implementing the integrated library system for the college libraries. There are three Govt colleges in Burdwan district and 15 Govt aided colleges affiliated to the University of Burdwan. Table 33 reveals the barriers to implementing the integrated library system in Burdwan District. It is observed from the table that the technical knowledge regarding implementing integrated library system in the college libraries is the dead barrier for both Govt and Govt aided colleges. It is also interesting to note that the Govt college libraries suffer much which can be counted upto 67% due to inertia of the governing body,

lack of finance as well as lack manpower and infrastructure. In case of govt aided college libraries the lack of finance is the second major cause that hinders the implementation of integrated library system. Therefore, the views regarding the implementation of integrated library system cover 4 pertinent factors as described in the table 33.

Points of view	Govt		Govt aided	
	No.	%	No.	%
Lack of Finance	2	67%	12	80%
Lack of technical knowledge	3	100%	15	100%
Innertia of Governing body	2	67%	10	67%
Lack of Manpower and infrastructure	2	67%	8	53%

Table – 33: Barriers of Colleges of Burdwan District

A 10.2 Barriers to implementing the integrated library system in the Colleges of Bankura District

Table 34 reveals the barriers to implementing the integrated library system in the colleges of Bankura district. It is seen that libraries of both Govt and Govt aided colleges have opined that all the factors listed under points of view have profound effect i.e almost 100% on the implementation of integrated library system. Thus, the positive attitude of the Government regarding the implementation of integrated library system or at the same time library development policy can be asked at the questionable level. It is also interesting from the table that Govt college libraries suffer much from manpower and infrastructure point of view as compared to libraries of Govt aided colleges.

Points of view	Govt		Govt aided	
	No.	%	No.	%
Lack of Finance	2	100%	16	94%
Lack of technical knowledge	2	100%	14	82%
Innertia of Governing body	1	50%	10	59%
Lack of Manpower and infrastructure	2	100%	13	76%

Table – 34: Barriers of Colleges of Bankura District

A 10.3 Barriers to implementing the integrated library system in the Colleges of Birbhum District

The table 35 reveals the implementing the integrated library system in the college libraries of Birbhum district. The libraries of Govt aided colleges have pointed over two important factors i.e the finance (92%) and technical knowledge (77%) those have profound effect towards implementing the integrated library system. The two other causes i.e the Governing body (54%) and lack of manpower and infrastructure (69%) have equal proportionl effect on the implementation of integrated library system.

Points of view	Govt		Govt aided	
	No.	%	No.	%
Lack of Finance	---	---	12	92%
Lack of technical knowledge	---	---	10	77%
Innertia of Governing body	---	---	7	54%
Lack of Manpower and infrastructure	---	---	9	69%

Table – 35: Barriers of Colleges of Birbhum District

A 10.4 Barriers to implementing the integrated library system in the Colleges of Hooghly District

The table 36 reveals the implentation of integrated library system in the college libraries of Hooghly district. It is seen from the table that major Govt college libraries are facing hindrance towards implementing integrated library system due to lack of finance and that is amounted to 67%. And even the libraries of the Govt aided colleges have their similar views on that factor which is 80%. It is also interesting to note that majority of the Govt aided college libraries have pointed over the other three factors i.e lack of technical knowledge, innertia of Governing body and lack of manpower and infrastructure have profound effect on implementing the integrated library system.

Points of view	Govt		Govt aided	
	No.	%	No.	%
Lack of Finance	4	67%	12	80%
Lack of technical knowledge	3	50%	14	93%
Innertia of Govt body	2	33%	10	67%
Lack of Manpower and infrastructure	5	83%	13	87%

Table – 36: Barriers of colleges of Hooghly District

1.9 Development of Domain specific cluster for CLBU software framework

College libraries are suffering to managed their resources by use of computer for the users and library staff due to lack of proper library structure (Dzurinko, 1998). This research work trying to solved the problem of digital resources through domain specific cluster and there are six domain specific cluster available in an automated and digital environment. Many libraries are in the process of rethinking the effectiveness of the automation tools they're using to provide library services, both within and outside of their library buildings. Internally, the core component driving many of these services has been the six domain specific cluster. The next generation of these systems are called "library services platforms." The softwares and standards that have been announced include: WorldShare Management Services by OCLC, Alma by Ex Libris, Sierra by Innovative Interfaces, Intota by Serials Solutions, Open

Library Environment (OLE) by Kuali, and service oriented architecture. When looking at the new library services platforms, this research work some radically different approaches being taken and, as with all technologies, each approach has its advantages. However, to understand those approaches, need to start with some common definitions upon which to make comparisons of three levels like matured level, middle level and infancy level and it also include three group (Group-I, Group-II and Group-III). In ILS cluster Group – I including Koha, Evergreen, OPALS, NewGenLib, Emilda and Weblis ; Group -II including like PhpMyLibrary, OpenBiblio, PMB, FireFly, Avanti, MyLibrary, Mylibrarian, Glibms, PhpMyAdmin and Group -III including like invenio, ivia, BibliteQ, MicroLCS, Refbase. Then we'll look at each of the new library service platforms. Finally, we'll consider a high-level view in order to understand what the approaches mean at a professional level. In DMA cluster Group – I including like CONTENTdm, Digital Commons, Dspace, Eprints, Greenstone, Fedora Commons and Group – II including like Biblical software, IntraText, Invenio, Islandora, Olive Tree Bible Software and Group – III including like Alfresco, Expanded Books, KnowledgeTree, Logos Bible Software, Pleade, SimpleDL and SobekCM. LCMS cluster including in Group – I like Atutor, Canvas, Moodle and eFront and Group – II including Chamilo, Fedena, Sakai and ILIAS and Group – III including Claroline, Dokeos, LAMS, OLAT, Totara LMS and WeBWork. CCI cluster including in Group – I like Blog, MediaWiki, Atlassian Confluence, Skype, Ekiga and Squirrelmail and Group -II including Wikispaces, Vidyos and Aver's whereas Group-III including MindTouch, Microsoft Office 365 and WikiWiki. FSS cluster including in Group-I like DbWiz, CUFTS, GODOT, Yaz, OAI/PMH (OCS, OJS, OJL, OHS, OMP). Group-II including like Pazpar2, Z39.50, SRW/U, OpenSearch and Group-III including like Linoski, Alexis, Walczyk, Tine, ExLibris, WebFeat and Primo. CMS Cluster Group-I including like Drupal, Joomla, SilverStripe , WordPress whereas Group-II including Concrete5, dotCMS, Frog CMS and MODx and Group-III including CushyCMS, ExpressionEngine, Radiant and TYPOLight. All the domain specific clustering software are represents in the table – 37 and only selected the matured level open source software and it describing in the following ways:

ILS cluster: Integrated Library System cluster
 DMA cluster: Digital Media Archiving cluster
 LCMS cluster: Learning Content Management System cluster
 CCI cluster: College Communication and Interaction Cluster
 FSS cluster: Federated Search System cluster
 CMS cluster: Content Management System cluster

Domain Specific Cluster for CLBU

Group – I = Matured level
 Group – II = Middle level
 Group – III = Infancy level

Domain Specific Cluster	Group - I	Group - II	Group - III
ILS Cluster	Koha	PhpMyLibrary	Sanjay
	Evergreen	OpenBiblio	Soul
	OPALS	PMB	Libsys
	NewGenLib		Suchika
	Emilda	Avanti	
	Weblis	MyLibrary	
		Mylibrarian	

DMA Cluster	CONTENTdm	Biblical software	Alfresco
	Digital Commons	IntraText	Expanded Books
	DSpace	Invenio	KnowledgeTree
	Eprints	Islandora	Logos Bible Software
	Greenstone	Olive Tree Bible Software	Pleade
	Fedora Commons		SimpleDL SobekCM
LCMS Cluster	Atutor	Chamilo	Claroline
	Canvas	Fedena	Dokeos
	Moodle	Sakai	LAMS
	eFront	ILIAS	OLAT
			Totara LMS WeBWork
CCI Cluster	Blog	Wikispaces	MindTouch
	MediaWiki	Vidyo	Microsoft Office 365
	Atlassian Confluence	AVer's	WikiWiki
	Skype		
	Ekiga		
	Squirrelmail		
FSS Cluster	DbWiz	Pazpar2	Linowski
	CUFTS	Z39.50	Alexis
	GODOT	SRW/U	Walczyk
	Yaz	OpenSearch	Tine
	OAI/PMH (OHS)		ExLibris
			WebFeat Primo
CMS Cluster	Drupal	Concrete5	CushyCMS
	Joomla	dotCMS	ExpressionEngine
	SilverStripe	Frog CMS	Radiant
	WordPress	MODx	TYPOlight
CCI Cluster : Ekiga and Skype used for Video conferencing purpose			
Other document management software (OCS, OJS, OJL, OMP)			

Table -37: Domain specific clustering software for CLBU

1.10 Development of Single Window Based Interface

This empirical section of the research work includes required parameters for designing the integrated software framework. It took two different routes to collect required factors that are to be considered for designing the system and finally merged all parameters into a single set of parameters. This set of parameters guided the design and development of domain-specific clusters (six in number). The views of the working professionals in college libraries are reflected in survey for requirements and global-scale recommendations are gathered by analyzing suggestions and guidelines as provided by related projects, eminent experts and RFPs of libraries. The basic cluster of the software framework plays the pivotal role in managing the core activities and in providing a platform where different domain-specific software may be fused together to produce required integrated setup. It includes Ubuntu ILS (a Linux flavor) as Operating System including LAMP architecture, Open-JDK, PERL, PHP and RDBMSs like MySQL and PostGreSQL. Domain specific clusters depend on this basic cluster to interoperate with each other. Multi-lingual resource management is an important activity of college libraries as in some college libraries regional language based resources cover up to seventy percent of the collection. This chapter is dedicated to develop mechanisms to manage processing and retrieval of multi-lingual resources in Unicode-compliant environment including provisions for easy-to-use input tools for different Indic-scripts with special emphasis on Bengali script. This research work identifying the six domain specific clusters (See Figure-2) required for integrated software framework like digital media archiving cluster, content management system cluster, learning content management system cluster, federated search system cluster and community communication interaction cluster. These clusters have been developed by using suitable open source softwares and open standards against parameters as identified in global recommendations. Therefore, it can be said that this research work is successfully intergated six domain specific clusters into a single framework as an off-the-shelf product for college libraries under the University of Burdwan. The college students, teachers and staffs are to be accessed of different services from the single window based interfaces. After installation and configuration of these software required to run the particular tool for the management of library tasks by machine. Access all the clusters from a single window based interface like integrated library system cluster, digital media archiving cluster, content management system cluster, learning content management system cluster, federated search system cluster and community communication interaction cluster to perform the specific library operations by using these open software.

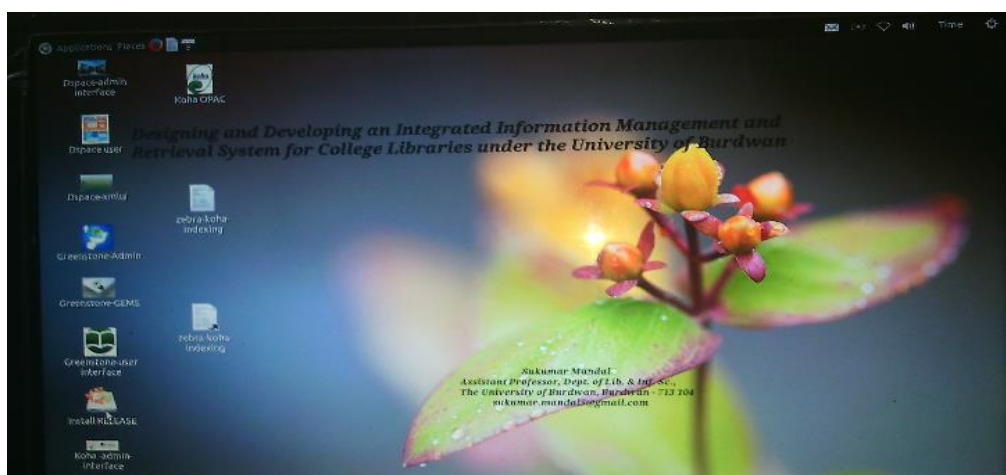


Figure - 2 : Single window based interface for CLBU

1.11

Development of ISO file for easy installation and configuration of

target

target

college libraries under the University of Burdwan

There are two types of Ubuntu versions are available in ubuntu home pages against on bit 32 or 64 bit both the desktop and server version (Clark, 2010). This research work select the desktop version to create and design the single window based interfaces in domain specific cluster for college libraries. Desktop version is support both character user interface and graphical user interface. In such a way it can easily manage all the tasks in housekeeping operations and information retrieval system. Obviously, it can observe that desktop version is more compatible to perform the all the tasks pinpointedly, exhaustively and expeditiously. After doing a research on Ubuntu as an operating system for designing and developing an integrated information management and retrieval system for college libraries under the university of Burdwan, here it is agreed that this software is so useful and making history for its popularity. Linux is facing a challenge to attract more users although its very helpful. But, it does not mean that if less people are using it so it's not very beneficial. The Figure – 3 will generate under the directory of remastersys.

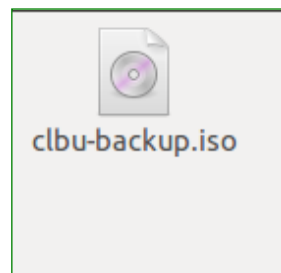


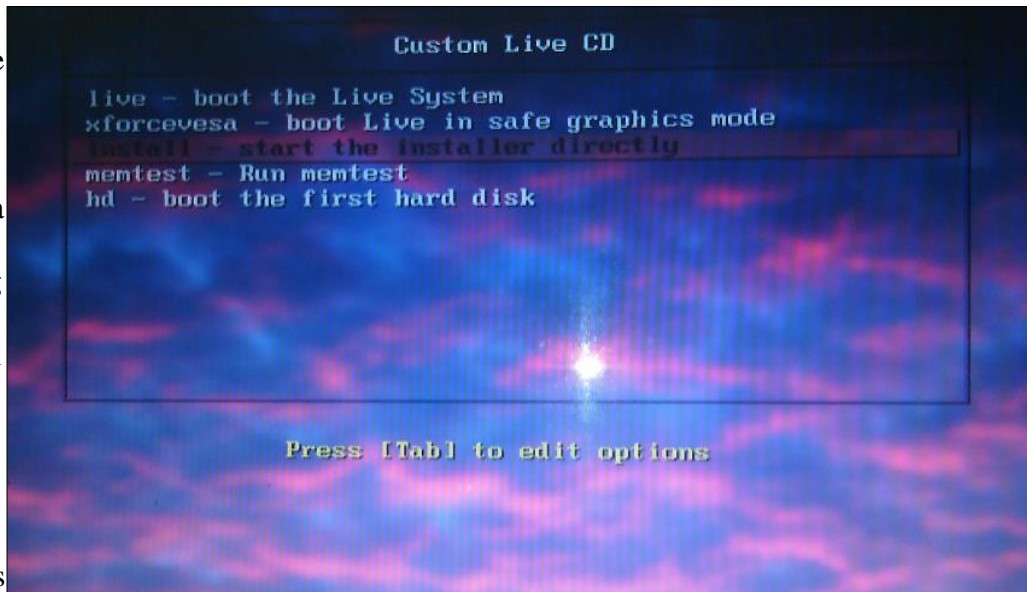
Figure – 3: ISO file for college libraries

This is the crucial tasks for the integrated library management and retrieval system. After creation of all tasks in ISO file and this file will be stored under the directory of home remastersys folder in Ubuntu. The ISO file for the generation of livecd it will be write by the DVD because size of the file is 4.2 GB. Obviously, this is possible to write in DVD by the braceron on Ubuntu. Automatically or manually eject the DVD from the DVD tray and again inserted it into the DVD tray. After that the computer will be restart and press the boot key. In most of the cases boot key is F12 and press F12 for booting the DVD. Now, start the boot menu of five areas here select installed directly and it will be start on boot (See Figure – 4) for the college libraries under the University of Burdwan. Academic institutions are drastically change in library information and technology both external and internal improvments. Traditional model is transform from manual to digital and also digital to virtual because increasing and proliferation of scholarly communication which enclourage peer-to-peer collaboration and sharing the resources among the users. Virtual learning is also possible through modern technology by moodle which can solved the learning content management system in colleges and outside of colleges also. Now, in recent libraries have operated large amount of informations both printed and online in college libraries. Libraries is the heart of the educational system and academic institutions with their host institution. In this circumstances libraries need to improve the new technologies in six domain specific cluster for college libraries.

However, in order to change the relevant areas to users and to provide the new services by applying open source software in college libraries. Identification, collection, organization and dissemination for a specific library resources to a particular user is also an important tasks that can be satisfy the users community in colleges. Library management is

possible to integration of institutional repositories by federated search system tool and discovery tool also. In addition to better management of libraries are increasingly reaching across the boundaries of colleges to provide different types of resources and seamless integration to the user communities in college libraries. Academic libraries technology must support the local area network to manage and share of information both economically and strategically.

Figure
- 4:
Live
DVD
interfa
ce for
colleg
e
librari
es



Every
colleg
e has
a

library, some of them are well stocked, and some of them are not. But one thing is common among them. Each one of them is suffering from fund constraints. Library is a dynamic system, it has to grow continuously to meet the ever-rising demands of the readers. In fact the solution of the problem lies not in securing more and more funds, which is virtually impossible, but in maximization of the utilization of the available resources. ICT is the most important tool which can help the college students in achieving this end, of course, if properly utilized towards single window based interface in all the college libraries. This live DVD used all the college libraries to fulfill the different tasks like acquisition, cataloguing, circulation, patron management, authority control, report generation, tagging, faceted navigation and so many parameters. All the software icon is appear in a desktop, its known as signle window based interface which can be access the domain specific software for college libraries. Searching and browsing is also possible on live DVD mode in different facets like author, title, subject, barcode and etc. Zebra indexing running during live DVD mode which index the bibliographic and authority records both the librarian as well as OPAC interfaces. Web 2.0 features are also available in this live DVD such as amazon cover images, google book cover, Z90.50 server and etc which fully support the unicode based multilingual standards. Regional language can be solved through the Bengali keyboard both the OPAC as well as librarian interfaces. Learning resources is properly manage by learning content management system and designing the content in systamatically through the content management software. Discovery layer services can be generated by using the discovery tool which successfully integrated this framework to manage the tagging, linking with bibliographic records and etc. Apart from the data is also send to other users through the discovery tool like VuFind. Harvested digital library is also known as federated search system or virtual library system. This is federated search system which extract informacion through harvester and provides the same being guided by suitable protocol to build federated search system; in such a system, a client sends a search parallel to a number informacion servers.

1.12 Conclusion

Research is like a relay race. Every research starts with the aims and objectives to solve a set of problems and invariably ends up with a new set of problems. The new set of problems leads to new horizon of knowledge. This research is no exception. It started with a set of objectives at the initial stage, designed the framework of integration for domain-specific clusters, identified and selected software or software groups for each cluster, developed seamless integration mechanisms to fuse together all the clusters along with their components parts in a single framework, tested the framework with considerable amount of datasets, and finally ported the framework into an off-the-shelf and ready-to-implement product. This long path of development process faces many challenges, many failures, many sleep-less nights and many moments of truth. At the end, the concluding part of the research work is an attempt to record achievements under three sections.

Achieving the Objectives

This research work centres around four groups of objectives namely i) understanding the requirements of college libraries under the University of Burdwan; ii) development of an accommodative software framework to integrate domain-specific application clusters; iii) development of six service clusters to support major activities of the software framework (ILS cluster to support library automation; DMA cluster to support digital archiving; LCMS cluster to support virtual learning environment and its integration with library support; CCI cluster to facilitate communication and interaction through synchronous and asynchronous tools; FSS cluster to support single-window search service for end users and CMS cluster to accommodate all the other five clusters); iv) application of open source software and open standards in developing Unicode-compliant multi-lingual document processing and retrieval and in porting the entire software framework into ISO file as off-the-shelf product or deliverable for this research work. The following sections reports achievements of this research work for these groups of objectives as set in Chapter 1 of the research project (see section 1.2 of the chapter 1).

Achieving Group I objectives

The group I objectives as set in chapter I are as follows:

To study and analyze – i) requirements of college library systems under the University of Burdwan; ii) global set of recommendations related with the architecture and service requirements for academic libraries; and iii) global set of standards related with library automation, digitization and user services;

This group includes three related components. Let us examine the achievements against each of these components:

i) requirements of college library systems under the University of Burdwan;

A questionnaire based survey shows that most of the college libraries under the University of Burdwan is in the process of library automation as far as networking and hardware infrastructure is concerned. The result shows that on an average college libraries (under the University of Burdwan) have three computers in LAN environment with TCP/IP connectivity

The analytical account of the survey shows following major facts:

(a) Out of three government colleges under the Burdwan district, two colleges (Government College of Education, Burdwan; Government General Degree College, Mangalkote) are having one computer each in the college libraries and one college (Government General Degree College, Kalna) possess three computers in the library.

(b) Out of two government colleges (Government General Degree College at Mejia; Government General Degree College, Ranibandh) under the Bankura district, each possess one computer in the library.

(c) Out of six colleges government colleges in Hooghly district, one college (which is the oldest college in the region i.e. Hooghly Mohsin College) provides six computers in the library. Another college, Chandannagar Government College, possesses two computers and the other four other government colleges such as Government Physical Education College for Women, Government Training College, Institution of Education (PG) for Women, Singur Govt. General Degree College, are having one computer in their libraries. All these college libraries are having at least one workstation with Internet connectivity and are LAN ready libraries.

As a whole, the survey carried out to know the state-of-the-art of computing facilities in government college libraries under the University of Burdwan, shows the readiness of the colleges for library automation and digitization as far as infrastructural provisions are concerned. Moreover, the survey also indicated that the authorities of the concerned colleges are eager to implement recommendations of NAAC peer review committee for implementing learner-centric ICT-enabled library services.

If, we now move towards government aided colleges in the districts which are mostly served by the University of Burdwan as educational hub, the situation is quite encouraging (as far as the survey results are concerned):

(d) In the district of Burdwan, out of fifteen (15) colleges, three colleges are having four (4) computers in the library; two college library possesses three (3) computers and six colleges are having two (2) computers in their libraries. Apart from these eleven colleges, the other four colleges include one computer each in the college libraries.

(e) Out of seventeen (17) colleges in the district of Bankura, two colleges possess four (4) computers in their libraries; three colleges include three (3) computers each in their libraries; four college libraries possess two (2) computers each and eight colleges are having one computer (1) each in their libraries. Interestingly, all the college libraries in government aided colleges in the district of Bankura reported that the libraries are equipped with Internet connectivity and LAN set up.

(f) In the district of Birbhum, out of the thirteen (13) colleges, one college possesses four (4) computers in the library; three colleges libraries are having three (3) computers in each of their libraries; two colleges include two (2) computers each and seven colleges provide one (1) computer in each of their libraries.

(g) Out of fifteen (15) colleges under the district of Hooghly, three colleges are having six (6) computers in their libraries; two colleges libraries include five (5) computers each; six

colleges possess four (4) computers in each of their libraries; two colleges are having three (3) computers in their libraries; one college library has provision of two computers and only one college library possesses one computer in the library.

In summary, the survey carried out to know the state-of-the-art of computing facilities in government aided college libraries under the University of Burdwan, shows the readiness of the government aided colleges for library automation and digitization as far as infrastructural provisions are concerned. Moreover, the survey also indicated that the most of the colleges are LAN ready and having at least one workstation to provide Internet connectivity to end users.

The situation of libraries in government colleges (although is not as encouraging as the situation in the libraries of government colleges), as reflected in the survey conducted for this research, shows that hardware and network infrastructure of the libraries of government aided colleges can support implementation of the integrated approach to library automation. But the costly software requirements as one time capital expenditure and recurring costs for annual maintenance and software upgradation prevent government aided colleges in venturing into library automation and digitization. Moreover, as a desperate attempt, many college libraries procured non-standard local software for entering books records and providing circulation facility. But this situation may be considered as a less than ideal solution, as after a few years the whole system will be non-compatible with global set of standards related to library automation and digitization. The next section shows how the global compatibility of the software framework has been achieved by following and implementing a set of global recommendations.

ii) global set of recommendations related with the architecture and service requirements for academic libraries;

This research work has decided that the global recommendations such as integrated library system for discovery interface (ILS-DI), IFLA-Working recommendations, and Open Library Environment (OLE) project, Quali ILS (as an experimental ILS developed on the basis of OLE project) and FOLIO recommendations will act as guiding base for the software architecture. Apart from these recommendations, RFP developed by leading academic libraries all over the world, have also been considered for designing the architecture of the software framework, developing the services of the software framework and establishing cluster interfaces. The major recommendations, as identified by Mukhopadhyay (2014), on the basis of the above mentioned are acting as baseline for the software framework. These are as follows:

- (1) Flexibility (Supports for wide range of resources; accessed by a wide range of customers in a variety of contexts);
- (2) Community ownership (Advocates systems that are designed, built, owned, and governed by and for the library community on an open source licensing basis);
- (3) Service Orientation (Prescribes technology-neutral service-oriented framework that ensures the interoperability of library systems);
- (4) Enterprise-Level Integration (Facilitates integration with other enterprise systems such as research support, student information, human resources, identity management, fiscal control, and repository and content management);

- (5) Efficiency (Provides a modular application infrastructure that integrates with new and existing academic and research technologies);
- (6) Sustainability (Creates a reliable and robust framework to identify, document, innovate, develop, maintain, and review the software necessary to further the operation and mission of libraries);
- (7) Improve discovery and use of library resources;
- (8) Support a clear set of expectations (framed systematically) for users (end users and power users) and developers;
- (9) Open and extensible for recommendations applicable to existing and future system requirements;
- (10) Support interoperability, inter-operation and cooperation; and be responsive to the user and developer community.

iii) *global set of standards related with library automation, digitization and user services;*

IEC Guide 2:2004 of ISO (International Standards Organization) defines a standard as a document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context. Standards perform important roles in the development of integrated library systems in view of the followings:

- to act as the pattern of an ideal;
- to set a model procedure;
- to achieve interoperability in heterogeneous environment;
- to establish measure for appraisal;
- to act as stimulus for future development and importance; and
- to help as an instrument to assist decision and action.

This research work, in different clusters, implemented standards under two groups de jury standards and de facto standards (voluntary/cooperative standards) keeping in view the future requirements of the software framework. The individual standards in each group has been included and implemented on the basis of global trends in library automation and digitization:

De jury standards	De facto Standards
<ul style="list-style-type: none"> • ISO – 2709 for bibliographic data interoperability; • Standard bibliographic formats compliant with ISO - 2709 (e.g. MARC 21, UNIMARC, CCF/B); • Z 39.50 protocol standard for distributed cataloguing; • Z39.71 standard for holdings statements; 	<ul style="list-style-type: none"> • MARCXML - MARC 21 data in an XML structure (developed by Library of Congress - http://www.loc.gov/standards/marcxml/) acting as base standard for bibliographic data export/import in place of ISO-2709; • MODS (Metadata Object Description Standard) - XML markup for selected metadata from existing MARC 21 records as well as original resource description (developed by Library of Congress – http://www.loc.gov/standards/mods/);

<ul style="list-style-type: none"> • BS ISO 9735-9:2002 Electronic data interchange for administration, commerce and transport (EDIFACT); • Z39.83-1 (NISO Circulation Interchange Part 1: Protocol (NCIP)); • Z39.83-2 (NISO Circulation Interchange Part 2: Protocol (NCIP)); • ISO/CD 28560-1(Information and documentation -- Data model for use of radio frequency; identifier (RFID) in libraries -- Part 1: General requirements and data elements); • ISO/CD 28560-2 (Information and documentation -- Data model for use of radio frequency; identifier (RFID) in libraries -- Part 2: Encoding based on ISO/IEC 15962); and • ISO/CD 28560-3 (Information and documentation -- Data model for use of radio frequency identifier (RFID) in libraries -- Part 3: Fixed length encoding); and • ISO/IEC 10646: 2003 (Universal Multiple-Octet Character Set or UCS). 	<ul style="list-style-type: none"> • MADS (Metadata Authority Description Standard) - XML markup for selected authority data from MARC21 records as well as original authority data (developed by Library of Congress – http://www.loc.gov/standards/mads/); • METS (Metadata Encoding & Transmission Standard) - Structure for encoding descriptive, administrative, and structural metadata (developed by Library of Congress -http://www.loc.gov/mets/); • PREMIS (Preservation Metadata) - A data dictionary and supporting XML schemas for core preservation metadata needed to support the long-term preservation of digital materials. (developed by Library of Congress – http://www.loc.gov/standards/premis/); • SRU/SRW (Search and Retrieve URL/Web Service) - Web services for search and retrieval based on Z39.50 (developed by Library of Congress - semantics http://www.loc.gov/standards/sru/); and • OAI/PMH Version 2.0 - Open Archive Initiative/Protocol for Metadata Harvesting (developed by Open Archive Initiative).
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Achieving Group II objectives

The group II objectives as set in chapter I are as follows:

To design an integrated software framework for accommodating different domain- specific software for performing basic as well as extended set of services as required for college libraries under the University of Burdwan and as recommended by relevant global agencies;

The first group of objectives as achieved by this research may be recorded in terms of the following statements - 1) logical grouping and listing of requirements of the college libraries under the University of Burdwan through the questionnaire based survey; 2) arranging logically global-scale recommendations as baseline for designing the software that can serve the requirements as reflected in the survey; 3) identification of global standards in the domain of library automation & digitization and implementation of the selected standards in the software framework. These achievements provide the necessary inputs in the achievement of the second group of objectives.

The second group of objectives of this research work have been achieved through a modular

design of the software framework. The chapter 4 through chapter 6 of the research work shows with the help of scripts, screen-shots and explanations that how these objectives have been achieved. The chapter 4 shows the development of the basic cluster, which can accommodate six related domain-specific clusters. The basic cluster of the software framework plays the pivotal role in managing the core activities and in providing a platform where different domain-specific software may be fused together to produce required integrated setup. It includes Ubuntu LTS (a Linux flavor) as Operating System, LAMP architecture as a space where different clusters can be fused together, Open-JDK, PERL, PHP as programming environment and RDBMSs like MySQL and PostGreSQL to hold bibliographic and repository level datasets. This basic cluster is of utmost important component of the software framework as the domain specific clusters depend on this basic cluster to interoperate with each other. The achievement of this group may be presented in a single sentence as follows: *“the design and development of open source software and standards based accommodative and interactive software architecture where domain-specific clusters required to support college library automation and digitization can interoperate”*.

Achieving Group III objectives

The group III objectives as set in chapter I are as follows:

to develop required service clusters

This research work has developed six domain specific clusters required for integrated software framework like automation cluster, digital media archiving cluster, content management system cluster, learning content management system cluster, federated search system cluster and community communication interaction cluster. These clusters have been developed by using suitable open source softwares and open standards against parameters as identified in Chapter-3. Therefore, it can be said that this research work has successfully integrated six domain specific clusters into a single framework as an off-the-shelf product for college libraries under the University of Burdwan. The chapter 6 of this research work shows the development of these clusters and the chapter 7 of the research work demonstrates the features and utilities of these clusters. The role of these clusters are as follows: ILS cluster for managing basic library operations and Web 2.0-enabled OPAC services; DMA cluster for archiving/dissemination of digital resources; LCMS cluster for extending facilities for online teaching-learning-evaluation; CCI cluster for facilitating institutional communication and interaction; FSS cluster for developing single-window federated search interface; and CMS cluster for organizing and retrieval of resources available inside these five clusters). All these clusters have been developed in an open platform and by using domain-specific open source software and related open standards. In other words this research work has achieved the specified objectives to support automation, digitization, and other related activities in college libraries under the University of Burdwan through different service clusters for i) supporting essential library services (ILS cluster⁷); ii) managing digital contents (DMA cluster⁸); iii) providing online teaching-learning-evaluation (LCMS cluster⁹); iv) facilitating institutional communication (CCI cluster¹⁰); v) extending federated search facilities (FSS cluster¹¹); and vi) seamless integration of these service clusters in a content management

⁷ ILS cluster: Integrated Library System cluster

⁸ DMA cluster: Digital Media Archiving cluster

⁹ LCMS cluster: Learning Content Management System cluster

¹⁰ CCI cluster: College Communication and Interaction Cluster

¹¹ FSS cluster: Federated Search System cluster

system (CMS cluster¹²);

Achieving Group IV objectives

The group IV objectives as set in chapter I are as follows:

designing the framework in Unicode-compliant environment for supporting multilingual document processing and retrieval with special reference to Bengali script and to develop mechanisms for transferring the integrated framework as ISO image for easy implementation in target college libraries.

As far as the college libraries in the state of West Bengal are concerned, multi-lingual resource management is an important activity for college libraries as in some college libraries regional language based resources cover up to seventy percent of the collection. The chapter 5 shows the achievements of the group IV objectives by develop mechanisms to managing, processing and retrieval of multi-lingual resources in Unicode-compliant environment including provisions for easy-to-use input tools for different Indic-scripts with special emphasis on Bengali script. This research work has integrated Avro-Phonetics and three other virtual keyboards in end user interfaces as well as in data entry interfaces. For example, the Google Indic transliteration facility with almost all Indic scripts (22 constitutionally recognized languages) is also made available in end user retrieval interfaces.

It is quite easy to apprehend that the software framework with six domain-specific clusters and an array of open source tools for end users is very complex to implement at the user end. This research work, has therefore, also set an objective, to develop ISO file as an off-the-shelf product as end point. This facility is aimed to help college libraries in implementing the software framework very easily at the point-of-utilization. This research work has explored the use of two open source tools namely Remastersys and Pinguybuilder for creating the ISO image.

The SWOT Analysis of the Software Framework

This research work has started its journey to achieve design and development of a software framework to support library activities of the colleges affiliated to the University of Burdwan. The empirical chapters of this thesis (chapter 3 through chapter 7) shows that goals and targets as set in chapter 1 have been achieved but at the same time the concluding part requires analysis of the strength, limitations and future opportunities related to the software framework. This section discusses these required analytical views under three sections.

A) Strength of the Software Framework

Cross Collection Discovery Service (CCDS) to support an improved end-user interface to submit queries, receive results, and make content selections

In general libraries are using different software (e.g. Koha for library automation, DSpace for institutional repository, Moodle for learning contents management etc), different metadata standards (MARC 21 family for bibliographic resources, Dublin Core for knowledge objects, IEEE-LOM for learning objects etc) and different retrieval techniques (text retrieval engines that are use in Koha, DSpace, Greenstone etc differ greatly in search syntax) for managing these diverse set of resources. As a result end users retrieval experiences are not quite

¹² CMS cluster: Content Management System cluster

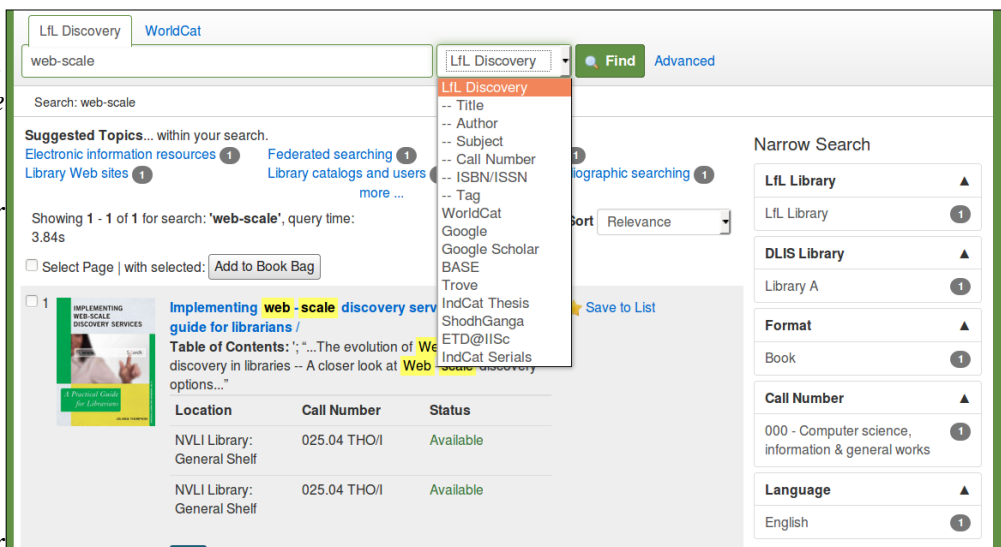
satisfactory as they need to move from one search interface to the other for making a comprehensive search. The situation is becoming more complex when libraries are providing lists of external resources (like journal portals, electronic databases etc) for end users and each of these external resources are again providing different user interfaces and different retrieval techniques. In simple words in present library search service users are running from post to pillar for obtaining desired resources.

The software framework of this research has developed Federated Search System (FSS) cluster to solve this problem. The FSS cluster has adopted cross collection discovery system namely VuFind and linked the FSS cluster with all other retrieval components for harvesting records through OAI/PMH protocol. In short, the strength of the software framework lies in providing –

1. end-user interface to facilitate a single-window search system for query submission (basic and advanced);
2. facilities for presentation of search results and ranking options for retrieved resources;
3. search and retrieval system for all local resources included in local ILS and local repositories;
4. full-text search options and linking to full-text resources included in local ILS (through 856 \$u in MARC 21 bibliographic format) and in local repositories (identified by Handle or some other link resolver);
5. Real-time interaction to local ILS to indicate availability of local resources;
6. Access to remote external resources (through API) from the same search interface.

The screen-shot, as given below, shows the single-window FSS cluster where users can search local library resources available from ILS cluster, full-text contents available from DMA cluster and at the same time users can extend search to externally available open access datasets (like BASE, OATD, etc) and subscribed datasets like (SCOPUS, EBSCO, Journal portals etc).

Integrated one touch facilities for easy day-to-day library management and enhanced user services



The other major features that are in built into the software framework are as follows:

- (i) Data backup and restoration is made possible through SQLyog over the

WINE emulation and through GUI

- (ii) Integration of automysqlbackup tool to determine backup schedule in weekly, monthly and daily basis
- (iii) Tools to optimize data tables in the backend RDMS like MySQL and PostGreSQL
- (iv) Integration of MarcEdit in Mono environment in the framework as MARC management tool
- (v) Developing OAI-compliant environment where all the clusters can be approached for content negotiation
- (vi) Support for external datasets like Amazon, x-ISBN, OCLC's API, Syndetics, AddThis etc
- (vii) Integration of social networking tools in end user interfaces
- (viii) Facilities for folksonomy and tag management
- (ix) Faceted navigation, Browse by Call Number, availability of advanced search operators including fuzzy searching
- (x) Cloud compatibility of the ILS cluster

Conversion of the software framework into ISO file for easy implementation at the college end

The Unicode-compliant and Web 2.0-enabled integrated framework has been ported into an ISO image. The ISO image is meant for distribution (in removable media or through web) and can be converted into a ready-to-install product by using suitable algorithm and programs. The ISO file includes all the domain specific clusters like integrated library system cluster, digital media archiving cluster, community communication interaction cluster, federated search system cluster, content management system and learning content management system. The ISO package can be installed, configured and utilized at the college end with the following components:

Integrated Library System (ILS)	Koha
College communication and interaction	MediaWiki, Blog and Wordpress
Content Management System	Joomla and Drupal
Learning Content Management System	Moodle
Federated Search System	VuFind and OAI-PMH protocol
Digital Media Archiving	Greenstone, Dspace and Eprints
Authority Control	Koha Authority integration and scripts for integrating VIAF to support Name authority control
Barcode Generation	Barcode Studio and Koha
Reference Management	Zotero and JabRef
Backup and restoration	SQLyog and automysqlbackup

Data conversion from one format to another	MarcEdit
Google Indic Transliteration	Koha OPAC
Web Searching Tools	Google CSE
Search indexing tool	Apache-Solr, Zebra and Lucene

B) Limitations

Nothing under the Sun is free from limitations. This research work is no exception. The limitations, as identified through the journey of research, are listed here with the possible reasons and tentative solutions.

Limitation - 1

- Problem** : Ports management for Apache-Solr in VuFind and Tomcat as Java servlet engine in DSpace
- Reason** : Both of these tools by default use port 8080 for working but the software framework requires to run both of these software. Apache-Solr as text retrieval engine for FSS cluster and Tomcat for DMA cluster
- Solution** : This issue has been solved through a make shift arrangement by running Apache-Solr in port 9090 and this modification call for the changes in different configuration files of VuFind and thereby creating problems in managing resources

Limitation - 2

- Problem** : Integration Authority control tools like NACO, SACO, VIAF etc in ILS cluster
- Reason** : NACO ad SACO is not yet available as Linked Open Data (LOD) and thereby making it difficult to include into the software framework through Open API. But VIAF is available as LOD but the API is working only upto version 3.16 of Koha
- Solution** : The solution of this problem requires external intervention and it has already been reported in Koha forum for designing suitable solution

Limitation - 3

- Problem** : SMS gateway integration in ILS cluster
- Reason** : Koha as software for ILS cluster of the framework requires subscription to SMS gateway (which is costly) and thereby this research fails to integrate SMS gateway in ILS cluster.
- Solution** : At the implementation end, colleges can subscribe to SMS gateway to enable the feature in ILS cluster

Limitation - 4

- Problem : Plural resolution in Indic scripts search
- Reason : Plural resolution is quite effective in Roman script based searching like a search by term 'catalog' can retrieve catalogs, catalogues etc through plural resolution but similarly a search on '□□□□' can not retrieve associated plural forms like□□□□□□□□, □□□□□□□□, □□□□□□□□
- Solution : The text retrieval engines in the software framework like Apache-Solr, Lucene and Zebra are not quite aware of the plural resolution mechanisms for Indic scripts and therefore in search interfaces users need to use wild character (like *, ?, %) at the end of the stem to retrieve associated plural forms.

Limitation - 5

- Problem : Large ISO file management
- Reason : The ISO file size has a limitation of 4 GB and beyond 3 GB it generates hybrid ISO file which is not compatible with BIOS of older computer systems
- Solution : This research work solved the file reduction process through a CUI interface tool called remastersys.sh but the resultant ISO is a hybrid ISO not compatible with architecture prior to Pentium.

Scope of Further Research:

It is customary that a research should end with a note on future possibilities. There are actually an array of future possibilities that can enhance the software framework. In fact, each of the limitations of this research may be considered as future direction of research in the domain under consideration. Apart from research areas like integration of subject authority and name authority tools in user interface and indexing interface of ILS cluster and DMA cluster, the future research may be taken up to include visual and integrated thesaurus support for cataloging and metadata encoding as well as visual navigation through resources by end users with the help of knowledge discovery tool like thesaurus. The software framework may be integrated with another cluster called Cultural Object cluster to handle cultural objects, museum objects, heritage objects etc and it will be a very challenging area in future that how cultural objects can be transferred over OAI/PMH protocol and how retrieval of cultural objects along side traditional library materials can be performed in discovery layer of the software framework.

Final Note

“Alice: Would you tell me, please, which way I ought to go from here?
The Cheshire Cat: That depends a good deal on where you want to get to.

Alice: I don't much care where.
The Cheshire Cat: Then it doesn't much matter which way you go.
Alice: ...So long as I get somewhere.
The Cheshire Cat: Oh, you're sure to do that, if only you walk long enough.”

— Lewis Carroll, Alice in Wonderland

References

- Ahmad, Hilal (2014). Library Software Awareness: A Survey of OPAC Vs Card Catalogue in IIT Delhi, IIT Kanpur, and Kashmir University. *DESIDOC Journal of Library & Information Technology*, 34 (4), 325-332 DOI: 10.14429/djlit.34.6164
- Anuradha, K.T. & Sivakaminathan, R. (2009). Enhancing Full text Search Capability in Library Automation Package: A Case Study with Koha and Greenstone Digital Library Software. *Proceedings of 2009 International Conference on Computer Science and Information Technology Singapore*, Oct 9-11,2009, pp. 232-236.
- Archana, S.N., Padmakumar, P.K & Beena, C (2014). Catalogue Interfaces of Integrated Library Management Systems (ILMS): Experiences in a Proprietary and Open Source Software. *DESIDOC Journal of Library & Information Technology*, 34 (1), 16-22.
- Baladrón, Carlos ; Aguiar, Javier M. ; Gobernado, Javier ; Carro, Belén & Sánchez, Antonio (2010). User-driven context aware creation and execution of home care applications. *Ann. Telecommun.* (2010) 65:545–556 DOI 10.1007/s12243-010-0164-4 (Accessed on Apr 14th, 2012)
- Bavakutty, M (1982). College Libraries in India. *International Library Review* 14, 394.
- Bhat, Iqbal and Mahesh, V. Mudhol (2014). Use of E-resources by Faculty Members and Students of Sher-E-Kashmir Institute of Medical Science (SKIMS). *DESIDOC Journal of Library & Information Technology*, 34 (1), 28-34.
- Biswas, Gautam (2008). NewGenLib, the first Indian open source software: A study of its features and comparison with other softwares. *23rd National Seminar of IASLIC*, 333-340.
- Boss, Stephen C. and Nelson, Michael L. (2005). "Federated Search Tools: The Next Step in the Quest for One-Stop-Shopping." *The Reference Librarian*, 44, 139-160. http://dx.doi.org/10.1300/J120v44n91_10
- Brennan, M., Funke, S., and Anderson, C. (2001). *The learning content management system*. Retrieved May 5, 2014, from <http://www.mindbranch.com/listing/product/R104-6256.html>
- Brentwood Library (2012). Request for Proposals for Purchase of an Integrated Library System.
- Carnevale, D. 2006. E-Mail is for old people. *The Chronicle of Higher Education*. 53 (7): A27. <http://chronicle.com/weekly/v53/i07/07a02701.htm> (accessed March 23, 2012). [Editor's note: Subscription required for access.]
- Chandrakar, Rajesh & Arora, Jagadish (2009). Copy cataloguing in India: A view point *INFLIBNET Newsletter*. 16 (2/3), 18-21.
- Clark, Alex (2010). *Plone 3.3 Site Administration*. Packt Pub.
- Cousins, Shirley and Sanders, Ashley (2005). Incorporating a virtual union catalogue into the wider information environment through the application of middleware: Interoperability issues in cross-database access. *Journal of Documentation*, 62 (1), 120-144. Emerald Group Publishing Limited 0022-0418 DOI 10.1108/00220410610642084.
- Cutter, C. A. (1876). *Rules for a Printed Dictionary Catalogue*. Washington, D.C.:

- Government Printing Office. Retrieved from <http://en.wikipedia.org/wiki/Cataloging> (Accessed on Oct 2, 2011)
- Daniel, D. & Dominic, J. (2011). Intrusion detection and prevention for Linux environment. *Indian Journal of Library and Information Society*, 24 (3/4), 193-203.
- Deshpande, K. S. User Orientation in College Libraries. *Library Science with a slant to Documentation* 15.12: 194.
- Digital Library Federation. (2008). *DLF ILS Discovery Internet Task Group (ILS-DI) Technical Recommendation*. Retrieved October 1, 2010, from <http://www.diglib.org/standards/>
- Discini, S. (2006). *Open Source Gaining Corporate Acceptance*. Sandhills Publishing, Lincoln, NE.
- Dunsire, Gordon & Willer, Mirna (2010). Initiatives to make standard library metadata models and structures available to the Semantic Web. *World Library and Information Congress : 76Th IFLA General Conference and Assembly*, 1-14.
- Dzurinko, Mary K. (1998). Integrated online library systems. *ILSR Integrated Library System Reports*. [Available online : <http://www.ilsr.com/iols.htm>]
- Esposito, J. C. (2006). *Wiring the dining experience*. *University Business*. October: 56-60. <http://www2.universitybusiness.com/viewarticle.aspx?articleid=573> (accessed March 23, 2007).
- Evans, G. E., & Saponaro, M. Z. (2000). *Developing library and information center collections*. Englewood, Colo: Libraries Unlimited.
- Farahi, Mina Tavassoli & Gandhi, R. T. D. Ramesh (2011). Adoption of information technologies in medical libraries in Karnataka, India and Iran: A comparative study. *International Journal of Library and Information Science*, 3(2), 38-45.
- Gatenby, Janifer (2002). Aiming at quality and coverage combined: blending physical and virtual union catalogues. *Online Information Review*, 26 (5), 326-334. ISSN 1468-4527. DOI 10.1108/14684520210447895.
- Gichora, Fred Gochi & Kwanja, Tom (2015). The impact of Web 2.0 tools on academic libraries in Kenya. *International Journal of Library and Information Science*. 7 (2), 21- 26 , February 2015 DOI: 10.5897/IJLIS2014.0518
- Guy, Robin Frederick (2000). Developing the hybrid library: progress to date in the National Library of Scotland. *The Electronic Library*, 18 (1), 40-50.
- Hafezi, Mehdi Alipour (2008). Interoperability between library software: a solution for Iranian libraries. *The Electronic Library*, 26 (5), 726-734 DOI 10.1108/02640470810910747.
- Haravu, L.J. (2009). Emerging Initiatives in Library Management Systems. *ICAL 2009 – Technology, Policy and Innovation*, 239-248.
- Henley, J. P. (1970). *Computer-based library and information systems*. London: Macdonald.
- Hopkinson, Alan (2009). Library Automation in Developing Countries: the last 25 years. *Information Development*, 25 (4), 304- 312.
- Kanetkar, Jayashree (2014). Development of Subject Gateways: A Status Update. *DESIDOC Journal of Library & Information Technology*, 34 (5), September 2014, pp. 367-375 DOI: 10.14429/djlit.34.5807
- Kipp, J. L., & Kipp, C. R (1961). *Indian Libraries and the Indian Wheat Loan Educational Exchange Program: A Report*. New Delhi: The Wheat Loan Office, American Embassy, 1961. p.78.
- Leong, Chee Khooon and Chennupati, K. Ramaiah (2014). Design and Development of Web-based Online Exhibitions. *DESIDOC Journal of Library & Information Technology*, 34 (2), 97-102
- Li, Xiaohua (Cindy) (2014). "What Would be the Future of the Integrated Library Systems?." *Proceedings of the IATUL Conferences*. Paper 3. <http://docs.lib.purdue.edu/iatul/2014/libservsys/3>

- Library and Information Technology Association (U.S.). (1982). *Information technology and libraries*. Chicago, IL: Library and Information Technology Association.
- Lubetzky, Seymour (1961). *International Conference on Cataloging Principles*. Paris. Retrieved from http://en.wikipedia.org/wiki/Seymour_Lubetzky (Accessed on Sept 15, 2011)
- Lyle, G. R. (1974). *The administration of the college library*. New York: Wilson.
- Mane, Manisha B. & Panage, B. M. (2015). Content analysis of university library portal: A detail study of Jayakar Library Portal, Savitribai Phule University of Pune. *International Journal of Library and Information Science*, 7 (5), 109-116. DOI: 10.5897/IJLIS2014.0532
- McDonald, Robert H. & Thomas, Chuck (2006). Disconnects Between Library Culture and Millennial Generation Values. *Educause Quaterly*, 1(4), 4-6.
- Morgan, E. L. (2002). Open source software in Libraries. Retrieved June 12, 2003. From <http://dewey.library.nd.edu/morgan/musings/ossnlibraries.php>
- Mukherjee, A. K (1965). Library Facilities in Training Colleges of India. *IASLIC Bulletin* 10, 54- 68.
- Mukhopadhyay, P.S. (2008). Library automation : A procedural model. Lecture note of Vidyasagar University.
- Mukhopadhyay, P. S. (2006). Five Laws and Ten Commandments : The Open Road of Library Automation in India. *XXII IASLIC National Seminar*, IIT Roorkee, pp. 27 - 36
- Mukhopadhyay, P.S (2008). *Library Automation through Koha*, p.37.
- Mukhopadhyay, P. S (2000). Progress of Library Management Softwares: an Indian Scenario. *Vidyasagar University Journal of Library and Information Science*.
- Musangi, Penninah S. (2015). Library 2.0 and the changing landscape of information services in academic libraries in Kenya. *International Journal of Library and Information Science*, 7(10), 183-187 , December 2015, DOI: 10.5897/IJLIS2014.0492
- National Knowledge Commission (2007). *Libraries: Gateways to Knowledge, a Roadmap for Revitalization*. New Delhi, NKC.
- O'Reilly, T. (2006). *Web 2.0 Compact Definition: Trying Again*. O'Reilly Radar (blog). Dec 10th 2006. Available online at: http://radar.oreilly.com/archives/2006/12/web_20_compact.html [last accessed 14/02/2012].
- Open Library Environment (2009). *The Open Library Environment Project Final Report*. Retrieved October 1, 2010, from <http://oleproject.org>.
- Pandey, Shri Ram & Singh, Pankaj Kumar (2011). Enabling ILAP as Digital Library Software: A case study with Koha. *8th International CALIBER – 2011*, 254-264.
- Omekwu, Charles O. (2007). Cataloguers in a global information network environment. *The Electronic Library*, 26 (2), 188-201.
- Rai, Namrata and Kumar, Shailendra (2011). Comparative features of integrated library management software systems available in Delhi. *The Electronic Library*, 29 (1), 121-146.
- Reddy, D. Jayanathan (1974). *Issues in Higher Education*. Madras: M. Seshachalem & Co., 1974. p.151.
- Sahai, Shri Nath (1990). *Academic Library System*. New Delhi: Allied.
- Sarma, Gautam Kumar (2016). OPAC Module in Open Source Library Management Software: A Comparative Study. *DESIDOC Journal of Library & Information Technology*. 36 (1). [dx.doi.org/10.14429/djlit.36.1.9223](https://doi.org/10.14429/djlit.36.1.9223)
- Sharma, R. N. *Indian Academic Libraries and S. R. Ranganathan: A Critical Study*. Delhi: Sterling Publishers, 1986. p.95.

- Svenonius, Elaine. (2000). *The Intellectual Foundation of Information Organization*. Cambridge, Mass: MIT Press.
- Stueart, R. D., & Moran, B. B. (1998). *Library and information center management*. Englewood, Colo: Libraries Unlimited.
- Sudhamaniks (2010). *Assessment and Evaluation of Open Source Library Automation Software Koha and NewGenLib adaptable to RGUHS Digital Library Operations and functions*.
- Tseng, G, Poulter, A., & Hiom, D. (1996). *The library and information professional's guide to the Internet*. London: Library Association Pub.
- Zico, Mohibuzzaman (2009). *Developing an Integrated Library System (ILS) Using Open Source Software Koha*. http://dspace.bracu.ac.bd/bitstream/10361/755/1/Mohibuzzaman_Zico_04101013_Thesis.pdf.
- Vaglio, Anna and D'Urso, Manuela (2008). Library customer service in an Italian university library: from ILL to circulation and back. *Interlending & Document Supply*, 36 (2), 116–119.
- Vastrad, Gayatri & others (2011). Federated Search and Discovery Tools. *8th International CALIBER - 2011*, 47-55.
- Veve, Marielle (2009). Applying the FRAD Conceptual Model to an Authority File for Manuscripts: Analysis of a Local Implementation. *Cataloging & Classification Quarterly*, 47 (2), 125–144.
- Vyas, S. D (1974). Does College Libraries Meet the Present Day Demand? *Indian Library Association Bulletin* 10, 101.
- Weber, T. (2004). *The Success of Open Source*. Harvard University Press, New York, NY.
- Willson, Rebekah & Given, Lisa M. (2010). The Effect of Spelling and Retrieval System Familiarity on Search Behavior in Online Public Access Catalogs: A Mixed Methods Study. *Journal of the American Society for Information Science and Technology*, 61

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