

# **Design of a Next-Generation Library Catalogue using Web 2.0 Technologies and Faceted Navigation**

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## **Abstract**

The latest generation of online library catalogues are also referred as OPAC 2.0 since it incorporates Web 2.0 technologies. Web 2.0 can be seen as the second generation of internet which offers many tools and techniques for creating user centred applications aimed at collaboration on web. OPAC 2.0 solutions are designed keeping in mind the user expectations in the social networking landscape. Faceted navigation is a well known technique for knowledge discovery by way of exploring and refining information base. A next-generation online library catalogue is different from traditional catalogues in terms of their usage of faceted navigation and web 2.0 technologies such as tagging, reviewing, rating and relevance ranking. Integration of these features into the library catalogue could transform the user experience and thus enhances the library services. This paper presents an overview of practical experiences of designing a new user interface for the CFTRI library OPAC utilizing the potential features of web 2.0 technologies and faceted navigation. It briefly explains the limitations of current system and evaluates the benefits of integrating these technologies. Emerging OPAC technologies are also highlighted.

**Keywords :** Online Library Catalogue, Faceted Navigation, Web 2.0, OPAC

## **1. Introduction**

The library catalogue has evolved through several years from the days of Cutter to current internetworked world and from traditional card catalogue to the computer based online public access catalogues (OPAC) to Web based applications. Even though the format and medium of catalogue have tremendously changed, but the purpose of exposing the collection to the users and pointing the users to library shelves remained the same. The functional aspects of catalogue have improved several folds and are also being transformed from librarian- centric to user-centric. The proliferation of information and communication technologies (ICT) and development of internet have all contributed to evolution of catalogue. Computerised catalogues have effectively replaced the traditional card catalogue since it has

advantages like space efficiency, retrieval using multiple parameters, and the ability to update the data online.

## **2. Online Public Access Catalogue (OPAC)**

The year 1960s had a major impact on library cataloguing with the development of MARC, setting the standard for encoding catalogue records electronically enabling computerised systems to search and retrieve the information effectively. MARC necessitates each bit of information in a catalogue record to be given numerical field, and sometimes an alphabetical sub field making it possible for a computer program, to be written that looks for numerical fields when a specific type of search, such as author, title or subject is requested. As all the information in the cataloguing record is encoded, optional searches could be done by ISBN, series, publisher, date or any other fields stored in the cataloguing record.

The first generation OPAC can be seen as an extension of card catalogue based on MARC format with online real time data. These were closely related to the card catalogue but were inferior to the latter, since it lacks subject access, cross references and browsing. The first generation online catalogues provided limited access points such as author and title, and were useful primarily for known-item searching. Dedicated computer terminals were used by the users to search the command driven online catalogue and the terminal emulated the same navigation method as previously there in the card catalogues.

The second generation of online catalogues brought qualitative improvements including multiple access points, user friendliness and powerful search mechanisms, such as boolean logic to combine search terms as well as ancillary functions, such as the ability to reserve items that had been issued/checked-out. At the same time, libraries began to develop applications to automate the purchase, cataloging, and circulation of books and other library materials. These applications, collectively known as Integrated Library System (ILS) or Library Management System, often include a library catalogue module that allows users to search the collections, which were focused on the physical items.

The first and second-generation catalogue provided a range of search features without being able to provide subject browsing preferred by many users for exploring the collection. Libraries included only inventory of holdings in their catalogues making it constrained by only referencing the library's document collection. It lacks a unified entry point to the many types of materials available in the collection, such as physical items, locally digitalized materials, and remote e-journal collections. These systems were more librarian-centred since quite a bit of familiarity with library systems are

required to effectively use it. A first time user may feel difficult to use the catalogue and may struggle in finding the required item. Non-library users need simpler and generalised system since the usage of OPAC system may be unfamiliar to them and it should have the mechanism to guide users with varied level of knowledge about the technicalities related to organisation of library materials. Today users are more familiar with sophisticated search engines like Google and they expect that the OPAC should function in a similar way. Even though, a search for an item in Google may show millions of hits, one may not see beyond two or three pages in the search results because the search results are ranked according to the relevance of the specific query and one need not go beyond these pages. This kind of relevancy ranking mechanisms is often not available in the present day OPACs. Hence users may go through the beginning pages of the search results and skip the remaining assuming that the OPAC listed results just like their favourite web search engines.

### **3. Emerging OPAC Technologies**

The current OPACs lacks socialising feature which is the recent trend in web applications. Exploratory searching is difficult and often lack basic features like spell check and good relevancy ranking. The attraction of most next-generation web applications which are not available in the present day interfaces includes coverage of diverse resources, in-depth search capabilities, facet based refining and more importantly the experience of Web 2.0. Because of these factors, it is clear that the present day OPACs are no longer adequate to meet the challenges in a highly networked and integrated environment. Hence librarians need to be focused on integrating client-oriented and user centric tools into their OPAC systems to provide better services and face the challenges. These tools and techniques comprise faceted navigation, keyword and controlled vocabulary searches, natural language search features and context-based, automatic spell check. Some libraries and library software vendors have already made available these features in their OPAC and others are in the process of introducing them. Some of the next-generation interfaces include Aquabrowser, Encore, Primo, Evergreen, Koha, Polaris and Vufind.

The tremendous development of web technologies and internet especially Web 2.0 technologies and social networking has created the framework for user community participation on the Internet. User tagging for subject key words, reviewing, rating and commenting are important web 2.0 concepts that can be easily incorporated into a library OPAC allowing users to enrich the catalogue and foster social interaction among them. Syndicated feeds or alerts such as RSS or atom feeds enables the users to keep themselves updated of new additions to the library which acts as an alternative to the traditional

current awareness service in the web 2.0 environment. Enhancing user services with community participation, feedback and opportunities for online social networking enables transforming the user experience and improves the catalogue's usefulness and usability. Web 2.0 tools can make the OPAC a powerful mechanism that is the centre-piece of libraries.

Interactive Web 2.0 features that can be integrated into the catalogue include:

- Faceted navigation
- Relevance ranking
- RSS and Atom feeds
- The ability for users to rate, tag, or review materials
- Refine results by characteristics such as date, format etc.
- Save records and searches
- Recommendations would be available for related materials
- Advanced search capabilities (including Boolean logic & phrase searching)
- The ability to mark, download/print records

The next-generation OPAC systems should be designed considering both rapid technological advances as well as user expectations. AJAX technology can be used to make the OPACs more dynamic and efficient, since it supports reloading of individual elements of a web page without having to re-display the entire page.

#### **4. CFTRI Library-Background**

Central Food Technological Research Institute (CFTRI), Mysore is one of the national premier laboratories setup under the Council of Scientific and Industrial Research (CSIR), New Delhi, and, it has since been recognised by a number of international institutions. Institute's focus has been towards low cost effective technologies, utilization of indigenous raw materials, bio-friendly processes with emphasis on integrated technology and high level pursuit for total technology underpinning food safety, health and nutrition to all sections of the population. CFTRI is an ISO 9001:2000 and ISO 14001:2004 organisation and NABL accredited for chemical and biological testing of samples.

Central Library of CFTRI also known as Food Science and Technology Information Services (FOSTIS) was recognised as the National Information Centre for Food Science and Technology (NICFOS) by DSIR/ NISSAT, Govt. of India, way back in 1977. The information centre has an extensive collection of over one lakh books and bound periodicals and subscribes to 276 current periodical titles from international and national publishers. In addition to the books and periodicals an extensive collection of reference materials including standards, patents, theses, dissertations, student project

investigations, and annual reports are available. The library has access to global information through several international databases, e-journals through CSIR Consortium, e-Books from CRC Press via high bandwidth Internet connectivity. The library has always been in the forefront in developing infrastructure in tune with advances in the Information and Communication Technologies (ICT) and is equipped with advanced computing facilities. A wide range of information services including Current Awareness Service, Document Delivery Service, Database Search Service, Online Public Access Catalogue (OPAC) and Library e-Bulletin are being provided by the library. The library caters to the needs of R&D community with latest information.

#### **4.1. Library Automation**

In the year 2000 the automation of library services was initiated using commercial software called Total Library Management System (TLMS). TLMS had an associated OPAC module which was introduced to the scientific community of the institute after the implementation. The OPAC benefitted the users who could search the entire holdings. Later, due to technical problems in software, FOSTIS has migrated to OpenBiblio, open source ILS software available from <http://obiblio.sourceforge.net/>. The software is written using PHP and MySQL containing OPAC, circulation, cataloguing, and staff administration functionality. OpenBiblio can be easily customised with a basic knowledge of PHP and MySQL.

Initially the software has been customised to suit the library's requirements and the available holdings data from TLMS software has been imported to the system. During the migration process, a major challenge was faced with the barcode, since the entire documents in the library were barcoded with the TLMS system generated barcodes (which were generated by the software automatically) and are totally different from the accession number of the book. To overcome this problem, the table structure and code were modified accordingly to relate the old barcode number with the accession number in the tables to avoid re-barcoding.

Additional modules were developed and integrated to fulfil the requirements of day-to-day activities include serials cataloguing, acquisition module for books purchase on approval basis through the library committee and advanced search features for OPAC, validity date checking for member details in the circulation. Circulation module has been rewritten using visual basic to make it application oriented enabling automatic gate pass printing for issue and renewal. Library materials including books, bound periodicals and current journals are being circulated using this module.

#### **4.2. Current Library OPAC**

The OpenBiblio software has an OPAC module which provides only basic search functionalities on metadata elements viz., title, and author and topic term. The search results can be sorted alphabetically by author or title. The current OPAC of our library is an enhanced version and basic search interface has been customised with additional features including the addition of access points viz, title, author, additional author/guide, corporate name, series, publisher, ISBN and accession number. The document types available are listed allowing the users to either restrict their search to individual document types or all items. The search results can be sorted on all the above fields in addition to year of publication.

#### **4.3. Limitations of Current System**

Since the current system is built for managing print collections, the collection management features and functionalities are not adequate for digital resources. The query interface in the existing system provides only field specific searches. If a single-search entry format is provided, which searches all metadata elements at a time, based on free-text search capability, will be of immense helpful to the users. The present system indexes metadata elements such as title, author, publisher etc. and documents are retrieved based on the query string matching these elements. Even though these elements retrieve relevant records based on the criteria, provision of content pages of documents, user community tags and reviews provide a richer discovery experience. Features like auto-suggest / auto-fill and browsing are not available in the existing system making the known items search difficult and exploratory browsing unlikely. Post search refining based on facets is an important improvement to the current system. Faceted browsing and navigation are standard methods for knowledge discovery. The current system should be supplemented with browse features like subject and alphabetical browsing. The subject browsing feature should be implemented in line with the classification system used in the library to provide the OPAC browsing to simulate the experience of browsing the stacks.

### **5. Design of New OPAC Interface**

The new interface we propose aims to design and implement a robust, user-friendly, efficient OPAC system utilizing the potential features of web 2.0 technologies and faceted navigation based on subject headings as well as other important key facets. The design is focused on making the OPAC oriented towards library users in an attractive way that inspires them to make use of the web 2.0 features like tagging and reviewing which will enrich the catalogue. The underlying architecture of the system is based on earlier one. The user

interface provides free-text search, basic search, advanced search, subject / alphabetical browsing and other advanced features including faceted navigation, configurable relevance ranking as well as guided navigation. This faceted navigation and the ability to browse the entire collection without entering a search term enhance the browsing functionality. Exposing the subject headings and classification details provides the option to narrow or refine a search by call number range/subject topic. Value added features like refining and reordering of search sets are available on result pages and the following post search options are provided.

- Refine results by - Subject, document type, publication date
- View results - Brief/Full record
- Reorder results - Relevance / title, author, publication date
- Mark/Download records - plain txt and RIS

The solution acts as a one-stop interface enabling the users to search and browse through all of the library's resources which includes not only library catalogue records but also documents from the Institutional Repository, in-house Bibliographical Databases (Food Technology Database and Indian Food Patents Database) and other documents available in electronic formats. It will broaden access and use of OPAC by the users of the CFTRI Library. The salient features include:

- Faceted Searching and Browsing
- Refining results by various criteria such as publication date, subject, author, publisher etc.
- RSS Feeds
- Provision of content pages and document description
- Review and tag items
- Save searches for future reference
- Options for receiving e-mail alerts
- Ability to mark and download metadata records
- Indian language search and virtual keyboard for Hindi books.

## **6. Implementation of New OPAC Interface**

The new interface was implemented using the existing system as its base and additional features are incorporated following the same conventions and standards without affecting the available functional modules. Latest features of PHP and MySQL including full text search capability were used for the purpose.

The following are the functional modules available in the new interface for users:

### **6.1. User Registration**

A Library user can register at the OPAC site by filling and submitting the registration form online. This enables the user to get access to the web 2.0 features of the catalog viz. writing reviews and comments, tagging documents with own keywords, saving the search history and settings for receiving alerts. Upon submission of the registration form an email will be sent to the users email address with a link to activate the account. The activation is necessary to complete the registration process and verify the email address of the user.

### **6.2. Login**

A registered user can login to the site with email address and password, the login process will verify the email/password combination with the database and if found correct, enables the privilege.

### **6.3. Search Interface**

The query interface is the core component of this enhanced OPAC system which includes both search and browse options. Search features available include Free text search, Basic search and Advanced search. The search result pages are augmented with various refining options viz. document type, publication date, and subject. Navigation links through different elements such as related subjects, author(s), and topical terms are available for effective utilization of the catalogue. Other import menu options available for individual records include (1) for viewing description about the particular document, (2) link to view the table of contents.

#### **6.3.1. Free text search:**

This search feature enables the users to query for documents in a natural language way combining the Boolean operators alike AND, OR and NOT.

#### **6.3.2. Basic search:**

Basic search allows search on field specific search viz., Title, author(s), publisher, ISBN etc. Either all document type or particular document type like books, theses, journals etc. can be selected by the user.

#### **6.3.3. Advanced Search:**

It has the capability to combine field specific searches with Boolean operators AND & OR.

#### **6.3.4. Subject Browsing:**

This is an application of semantic web technology to the OPAC interface. The catalogue records are linked with subject headings based on the colon



classification system to facilitate the browsing based on subject areas from broader to specific fields and vice versa.

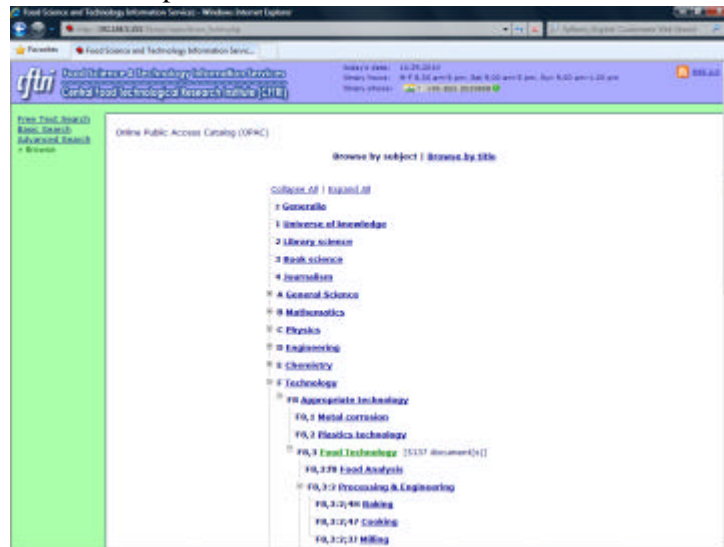


Figure 1. Subject Headings Hierarchy

### 6.3.5. Alphabetical browsing:

Provides alphabetical browsing of various documents types. The user will be able to select a particular document type such as journal and browse the database title-wise alphabetically.

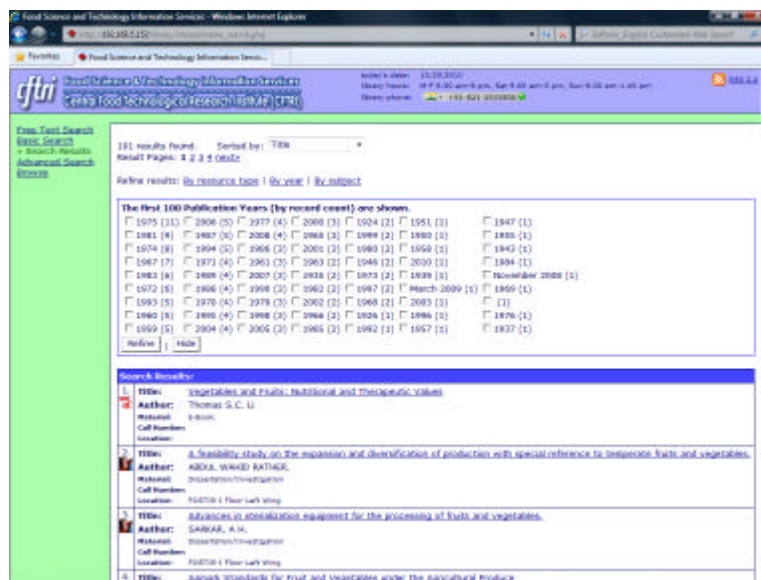


Figure 2. Post-search refining by publication date

#### **6.4. Spelling Suggestion:**

A Google style 'Did you mean?' spelling suggestion for the search keywords has been implemented using php-pspell (Portable Spell Checker Interface Library) functions. In order to configure PHP with pspell support, we need GNU Aspell, which is a free and open source spell checker suite.

#### **6.5. Writing Reviews & Comments and Rating items:**

This interface allows the users to write reviews and comments regarding coverage, quality of content and usefulness of a particular document. It also allows the users to rate an item based on the above mentioned criteria. These reviews, comments and ratings will be of immense use for other users as they are getting the gist of the document and results in socializing the OPAC interface.

#### **6.6. Tagging:**

Tagging is popularised by websites associated with Web 2.0 and is an important feature of Web 2.0 services. Users can tag items / documents with their own terms or keywords. This kind of metadata helps describe an item and allows it to be found again by browsing or searching. Tags are generally chosen informally and personally by the users.

#### **6.7. Saving searches & Setting email alerts:**

Registered users can save the searches made by them for future reference. It also enables them to set and receive periodic email alerts regarding new additions based on the searches made by them. Once an alert has been set by a user, he/she can receive automatic alerts through email with details of new materials relevant to the topic of interest.

#### **6.8. RSS Feeds:**

RSS Feed facility is available for users who want to receive timely updates from OPAC system. The RSS feed includes metadata elements such as title, author and publication date. The benefit of RSS feed is letting system syndicate content automatically. Standard icon is provided for the user to subscribe to the feed and clicking on the RSS icon in a web browser initiates the subscription process. The RSS reader checks the user's subscribed feeds regularly for new work, downloads any updates that it finds, and provides a user interface to monitor and read the feeds.

#### **6.9. Marking and downloading of records:**

Users can mark individual items during the course of searching the catalogue. These marked items can be downloaded in formats like RIS and plain text.

## 6.10. Suggestion & Feedback:

Separate interfaces are provided for users to suggest purchase of new documents and also to give feedback about the new system. This module will forward both the suggestion and feedback to librarian via email automatically.

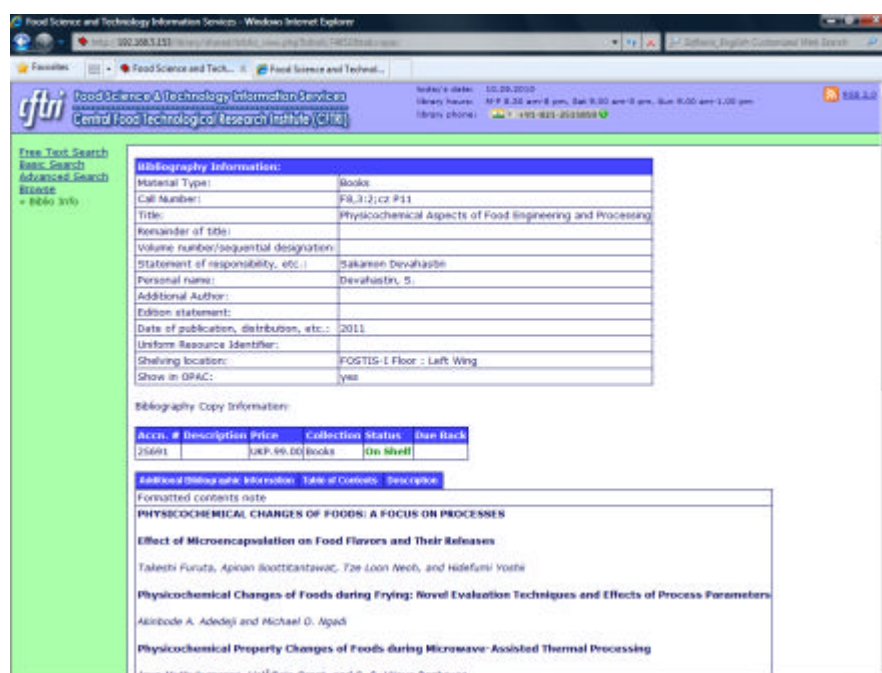


Figure 3. Full Record view

## 7. Hardware and Software

The tools, platform, hardware and software used for developing and implementing the new interface are given below:

### 1. Hardware:

Server	Intel Xeon Dual Core Processor @ 3.0 GHz or more, 2 GB RAM, 143GB x 3 SCSI HDD RAID 5 Configuration Gigabit Ethernet card / CD±DVD Drive Monitor / Keyboard & Mouse
For clients	Latest PC with Windows or Linux Operating system and Internet/network connectivity is recommended

## 2. Software:

On the Server, the system requires the following software:	
RDBMS	MySQL version 5 or higher
Web Server	Apache HTTP Server version 2.2 or higher
Scripting Language	PHP Version 5.2 or higher / Ajax & JavaScript
Operating System	Windows or Linux OS
On the client side, the software requirement is any Web browser with JavaScript support. Microsoft Internet Explorer / Mozilla Firefox etc.	

## 8. Conclusion

Given that the OPAC is the primary method of patrons' interactions with library collections, the goal of modernizing the OPAC System is to offer features of faceted navigation, advanced searching and browsing combined with relevancy ranking and refining, RSS feeds, and web 2.0 functionalities including tagging and reviewing. A close assessment of local user behaviour has been taken into consideration as far as possible while designing the user interfaces to enhance responsiveness to user needs and increased user satisfaction. Users want OPAC systems that empower them as users by providing them with simple, intuitive search interfaces, advanced post search refining and sorting, downloading, and e-mailing features, and value-added content in the form of full-text information.

The new system incorporates many of the powerful features of Web 2.0 technologies and will certainly improve the overall OPAC experience for the library users as an integrated tool. The challenges taken include the design of the improved search and richer discovery interface with configurable ranking of search results, subject browsing and faceting for filtering search results. Social networking features like user tagging and reviewing have been incorporated primarily to transform the new system into more user-centric. The system allows book marking of records during the course of browsing the catalog. These book marked items can be exported to various formats like plain text and RIS featuring data interchange between the OPAC system and other reference management software. Zotero is a Firefox extension which helps to collect, manage, cite, and share research sources from compatible websites with a single click. Making the OPAC system compatible with Zotero is an important future enhancement. Other future enhancements include the following:

- Export records in XML and MARC format
- OAI-PMH and Z39.50 support
- Instant Messaging facility
- Alert on mobile phones & access through mobile devices

- Zotero Compatibility & provision of Wiki Pages

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