Reengineering Library Services with Emerging Technologies

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Abstract

The emergence of ICT has made communication process dynamic and interaction across boundaries is now possible, fast and reliable. Libraries and information centers should now adopt these technologies to provide services to their patrons by using mobile phones, cellular networks, cable television and internet. In library scenario, the needs of users are always dynamic and to satisfy diverse needs of all users quickly is a complex task for any knowledge professional or librarian. ICT, Internet and library automation softwares made it possible for users to locate what they want without going to library and fulfill their needs. In information system user is an important component and "Know thy Customer" is a cardinal rule. This article focuses on how advanced technologies like mobile technology, cloud computing, GIS and WWW will play effective role in creating, processing, storing and disseminating information in a library scenario.

Keywords: Cloud Computing, Digital Reference Services, GIS, Geospatial, Library Services, Mobile Technology, World Wide Web

1. Introduction

Libraries and Information centers have to evolve measures continuously to keep up with the changing requirements of their patrons. The father of library science in India, Dr. S. R. Ranganathan' s philosophy reflects "Right information" to the "Right user" in a "Right Personal way" at a "Right time" in his pioneer work "Five Laws of Library Science." Due to information explosion and information pollution knowledge professionals and librarians are facing many challenges. Moreover information are available in various formats, so in order to meet library patrons demands and for running library effectively and efficiently, librarians require skills and must have to introduce new techniques, tools, services to process, store, analyze and to disseminate information to their patrons. This paper highlights how knowledge professionals can adopt technology such as mobile technology, GIS technology, Cloud Computing and introduce new services despite traditional library and information services in order to serve library patrons in a better way.

2. Objectives

- To understand and analyze structure and utility value of new technologies in the library scenario.
- To find out technological challenges and areas of application of emerging technology in the automated library system.
- To evaluate application of technological services with their advantages and disadvantages.

3. Mobile based Library and Information Services

A growing number of mobile technology users report using the internet in 2012 via mobile phones. The emergence of functional mobile computing technologies enables 'ubiquitous' (anywhere\ anytime) access

to E-mails, chat, web-browsing, useful network services and applications. Smart phones, PDA, and other mobile devices become more powerful for mobile web experience. Wi-Fi technology is also now common and playing key role in network based information creation and sharing. About Wi-Fi standards, there are a, b, g and n, a and b, are no more in use, while g uses 2.4 GHz frequency to transmit the data, it has theoretical maximum, transfer rate of 54 mbps, and n can transmit data at 2.4 and 5 GHz frequency. In Wi-Fi technology router comes with tons of security modes like WPA (Wi-Fi Protected Access), WPA2 etc. Now librarians can provide effective information and reference service to their users if they adopt mobile phone technologies, it is not only an instrument of communication but library services can be provided to end number of users with the help of mobile technology. Librarians need to do publicity of information products and services to interested users which are very important step, as today the cost of information creation and digital reference services are high, moreover maximum utilization of valuable contents is also necessary, so librarians need to attract them and encourage them for use; they have to make library services more attractive and accessible. Mobile phones and email are also important tools for giving answer of user's question\ query within less time and also fast, reliable way of communication. Most libraries, especially in academic institutions in India, have one phone line, which is used by chief librarian for administrative purpose and intra-personal communication within the organization. But today emergence of ICT revolution has made mobile phones affordable as well as very popular that it could be deployed at inquiry desk as library community also started using internet capable smart phones, social networking sites and mobile devices such as Blackberry, iPhone, iPad, Android, Phablet, and E-mail, short message services (SMS) available on mobile phones can be used to inform library user about user orientation programmes, upcoming events, new arrivals, circulate significant circulars, information literacy programmes etc. Use of broadcast, one text massage can be sent to all library contacts listed in the address book on the mobile phone at once and to give latest information to end users.

Figure 1

Librarians also can send renewals notification alert to their users, information about due and overdue documents messages can send through mobile device and some internet service providers offer free SMS to mobile phone service users on the Internet. Despite this, social networking tools such as Face book, Twitter, MySpace, Second Life are very popular among people, they use them via their smart phones but the only problem is to connect people and contents in a meaningful way and library homepage is not frequently visited by users, so librarians can reach to their patrons via these social networking tools. Some libraries in India have their presence on these social networking sites, So librarians and knowledge professionals should experiment to provide library and reference services to mobile users via SMS and social networking sites, services such as library help and Text a Librarian can provide technological infrastructure to support text based services to mobile users. There is also need to simplify library catalogue\OPAC so that users can use catalogue on the small screens of mobiles. OCLC had released an iphone application enabling users to search WorldCat and locate resources at their local academic or public library. The facility of loading podcasts of lectures, tours, tutorials onto both iTunes U and You Tube which can be downloaded and access from users compatible devices are another area of advanced mobile based services. So mobile phone technology could have significant impact on libraries and information services. Smart phones and mobile technology have changed the way we create, use, distribute and communicate information. The application of telecommunication technology and mobile phones to an automated library system can bring more efficiency to library services.

4. GIS Technology (Geographical Information System) and Library

We are at exciting point of using GIS technology in libraries as it combines data retrieval with data display in a visual form for a particular location. Tomlinson (1998), the leader of Canadian Geographic Information System, coined the term 'Geographic Information System' in the early 1960s to refer to any computer application that perform functions with geospatial data (data related to space). GIS basically handles two kinds of data: Spatial data also referred as geographic co-ordinate data (records point, line, area) and another is attribute data, information related with particular geographical feature. GIS technology is used in India mainly for land and crop analysis, survey and planning in case of natural disasters such as earthquakes, flood and for forest study. Geographic information system mainly deals with the information about places on the Earth's surface, about where something is or what is at a given location, detailed information about the location of all buildings in a city. Pictures and maps are powerful and effective form of communication than text and tables. In the library scenario, some areas for application of GIS in library are shown in Fig. 2

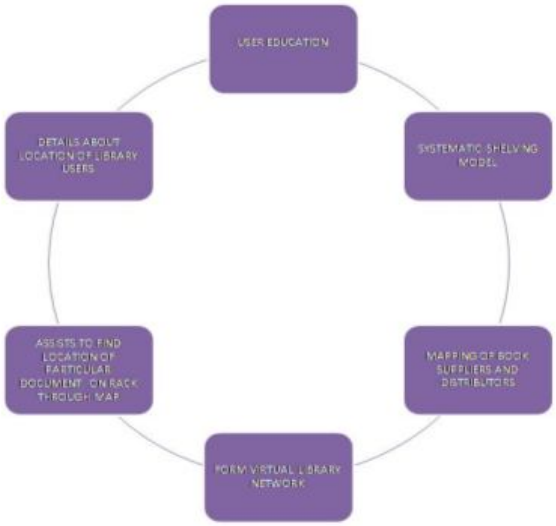

Figure 2 Areas of Application of GIS Software in the Library

The significant steps involved in application of GIS in libraries are drawing library building map, floor maps and designing the database, developers can take help of AutoCAD for preparing accurate architectural layout of library building. Application of GIS in libraries will certainly prove helpful especially in user education, they will be guided towards locational details of various sections of library, documents and organization of reading materials are displayed through images and texts. In library documents are arranged on racks systematically by using a particular scheme of classification (like DDC, UDC, LC, CC etc.). As the collection grows subjectwise in the library, books having same subject comes under same rack location, and then retrieval of a particular book becomes time-consuming process especially in the core subjects as latest books are added every year in the main and key research area of the organization. Here the implementation of GIS will be proving helpful. Besides this, literature available on a specific subject and placed at various sections of library can be sought easily; bibliographical details even when the book is also physically not available on rack can be read just by sitting across the computer terminal. Wayne State University's Mr. Kane, inventor of hyper card call no. directory, expressed his concern about the problem faced by library users in finding reading material; "Existing library systems are good at answering questions 'what' yet neglect the important question of 'where'."Another key issue is delay-delivery of documents by distributors and vendors and as they are located in diverse geographical area, from transportation of materials and administrative point of view, it is very inconvenient and time consuming process to tackle and library services are also affected, so mapping of book suppliers and distributors will certainly lead towards better policy. The book supply activity can be coordinated by networking and a new book-purchase model can be formed. In the same way to survey the location of library users, demographic characteristics of users (especially in case of public libraries as users are located at different places) and to plan book–delivery service for library patrons in their location in a convenient way, GIS can be used. Analysis of service area

population will help in deciding the center location of establishing new library and where another branch should be opened in that location or not. Conducting survey of proposal of library networks by mapping library locations would be beneficial for national or state agencies like Library Associations who are primarily concern with such projects. In this connection, the book "Geographical information system (Gis) in library and information services."(2006) by Dr. D. N. Phadke deserves a special mention. For a multi-storeyed library building GIS technology can be applied. Nowadays Global Position Systems (GPS) and web-based mapping applications like GoogleMaps are also play active role, LIS research will also continue to organize and disseminate geospatial data. Though there are many advantages of application of GIS in libraries, it is somehow complex process and the project GIS is also resource intensive, besides technical expertise, sponsoring agency is also required to implement GIS in the library. One area of application of GIS is also to make GIS curriculum as a part of LIS education. There are a number of open source and proprietary GIS softwares available. Some of them are open source desktop GIS projects; (reviewed in Steiniger and Bocher 2008-2009) they are listed below:

- TerraView – Handles vector and raster data stored in a relational or geo-relational database, i.e. a frontend for TerraLib.
- TatukGIS-Windows (XP, Vista, 7, 8 and Server 2003, 2008 & 2012). System requirements same as for the Windows operating system.
- MapWindow GIS – Free desktop application and programming component.
- GRASS GIS – Originally developed by the U.S. Army Corps of Engineers: a complete GIS.
- SAGA GIS (System for Automated Geoscientific Analysis) –- A hybrid GIS software, has a unique Application Programming Interface (API) and a fast growing set of geoscientific methods, bundled in exchangeable Module Libraries.
- Quantum GIS (QGIS) – Runs on LINUX, UNIX, Mac OS X and Windows.
- uDig – API and source code (Java) available.
- JUMP GIS / OpenJUMP ((Open) Java Unified Mapping Platform) -The desktop GISs, OpenJUMP, SkyJUMP, deeJUMP and Kosmo all emerged from JUMP.

Besides these FOSS GIS softwares, open source GIS tools are also available.

The FOSS GIS listed above are popular worldwide. To test basic functionality of FOSS GIS software, creating a thematic map, adding a shapefile (a common GIS file format, created by ESRI-Environment Systems Research Institute), adding an attribute table and joining it to a shapefile based on a common field, symbolizing data with using a colour scheme and labeling with the help of any of these FOSS GIS software are significant steps to test their ability of performance. It is a multi-step process that requires several tools. Usually it is observed that FOSS GIS have some limitations while compared with powerful proprietary GIS softwares

such as ArcView or ArcGIS especially FOSS GIS are unable to create automating labeling and usually proprietary softwares are better in terms of support for various projection, navigation and co-ordinating systems. Some Libraries in UK, USA and other countries are already started using GIS. Library professionals should try to find affordable means to apply this technology, it will be beneficial not only for the library patrons if book location is added to OPACs, but also library collection management system will be improved. A multi-phase GIS literacy project should start at state level, to introduce and equip librarians with theoretical, technological and new application skills required to provide access to spatially reference data in all formats.

5. Cloud Computing and Library

Libraries can certainly improve their services with the help of cloud computing and web collaboration. About the historical background of Cloud Computing, J. C. R. Licklider (ARPANET, 1969) suggested that everyone on the globe to be interconnected via network and accessing data through any site and from anywhere, then John MacCarthy proposed the idea of computation being delivered as a public utility. In the simple terminology, Cloud is a virtualization of resources and services that maintains itself and in cloud computing, distributed, grid and utility computing combined to perform functions with dynamically changing requirements. Resources like software, hardware and platform are provided on demand as well as it is a secure, reliable data storage center. This is a dynamic model where user has to pay-per-subscription or scalable system, it is a real time service delivered through internet. About the emergence of Cloud computing, Salesforce. Com came into existence in 1999, Amazon web services came into 2002 and with the emergence of Web 2.0, Google and others started introducing browser based enterprise applications through services such as Google Apps. As bandwidth is available at great quantity and at cheaper rate, omnipresence of internet and as computer hardware and software become more valuable cloud computing emerged rapidly.

6. Cloud service model has the following three main models

- Platform as a Service (PaaS): Build web-applications and deploy application without installing any tool or their system. The PaaS provider manages, upgrades, patches and other routine system maintenance. About main benefits of PaaS, simplified deployment, lower risk, pay-per-use model and scalability are there. About the disadvantage of PaaS, it may happen that some applications are local and some are in cloud (public cloud is also referred as commercial cloud and private cloud as individual cloud). So there will be increased complexity when one wants to use data which is in cloud with the local data.
- Software as a Service (SaaS): It is a software delivery model as well as business model, In Cloud computing, SaaS architechture eliminates the need to install, run and maintain software, service delivered through the browser and no expert team is required to maintain the software. SaaS providers provide this service by downloadinding the application for customers or they may host the application on the web server either on contract basis or on the basis of license agreements. Some risks are also involved such as frequent changes in operating system, cancellation and out of datedness of software.

- Infrastructure as a Service (IaaS): The freedom of running any operating system and except underlying cloud infrastructure, the control of operating system, and application, storage and network capacity will remain in hands of users. Libraries can share hardware and other computing resources, so the cost of server and maintenance will be saved. Today manufracturers are lauching their own cloud computing products and services. Some examples of IaaS providers are ServePath's GoGrid, Skytap's Skytap virtual lab, 3 tera's, Amazon's Elastic Compute Cloud, AT &T, IBM & Unisys, Gni's GNi Dedicated Hosting, and IBM's Computing on Demand. On the whole, Cloud computing has many unique features such as cost-effectiveness, security, scalability, versatility, virtualization, user-friendliness, scalability and resource optimization. In the library scenario, the problem of IT infrastructure, shortage of I. T. experts, financial problems, data integrity, upgrade and maintenance, intellectual property management related issues, backups can be solved by cloud based services. Today libraries manage servers for capturing, storing, processing, transmitting data and it also requires a lot of investment in terms of expertise, hardware and software and operational costs, so one of the most outstanding feature of cloud computing is that libraries can provide efficient services without owning servers. To support data sharing effectively, access management strategy is used in cloud computing. This technology is relatively new in the field of library and utilization of cloud computing in the library depends upon the efforts of library professionals.

7. Internet Based Information Services and Information Management

A vast array of databases and services are available on the internet. But retrieval is recognized to be a complex problem on the internet as the databases mounted on the internet are also in wide variety and available in different formats. So librarian should design interfaces that help users who search for information sources and services on the internet or mail them direct link that will lead to particular information source. Subject directories and search engines can provide mechanism which aid users to search the entire internet for relevant information. Various search engines follow different principles so for a particular query or keyword each search engine will display different results. Alta Vista, Hot Bot, Lycos, Infoseek, Excite are popular search engines while Metacrawler and Dogpile are examples of multithread search engines. Subject databases from reputed academic institutes and local and national governments are also providing information for public through their websites. Closed and private version of internet i.e. intranet is a powerful tool to communicate and provide information services within the organization. In India many big organizations are using intranet as information can be easily handled and disseminated through intranet. Listeserves (electronic, discussion groups) on a variety of topics such as digital libraries, reference services are available so participants have an opportunity to exchange current information and conduct dialogue of these Listeserves. Users have only need to send e-mail message to the appropriate address with the message –subscribe and can create user ID. Recent development and research in the field of e-publishing is responsible for remarkable growth in the digital collection and electronic information especially in the research and academic libraries. E-books, e-Journals, Institutional repositories, Online services and information portals are main elements of e-resources in the library scenario. Today with the help of open source digital library software it is possible to create digital library in an economic way and with less I.T. skills.

Koha, NewGenLib, OpenBiblio, Evergreen, PhpmyLibrary, GNU Library Management System and Libsys are popular integrated library management softwares, while Drupal, Jumala, Wordpress, Mambo, Typo3 are examples of popular content management system softwares. For Institutional Repository, Dspace, Fedora Commons, CDSware, Eprint, Ganesha, XTF, VuDL are popular in academic and research libraries. There is an expotential growth of information as the number of websites and URLs are also flooding on library web pages. Besides library automation, the role of content aggregation and integration is important as different access models are also offered by publishers and vendors. Knowledge professional should redesign library portal in such a way that it will become integrated network of resources (In-house as well as internet based). The latest trend in digital library service architecture is SRU- a standard XML based search protocol for internet search queries, utilizing Contextual Query Language. SRW is variation of SRU, here messages are conveyed from client to server through XML over HTTP. Copyrights clearance, licensing agreements, access policy should be framed to take better advantage from e-resources. Usually, the cost of access to e-resources is economic than the cost of buying e-resources. As the number of e-resources and users increase, information management becomes the most crucial task for knowledge professionals. Internet and WWW provide a platform for Web 2.0 (coined by Tim O' Reilly and John Battelle, 2004). Application of Web 2.0 and Library 2.0 (coined by Michael Casey) technologies in library enables the users two way communication. Library users can be informed about new library services via RSS Feeds (Rich Site Summary\ Really Simple Syndication), which is created by XML, and can be read with help of RSS reader. There are many RSS readers available for free downloading from the Internet, some popular RSS readers are Google Reader, Feed Burner, Bloglines and Newsgator. With the help of RSS Feeds users get information regularly without visiting the actual sites, via dedicated URLs, RSS Feeds and can keep themselves up-to-date. Blogs, tagging, folksonomy, Podcast etc. are also prove useful for creating, sharing and distributing information in a meaningful way. Synchronous reference services like chat, IM (Instant Massage) can be provided with IM softwares such as Yahoo Messanger, Google Talk, Windows Live Messanger and VoIP, video conferencing are also popular to provide digital information services, similarly asynchronous digital reference services like FAQ, E-mail and other web form are already provided by many libraries in India. Now Webinars on specific theme and subject, geo-tagging, semantic web, ontologies (data of information), virtual reference services are also emerging so there is need for knowledge professionals and librarians to acquire necessary skills to work with this third generation of web technologies. Library homepage can provide valuable services with the help of appropriate software, online services in the form of 'Ask a Librarian' and 'Ask Us Now' or FAQ are already popular in many academic and special libraries. Direct access for documents, on CD-ROM for many books (as many publishers provide hard copies of books with soft copies of same title especially in literature, social science, IT, enpsyclopaedia, dictionaries etc. subject areas), is already used by some libraries, and other option is remote access where members of institute have login Id and password so they can have access to databases and contents which are available on institute's website and library's homepage. There are electronic journal publishers and suppliers and the project of digitization of journals would certainly enhance the electronic document delivery service efforts. In India Government funded consortium (National Knowledge Resource Consortium), INDEST-AICTE consortium (open consortia, funded by MHRD), UGC-

INFONET (funded by UGC), CeRA, HELINET, ERMED consortium and many voluntary consortia like FORSA and IIM library consortia (shared budget model) are available. Title- by-Title subscription model, print plus model, electronic plus model are notable purchasing models in the Indian library scenario. Library networks and consortia are focusing on resource sharing, creation of catalogues and bibliographical databases. But there is need to emphasis conference papers, research articles etc. along with other e-document delivery service as conference papers, proceedings are also significant source of creation of knowledge and dissemination of information. Usually the costs of electronic documents especially scientific and technological documents are very high; here the role of consortia is important.

8. Conclusion

With the help of technological advances, library and knowledge professionals need to redesign library services to support learning, teaching, research, and other developmental activities. To provide virtual and digital library services via technologies such as Cloud computing and GIS, high bandwidth is required and if the internet connectivity is lost, the services will also discontinue, so country wide strong I. T. infrastructure is pre-requisite. Bridge the digital divide and access to digital resources will definitely help to provide effective and valuable information services to library patrons in order to satisfy their information needs and for that librarians should perform the role of webmaster.

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