

Enhancing the Usability of Library System at CSIBER using QR Code

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Abstract: With the advancement in information technology, the information is no longer confined to a single physical location. With the parallel advancement in mobile technology, the information is available anywhere and at any time with a single click. The quick response (QR) code has further rendered it easier to access information using QR scanner installed smart phones without memorizing complex web addresses. The intent of this research is to enable an end user a quick access to the CSIBER library resources by revealing its current location in the library. To enable this an open source tool is designed and developed which queries an end user for book information and instantly reveals its physical location in the library. The tool is deployed in two different environments, intranet environment using J2EE technology with JBOSS application server and MS-Access as backend. The latter deployment option focuses on integrating the tool with institute's web site to widen its scope and make it reachable from any location at any time using PHP as a server-side scripting language and MySQL as backend. The data migration tool is developed in Java for converting from MS-Access database to MySQL database.

Keywords: QR Code, Library services, Data Migration, OPAC web interface, PHP MYSQL.

I. Introduction

In this digital age with the advances in communication technology, data and information is no longer tied to physical location. The current generation students are often adept at “multiprocessing” and make an abundant use of internet resources rather than the offline library resources. This can be attributed to an ease of finding information on one click rather than spending time in searching the book in the library [1-2]. But in recent years, library system has become technologically advanced providing new services such as OPAC interfaces, virtual cataloguing and referencing, automated current awareness and downloadable media which are accessible from personal computers and/or mobile devices [3].

OPAC, an Online Public Access Catalogue also called as library catalogue is an online database held by a library. A catalogue is said to be a library's collection which includes a details of bibliographic of a particular book, which provides services for book reservations, informs the user about the holdings of the library, borrower status checking and so on and also other material available at library. In addition to these, members can also be able to get information about borrowing, reservation etc. OPAC is also called as gateway of library services. OPAC gives the users online access to the library's catalogue allowing them to search and retrieve records from the online catalogue and depending on the underlying library management software.

To access data directly using mobile phone without memorizing the web addresses, scanning a QR code is easy and convenient. QR code was invented by the Denson Wave- Toyota Motors subsidiary in 1994 [4-5]. It is a two dimensional barcode that has the ability to set a piece of long multilingual text, a linked URL, a business card or any information, which is readable by mobile phones with cameras and QR Scanners. The literature reports various applications of QR code in educational domain. Some of the documented uses of QR code in education are:

- Can be added to word documents for students to verify their answers
- Used to promote school events
- Used get immediate access to wireless network
- Can be used to vote using twitter tools
- To enhance information in books
- Sharing web resources with students
- To give access to important information
- To create virtual tour of an institute
- Can be linked directly to Google maps
- Linking reading books to online resources

We need to take into account that by using QR codes and new technologies in the library, we are helping to reinforce our image of modernity, and are thus beginning to be seen as a source of dynamic information that is evolving without losing sight of technological advances. This advanced feature provides a great opportunity for users to link libraries from the physical to the virtual as QR codes can be created online and printed in a matter of minutes, without any special equipment.

Though QR code is characterized by high speed scanning, dirt and damage resistant with huge storage capacity and able to store any kind of information, education field is still way behind in use of QR codes [6]. Therefore the purpose of our research is to investigate a way to find a single platform approach with integration of third party library system with educational institute website using QR code to provide library services with seamless workflows to increase efficiency.

II. Literature Survey and Prior Art

In this literature review, references of the relevant work have taken and explained the same with respect to this research. This section surveys the most relevant studies carried out in this field to date. This review is supplemented by referring about 25 research papers. Some selected references for broad overview are taken here.

A report by Michael J. Whitchurch contains a small sampling of QR code implementations and a summary of what has been done to encourage student engagement with the library through the use of QR codes at the Harold B. Lee Library at Brigham Young University [9]. Student engagement is promoted by supporting library services that are unique or improved over past approaches. Implementation hurdles are manageable and include producing and designing the codes, locating them effectively and having access to compatible hardware, though student ownership of smartphones is rising rapidly are explained by authors.

Authors in [10] have shared the experience and gave some examples of use of QR codes at the Universitat Politècnica de València (UPV) Libraries in Spain. They have described how QR codes gives access to mobile website, to download documents and to promote literature blog. It also described how to promote QR codes to both users and librarians, including some best practices. The M-Library Project (funded by the Scottish Library and Information Council) conducted a survey across three universities in the UK, and looked at successfully implemented mobile services in UK academic libraries. Some libraries have put the resource into creating full apps or sites, whilst others have implemented small but effective changes. This project explains the procedure and issues of library access using QR code.

Yet another paper by Ching-yin Law et.al surveys the usage of QR codes in education, this paper reports user characteristic of QR codes, processes of generating and reading QR codes, commercial applications using QR codes, educational applications using QR codes, suggestions and implementations of QR codes in school education [4]. Cheri Dobbs has placed a QR code on the library home page with a link. This permits students to access page from their mobile phones [11]. This library webpage lists links to the online database subscriptions. Neil Ford reports student experience of finding e-books with help of QR code. Data generated from this project can be used to increase academic awareness of e-resources, improve collaboration in stock work and identify collection development needs [12]. Ally et.al have designed QR code for Bournemouth University library, QR code links to library URL [13]. Authors have reported study of gathering library data, review of QR code development history, structure, benefits and challenges and its application in library and information centers [14].

III. Current System

The CSIBER library serves the entire staff, students & its alumni to help them in their academic work. It provides necessary facilities to its readers to attain proficiency in the fields if their specialization and to acquire general knowledge. Presently the library is equipped with 74815 books, 167 periodicals including national and international journals in various areas such as management, computers, social work and environment.

All the Library activities including acquisition, cataloguing, circulation, serial control and stock verification is automated by using Libsys software package. The OPAC facilitates searching of various catalogues to retrieve bibliographic details available in the Library database. The Library uses barcode technology for computerized circulation system and stock verification. Every document in the Library bears a barcode and every authorized user has a bar-coded patron card, which in turn, facilitates their identification in the circular process. The Library has developed in house facility for bar coding of books and patron cards.

OPAC helps the user to retrieve the reading material by author, title, subject, classified number & publisher. The OPAC also provides information about the status of the current journals available in the Library. Library OPAC Address: <http://192.168.1.111:8080/opac>

The institute’s website www.siberindia.edu.in is developed in Joomla, a Content Management System. This site is registered with Enet-India (www.registry.ernet.in) and hosted by GoDaddy (in.godaddy.com). The design and development of this site was carried out in house.

3.1 Lacunae in the current system and proposed solution

Currently library maintains information about the various resources in an OPAC database. During stock verification the location information is maintained separately in an excel spreadsheet. Due to this locating a book requires multiple file lookups, which is time consuming and also requires the availability of library staff. Presently the location information is not integrated with main library information system. To overcome this limitation an integration tool is designed and developed for fast access to the library resources from any location at any time using QR scanner enabled smartphones.

IV. Proposed System

4.1 Application Architecture and Control Flow Logic

The system employs two-tier architecture where data access code is separated from presentation tier, offering web interface to an end user. The interaction between various modules of this system is shown in Fig. 1 and the corresponding control flow logic is shown in Fig. 2.

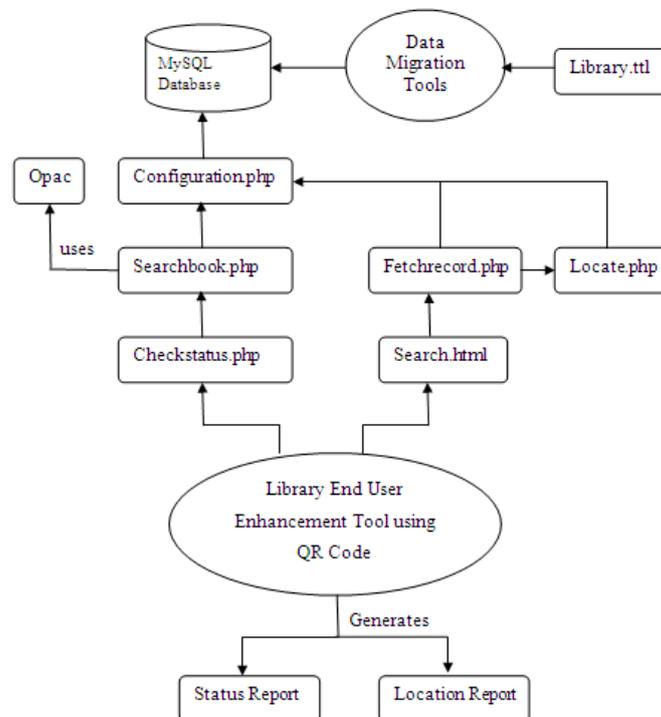


Fig.1 Proposed System Architecture

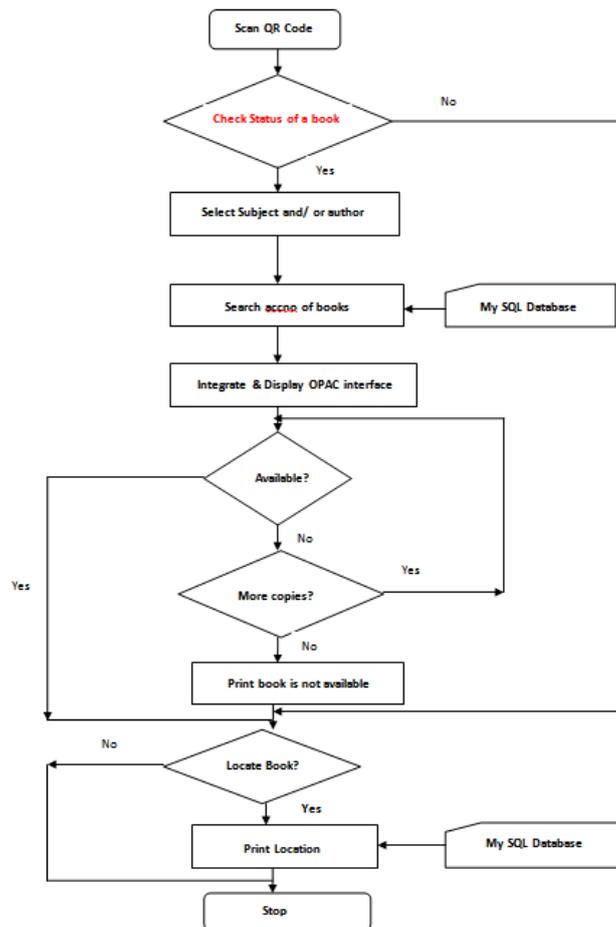


Fig.2 Control Flow Logic

4.2 Algorithm

/* Any high level language interfacing with back end database management system provides high level API for primitive database functions such as creating a connection object, checking the current position of the resultset pointer and selecting a set of rows based on the given criterion. Hence this algorithm assumes some standard functions as shown below:

Standard Functions used in the Algorithm

getConnection - is a built-in function returning Connection object for a given connection string

selectRows() - is a built-in function retrieving matching rows for given column names and a table name.

isEOF(ResultSet) - is a function which returns a boolean value, indicating whether the resultset pointer is at the beginning of or at the end of resultset.

*/

/*

conString : Connection String for connecting to a back end.

*/

/*

Input : book title/book author

Output : List of selected books with a link 'CheckStatus' interfacing with Opac

*/

function checkStatus(title : String, author : String)

```

{
con=getConnection(conString);
if (title != null && author != null)
query=selectRows(title, author, book);
else if (title == null && author != null)
query=selectRows(title, book);
    
```

```
else if (title != null && author ==null)
    query=selectRows(author,book);
resultSet=getResultSet(con,query);
while((isEOF(resultSet) == false)
{
    Read row;
    Print row;
}
}
```

```
function locateBook(accno : int)
{
    con=getConnection(conString);
    query=selectRows(accno, location);
    resultSet=getResultSet(con,query);
    if ((isEOF(resultSet) == false)
    {
        Read row;
        Print row;
    }
    else
        Print "Location Inforamtion Not Available";
}
}
```

```
function fetchRecords(title : String, author : String)
{
    con=getConnection(conString);
    if (title != null && author != null)
        query=selectRows(title, author, book);
    else if (title == null && author != null)
        query=selectRows(title, book);
    else if (title != null && author ==null)
        query=selectRows(author,book);
    resultSet=getResultSet(con,query);
    /* Pagination of Output */
    count = getCount(resultSet);
    pages=count/records_per_page+1;
    page=1;
    while (page < pages)
    {
        Print page_link;
        Page=page+1;
    }
}
}
```

```
function pagelink_click(page:int)
{
    con=getConnection(conString);
    query=selectRows(title, author, book);
    to=page*records_per_page;
    from = to - records_per_page + 1 ;
    resultSet=getResultSet(con,query,from,to);
    while((isEOF(resultSet) == false)
    {
        Read row;
        Print row;
    }
}
}
```

4.3 Application Modules

- i) Data Migration Module – This module is implemented in Java for converting data stored in library.ttl format into MS-Access and MySQL databases. TTL is a file extension associated with Tera Term Macro files. Different application architectures are explored for improving efficiency by optimizing data migration time.
- ii) Web-OPAC Integration Module - For checking the current status of library resource an OPAC interface is integrated with the website which reveals the desired information based on the information used to query the resource availability.
- iii) Book Info Module - This module provides an end user with the resource information based on title and/or author entered by the user. The paginated output is generated for an easy navigation.
- iv) Location Specification Module - The purpose of this module is to enable an end user a quick access to the required library resource by specifying its current physical location in the library.

V. Results And discussion

The above system is implemented in two different environments, an intranet environment using J2EE technology with JBOSS application server and MS-Access as backend. The structure of the database used in implementation is depicted in Fig. 3.

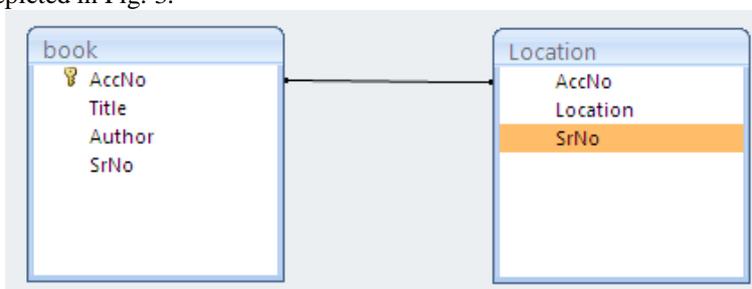


Fig.3 Structure of Database

The system is also integrated with institute’s website, www.siberindia.edu.in in order to widen a scope and make it reachable outside the campus. The main challenge was experienced in exporting of huge library data to web hosting data storage. Mysqldump tool was used for creating backup of library database which was restored on webhosting database using fragmentation. The library page of a web site contains a link, to access the location information as shown in Fig. 4. The partial code used in system implementation is given in Appendix I.

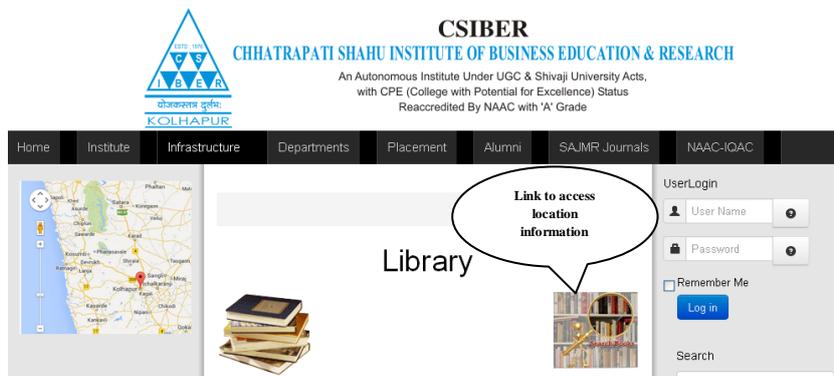
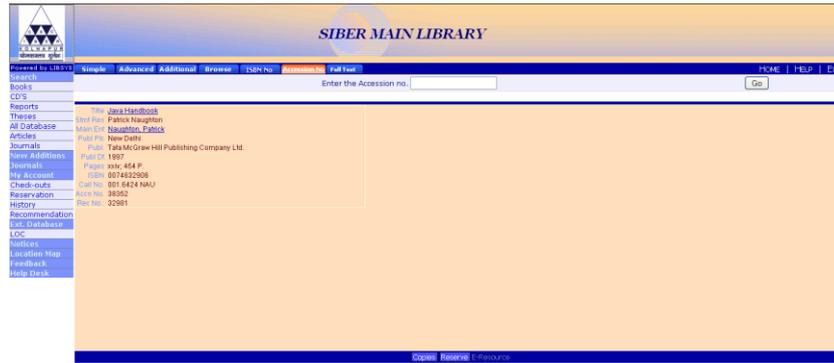


Fig. 4 Library page of a web site

The second challenge faced was in generating a paginated output for intranet environment using MS-Access as backend. For selecting the range of records in access database conforming to title phrase “java”, the following query was employed:

```
SELECT title, (SELECT COUNT(*) FROM book b2 WHERE title Alike '%java%' AND b2.id <= b.id) AS SrNo FROM BOOK b WHERE title Alike '%java%';
```

Fig. 5 shows the integration of OPAC search page with the system to check resource availability. Fig. 6a-6b show GUI screens for checking the status and location of the books based on title and/or author as required by an end user. Fig. 6c shows the current physical location by displaying rack number on which the book is located.



Click on copies button above.

Back...

Fig. 5 Integration of OPAC search page with the system



Fig. 6a GUI screen for checking the status

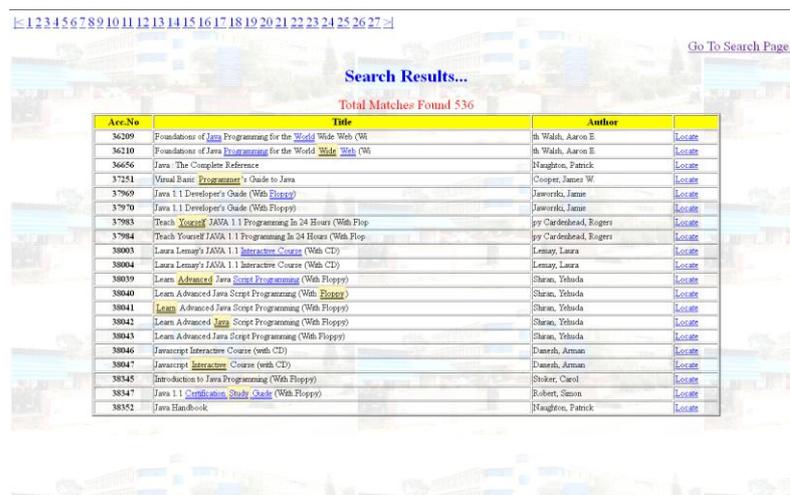


Fig. 6b GUI screen for checking the location

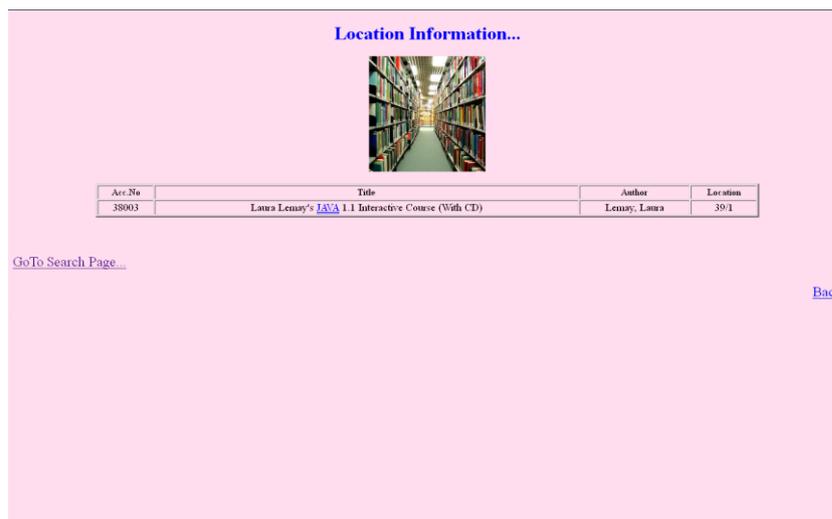


Fig. 6c GUI screen showing current physical location

The link to the search page can be established by scanning the QR Code shown in Fig. 7, using QR code scanner.



Fig. 7 QR Code

VI. Conclusion and Scope for Future Work

In this paper authors have integrated library OPAC interface with the CSIBER web site with QR code facility to the users for quick and easy access to the library services. The facilities provided are as follows:

- Book search by giving title and/or author of the book with number of copies available
- Locating the shelf where the book is placed
- Checking the availability of the books

The interfacing of OPAC library system with the web site is done using PHP MySQL programming language. The resultant approach will surely give the users an access to the library services from anywhere through QR code or directly by visiting the website.

Due to the large size of the database it is extremely time consuming to migrate data from one Database Management System to another. In order to minimize this different application architectures based on multithreading or distributed technology can be adopted. In future authors intent to develop a distributed application for optimizing data migration time using either RMI technology or Hadoop.

Acknowledgements

The research work undertaken and reported in this manuscript has been carried out in Chatrapati Shahu Institute of Business Education and Research Kolhapur, India. Authors would like to thank Dr. R.A. Shinde, Managing trustee, Dr. M.M.Ali, Director, Dr. R.V. Kulkarni, Head of Department, Library Staffs and all colleagues of this institute for their encouragement and help during this research. The same is gratefully acknowledged.

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