Mobile Information Services and Initiatives in University Libraries: A New Way of Delivering Information

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ABSTRACT

Students these days are seen in campuses and other study environments bowing their heads to mobile devices to seek information. Studies show that students are heavy users of their hardware, spending an average of 19.6 hours per week using an electronic device. The purpose of this paper is to explore the mobile library services initiated and adopted by some prominent academic libraries for the easy mobilisation of their existing services and also to assess how such services can be helpful to the user community. Moreover, the study raises awareness of the important mobile library services, some of them that are already in use in different Academic libraries and how the other services could help libraries to mobilise their information in fast and time bound manner that too without the constraints of space and time. The value of the study is to helping academic libraries to identify and embrace the mobile initiatives. With these mobile initiatives, libraries can provide a wide array of mobile services to the interested users.

Keywords: Mobile technologies, mobile library services, mobile apps, quick response codes, libraries

1. INTRODUCTION

Information Technology is playing a crucial role in academic library because of the great advances in the ICT that eventually has helped libraries to be globally ubiquitous. In academic libraries it is the University library that has to take the lead by becoming knowledge portals. In the last decade the rapid growth in information systems and modern miniature technologies have made libraries challenging to retain with increased demands using obsolete operations so there is an urgent need to mobilise library services for smooth flow of information. The use of mobile devices to access the internet and search for information is growing considerably[1]. Technology improvements such as cell phones, low cost connectivity and faster data transmission are among the most important factors which have led to the growing use of mobile devices[2]. Therefore, it is clear that academic libraries can expect and understand that the best medium to access their services is via mobile devices and there is need to adapt to this reality. According to Yue[3] the mobile libraries will realize the dynamic release of mobile information, mobile information queries, mobile renewals and reservations, mobile virtual reference service, electronic resources uploading and downloading and search permissions to access electronic literature database.

In the age of "information on the go" academic libraries can serve their users by leveraging the growing capabilities of mobile technology. They can mobilise and therefore promote their traditional services by offering mobile access to their websites and OPAC's. With a good internet speed, a user can access with ease anytime, anywhere his or her library. Thus, providing library services via mobile phones expand the scope of the library services and a library takes a giant step toward becoming a round-the-clock service[4]. With some mobile initiatives libraries can provide a wide array of mobile services to the interested users. Some main initiatives that are in use in some prominent libraries across the globe are discussed below.

2. LITERATURE REVIEW

The rapid increase of mobile environment and its ubiquitous nature has made mobile devices an indispensable part of life. Educause which produces an annual "HorizonReport" to document the "time to adoption" for various technologies entering main stream use on campuses, placed "Mobile Computing" in their "one year or less" adoption horizon in 2010 report[5]. Karim, Darus & Hussin[6] found that perceptions on the application of wireless hand services in the context of library and information services were to be very positive. A high majority of the respondents indicated their willingness to become the users of such services if offered. In library arena a variety of mobile web applications have been developed, including mobile library websites and MOPACs (Mobile OPACs), mobile collections, mobile library instruction, mobile databases, mobile library tours, mobile learning, library SMS notifications, mobile library circulation, QR

codes, access to services (such as reserving study rooms and checking out laptops and e-book readers), and SMS reference[7]. Short Message System or SMS reference is becoming increasingly popular in academic libraries as a way to provide reference services to patrons from any location[8]. The number of genuine library apps grows, so does the number of library web sites that are optimized for mobile users[9]. The same is true for database-apps and mobile interfaces. Many huge database-providers offer a mobile version of their services[4]. Kroski[10] finds that 44% of academic libraries and 34% of public libraries currently offer mobile libraries to some extent to their patrons; two out of five libraries surveyed (both academic and public). Further, Kroski[10] also highlights the other services libraries offer, or plan to offer, on their mobile web sites: mobile layout of website, Mobile catalog interface, SMS reference, text message notifications. An American Library Association study in 2010 found that 66% of public libraries offered e-books to their users (up from 55% the previous year). An estimated 83 percent of libraries offer online audio content and about 63 percent offer online video content[4].

3. OBJECTIVES

The objectives of the study are to:

i. Highlight all the mobile applications in library arena

ii. Create a benchmark for libraries to mobiles their resources

iii. Understand how such services could benefit users anytime and anywhere

iv. Identify libraries that have already implemented mobile library services.

4. MOBILE LIBRARY INITIATIVES

Mobile library applications opens door for libraries for myriad opportunities. There are many initiatives that are adopted by libraries to expedite their existing services and to make them mobile friendly. Kroski[10] "On the Move with the mobile web: Libraries and mobile technologies" is one of the in depth study on the adoption of mobile technology in libraries. Similarly, Murray[11] and Lippincott[12] have also highlighted some initiatives on incorporating mobile applications in library services. Some main initiatives that are in use in some prominent libraries across the globe are discussed below.

4.1 Mobile Library Websites

A Mobile website is an important component of mobile library services. It is basically a short version of large website that is designed and optimised for viewing on mobile devices. They may even be hosted on their own sub domain. The general purpose of a mobile website is to make the content or at least a subset of the content, available to the users. Mobile websites complement the existing library websites to and help extend resources and information to users through their mobile devices.

One advantage of developing a mobile library website is that it only needs to be developed once, unlike native applications that need to be developed for each specific mobile platform. Another advantage of mobile websites is that they are easier to maintain than native applications, the third advantage of developing mobile library website is that it is more cost effective than developing a native application. It is important that a library's mobile website initiative develops applications that work on both the smart phones and web enabled phones equally[11].

The University of Richmond Library offers a catalog search, real time laptop and PC availability information and Ask a librarian services by email, SMS, or IM. Another example comes from the University of Virginia Libraries' mobile web site, which provides news and events, information about library exhibitions, directions, library hours, and a text only version of their entire web site[13]. New York University Libraries, with the Arch mobile portal, chose to focus on their electronically available resources, and allows searching of their electronic resources by title, subject, or format, as well as including basic library information. On the other hand, a specialised library may make different types of information available. For example, Boston University Center Medical Library made mobile versions of their subject guides, and made their e-books, e-journals, databases, and library site searchable[13].

Mobile websites are fairly easy to create, publish, maintain and easy to use and it forms the foundation of the app or application. Most common mobile websites are built simply by using HTML. One distinctive advantage of using mobile websites rather than creating an app is that it is easy forn posting updates or to make design changes, there is no intermediary like an app store submission process. One more advantage is that it is compatible with any web enabled phone not just only Smartphone's. Moreover, this technology doesn't need any advanced mobile browser therefore; more people can easily make use of it. Even though old web enabled phones are being superseded by the new Smartphone's, it's always a good approach not to exclude them completely. Figure 1 presents the screenshot of the mobile library website, the Chillicothe & Rose County Library.

Figure 1. Snapshot Mobile Library website of Chillicothe and Ross Public Library.

(Source: http://www.crcpl.org, accessed on 3 January 2017)

4.2 Mobile Catalogue

M-OPAC is the online public access catalog which is accessible through mobile. The Web-OPAC of the academic library sites includes different types of search strategy and tactics in a condensed manner which is easily visible in desktop and provides faster search results while it becomes slow when accessed on mobile devices. The mobile optimised online public access catalog should provide simple search facility against the author, title, and subject. The search result should be informative and contains information about book and its availability in concise manner. It requires a dedicated concise search page for simple search. Whether it is not possible, the link of Web-OPAC can be given for it.

One of the first services to go online was the library catalog; before the World Wide Web was invented, libraries provided dumb-terminal access to their catalogs. Similarly the library catalog is one of the first things that ought to appear in the mobile realm. Certain catalog features, such as account access, make particular sense for mobile users. Mobile OPACS or MOPACS provide library users with varying degrees of access to the information contained in traditional OPACS and tend to be either transcoded websites formatted for handheld devices or a standalone, downloadable applications[11]. Many libraries' mobile catalogs, such as Michigan's ANN Arbor District Library, require the use of the phone's browser. Other public libraries with MOPACS include Nashville Public Library http://tinyurl.com/nplairpac, the New York Public Library (http://m.nypl.org/search/leo).

In March 2009, OCLC introduced a pilot program for Worldcat, allowing patrons to search for and locate library resources in libraries via an app from their mobile device. Users can enter various search terms, such as author, keyword, or title and even find a participating library by typing in a zip code[11]. By employing a multi-prefix incremental search, WorldCat Mobile will provide a list of auto-completed matches when the first few letters of a book title, book category, or library location are entered (Fig. 2).

4.3 Library Apps

Mobile applications, apps for short, are standalone, dedicated pieces of software or web applications/sites
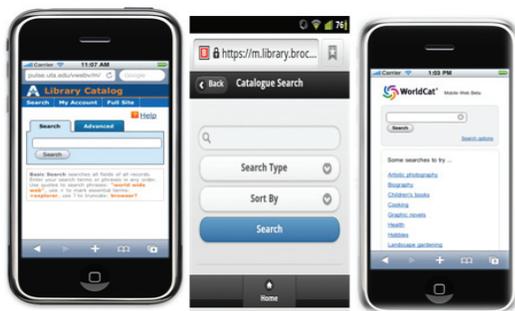
Figure 2: Snapshot of mobile OPAC (MOPAC)

(Source: http://pulse.uta.edu/vwebv/, Accessed on 1 January 2017)

that enhance our mobile devices capabilities and access information in an elegant, consistent ways, and are the means for creating new services for our mobile patrons. Likewise, library apps are software applications developed and coded with a specific operating system. Users have to download them in prior of use. Through an app, users are still able to access networked information that is linked by the app[14]. Library mobile applications (apps) can allow users to search, bookmark, annotate, link, and highlight content from scripture, general conference talks, lesson manuals, and other curriculum on mobile devices. Recently, many large public and academic libraries have also developed their own apps. For example, the UCLA library app provides a convenient way for users to search content of the UCLA library on an Android phoneUsers can also find library hours, contacts, and laptop availability at campus locations[15]. Developed by the UCLA library, mobile applications include the following: search

i.   Library catalog and filter (keyword, title, author, subject)

ii. See description, availability, and location of items

iii. Read reviews

iv. Find library hours and contacts

v.   See number of laptops available by campus location.

Indeed, university library apps can provide users access to the library catalogue, databases, and library guides from the palm of their hand. Users can also look up library locations, borrower information, library news, and ways to contact librarians. In addition, the location-based services are available only on a library mobile app, which peak user interests in terms of mobility[15]. Therefore, libraries and librarians face the critical issue of determining how to stimulate intention for use of library apps and how to meet user needs.

When people speak of "apps" they are most likely referring to native applications, as these applications were some of the first introduced with native calendaring and email applications on specific devices. These native "apps" or applications are installed and run on a device and offer a rich user interface and an in app experience. The mobile app could be built to access local hardware and software functions like the camera, messaging/notification capabilities, geo-location tracking and so forth. These features will improve the whole experience, and offering a good experience will encourage users to return (Fig. 3).

4.4 Library SMS Notifications

Text message alerts is an entry-level mobile web service for a library to offer its patrons speedy news announcement, event reminders, and other requested information. It also offers SMS notifications to inform students when their items are due back, remind them about overdue items and advise them of fines incurred.

Figure 3. Snapshot of Mobile Library app

Some of the SMS notification services highlighted by Wang, Ke & Lu[16] that libraries provide to its users are:

i.   Due-day reminder service: This service sends reminders to patrons when their borrowed items are coming due

ii. Renewal request service: This service accompanies the due-day reminder service. If a patron receives a due-day reminder and wants to renew the item, the patron can click a renewal-request hyperlink provided in the text message to extend the due date of a borrowed item

iii. Overdue notification service: This service reminds patrons about overdue items

iv. Request arrival notification service: This service reminds patrons about the availability of reserved items

v.   News and event reminder service: This service sends reminders to patrons about important news, exhibitions, instructions, and so on

vi. New title notification service: This service lets patrons get informed of newly acquired titles. This service accompanies the preview and reservation of new titles. All the above SMS services are opt in, which means that patrons can determine by themselves whether to use any or all of these services. Patrons only need to activate on the library website and fill in their mobile phone numbers to avail of these services. Currently, patrons can use these services free of charge.

4.5 SMS Reference Service

In traditional libraries reference services are the functions performed by a trained reference librarian to meet the needs of the patrons, instructing users in finding the relevant information of their need, referring patrons in locating appropriate information in time bound manner. But present day reference services at libraries are becoming increasingly virtual as more and more researchers are working remotely. Technologies such as instant messaging, e-mail, and now SMS text messaging are making it easy for libraries to maintain relevance as information hubs by offering convenient services to busy users. New ask-a-librarian services are offering mobile patrons the ability to text in their research questions
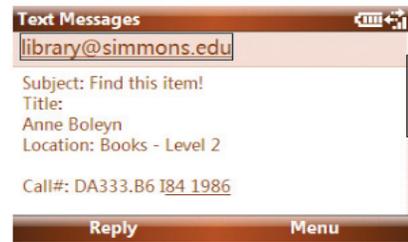

Figure 4. Mobile SMS Notifications.
(https://libraryh3lp.com/sms-reference-service)

from afar[10] (Fig. 4).

Texting has become a popular form of communication, especially among the younger generation. SMS reference can allow libraries the opportunity to access students via a familiar accessible service. For many libraries texting is used to complement the various other reference services currently being used by institutions, such as in-person, phone, e-mail, and chat. However, it is important that individual libraries evaluate the appropriateness of this technology for their patrons: Does it meet one's clients' needs instantly? Is SMS a relevant form of communication for one's patrons? and finally, can SMS technology be easily provided[7].

Libraries using AltaRama's Reference by SMS Service receives a unique mobile phone number that can be advertised as the text number for that library. Rather than going to a mobile phone, texts can be automatically sent to an email address specified by the library. To respond, the librarian simply hits the usual "Reply" link in that email; responses are then automatically delivered to the patron's mobile phone as a text message. This service will appeal to those librarians unaccustomed to texting and to those whose typing skills may be faster than their texting abilities[11].

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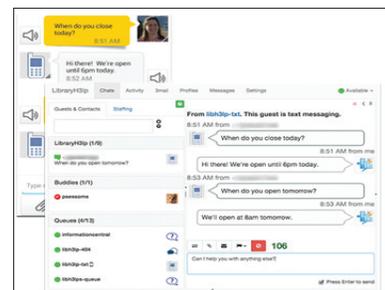
Figure 5. Snapshot of SMS reference services.
(Source: https://libraryh3lp.com/sms-reference-service)

4.6 QR Codes

QR code is the trademark term for Quick Response Code and it's also known as two dimensional barcodes[17]. The QR code is a two-dimensional code they can contain hundred times more data OR information than simple barcode. Quick Response Codes are generated by the QR Code generator and reading by the QR code readers by scanning using smart phones, tablets and computer. QR Code is capable to be store information (numbers, texts, hyperlinks, contact details, calendar information, e-mail addresses, phone numbers, SMS, maps, social network information etc. in any direction i.e., horizontally and vertically. QR code store maximum information up to 7089 characters numeric only, 4296 characters of alphanumeric and binary (8 bit) 2953 bytes in single barcode and single code can be divided in to 16 portion of a code at maximum. A QR code is capable to reading with high-speed in 360° (Omni-directional).

Libraries are increasingly looking to mobile technologies, including quick response codes to better serve the patrons. As mobile devices become more popular among library users, the interest of using QR codes in academic libraries has also grown in recent years. A number of libraries have begun experimenting with the technology[18]. Some of the popular uses of QR codes in libraries follow:

i. Library audio tour

ii. Group study room scheduler

iii. Marketing/promotional materials

iv. Linking from print to electronic journal holdings

v. Providing an electronic alternative to physical books

vi. Promoting online audio visual materials

vii. Embedding video help

viii. Bringing external resources into the library

ix. Finding appropriate help

x. Taking the catalogue record with you

xi. Linking from course syllabi.

There is an urgent need of implementing QR codes in libraries as it will not only save the time but it will also make the services aesthetically appealing. The other important aspect that libraries need to evolve is the marketing of QR codes to highlight their importance so that more and more services will come under the ambit of QR code. Some more examples of QR code in libraries as highlighted by Garrett[19] include:

i. Linking from subject areas in the stacks to related electronic resources, Running brief instructional videos, Connecting to useful Web-sites for further information, Offering contact details for library staff

ii. Linking to a Web page that allowed patrons to locate books nominated for a teen literature prize, vote for their favorite, leave comments, and so forth

iii. Enhancing exhibits with a QR code link to songs, videos, Web sites, surveys, contests, etc. or other information that augments the exhibits

iv. Placing codes in the library stacks/end caps or magazine/journal areas that point to online electronic holdings of print materials or related subject guides, linking to library audio tours for orientations

v. Offering patrons basic information about an item, including the location and call number in catalog records. Users can scan the code and head to the stacks rather than writing or printing, taping to video/DVD cases, linking to mobile friendly video trailers

vi. Placing code on staff directory pages and research guides that go to mobile friendly sites for later reference

vii. Adding code onto audio book cases for author interviews or books for reviews, displaying code on study room doors connecting to room reservation forms

viii. Offering library video tutorials –linking a QR code to a YouTube selective list of videos, which will create an App for easy access to those videos

ix. Embedding QR codes on event posters. The code can link to a URL with more information, audio or video, a directory, downloadable material or other information

x. Putting QR codes on your print magazines and journals that link to their online counterparts

xi. Encoding RSS feeds for quick delivery of current information, Sending SMS text messages, Sharing contact information

xii. Linking online study room reservation calendars to the physical room by placing a QR code on the door. Patrons can reserve the room or view the schedule to see when the room will become available by scanning the code (Fig. 6 and 7).

Figure 6. QR code. (Source: https://helpx.adobe.com/indesign/using/generate-qr-code.html, Accessed on 1 January 2017)

Figure 7. QR code in a library. (Source:http://www.slideshare.net/ravindrachaudhary3110/qrcode-presentation-slide)

4.7 Mobile Collections

As with traditional collections, mobile collections span a wide range of content and an equally wide range of delivery methods. "This spectrum runs from mobile access to reference sources to audio book collections and databases[11]. Kroski[10] describes audio book, eBook, music and video files as typical collections available on mobile devices. Whether these collections are directly accessible from the users' devices, or are loaded by library personnel on equipment available for checkout depends on the nature of the collection.

i.   Audio

Mobile devices have the property to store audio lectures that can be listened anytime. For example, the Crouch Fine Arts Library at Baylor University offers *Audio reserves 2Go*, so that all listening assignments are in the palm of the user's hand. They loan preloaded iPods with listening assignments and organize them by course and teacher. These iPods are available for a 12-hour's checkout and can leave the library.

ii.   References

Fox[20] lists a number of publishers who have worked with mobile service providers such as Mobifusion to adapt popular reference materials to a mobile-friendly design. These works include World Almanac, World Book, and standard dictionaries and thesauri". According to Lippincott[12] clinical professionals and other researchers working in the field may find ready access to directories, handbooks, and the like to be of great utility in the field. For most effective access, Lippincott[12] advises that these resources should be organised via subject guides that are formatted for mobile retrieval.

iii. Google Books

A mobile version of Google's Book Search is also available to those with an iPhone or an Android, providing access to more than 1.5 million mobile public domain books in the United States and over 500,000 outside the United States. Libraries can choose to link their OPACS to Google Books, allowing handheld devices to access these versions, which are enhanced for small screen reading[11]. For example, the University Libraries at Murray State University have linked their Voyager OPAC (http://racertrac.murraystate.edu/vwebv/searchAdvanced) to Google Books, offering patrons the choice to read a book full text online, see a Limited Preview, or just glimpse an "About This Book" abstract. It is not inconceivable to imagine a link in an OPAC to Google Books launching the Google app on the iPhone or Android[11].

iv.   OverDrive

Murray[11] discusses the OverDrive Media Console for Windows Mobile. Rather than using a Mac or PC desktop as a go-between for content, patrons can employ their smart phones equipped with the Windows Mobile computer operating system and the OverDrive subscriber card. Although eBooks are not yet available via OverDrive, their audio books, music, and video can all be wirelessly downloaded onto these phones.Patrons can even use OverDrive's Download Library Search to locate local library resources to checkout. According to OverDrive's director of marketing, the company is currently developing similar OverDrive Media Console software for Androids, Blackberrys, and iPhones.

4.8 Mobile Library Circulation

Not all new mobile tools for libraries involve direct patron interaction. Some can be used behind the scenes to offer improved library services. The SirsiDynix Company has developed a handheld circulation tool called PocketCirc that enables librarians to access the Unicorn Library Management System on a PDA. This wireless solution enables staff to assist patrons in the stacks, check out materials while off site (for example, at community or campus events), and update inventory items while walking around the library[10].

4.9 Mobile Audio Tours

For the busy library patrons libraries offer Audio/Video tour services for their mobile devices. Such tours help to know the university library system and services. In the past there were some dedicated mp3 players to guide new users through the library. But, the mobile devices have made the task very easy, a user can simply scan a QR Code to get a video that can eventually guide him to many services and locations of the library. Mobile audio tours can be of great help to librarians, especially in areas of tight scheduling and staffing shortage. Although these self-discovery tours may be less expensive to operate than traditional human tours, equipment maintenance and rental operations may not be cost effective for some visitors and organizations[21].

Duke University Libraries provides a 10-part audio walking tour of its Bostock Library, available for download as MP3 files[10]. The Simmons College Library offers students, faculty, and staff the ability to check out an iPod pre-loaded with a guided audio tour of its Beatley Library and Information Commons. The University of Southern California offers an 8-part video tour of its Doheny Memorial Library through its iTunes University Campus Life channel, giving remote mobile users a glimpse of the structure. Students and staff at Arizona State University can download a walking tour of the Hayden Library through the Library Channel on iTunes U10. The C.V. Starr East Asian Library at Columbia University provides enhanced audio podcasts of its facilities in English, Chinese, Korean, Japanese, and Tibetan.

4.10 Mobile Augmented Reality

Augmented reality has emerged as a new interactive technology and its unprecedented way of complementing the physical environment with virtual annotations offers innovative modes for accessing commercially-relevant content[22]. It allows a level of immersion that no virtual equipment can provide. Augmented Reality has been already used in many applications as surgery, inspection

of hazardous environments, engineering. The use of Augmented Reality in libraries is penetrating.

Augmented Reality aims at simplifying the user's life by bringing virtual information not only to his immediate surroundings, but also to any indirect view of the real-world environment, such as live-video stream[23]. AR enhances the user's perception of and interaction with the real world.

While Virtual Reality (VR) technology or Virtual Environment as called by Milgram, completely immerses users in a synthetic world without seeing the real world, AR technology augments the sense of reality by superimposing virtual objects and cues upon the real world in real time (Fig. 8).
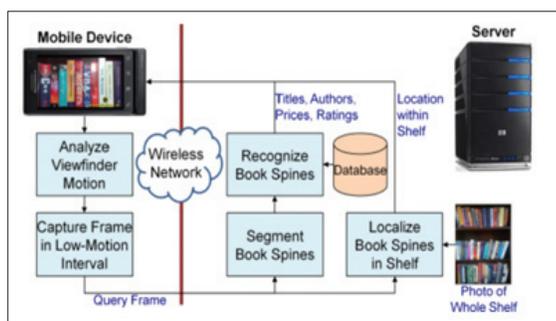

Figure 8. Block diagram of our mobile augmented reality system.

Mobile Augmented Reality (AR) applications represent a profound opportunity for increased access to print and digital library collections. AR applications can deliver an engaging and interactive information experience. Applications that overlay graphical data are well suited for in-library engagement as well as off-site real world interaction with library content. Most augmented reality apps in libraries are currently in the research and development phase[22]. The current state of mobile in libraries is such that many libraries now create and adapt their catalogs for mobile access. Mobile augmented reality applications offer much for the integration of library resources into user's information environment. Libraries, through further research and development efforts, can continue to expand and extend the library presence in this environment through augmented reality applications[24]. The following use cases user models are advanced for possibilities of providing new and highly interactive library experiences:

(i) Physical Book Stacks Browsing:

A use case for augmented reality applications includes the integration of digital library content into the physical stacks browsing experience. Consider a first time user to a library. Orienting in the book stacks is both a challenge and also an incomplete introduction to the totality of available services of the library. The new student may consider the physical book stacks to be the only available library resource. The new user is not aware of the digital items of the collections. With an augmented reality service in the library book stacks, the mobile app user can use the software to first identify the stacks that he/she is in (i.e., identify a subject area

of "dictionaries"), and then the software will overlay a range of digital content to this physical presence, once the meaning and subject area of the shelf are identified by the software.

A mobile augmented book stacks application is quickly accessed from a user's smartphone and does not require users to enter a search query; it allows them to use their stacks location and smartphone as a query point for additional library information. No comparable digital collocation service yet exists in libraries, and no service can overlay access to the range of electronic resources to a person's location in the print collection. The service will be available soon.

(ii) Library Navigation:

This applied mobile augmented reality research is particularly relevant to the problem of library way-finding. These way-finding problems include understanding call numbers or other library specific numbering such as such as the shelf ranges or even the column number on the ranges that are typically utilised for inventory control. Researchers have studied mobile applications for collections based way-finding and have found that mobile applications can draw the users' attention to the environment in ways that aid a user in her path to a known item. Furthermore, researchers plan to study augmenting a way-finding app with directional "tunnel" overlays that can draw student's attention to the most important features of the stacks while they are navigating to a desired item in the library.

(iii) Optical Character Recognition (OCR):

The mobile app will use modified OCR software and check a suggestion database to identify library resources that will support the assignment or topical interest; checking against a database of course reserves for the class and other relevant sources of data (course specific help guides); and suggesting library resources and research databases that are relevant; this information package can be viewed on the phone, or students will have the option of sending the information to themselves via email or other social networking platforms; as students value collaboration and social aspects of research.

(iv) Facial Recognition:

Currently, library staff uses a full workstation computer to connect to a scanner that scans the patron's barcode. The library's barcode scanners for scanning a patron ID may not be necessary, if a clerk can use a library smart phone in order to scan a patron's picture ID. The picture that is scanned will then does feature detection and patron recognition in order to charge out the patron's items. These types of applications could result in cost savings for the library, as many of the transactions that are happening at the circulation desk do not require the full resources of a desktop computer. In fact these transactions could be handled with a small tablet computer loaded with library facial recognition software that will replace the traditional desktop paradigm.

(v) Identify Building Services and Collections:

An augmented reality application that can identify buildings by simply holding the phone's camera up to the building could be particularly useful for a large university campus or institutions with multiple library sites. The user of this augmented reality app can use this to identify the name of the library building and the hours of the library building[22]. It can tell users when it will be closing and overlay information such as current computer availability, technology availability or even seating availability in the library. The theoretical mobile augmented reality service here is using a software tool that performs feature point recognition algorithm in the app that identifies the library building and then connects with a database of services offered. (Fig. 9).

Figure 9. Augmented reality app for shelf reading.

4.11 Mobile Instructions

Library users' who don't have the time or inclination to attend an on-site workshop, can still get the most out of the library resources by accessing classes and tutorials on their mobile devices. Libraries have begun distributing their knowledge and expertise with library systems and materials via MP3 and video files which patrons can take with them.

The Washington State University Libraries offer patrons how-to help with library tools and resources through brief MP3 audio recordings which can be uploaded to iPods and other mobile devices. The WSU Libraries present a 3-minute guide to the map collection, 2-minute tutorials on how to select search terms and use Boolean operators, as well as instructional audio casts on using their online databases to find journal articles. The Sheridan Libraries at Johns Hopkins University offers lengthy podcasts instructing listeners how to create maps, conduct citation searches, and ask-a-librarian. The Alden Library at Ohio University has created a series of short audio files describing intercampus requests, reserving group study rooms, obtaining reference assistance, and library workshops.

University has hundreds of educational podcasts which can by uploaded to patrons' MP3 and portable media players and taken to-go, many of which are from college and university libraries. The Texas A&M Libraries has their own channel on iTunes featuring down loadable video casts covering topics such as finding books, articles,

databases, and e-journals, several types of library catalog searches, and a virtual tour of the library. The Faculty Workshop Series at the Arizona State University Libraries is a video podcast series which can be found by accessing the ASU Library Channel within iTunes. The three to five minute videos concerning finding articles, getting started doing library research, and finding books can be viewed on portable devices such as a video iPod at the learner's convenience. (Fig. 10).

Figure 10. Snapshot of mobile printing.

4.12 Mobile Printing

Mobile printing allows users to print documents from their mobile devices by wirelessly connecting to a printer. However, the implementation of this technology is hindered because of its dependence on the capabilities of mobile devices[25]. The operating systems of many mobile devices do not include print capabilities and the user must download software to enable this function. Additionally, the memory and processing power of mobile devices may also affect the appearance of documents and increase their print time. Further problems may arise when devices fail to communicate properly with the networked printers[25]. The working group determined that these issues, combined with the cost and difficulty of finding software which accommodated most mobile devices, made the option of mobile printing unfeasible at this point in time[10].

4.13 Mobile Databases

It's not only libraries that have seen the writing on the wall with regard to the mobile Web, but academic software and database providers have started taking portability to heart[10]. The scholarly citation management application, Endnote has rolled out mobile functionality for Pocket PC owners with their X1.0.1 release. Factiva's news database has a search interface for mobile Web users, as does the Westlaw legal research database. Library patrons can access detailed company information while on the road through Hoover's Mobile, and the National Library of Medicine makes it possible for medical students to research remotely through PubMed for handhelds[10]. Database publishers have started to evolve mobile friendly applications or formatting the old versions of their databases that fits well in the mobile environment. Murray[11] lists several databases in his blog, including Music Online and the Social Science

Research Network (SSRN), which have developed apps for mobile devices. Alexander Street's Music Online app allows subscribers to cross-search hundreds of thousands of audio recordings, scores, videos, and full-text music reference materials as well as update playlists.

On 19 November 2009 Social Science Research Network announced that the availability of a downloadable app granting mobile access to their e-library, an Abstract Database containing over 260,300 abstracts to scholarly working papers and an Electronic Paper Collection, which has over 213,700 downloadable full text pdf documents. Database providers such as Factiva, LexisNexis, Ovid, PubMed, and Westlaw have also developed mobile interfaces, with emphasis in the medical and legal fields[21]. EBSCO too has announced EBSCOhost Mobile, providing a mobile interface for EBSCO products (Fig. 11).
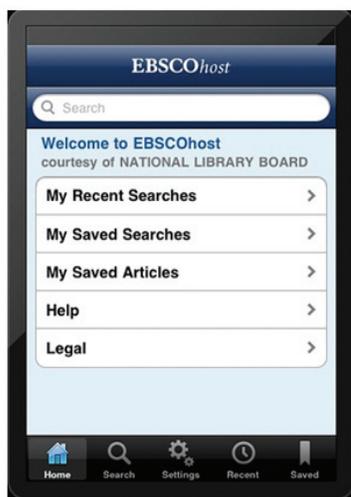
Figure 11. Snapshot of EBSCOhost mobile database.

4.14 Mobile Services for Visual and Hearing Impairments

Another important use of the mobile technology is for special libraries to use the devices to assist the persons with special abilities like visual or hearing. Many such people are often unable to access because there is no special interface for them. Mobile devices such as smartphones which have screen readers that can help the disabled to access information.

Visual or vibrating alerts, relay services and hearing aid compatibility devices make mobile phones accessible for the deaf and hard of hearing, while features such as voice recognition and auto text are needed by those with physical disabilities[26]. The use of augmented reality refers to the "addition of a computer-assisted contextual layer of information over the real world, creating a reality that is enhanced or augmented using either text to speech" or vice versa.

5. CONCLUSIONS

The application of mobile phone is not new in academic libraries. Many academic libraries across the globe were already using SMS services to their users

to provide them notifications regarding the library. But now the mobile computing has revolutionised libraries by enabling the users hassle free admittance to "information on the go" service. With the ubiquity and relative success that mobile users have with Google and other search engines, libraries need to be competitive in order to remain relevant[27]. The role of mobile technologies and mobile library initiatives for information access in academic libraries can't be underestimated. In this paper, different mobile initiatives like mobile library website, MOPAC's, mobile SMS reference services, mobile library notifications, QR codes, augmented reality etc. are highlighted with examples of Universities that have already made inroads in mobile library services. Moreover, how these mobile library services would help to facilitate access to information in ubiquitous and time bound manner has also been discussed in detail. For libraries, especially academic libraries to stay relevant in the mobile era there is a need to implement mobile library technologies for the maximum access of their resources and for the satisfaction of their users and how they facilitate access to information are discussed to understand how libraries can leverage them for making their services fast and smart. In order for libraries to stay relevant, libraries must implement mobile library technologies for the maximum access of their resources and promotion of their services.

REFERENCES

1. Vassilakaki, E. Mobile information services in libraries: A review of current trends in delivering information. *Inter. Lending Docu. Suppl.*, 2014, **42**(4), 176-86.

2. Yue, H. Research and development of the mobile library based on WAP technology. *In* 2nd International Conference on Industrial Mechatronics and Automation, ICIMA, May 2010, pp. 191–194. http://ieeexplore.ieee.org/document/5538338/ (accessed on 5 December 2016).

3. Villoldo, M.A., *et al*. How to mobilize your library at low cost. *Lib. Quart.*, 2012, **22**(2), 118-45.

4. Vollmer, T. There's an App for that. Libraries and mobile technology: An introduction to public policy considerations. USA: ALA, Office for Information Technology Policy, 2010.

5. Johnson, L., *et al*. The NMC horizon report: 2015 Museum edition. New media consortium. 6101 West Courtyard Drive Building One Suite 100, Austin, TX 78730, 2015.

6. Shahriza A.K.; Nor, S.H.D. & Ramlah, H. Mobile phone applications in academic library services: A students' feedback survey. *Campus-Wide Info. Sys.* 2006, **23**(1), 35-51.

7. Herman, S. SMS reference: Keeping up with your clients. *Electronic Lib.*, 2007, **25**(4), 401-08.

8. Paterson, L. & Boon, Low. Student attitudes towards mobile library services for smartphones. *Library Hi Tech*, 2011, **29**(3), 412-423.

9. Pianos, T. EconBiz to go: Mobile search options for business and economicsdeveloping a library app for researchers. *Library Hi Tech*, 2012, **30**(3), 436-48.

10. Kroski, E. On the move with the mobile web: Libraries and mobile technologies. *Lib. Tech. Reports*, 2008, **44**(5), 1-48.

11. Murray, L. Libraries like to move it, move it. *Ref. Ser. Rev.*, 2010, **38**(2), 233-49.

12. Lippincott, J.K. A mobile future for academic libraries. *Ref. Serv. Review*, 2010, **38**(2), 205-13.

13. Griggs, K.; Laurie, M.B. & Hannah, G.R. Library/mobile: Tips ondesigning and developing mobile web sites. *Code4lib J.*, 2009, **8**, 11-23.

14. Han Rebekah Wong, S. Which platform do our users prefer: website or mobile app? *Ref. Serv. Rev.*, 2012, **40**(1), 103-15.

15. Chang, Chiao-Chen. Library mobile applications in university libraries. *Lib. Hi Tech*, 2013, **31**(3), 478-92.

16. Wang, Chun-Yi; Hao-Ren Ke & Wen-Chen Lu. Design and performance evaluation of mobile web services in libraries: A case study of the Oriental Institute of Technology Library. *Electronic Lib.*, 2012, **30**(1), 33-50.

17. Shakil, M.; *et al*. Quick response code in oral and maxillofacial radiology. *J. Oral Maxillofacial Radiology*, 2014, **2**(3), 95.

18. Lo, Leo; Jason, C. & Danielle, T. Putting QR codes to the test. *New Lib. World*, 2013, **114**(11/12), 459-77.

19. Garrett, T. QR codes and libraries. *Florida Lib.*, 2012, **55**(2), 27-29.

20. Fox, M.K. Information anywhere. *Net Connect Lib. J.*, 2008, 2-5. http://www.libraryjournal.com/article/CA6599045.html. (accessed on 3 January 2017).

21. Buczynski, J. Libraries begin to engage their menacing mobile phone hordes without shhhhh!. *Internet Ref. Ser. Quar.*, 2008, **13**(2/3), 261-9.

22. Javornik, A. Augmented reality: Research agenda for studying the impact of its media characteristics on consumer behaviour. *J. Retail. Consum. Serv.*, 2016, **30,** 252-61.

23. Zlatanova, S. Augmented reality technology. Delft University of Technology, Faculty of Civil Engineering and Geosciences, Department of Geodesy, Section GIS Technology, 2002.

24. Hahn, J. Mobile augmented reality applications for library services. *New Lib. World,* 2012, **113**(9/10): 429-38.

25. Nowlan, G. Going mobile: creating a mobile presence for your library. *New Lib. World*, 2013, **114**(3/4), 142-50.

26. Narasimhan, N. & Leblois, A. Making mobile phones and services accessible for persons with disabilities. A joint report of ITU—The International Telecommunication Union and G3ict-the global initiative for inclusive ICTs, 2012.

27. Reese Bomhold, C. Educational use of smart phone technology: A survey of mobile phone application use by undergraduate university students. *Program*, 2013, **47**(4), 424-36.

Websites

1. http://www.crcpl.org.

2. http://pulse.uta.edu/vwebv/.

3. http://ualr.edu/library/files/2012/09/UALRmobile.jpg.

4. https://libraryh3lp.com/sms-reference-service

5. https://helpx.adobe.com/indesign/using/generate-qr-code.html.

6. http://www.slideshare.net/ravindrachaudhary3110/qrcode-presentation-slide.

7. https://www.researchgate.net/publication/221265915_Mobile_augmented_reality_for_books_on_a_shelf.

8. http://www.i-programmer.info/news/105-artificial-intelligence/2187-augmented-reality-app-for-shelf-reading.html.

9. http://www.samsung.com/us/mobile-print-app/

10. https://bizlib247.files.wordpress.com/2011/10/ebsco-app1.jpg.

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