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Module : 17 Library Automation: Definition, Need, Purpose and Advantages

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Library Automation: Library Automation: Definition, Need, Purpose and Advantages

I. Objectives

Objective of this module is impart knowledge to the students on:

- Basics of library automation;
- Various modules and sub-modules of a library automation software package and their general features and functionalities;
- Important LMS packages available in the market; and
- Standards in library automation and resource sharing;

II. Learning Outcomes

After completion of this lesson, learner would study about the basics of library automation, various modules and sub-modules of a library automation software packages and their general features and functionalities, important Library Management Software packages available in the market and standards in library automation and resource sharing.

III. Module Structure

1. Introduction
2. Definition of Library Automation
3. History of Library Automation
4. Need & Purpose of Library Automation
5. Planning for Library Automation
    - 5.1 Hardware Requirement
    - 5.2 Local Area Network (LAN)
    - 5.3 Integrated Library Software and Criteria for Selection of a Software
    - 5.4 Creation of Databases of Records
    - 5.5 Retroconversion of Bibliographic Records
    - 5.6 Manpower and their Training
6. Standards and Protocols
    - 6.1 AACR-II
    - 6.2 Machine Readable Catalogue (MARC)
    - 6.3 Z39.50 or OAI-PMH

1. Introduction

Libraries are known for using Information and Communication Technology (ICT) both for automation of its routine activities as well as for providing search services to the users. Computers are increasingly used in libraries both for internal operations as well as for accessing information that is available in the four walls of the library. The application of computers avoid repetitive jobs and save labour and time both for users as well as outside the library staff. Computers are not only used as a data processing tool, but also for information storage, access and retrieval.

The use of computers for information storage and retrieval began with the production of computer-generated and printed indices for scientific and technical literature in 1960s. Subsequently, several organizations started using computers not only for generation and printing of indices but also for creation of computer readable databases, By early 1970s, several published indexing and abstracting journals, such as Biological Abstracts, Chemical Abstracts, Index Medicus, etc. were not only produced by computer, they were also made available as computer-

readable databases on magnetic tapes and several organizations started subscribing to them on magnetic media to organize local information storage and retrieval services.

Integrated library automation packages were introduced in libraries in 1970s. Mini-computers were used in 1970s in the libraries to computerize operations like circulation, acquisition, cataloguing, serials and Library OPAC. The trend picked-up in early 1980s with introduction of PCs at a cost affordable to the libraries. Past two decades have witnessed unprecedented developments in computer technology. Resultantly, inexpensive computing resources are now within easy reach of libraries. Computers are being used increasingly to automate various activities in libraries using a suitable off-the-shelf general or specific-purpose software package now available in a wide range for library automation.

This module covers definition, history, need & purpose of library automation. Planning for library automation, automation of in-house operations i.e. Cataloguing, OPAC, Circulation, Acquisition, Serial Control etc. Barcode Technology & RFID is also covered in this module.

2. Definition of Library Automation

The Oxford English Dictionary (Simpson & Weiner, 1989) defines automation as "application of automatic control to any branch of industry or science by extension, the use of electronic or mechanical devices to replace human labour".

ALA Glossary of Library and Information Science defines automation as "the performance of an operation, a series of operation or a process by self activating, self controlling, or automatic means. Automation implies use of automatic data processing equipment such as a computer or other labour saving devices". Although, the term automation was first introduced by D. S. Harder in 1936, the word library automation is being used in literature for the last five decades.

According to Encyclopedia of Library and Information Sciences (Kent, 1977) "Library Automation is the use of automatic and semiautomatic data processing machines to perform such traditional library activities as acquisitions, cataloguing and circulation. These activities are not necessarily performed in traditional ways, the activities themselves are those traditionally associated with libraries; library automation may thus be distinguished from related fields such as information retrieval, automatic indexing and abstracting and automatic textual analysis".

Library automation is the general term for ICT trends and techniques that are used for replacing manual system in the library. The term “integrated library system” refers to sharing of a common database (for documents and patrons) to perform all the basic functions of a library.

3. History of Library Automation

The initial work on library automation began in 1930's when punch card equipment was implemented for circulation and acquisition in libraries. During the 1930's and early 1940's progress on computer systems was slow because of depression and World War II. The library automation progressed along with the developments in computer and communication technology. The landmark developments in history of library automation are as follows:

- From 1946 to 1947, two significant computers were built. The ENIAC I (Electronic Numerical Integrator and Calculator) computer was developed by John Mauchly and J. Presper Eckert at the University of Pennsylvania. It contained over 18,000 vacuum tubes, weighed thirty tons and was housed in two stories of a building. Another computer, EDVAC, was designed to store two programs at once and switch between the sets of instructions.

- A major breakthrough occurred in 1947 when Bell Laboratories replaced vacuum tubes with the invention of the transistor. The transistors decreased the size of the computer, and at the same time increased the speed and capacity.

- The UNIVAC I (Universal Automatic Computer) became the first computer using transistors and was used at the U.S. Bureau of the Census from 1951 until 1963. Software development also was in progress during this time. Operating systems and programming languages were developed for the computers being built.

- Invention of integrated circuit by Robert Noyce of Intel and Jack Kirby of Texas Instruments in 1960s can be considered as yet another landmark. All the components of an electronic circuit were placed onto a single "chip" of silicon.

- Development of a new indexing technique called "keyword in context" (KWIC) by H.P. Luhn, in 1961 for articles appearing in Chemical Abstracts. Although keyword indexing was not new, it was found to be very suitable for the computer as it was inexpensive and it presented multiple access points.

- Use of computer for the production of machine readable catalogue records by the Library of Congress (LoC) in mid-1960s. Between 1965 and 1968, LoC began the MARC I project, followed quickly by MARC II. MARC was designed as way of "tagging" bibliographic records using 3-digit numbers to identify fields.
- The MARC II format became the basis of a standard incorporated by NISO (National Information Standards Organization) in 1974. This was a significant development because the standards meant that a bibliographic record could be read and transferred by the computer between different library systems.

- ARPANET, a network established by the Defense Advanced Research Projects Agency in 1969 brought into existence the use of e-mail, telnet and ftp.

- The use of commercial systems for searching reference databases (such as DIALOG) began in 1970s. BALLOTS (Bibliographical Automation of Large Library Operations) in the late 1970's was one of the first and later became the foundation for RLIN (the Research Libraries Information Network).

- The On-line Computer Library Center started its first cooperative cataloguing venture in 1970s. This significant project facilitated technical processing of library materials in member libraries.

- A sub-net of ARPANET made MELVYL, the University of California on-line public access catalogue, available on a national level in 1980. The MELVYL is still used as centralized integrated library software by all the campuses of University of California.

- During 1980s, the size of computers decreased, at the same time, technology provided faster chips, additional RAM and greater storage capacity. The use

of microcomputers during the 1980's expanded tremendously into the homes, schools, libraries and offices specially in developed countries.

- The UNESCO started distributing Micro CDS / ISIS in 1980s through its distribution centre in every developed country. Free availability of Micro CDS / ISIS, developed specially for library applications, proved a boon for the librarians in developing countries.

- Several integrated library package started appearing in the market place. The LibSys in India was launched towards the end of 1980s.

- In 1980s, several other software became available to librarians, such as spreadsheets and databases for help in library administration and information dissemination.

- The introduction of CD-ROMs in the late 80s changed the way libraries operate. CD-ROMs became available containing databases, software, and information previously only available through print, making the information more accessible.

- Connections to "outside" databases such as OCLC, DIALOG, and RLIN continued, however, in the early 90's the databases that were previously available on-line became available on CD-ROM, either in parts or in their entirety. Libraries could then gain information through a variety of options.

- The Internet gave rise to yet another era in library automation. The use of networks for e-mail, ftp, telnet, Internet, and connections to on-line commercial systems grew.

- The World Wide Web developed in 1993 became the fastest growing media of information delivery of all kinds.

- Expert systems and knowledge systems became available in the 90s with improvement in software and hardware capabilities. With the development of more advanced silicon computer chips, enlarged storage space and faster, increased capacity telecommunication lines, the ability to quickly process, store, send and retrieve information is causing the current information delivery services to flourish.

4. Need & Purpose of Library Automation

The exponential growth of information has made manual system redundant necessitating requirement of computerized information storage and retrieval. Effective and efficient handling of huge quantum of information is only possible by using computers, which have the added advantage of being highly accurate, and timely that adds value to information. Use of computers in automating the library routines is specifically useful for the following reasons:

- Much of the works involved in library are repetitive, tedious, and mechanical in nature requiring accurate updating of records in files. The same bibliographic record in a library is used to perform multiple operations. Each operation may concern with individual copies of a title. A bibliographic record created at the time of ordering a document is first used for its acquisition, then for technical processing and subsequently for library OPAC, circulation, binding, etc.;

- Automation permits decentralized access to a bibliographic record by multiple users. A staff member in a branch library can verify the status of an order without maintaining duplicate files or without making an enquiry. A user can check to see if a book is out on loan or available on the shelf of the library;

- The application of information technology in libraries results in increased operational efficiency. It ensures ease of functioning, accuracy and economy in human labour with greater speed;

- The library staff, specially the younger ones, finds use of computers interesting and exciting. Use of computers can be a motivating factor for several library staff members;

- The IT increases productivity of library staff. It relieves professional staff from clerical chores so that they can be fruitfully used for user-oriented library services; and

- It improves quality of services rendered by the library.

5. Planning for Library Automation

Planning library automation involves a number of key decisions with regard to purchase of integrated library software, computer hardware (server and PCs), building library databases (books and patrons), setting-up network infrastructure, manpower requirement and training, etc. Various issues involved in the process of planning library automation are described below.

5.1 Hardware Requirement

The process of automating library requires hardware both for hosting the library software and databases, i.e. servers, as well as computers to access it, i.e. clients. Server for library automation need to be computationally powerful, have adequate memory to handle the multiple access and transactions both by library staff as well as by the library users, have sufficient and secure disc storage for the database(s) and have good communication capabilities. It is important that the server is scalable so that additional storage, processing power or networking capabilities can be added, whenever required.

Clients are the machines that reside on the user's end or kept in library for users to access library OPAC. PCs with adequate hardware and requisite software to access Library OPAC may be presecribed so as to achieve efficient and effective interaction with the library OPAC. Access to Web version of OPAC (Web OPAC) requires an Internet-enabled multimedia PC equipped with an Internet Browser like Internet Explorer and Google Chrome as their clients.

5.2 Local Area Network (LAN)

A Local Area Network (LAN) is a required to facilitate interaction between server and clients. As such, setting-up a LAN is a pre-requisite for effective library automation. The library may have its independent LAN or it could be a part of the institutional LAN. Setting-up a LAN requires communication equipment like communication switches, routers, hubs, modems and other items. These hardware and software items are required for setting-up any network and are not specific to a library automation.

5.3 Integrated Library Software and Criteria for Selection of a Software

An integrated library system or an integrated online library system is used for computerization of in-house activities of a library. Such application packages use a single bibliographic database and a set of interrelated application programs to support multiple library operations. Most integrated library packages are modular in design consisting of a number of optional and basic modules. Most library package typically incorporate modules for: Acquisition, Cataloguing, Circulation Control, Serials Control and Public Access Catalogue. Online Public Access Catalogue is often principal motive for implementation of an integrated library package. Several off-the-shelf packages are available in the market which can be used for computerization of in-house activities of the Library. These software packages are available for single user in a workstation mode (Windows and its different version) as well in simultaneous multi-user environment on Windows/Linux Operating Systems. Some of the important library automation software packages are mentioned below:

Sr. No.	Software Packages	Name of Developers
1	ABCD (Automation of LiBraries and Cen-ters of Documentation)	BIREME (WHO, Brazil)
2	E-Granthalaya	NIC
3	Evergreen	Georgia Public Library System
4	KOHA	Katipo Communications Ltd
5	Liberty 3	Softlink Asia
6	Libman	Master's Software, Nagpur
7	Librarian Suite	Soft-Aid Computers Ltd
8	Libsoft	LIBSOFT SOLUTIONS
9	Libsys	Libsys Corporation
10	Libtech	Libtech Software Developers
11	Nettlib	Kaptron Pvt Ltd
12	NewGenLib	Verus Solutions Pvt. Ltd.
13	OPALS	Media Flex Inc
14	SLIM ++ & SLIM 21	Algorhythms Consultants Pvt Ltd
15	SOUL	INFLIBNET Centre
16	Troodan	Comtek Computers
17	Virtua	Virginia Tech Library System (VTLS) Inc

Table-1 Important Library Automation Software with Developers Name

5.4 Creation of Databases of Records

Three important databases that are required as pre-requisite to the library automation are as follows:

i. **Database of Library Books**: Building database of library books is one of the most important activities in the process of implementing library automation. This activity involves identification of document types available in the library, i.e. books, conference proceedings, theses and dissertations, reports, electronic books, microforms, standards, patents, etc. and associated data elements. While the records for recent books acquired would be generated during the process of book acquisition, records for existing document collection will have to be created through a process called "retro-conversion". Storage capacity required for storing the database of library books would depend upon the number of records corresponding to the documents that the library possesses.

ii. **Database of Journals**: The database of journals would include not only the current journals and issues received, but complete holdings of journals including back volumes of current journals as well as those which have been discontinued or ceased publications. Storage capacity required for storing the database of journals would depend upon the number of journals that the library has.

iii. **Patron Database**: Patron database would consist of names of authorized users along with their categories, which, in turn, determines their privileges in terms of number and types of documents that they can borrow and period of issue. The patron database requires regular updation as new users register and when the existing members leave. In an educational institution, patron database requires updation more regularly, at least every semester as new batches of students join and the existing ones leave after completing their courses. As every book requires a unique accession number, every patron requires a unique membership number. It would be ideal that a unique identification number, i.e. enrolment number in case of student, and employee code in case of staff is used as unique number across an institution.

5.5 Retroconversion of Bibliographic Records

There are a wide range of options available to libraries for retrospective conversion of bibliographic records available in a library. These methods include:

i. **Direct Keying-in of Records:** The libraries may choose to directly key-in the bibliographic details for documents available in their libraries. Preparation of "Data Input Sheet" is the first step in this process. Data Input Sheet should be prepared by professionally qualified staff who are well-trained in the skills of cataloguing. While data input sheet should be prepared afresh for each document, help may be taken from the shelf list / catalogue card, in case it exist. Standard subject headings or thesaurus should be used for assigned subject headings to the catalogue records. The job of retro-conversion can also be out-sources to an out-side agency with built-in terms and conditions for quality control. Fig.1 below provides a sample data input sheet.

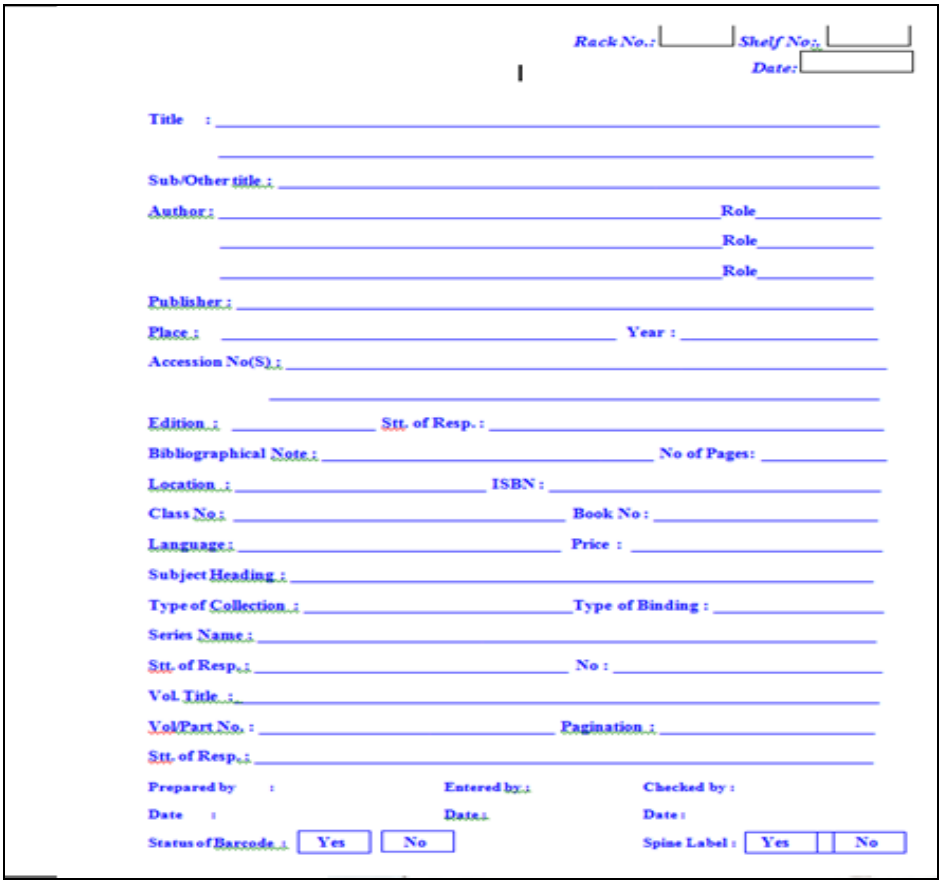

Fig.1 Data Input Sheet

i. **Buying Records from External Source**: Libraries may also buy bibliographic records for their books in a standard format from external sources like OCLC. The OCLC supports "custom cataloguing" as well as "batch processing" of bibliographic records for libraries.

ii. **Downloading Records from Library of Congress Online Catalogue / INFLIBNET Union Books Catalogue**: Bibliographic records can also be downloaded from the Library of Congress (LoC) Online Catalog (http://catalog.loc.gov/) as well as from the INFLIBNET Union Catalogue of Books (http://indcat.inflibnet.ac.in/) in MARC 21 format. Records downloaded from the two catalogues can directly be ported to MARC 21-compliant integrated library software.

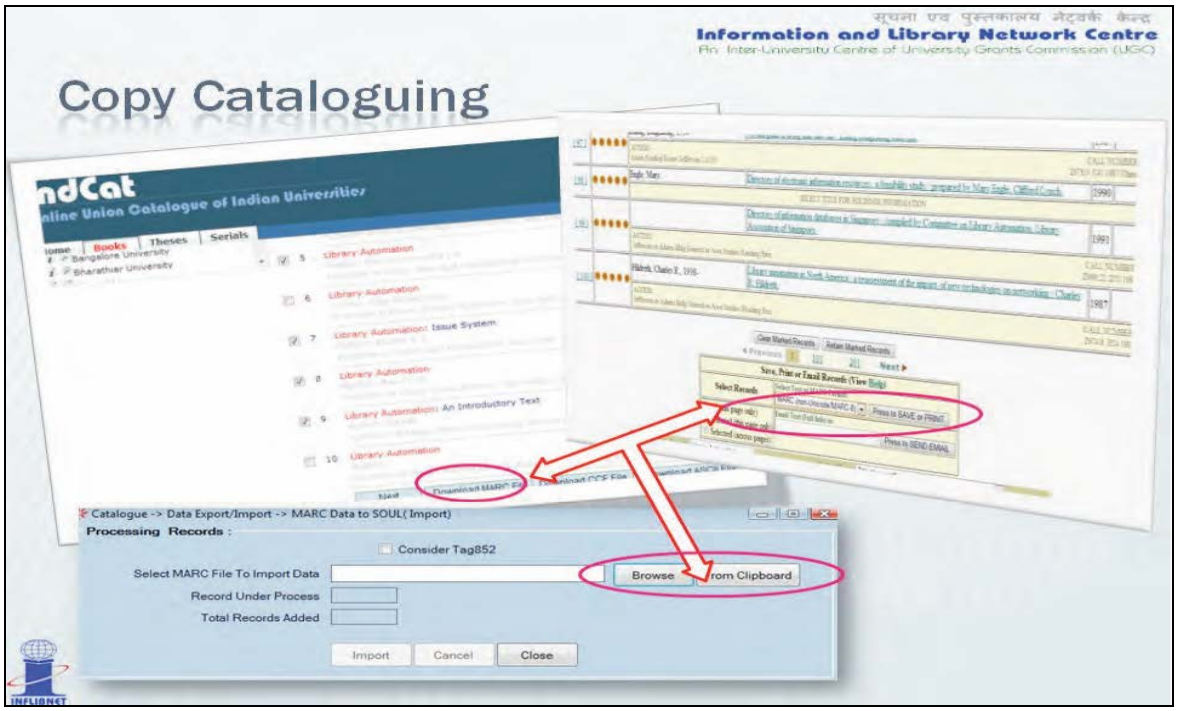

Fig.2 shows bibliographic records downloaded from Library of Congress (LoC) and IndCat database into SOUL 2.0 software

iii. **Scanning Title Page**: Software programs have also been developed to scan title page of a book, OCR it and transfer the OCRed content into the software with minimum human interference. However, success rates in OCR and intelligent recognition of appropriate field and sub-field is very low in most of the cases.

In practice, libraries will have to adopt a mixture of above mentioned methodologies depending on the quality and content of the catalogue to be converted. A typical library in India may not get more than 45 to 50% of its records from OCLC or any other external sources. Remaining cataloguing records have to be produced locally by direct keying them in.

5.6 Manpower and their Training

Trained and skilled manpower is a crucial requirement for successful automation of library. Most software vendors provide elaborate training for handling their software, both "on-the-job" for all staff members of a library, as well as at a common place along with other users. Training is usually provided at two levels, i.e. basic training for all staff members and advanced training, for system administrator. It is necessary to repeat the training after a short gap when staff members have some exposure of using the software. "On-the-job" training programmes are better not only because it benefits large number of users but it also solve local technological problems that can be solved with the availability of experts at the time of imparting training.

It may also be necessary to impart basic level training to staff members before training them on the library software. Some of the staff members may not have any exposure on use of computers. A basic training programme is also essential for the user of the library to make them competent to use library softwares most effectively. It is important that users are also trained in the art of searching the OPAC so that they can conduct better searches that provide better results and save their time. Proper training would make library staff more competent enabling them to provide qualitative services.

Besides training existing library staff, it may also be advisable to hire additional manpower with qualifications and experience in computer applications in libraries. The library may also bank upon expertise available within the Institute in its Computer Centre.

6. Standards and Protocols

Standards and protocols are of permanent importance in the process of implementation of library automation. Standards and protocols are instrumental in facilitating the operability, data transfer and data change. Important standards and protocols as applicable in library automation are as follows:

6.1 AACR-II

The first edition of AACR appeared in 1967, a cooperative effort of catalogers in the U.S., U.K., and Canada. The second edition, published in 1978 and revised in 1988, was developed by the Joint Steering Committee for Revision of AACR with Michael Gorman and Paul Winkler as editors.

The AACR provides descriptive cataloging of all types of materials likely to be found in general library collections. Individual chapters, books, pamphlets, and printed sheets, cartographic materials, manuscripts, music, sound recordings, motion pictures and video recordings, graphic materials, computer files, three-dimensional artifacts and realia, microforms, and serials. AACR provides rules guide for catalogue (i) constructing descriptions to identify and represent bibliographic works in catalogs; and (ii) constructing uniform headings (for persons, corporate bodies, geographic places, and titles) to be used as access points in catalogue. They do not cover subject cataloguing.

6.2 Machine Readable Catalogue (MARC)

The Library of Congress developed MARC in the 1960's. "Machine readable" means that the computer can read and interpret information found in the cataloguing record. MARC is a standard for recording bibliographic data at the logical level. It contains elements for content, physical and process description. MARC is not a single standard, but rather a framework within which each country has developed an individual standard. The MARC21 is becoming a "de facto" standard as it is being adopted as a common bibliograhic format by various National libraries. MARC 21 is the technical standard for the encoding of bibliographic information.

6.3 Z39.50 or OAI-PMH

Z39.50 is an ANSI / NISO standard for information storage and retrieval. It is a protocol which specifies data structures and interchange rules that allow a client machine to search databases on a server machine and retrieve records that are identified as a result of such a search. Z39.50 protocol is used for searching and retrieving bibliographic records across more than one library system. This protocol is not used by the Internet search engines (they use http). It is more complex and more comprehensive and powerful than searching through http.

Z39.50 has been extended to allow system feedback and inter-system dialogue. Like most applications working under client-server environment, Z39.50 needs a Z39.50 client program on one end, and a Z39.50 server program on the other end.

The name Z39 came from the ANSI committee on libraries, publishing and information services which was named Z39. NISO standards are numbered sequentially and Z39 is the 50th standard developed by the NISO. The current version of Z39.50 was adopted in 1995 superseding earlier versions adopted in 1992 and 1988 respectively.

6.4 FRBR (Functional Requirements for Bibliographic Records)

FRBR was developed by an IFLA Study Group (1992-1997). IFLA continues to monitor the application of FRBR and promotes its use. FRBR includes a conceptual model of entities and relationships and attributes; identifies specific user tasks that bibliographic records are intended to fulfill: find, identify, select, obtain; and recommends a set of elements for inclusion in national bibliographic records.

As Patrick LeBoeuf put it, FRBR is "a framework for commonly shared understanding". It describes what librarians generally agree on in general terms. It's not a revolutionary system of new ideas and can't be thought of in abstraction from the past library experience and the current library practices.

6.5 Dublin Core

The Dublin Core refers to a set of metadata element that may be assigned to web pages so as to facilitate discovery of electronic resources. Originally conceived for author-generated description of web resources at the OCLC/NCSA Metadata Workshop held at Dublin, Ohio in 1995, it has attracted the attention of formal resource description communities such as museums, libraries, government agencies, and commercial organizations. The Dublin Core Workshop Series has gathered experts from the library world, the networking and digital library research communities, and a variety of content specialists in a series of invitational workshops. The building of an interdisciplinary, international consensus around a core element set is the central feature of the Dublin Core. A set of 17 core elements in Dublin Core include: Title, Creator, Subject and Keywords, Description,

Publisher, Contributor, Date, Resource Type, Format, Resource Identifier, Source, Language, Relation, Coverage, Rights Management, Audience, RightsHolder.

Dublin Core is being expanded with “qualifiers” for each core elements. For example, core element “creator” can further be qualified as “creator.author” or “creator.compiler” or “creator.editor” to specify that creator is an author, or a compiler or an editor.

6.6 ILL Standards

The ISO InterLibrary Loan Protocol (ISO ILL) was developed to provide uniform procedures when accessing a library across a network to order copy or loan material, and for carrying out the administrative tasks involved in loan management. However, it only provides ordering and loan management functionality, it does not provide any services to search for or locate an item nor to have the item delivered electronically although it provides some facilities for billing and accounting, these are fairly simple.

The standard defines a number of services available to the requesting site and the supplying site. The standard models the activities involved in a variety of scenarios, which include:

- Simple request (with a reply indicating failure to supply),
- Request for the loan of an item with full tracking of the loan including recall notices, renewal request, reporting of lost or damaged items,
- An unsatisfied request being passed to a backup library for supply.

The ILL protocol is described and defined in two standards documents: ISO 10160 Interlibrary Loan Application Service Definition and ISO 10161 Interlibrary Loan Application Protocol Specification [ILL]. The standard was first approved by ISO in 1991 after several years of collaborative international development, consultation and review.

6.7 Open URL

Open URL is an emerging standard for transporting information within a URL to a ‘resolution server’ that can accept the URL syntax and provide context-sensitive services based on the information in the URL. The metadata in the URL describes

the resource that is being requested by the user. The Open URL is a standardized way to pass information in the URL between different resources. Some common elements that are passed are ISSN, ISBN, title, volume, issue, author, date etc. When this Open URL is passed to the resource, the resource can deliver the appropriate information. For e.g. a link from a journal in the Web OPAC can deliver information pointing to the full-text of the journal in one of the library's licensed full-text database.

The Open URLs are defined as an interoperability model that facilitates context-sensitive reference linking in distributed libraries. Powell, A (2001) defines it as a mechanism for encoding a citation for an information resource, typically a bibliographic resource, as a URL. The open URL is, in effect, an actionable URL that transponds metadata, or keys to access metadata, for the object for which the Open URL is provided. It is syntax to create web-transportable packages of metadata and/or identifiers about the information object. Such packages are at the core of context-sensitive or open linking technology. Open URL is a dynamic URL that carries metadata (instead of the address of specific web page) as a representation of information of a bibliographic resource. It consists of metadata representing a citation, which can be moved from one system to another.

6.8 Search/Retrieve Web Service (SRW) and Search/Retrieve URL Service (SRU)

SRW and SRU are intended to define a standard form for Internet search queries as well as the structure of the responses. SRW/U was developed mainly with the aim of simplifying some of the complexities involved with the Z39.50 protocol, while keeping the useful parts of the protocol, such as CQL3 query syntax. SRU/SRW services are easy to implement compared to Z39.50, mainly because SRU/SRW are Web-based protocols. Another important benefit is that SRU and SRW can be combined with other Web-driven applications such as OpenURL. Typically, SRU/SRW queries are encoded in URLs, the search results are in XML, and their records are encoded using the DC format.

7. Automation of In-house Operations

Most integrated library systems consists of five modules, namely acquisition, cataloguing, Library OPAC, circulation and serials control, that are used to automate various in-house operations of the library. Besides, several integrated

library systems also offer additional modules for article indexing, stock verification, report generation, handling media, etc. A brief description of features and functionalities of various modules of an integrated library systems is given below:

7.1 Cataloguing

Cataloguing is a core application module that facilitates creation, updation, and management of bibliographic database of the library. Several cataloguing capabilities are widely implemented across a wide number of integrated library packages although system-specific variations can affect the convenience with which particular tasks are performed. Most integrated library software support MARC 21 records as well as partial MARC 21 records, i.e. a vendor or a user can define minimum field content for bibliographic records with a provision to leave other MARC 21 fields blank. Some systems also support non-MARC formats with library-defined fields. Typically MARC and non-MARC records can coexist within a library's database.

Most integrated library system permit direct entry of original cataloguing data through input screens as well as import of machine-readable cataloguing records from machine-readable sources such as MARC–format tapes / CDs produced by national libraries, bibliographic utilities, retrospective conversion services or other sources. Many integrated library system also support an online interface for direct transfer of cataloguing records from bibliographic utilities such as OCLC or Library of Congress or CD-ROM information products. In some integrated library systems, cataloguing workforms are displayed with field names as an alternative to MARC 21 tags and subfield codes. In client / server implementations, cataloguing workstations are Windows-based microcomputers with graphic user interfaces. Depending on the system or customer preferences, newly entered catalogue records may update a database of library immediately or at scheduled intervals.

Depending on the system, authority control may be incorporated into the cataloguing module or offered as a separately purchased component. In either case, the authority control establishes and maintains authorized forms and cross-references for designated field values. As bibliographic records are entered, field values subject to authority control are automatically checked against authorized forms, with new or questionable names and headings being flagged for review. System-specific variations determine the fields to which authority control can be applied. Author's names, uniform titles, series titles, and subject headings are the

most commonly controlled fields. Depending on the system, authority records may be key-entered, generated from existing headings in a library's catalogue, or imported in machine-readable form from external sources. Global editing capabilities facilitate the modification of headings. Some integrated library systems permit multiple authority files or support thesaurus-like cross-reference structures that include broader terms, narrower terms, related terms, and scope notes, in addition to the familiar "see" and "see also" entries.

Major activities and services supported by the Catalogue Module of integrated library software include:

- Creation of pre-defined worksheet and input of catalogue records;
- Provision for fetching records from Acquisition Module for titles that are "in process" of acquisition but yet to be catalogued;
- Provision for appending digital objects including textual and non-textual (image, audio or vidio) files;
- Provision for incorporating link to Internet resources including "http" or "ftp" links;
- Maintenance of name and subject authority file including provision for construction of thesaurus;
- Provision for generating subject bibliography and list of references;
- Provision for editing, correction and removal of bibliographic records;
- Arrangement of bibliographic records in a pre-defined filing sequence;
- Printing of catalogue cards, bar code, spine labels, etc;
- Update holding, i.e. number of books, their collection codes, transferring from one collection to another, etc.;
- Generation of current awareness services / recent arrivals, SDI services, etc.;
- Listing of catalogue records by specified criteria such as subject, geographical area, date of publication, alphabetical by titles / author or their combination ; and
- Generation of indices (author, title, series, subject headings, words in title / series, etc.)

Most library integrated systems requires creation and maintenance of a number of pre-defined "masters" before using the cataloguing module. These masters are used by the software uniformly for cataloguing and related activities. Masters specific to cataloguing module are: Fixed Field, Classification Scheme, Data Entry Templates, Report Templates, etc. A screenshot of main menu of a Catalogue Module of SOUL 2.0 software is given below:

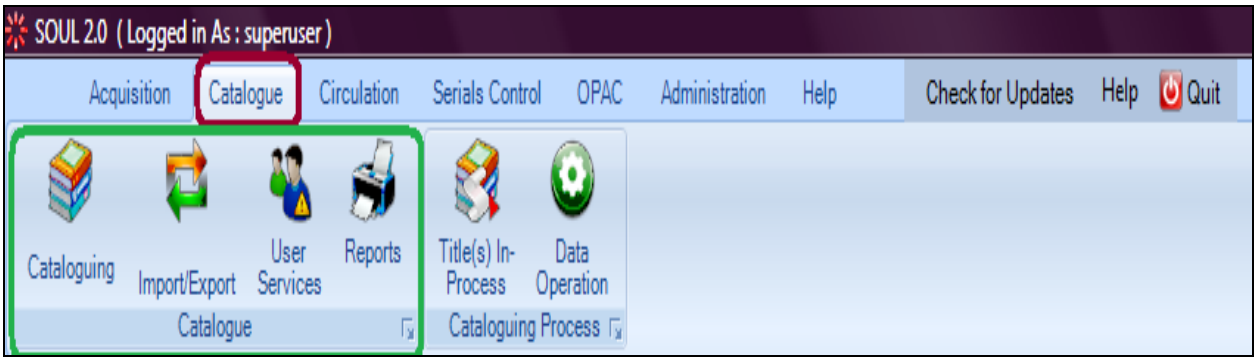

Fig.3 Main Menu of a Catalogue Module of Soul 2.0

7.2 Online Public Access Catalogue (OPAC)

The introduction of Online Public Access Catalogue (OPAC) modules in the late 1970s and early 1980s signaled the transition from single-purpose circulation control systems to truly integrated library system. For many libraries, the implementation of an online catalogue as a substitute for a card or book form catalogue is the principal motive for installing an integrated library system.

Most OPAC modules are menu-driven, although a command-driven expert mode are also being supported by some software. Menu-driven interfaces are essential for institutions, such as public libraries, that serve diverse clienteles and have limited opportunities to train their user populations. Command-mode searching appeals most strongly to academic or special libraries, where frequent users with complex retrieval requirements can be trained in advanced search techniques. Command-mode searching is also potentially useful for reference librarians, enabling them to initiate retrieval operations that are cumbersome or impossible to perform with menu-based searching.

Designed for novice users, menu-driven OPAC modules are characteristically straightforward in concept and operation. Search options, identified by abbreviations or numbers, are typically listed in introductory screens for operator selection. Brief instructions explain search procedures and indicate the proper syntax for search statements. More detailed information is presented in help screens that may be invoked by functions keys. While vendors supply the initial text of help screens their content can often be edited by libraries to incorporate local information.

Most integrated library systems support conventional character-based video terminals as OPAC workstations. In client / server implementations, however, OPAC workstations are Windows-based microcomputers. They rely on pull-down menus, dialogue boxes, mouse operations, and other graphical user interface components to simplify the entry of search commands and formatting of retrieved information. With development and proliferation of Internet and Web resources, most library integrated software also support Web interfaces to the OPAC. The Library catalogues for major libraries even in India can now be searched through the Web site of libraries using popular web browsers, such as Microsoft Internet Explorer, Google Chrome etc.

All OPAC modules permit searches by author, title, and subject. Typically, a user specifies a field to be searched and a name, subject heading, or other value to be matched. Other retrieval capabilities vary from system to system. For maximum flexibility, some integrated library systems allow any library-designated field within bibliographic records to be indexed for retrieval purposes. In other cases, indexed fields are predetermined by the vendor, but the list is often sufficiently broad to satisfy diverse library requirements. Root-word searching, relational expressions in search statements, and Boolean operations are commonplace. Some integrated library system permit keyword searching of designated fields, particularly titles and subject headings. Several integrated library system support proximity commands, wildcard characters, and other capabilities commonly associated with full-text retrieval systems. Such capabilities are most relevant for bibliographic records that contain abstracts or other long text segments. Some integrated library system allow a library to define a portion of its holdings, such as a special collections catalogue, that can be searched separately. For example in LibSys, text books, Ph.D. theses, reference collections, etc. can be searched separately as well as together with the entire database.

If only one bibliographic record satisfies a retrieval specification, it is usually displayed immediately. If multiple records are retrieved by a given search, most OPAC modules provide a count of the number of retrieved items, followed by a scrollable display of brief bibliographic records that include some combination of author, title, publication date and call number. The searcher can select one or more records for detailed display.

Full bibliographic records are usually displayed in a format called “pneumonic” with field labels that clearly identify specific data element. With some integrated systems, display formats are pre-determined for specific types of library materials; in other cases, a library can specify the fields to be included in brief and full record

displays. The inclusion of holdings information, such as the locations of copies and their circulation status, in retrieved records is an essential attribute of integrated library systems. Such information is often contained in continuation screens or "pull down" menus that can be displayed at the searcher's option. Some integrated library systems can display full MARC records with tags and subfield code, although that format is more appropriate for technical processing operations than for public catalogue access.

When no bibliographic records are retrieved by a given search, most OPAC modules display a scrollable, alphabetized list of field values that most closely match the search term. If authority control is implemented, cross-references are displayed for invalid or related headings. In the absence of a cross-reference, some systems will automatically substitute the closest matching name or word for a search term that fails to retrieve bibliographic records with an assumption that a typographical error or misspelling led to the retrieval failure. A screenshot of main menu of a OPAC Module of SOUL 2.0 software is given below:

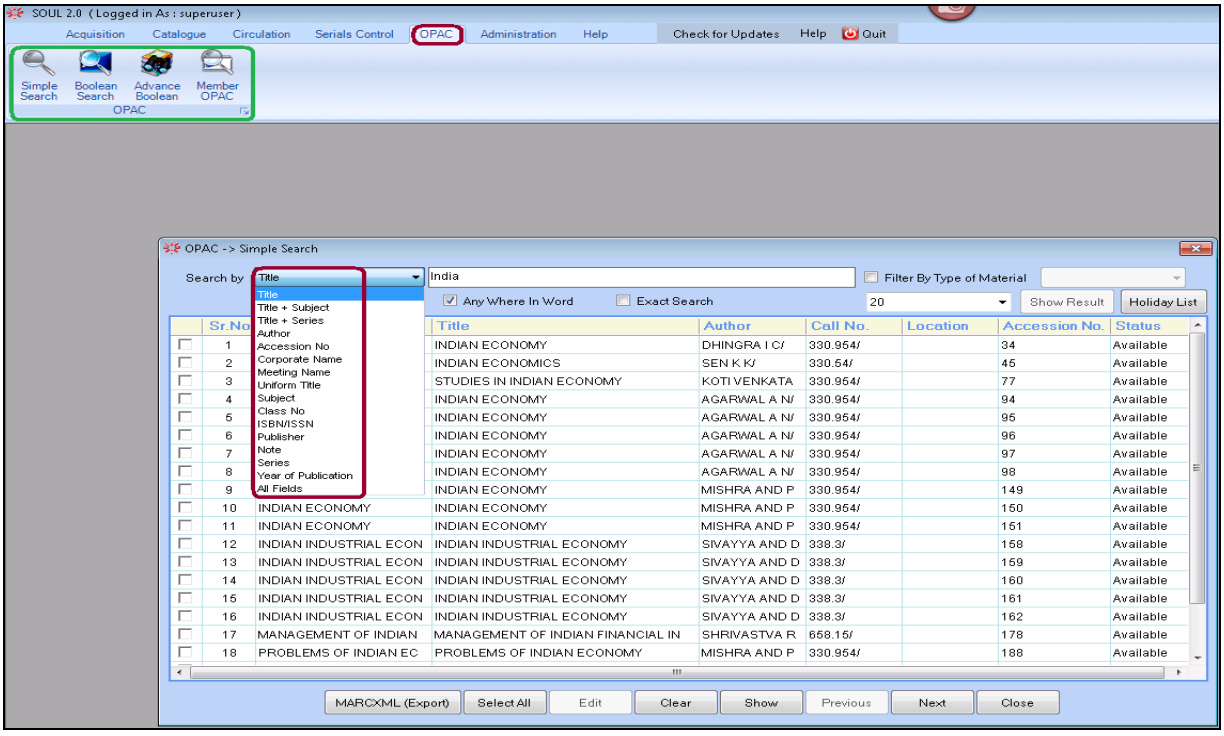

Fig.4 Main Menu of a OPAC Module of Soul 2.0

7.3 Circulation Control

The circulation control modules of integrated library systems is concerned with automation of a variety of tasks, including check-out, check-in, and renewal of

library materials; reservations; fines calculation, collection, and recordkeeping; creation, maintenance, and retrieval of borrower records; and printing of reports and notices. Drawing on three decades of library experience with computer-based circulation management, most circulation control modules are very well developed. Libraries define loan periods, fine rates, renewal restrictions, and other circulation characteristics for specific types of items and borrowers.

All circulation control modules perform check-out, check-in, and renewal operations in real-time. The circulation status of specific copies is immediately reflected in OPAC displays. All circulation control modules block transactions in case of exceptional conditions, such as delinquent borrowers or items on reservation, are encountered. Borrower records can be key-entered or transferred from machine-readable sources, such as student registration records or employee databases. Brief bibliographic records can be created for items that are not catalogued or to track materials received through inter-library loan. All circulation control modules support barcodes to simplify the entry of item and borrower identifiers, although specific barcode formats may vary from system to system. Integrated library systems commonly produce a variety of circulation reports and other printed documents, including overdue notices, fine notices, bills, borrower lists, lists of missing items, and statistical reports of circulation activity. Some integrated library system support a telephone dialing and voice notification capability for hold and overdue items.

Many integrated library systems provides online access to transactions records to registered borrowers, thereby reducing staff time spent by library staff on borrower's inquiries. Borrowers can review the items they have in circulation, items they have on hold, fines dues, and any block on their records. Increasingly, borrowers can reserve items retrieved through OPAC searches. Reservation may also be placed on items that are on order or awaiting cataloguing. Self-service check-out terminals are now getting popular in libraries using RFID technology.

Fully-developed circulation modules can accommodate a broad range of transactions including the followings:

- Membership Record Keeping: Maintenance of a database of authorized users and define their entitlements as per their category, i.e. faculty, students (Ph.D., PG or UG) and staff;
- Provision to check-out and check-in library documents as per authorization of a given user;
- Handling reservations;

- Overdue follow-ups and Recall ;
- Renewal of loaned items;
- Stock verification;
- Inter-library loan and transaction of books borrowed through ILL;
- Calculation of fines;
- Analysis of circulation transactions;
- Handling special categories of borrowers and special types of materials;
- Notifications to delinquent borrowers (users with overdue books, unpaid fines, etc.);
- Printing of due date slips, no dues, routing slips, etc.;
- Queries handling: both on borrowers and collection; and
- Report generation: overdue and recall notices, reserved titles, checkouts to borrowers, stock verification list, delinquency records, loan statistics by category of users, etc.

Bar codes and RFID are two automatic identification technology that are used in the process of circulation. These two technologies are briefly described in this module.

Most library integrated systems requires creation and maintenance of a number of pre-defined “masters” before using the circulation module. These masters are used by the software uniformly for circulation processes and for report generation using circulation module. Masters specific to circulation module are: Institute / Library Details (printed on stationery), Category of users and Calendar. A screenshot of main menu of a Circulation Module of SOUL 2.0 software is given below:

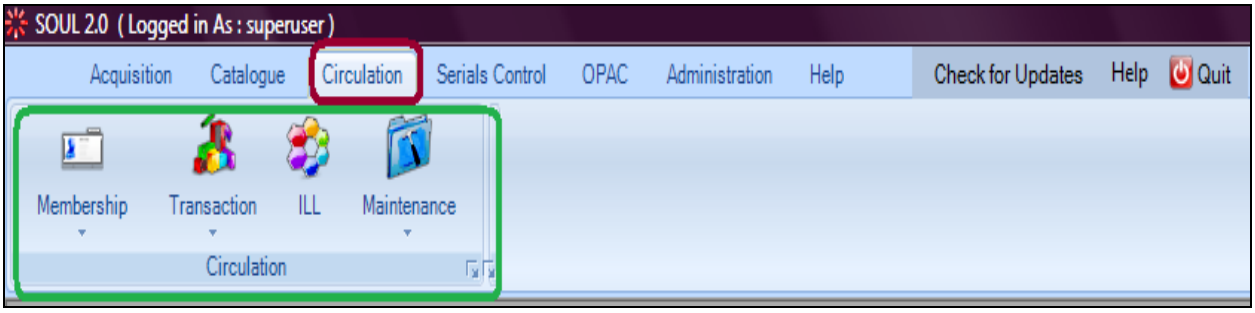

Fig.5 Main Menu of a Circulation Module of Soul 2.0

7.4 Acquisition

The primary objectives of automated acquisition module is to manage and control library budget effectively, speeding the process of library acquisition by

automating process of ordering, receipt and payment of documents in library. Because acquisition module are fully integrated with other system components, records for ordered items are included in the library's bibliographic database, and on-order status is reflected in the online public access catalogue. Purchase orders may be printed in several formats. Most acquisition module support electronic transmission of orders to other vendors. Most acquisition module will monitor items for arrival within library-specified time period. Claiming notices may be issued manually or automatically. Subject to system-specific variations, acquisition module can also print invoice forms, work slips, cancellation notices, and payment vouchers. Management and statistical reports may be printed at specified intervals or on demand.

Fully-developed acquisition module can accommodate a broad range of procurement transactions including the followings:

- Book selection;
- Pre-order searching;
- Approval processes: printing of approval list and subsequent follow-up (approved, not approved, duplicate, etc.;
- Print or e-mail purchase orders for books;
- Query letters to vendors;
- Print or e-mail reminders / cancellation;
- Handle standing orders, blanket orders, prepaid orders, gifts and exchanges, membership, etc.;
- Receipt and accessioning of documents (system-generated accessioning / manual accessioning);
- Invoice processing;
- Payment requisition to accounts for releasing payment;
- Reminders and follow-ups for non-receipted documents;
- Handle budgeting / distribution of budget amongst Departments / Centres / Schools and Division, etc. and generating budget status reports;
- Print accession list;
- Notification to users (arrival of books / out-of-stock / out-of-print, etc.);
- Vendor performance report;
- Report on out-standing orders / orders under process / books under process; and
- Handling queries on acquisition such as title in process, pending and overdue orders, pending titles, etc.

Most library integrated systems requires creation and maintenance of a number of pre-defined “masters” before using the acquisition module. These masters are used by the software uniformly for procurement of documents. Masters specific to acquisition module are: Currency Management, Vendor Management, Budget Management, etc. A screenshot of main menu of a Acquisition Module of SOUL 2.0 software is given below:

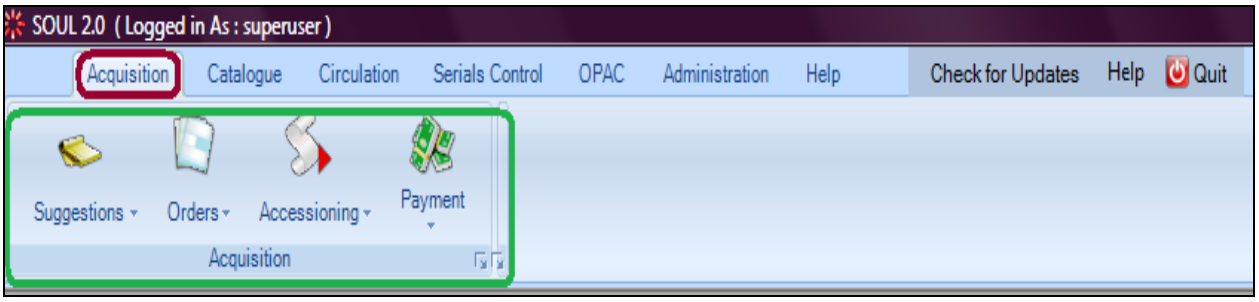

Fig.6 Main Menu of a Acquisition Module of Soul 2.0

7.5 Serial Control

Serial Control Module are designed to manage magazines, journals, newspapers, monographic series, and other materials that libraries receive on a continuing basis, whether at regular intervals or as irregular supplements or special publications. Automation of serials control system helps to handle serials more easily, quickly and more effectively. With some integrated library systems, ordering and claiming of serial publications are handled by the acquisition module, while the serial control module supports check-in, routing, and binding of received issues. Alternatively, a serials control module may handle all aspects of serials management, including procurement and claiming. That approach does not require implementation of the acquisition module as a precondition for serials control.

The serial control module keep track of publication patterns and will predict the receipt of specific issues. Claiming notices for missing issues may be produced manually or automatically. Some integrated library system support electronic transmission of claims. Serials holdings information is included in the library’s OPAC, which is updated to reflect the receipt of new issues. Typical management and statistical reports include serials catalogues and union lists, on-order lists, lists of issues received, lists of issues past due, lists of claiming notices sent, and vendor performance reports. Some integrated library systems will also print routing slips for received issues and pull-slips for items to be sent to the bindery.

Fully-developed serials control module can accommodate a broad range of routines required for automating serials acquisition and management including the followings:

- Input of serials data;
- Ordering: ordering of new journals, and renewal / cancellation of existing journals, handle approvals (approved and rejected journal titles);
- Receipt: Receipt of individual issues of journals;
- Claims Monitoring: Sending reminders for missing issues of journals;
- Routing and circulation of individual issues of journals;
- Holding Information: With information about complete volumes, volumes with missing issues and missing volumes;
- Services: List of periodicals received in a month / fortnight / week, list of periodical renewed / added, list of periodicals cancelled, report on serials holding;
- Management service: Keeping track of amount spent on subscriptions, binding of volumes and holding information, etc.;
- Queries Handling: Queries pertaining to new serials, renewal of serials, their receipt, vendors, their performance, recent arrivals, etc.; and
- Report generation: report on missing issues, complete volumes, binding orders, accession register for bound volumes, budget and expenditure analysis.

Most library integrated systems requires creation and maintenance of a number of pre-defined "masters" before using the serials control module. These masters are used by the software uniformly for procurement and maintenance of serials. Masters specific to serial control module are: Currency Management, Vendor Management, Budget Management, Publisher Master, Binders, Frequency Master, Delivery Mode, Physical Media, Binding Type, etc. A screenshot of main menu of a Serial Control Module of SOUL 2.0 software is given below:

Fig.7 Main Menu of Serial Control Module of Soul 2.0

7.6 Other Modules

Depending on the integrated system, a few more modules are offered either at bundled cost or at additional cost that provide useful functionality. Many integrated systems, for example, offer report-generation modules with customized output capabilities that supplement the preformatted management and statistical reports produced by cataloguing, circulation control, acquisitions and article indexing modules. Media booking modules provide circulation control for videotapes, films, and other audiovisual media, as well as equipment and facilities that are subject to advance reservations. Typical management reports and notices include media catalogues, reservation work slips and schedules, media activity reports, overdue notices, and usage summaries. Reserve room management is principally intended for academic libraries.

To extent their functionality, integrated library system increasingly incorporate external information resources into OPAC searches. electronic books, backfiles of journals and other e-resources, obtained from publishers, can be locally mounted and listed in OPAC as hyper-linked items. Some vendors of integrated library system also provide interfaces to CD-ROM information products, online information services, and Internet sites. Since the mid-1980s, integrated library system vendors also offer gateway access to the catalogues of other libraries. The NISO Z39.50 standard is supported by many integrated library systems at the client and server levels. The Z39.50 standard defines an interface that permits communication between the compliant computer systems of different vendors. It allows an OPAC terminal of one integrated system to search an external computer system using the retrieval commands and operating procedures associated with the terminal's host system.

8. Automatic Identification

Automatic identification of documents in a library and patrons is an important component of effective automation of circulation as well as several other processes. Bar code technology and RFID are two automatic identification technology. These two technologies and their applications are briefly described below:

8.1 Bar Code Technology

Bar code technology is being used in library and businesses for past 35 years to minimize data entry errors, speed processes, and reduce costs. Most books, journals as well as other consumer products in the market carry black and white thin and thick strips. These black and white strips are known as barcodes. Barcode technology offers a mechanism that can be used for identification, location and tracking of items that are bar coded. Book Bank modules are typically required by academic libraries that facilitate long-term issue (for given semister) of multiple nos. of text books to students entitled for the facility.

Barcode is not a new technology, it was introduced in 1940 although it was first applied commercially in 1960's as a method for tracking rail road cars. Since then, it has been used extensively in consumer industry, material handling industries and libraries. The structure of a barcode is given below:

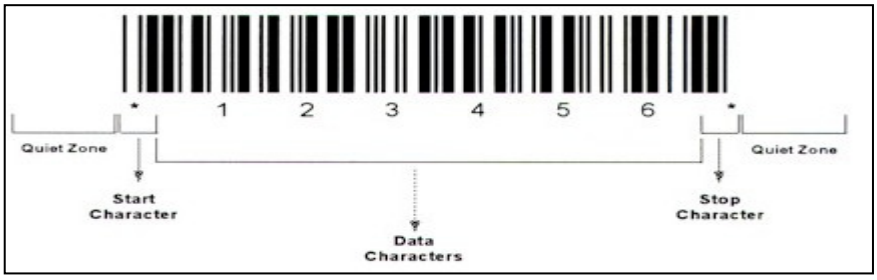

Fig. 8: Structure of a Barcode

8.2 Radio Frequency Identification (RFID)

RFID (Radio Frequency Identification) is a term used for a radio-enabled device that communicates with or interrogates a tag or smart label, which is embedded with a single microchip processor and an antenna. The origin of the term lies in the invention of "tags" that reflects back or re-transmit a radio frequency signal. The two components of RFID are tags and readers. The tags or label is equipped with a single microchip processor, an antenna and an ID code that can be embedded in almost any object. RFID readers are radio-enabled devices, that communicate with or interrogate RFID tags or labels wirelessly and obtain the ID code on the tags from a distance of several inches. The RFID readers can be fixed

or made portable just like barcode scanners. RFID can also be referred to as a high-tech version of the barcode.

In the past few years, the cost of RFID tags have come down drastically. Low cost RFID tags, typically costs less than Rs. 40.00 each for up to 1 metre range making the technology affordable as an alternative to the barcode, magnetic strip or printed label. RFID has advantages that include tolerance of mis-orientation and obscuration, lower cost over life and ability to "read". Most importantly, RFID tags are cheap enough to be disposable and thin enough to go even inside the sheets of paper in some cases.

9. Next Generation Library Management System

While traditional integrated library management software (LMS) caters to most of the requirements related to in-house operations of a library, near explosion of e-resources including web-based open access content, licensed resources, born-digital documents within an organization, rapidly evolving Internet and Web 2.0 technologies, growing number of web- savvy users and their increasing expectations led to next generation library system.

Next-generation library system, often referred to as "next-generation library platforms" are expected to offer advanced features and functionality catering to the requirement of a hybrid physical and a digital existence of today's library embedding Web 2.0 and Library 2.0 features and functionalities such as tagging, patron-driven acquisition and ability on part of users to save search results, create lists and add comments and reviews. In addition, individual catalogue records should have facility to accommodate additional data such as tags, lists and reviews, cover images, multiple icons and graphics, tables of contents, holdings data, links to similar items, data on previous borrowers of a book, etc.

Some of the important next-generation features and functionalities that the next generation library management software should support (Wang, 2012), are as follows:

i. **Cloud-based Application:** Moving away from conventional 'hosting' locally on to a server to 'cloud' based implementation, i.e. Integrated library software is offered as Software-as-a Service (SaaS), or further, Platform-as-a-Service (PaaS) on a platform hosted by vendor which is shared by many separate and distinct libraries.

ii. **Comprehensive Library Resources Management:** The next-generation ILS should respond to the shift from physical to digital collection in today's library. As such, it should be able to manage all library materials regardless of their formats or location. The library database should be able to integrate all electronic resources subscribed by a library with physical resources it possesses seamlessly. In other words, the next-generation ILS should integrate functionalities of an Electronic Resource Management System (ERMS) adopting workflow of a library including acquisition and licensing.

iii. **Service-oriented Architecture:** To facilitate migration from conventional library automation system to "library services platform" where various components and sub systems are 'loosely' coupled using web-based Service Oriented Architecture (SOA) model. The SOA model would facilitate interoperability of components of library system with other systems facilitating easier integration with 'admin' systems such as student registry, faculty directory and finance. Use of Service Oriented Architecture (SOA) leads to platform independency allowing its users to pick-up software and hardware of their choice without getting locked to a single vendor.

iv. **Ability to Meet the Challenges of New Library Workflow:** The process of acquisition and licensing of e-resources is not only different from acquisition of physical resources, it is also complex involving multiple decisions and multiple steps at various stages in the process of acquisition and delivery of e-resources. As such, the next generation Library System should not only be different from the existing library system, it requires completely new workflow facilitating customization and flexibility. The next generation systems should be able to unify the acquisition of electronic information resources, such as e-books and e-journals as well as traditional print materials in the same system.

v. **Next Generation Discovery Service:** One of the most important feature of the next-generation library system is 'discovery service' that will offer the possibility of unified search to local print holdings (OPAC), specialized and commercial databases subscribed by the library, local repositories and open access resources with built-in social networking capabilities.

   The next generation library system should offer a single search box for all types of resources with features for advanced relevance ranking, faceted search, social tagging of records, persistent links to records, RSS feeds for searches, and the ability to save searches or export selected records to standard bibliographic management software programs. The system should be integrated

with the library's OPAC with a smart interface and navigational facility retaining features for providing real-time circulation status, prominent borrowers of a book, etc.

Some of the library management software imbibing features and functionalities of 'next generation library platform are: Alma from ExLibris, Sierra from Innovative Interfaces, WorldShare Management Services from OCLC, Chorus from Capita, Intota from Serial Solutions, Open Library Environment from Kuali Foundation and Open Skies from VTLS.

The next generation library management software should support some of the important next-generation features and functionalities such as Cloud-based Application, Comprehensive Library Resources Management, Service-oriented Architecture, Ability to Meet the Challenges of New Library Workflow, Next Generation Discovery Service etc.

10. Summary

An Integrated library management software is used for computerization of in-house activities of a library i.e. cataloguing, circulation, acquisition, serial control OPAC, stock verification, etc.

A number of integrated library software packages are now available in the market, such as Libsys, SOUL, Virtua, SLIM++ etc.for automating all library operations. The library automation package should be selected in such a way that it should satisfy the present and prospective requirements of a library.

There are a wide range of options available to libraries for retrospective conversion of bibliographic records of documents available in their libraries. These methods include direct keying-in of records, buying records from external source like OCLC, downloading records from Library of Congress Online Catalogue / INFLIBNET`s Union Catalogue of Books and scanning of title page.

Most integrated library systems covers five modules i.e. acquisition, cataloguing, Library OPAC, circulation and serials control, that are used to automate various in-house operations of a library. Besides, several integrated library systems also offer additional modules for article indexing, stock verification, report generation, handling media, etc. Bar code technology and RFID are two automatic identification technology used for library automation.

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