

# QR Code based Library Management System

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**Abstract:** Library management system from ancient age one of the research area and bar codes are extensively used in most of the modern library management system. This Research project is aimed to develop smart library management system using QR code. QR codes are two dimensional matrix barcodes. QR codes can be widely used in both commercial and institutions with the increased use of smart phones, as smart mobile phones can scan the sensible data. Use of QR code in Library management system is very easy but still in primary stage. Library should try to keep up with digital world with various technologies in this modern age. The importance of library system is because these systems are used as primary resource of information by many peoples. Most of the libraries currently working with large number of persons for daily activities and supervision. QR code based Library management system is very efficient and reliable for Librarian, staff and students. This system will simplify library processes to keep track of all records, and make library more directly accessible to its users. In this system python Qt5 frame work application is being used for College Library database which can be accessed through out the institution. This system works in real time and easy access to information to every member associated with the system. Users must be registered with the system administration after which they can access their accounts and database. It reduces the bourdon on the librarian as it will help to track the books available and issued person for any book and total number of books along with ageing analysis.

**Index Terms:** QR code, Matrix barcode, Library Management system, python, Qt5 frame work.

## I. INTRODUCTION

In this digital world in advances in communication technology data and information is no longer tied to physical location. Current generation students often adapt at multiprocessing and make use of internet resources rather than offline library resources. This can be attributed to an ease of finding information in one click rather than spending time in searching books. The primary issue for any library system is organization and record keeping. Due to large no. of users and items there are chances of misplace of books due to frequent movement of books within or outside of library. The struggle for librarian and users to find the books.

To overcome all the difficulties of Librarian and users and improve the overall functioning of Library a QR code based Library Management system is introduced. In this system Database for all books, staff and students is being made with the use of QR code and same is uploaded in system with python flask framework. Implementation of Library Management System using python Qt5 framework is based on the database management system. This software is designed to manage all records of books and information of staff and students for issue and return of books. The database refers to collection of records that manage to produce useful information. The data can access, modified managed, controlled and organized to perform various data processing operations. The data indexed across rows, columns & tablets that makes workload processing operations [9].

QR codes are 2D matrix barcodes that is scanned using exploitation sensible & web capable smart mobile phones having camera with website address, email address, details of things within catalogue, phone nos. The QR codes is 2D symbols developed by Toyota Denso wave 1994 with first aim that symbol is easily decoded by scanner instrumentation at huge speed with vertical and horizontal directions. There are mainly four kinds of data such as numeric, alphanumeric, byte or binary and Kanji which are encoded into information or through supported extensions.



Fig.1: QR code Bitmap

Python flask framework is a technology that is used for developing library management system. Flask is web frame work written in python. It can be classified into micro framework because it doesn't require any particular tools or libraries and has inbuilt database. It has no database abstraction layer, Flask support extension that can add application features. Extension exists for object relational mappers from validation, upload, handling, various open authentication technologies and some common frame work related tools. Extensions are updated far more frequently than the core flask programme.

Database can be classified into five different categories:

1. Object oriented
2. Relational
3. Distributed
4. Hierarchical
5. Network

Database management system is used to improve and manage the storage. It also offers a systematic approach to manage database by

an interface for users as well as accessing the databases by apps.

#### A. QR Code:

The QR codes is 2D symbols developed by Toyota Denso wave 1994 with first aim that symbol is easily decoded by scanner instrumentation at huge speed with vertical and horizontal directions [12]. Details of QR codes are:

##### a) QR Code Structure

QR codes were developed in by Denso Wave, a Toyota subsidiary as a matrix code to maintain information in two vertical and horizontal dimensions. QR codes were introduced freely as a method for qualifying shelving in production units in 1994. These codes are in line with the international standard of ISO/IEC18004, although it does not support all existing smart phones. The aforementioned standards increase the number of producers and readers of QR codes and also make them compatible with each other, although one must consider the possible problems of these standards in smart phones. QR codes features include high reading speed, data storage and transfer, 360-degree readability, resistance to contamination and defects and adding up to 16 symbols to the structure (2). The QR code typically appears as a small white square with black geometric shapes, colour and even branded QR codes are now being used, though. QR codes can hold much more information than a regular barcode.

The information encoded in a QR code can be a URL, a phone number, an SMS message, a Vcard, or any other type of texts. They are referred to as QR (Quick Response) because they allow the contents to be decoded at a high speed (8). A QR code is capable of holding 7,089 numeric characters, 4,296 alphanumeric characters, 2,953 binary bytes, 1,817 Kanji characters or a mixture of them. The data capacity is much higher than other 2D codes such as PDF417, Data Matrix and Maxi Code and it stores information in both vertical and horizontal directions. A QR code can be read from any direction in 360° through position detection patterns located at the three corners as shown in Figure 1. A QR code can be read even if it is somewhat distorted by either

being tilted or on a curved surface by alignment or timing patterns.

The error correction capability against dirt and damage can be up to 30%. A linking functionality is possible for a QR code to be represented by up to 16 QR codes at maximum, therefore, a small printing space is possible. The size of a QR code can vary from 21x21 to 177x177 cells by 4 cell increments in both horizontal and vertical direction. Data can be easily encrypted in a QR code to provide a confidentiality of information embedded in the code. It can also handle various languages. For examples, there are a number of standards adopted by Asian countries like GB/T 18284 by Chinese National Standard in 2000, KS-X ISO/IEC 18004 by Korean National Standard in 2002, and TCVN7322 by Vietnam National Standard in 2003(9).

### b) QR Code & Scanner

QR code (abbreviated from Quick Response Code) is the trademark for a type of matrix barcode (or two-dimensional barcode) first designed for the automotive industry in Japan. A barcode is a machine-readable optical label that contains information about the item to which it is attached. A QR code uses four standardized encoding modes (numeric, alphanumeric, byte/binary, and kanji) to efficiently store data; extensions may also be used [11].

The QR code system became popular outside the automotive industry due to its fast readability and greater storage capacity compared to standard UPC barcodes. Applications include product tracking, item identification, time tracking, document management, and general marketing.

A QR code consists of black squares arranged in a square grid on a white background, which can be read by an imaging device such as a camera, and processed using Reed–Solomon error correction until the image can be appropriately interpreted. The required data is then extracted from patterns that are present in both horizontal and vertical components of the image.

### c) Application

Librarians and staff of a large university, small institutions, public libraries and museums provide useful ways for implementing QR both in traditional and online. In general, the applications of these codes in libraries are as follows:

- ❖ Providing ready-to-use guidelines at required locations.
- ❖ Step by step guides for machines such as printers and copy machines.
- ❖ Providing a list of library guides on the subject of books on shelves.
- ❖ Showing the where about of e books on the shelves.
- ❖ Linking the user to digital libraries on campus.
- ❖ Offering services such as chat, instant messaging and mobile version of the electronic library Catalog or database.
- ❖ Usable for services like ask the librarian, and in the traditional reference desk and all public.
- ❖ Access to computer stations.
- ❖ Usable in library tours. - Providing maps of the library instead of a single map.
- ❖ Providing relevant reviews of library resources.
- ❖ Linking to a phone number shown on a web page without having to dial the number

### B. Python QT5

PyQt5 is a comprehensive set of Python bindings for Qt v5. It is implemented as more than 35 extension modules and enables Python to be used as an alternative application development language to C++ on all supported platforms including iOS and Android.

Python is a general-purpose, dynamic, object-oriented programming language. The design purpose of the Python language emphasizes programmer productivity and code readability. Python was initially developed by Guido van Rossum. It was first released in 1991. Python was inspired by ABC, Haskell, Java, Lisp, Icon, and Perl programming languages. Python is a high-level, general purpose, multiplatform, interpreted language. Python is a minimalistic language. One of its most visible features is that it does not use semicolons nor brackets. It uses indentation instead. There are two main branches of Python

currently: Python 2.x and Python 3.x. Python 3.x breaks backward compatibility with previous releases of Python. It was created to correct some design flaws of the language and make the language cleaner. Python is maintained by a large group of volunteers worldwide. Python is open source software. Python is an ideal start for those who want to learn programming.

This tutorial uses Python 3.x version.

Python programming language supports several programming styles. It does not force a programmer to a specific paradigm. Python supports object-oriented and procedural programming. There is also a limited support for functional programming.

QDate, QTime, QDateTime

PyQt5 has QDate, QDateTime, QTime classes to work with date and time. The QDate is a class for working with a calendar date in the Gregorian calendar. It has methods for determining the date, comparing, or manipulating dates. The QTime class works with a clock time. It provides methods for comparing time, determining the time and various other time manipulating methods. The QDateTime is a class that combines both QDate and QTime objects into one object.

## II. LITERATURE SURVEY

**2.1 Majid Bayani, Alberto Segura, Marjorie Alvarado, Mayra Loaiza** "IoT-Based Library Automation and Monitoring system: Developing an Implementation framework of Implementation" Volume 8, number 1 | Technical Article 3 | Jan-Jun 2018 | e-Ciencias de la Information

**Concluded:** Using the mobile applications is a trend. People are spending high percentages of their time using their smart phones and mobile apps, then applying a library mobile application can increase the users' library usage rate. It is very common to use the smart phones to connect to the Internet, to buy a product, to pay a service, to watch a video and to get access to numerous online services. One of the advantages related to the library service management which the IoT can offer is that

once the users download and install the library application, they can have access to all online services prepared by the system. It can play a key role in the human's global data access and knowledge propagation in a fast, more efficient and smart manner. [1]

**2.2 Suhas Holla, Mahima M Katti,** "Android based mobile application development and its security". International Journal of Computer Trends and Technology- volume3 Issue3- 2012

**Concluded:** In this paper we concluded that the mobile application is very important and simplest use and convenient to user because all applications are done by Java Script language A small application that runs on a smartphone and a tablet is called an app. The speed of applications or page loading mustn't keep users waiting. However, issues such as this, are usually checked by quality assurance, which is a part of a smart mobile application or software development. Security is the main concern of any software application. Security related problem faced by the many of the mobile user's this is vital to many apps However, issues such as this, are usually checked by quality assurance, which is a part of a smart mobile application or software development. Security is the main concern of any software application. Security related problem faced by the many of the mobile user's this is vital to many apps. It is one of the first topics of discussion between you and software developers. No leaks of the users' private information are allowed. Support and updates are one of the primary issues. To build a long-standing app, you need to consider support and updates. Maintain the server. Ensure that your content is made up of up-to-date, relevant information. Analytics is essential feature of a software application. As a mobile app developer, one key component is to incorporate analytics into your mobile app. [2]

**2.3 U. Narmadhaa, P. Pavithra, M. Tharuneswari, S. Sowmiya, Nagarajan.** "Enhanced QR-code based application for library management system using android". International Journal on Applications in Information and



Communication Engineering Volume 3: Issue 1: February 2017, pp 46-49.

**Concluded:** QR code (abbreviated from Quick Response Code) is the trademark for a type of matrix barcode (or two-dimensional barcode) first designed for the automotive industry in Japan.

A QR code consists of black squares arranged in a square grid on a white background, which can be read by an imaging device such as a camera, and processed using Reed–Solomon error correction until the image can be appropriately interpreted. The required data is then extracted from patterns that are present in both horizontal and vertical components of the image.

QR codes features include high reading speed, data storage and transfer, 360degree readability, resistance to contamination and defects and adding up to 16 symbols to the structure. [3]

**2.4 Lambodara Parabhoi, Nivedita Bhattacharjya, Rupashree Dhar** “Use of QR Code in Library” [researchgate.net/publication/318259063](https://www.researchgate.net/publication/318259063) January 2017

**Concluded:** Libraries are now being very challenged by the development of various technologies. In this present era, the new technology like QR code demands the changes of information handling in the library. The user would have easy access to most current and necessary information related to the library by using QR code. So to make the effective use of QR code among the user community, library professionals must organize user awareness program, orientation program, etc. [4]

**2.5 Mr. Nagesh L. Londhe, Dr. Suresh K. Patil** “Open source library management systems: a survey and present developmental status” International Journal of Library and Information Science (IJLIS) Volume 4, Issue 1, January - April (2015), pp. 38-54

**Concluded:** This study covers thirty-one open source library management systems projects, which are developed during 1999 to 2014 and tries to present the state of development. Researcher has also attempted to present

historical overview of development and update picture of library management systems. This is one of the comprehensive up-to-date survey. This study reveals that only fifteen LMS projects shown recent activity in community and their releases. Fourteen projects do not show any activity for than four years since their last activity (release and community) upto the date of data collection (Dec. 2014). Two projects developmental status could not be determined due to unavailability of data. This study reveals that maximum number of active projects is having an institutional support. This study also reveals there are considerable number of weekly downloads for old releases of some inactive state projects. [5]

### III. LIBRARY MANAGEMENT SYSTEM

#### A. Current Library Management system:

Library management system is all about organizing, managing the library and library-oriented tasks. It also involves maintaining the database of entering new books and the record of books that have been retrieved or issued, with their respective dates. Presently all the operations of library are carried out manually.

Main operations involved in library system are:

- Introduction of new arrived book in the record of Library.
- Record of List of book available along with their version in the library.
- Record of Staff.
- Record of students.
- Storage plan of books in the library.
- Issue of books.
- Return of books.

#### B. Proposed Library Management system

The main aim of this system is providing an easy to handle and automated library management system. This system provides features and interface for maintaining librarian’s records, Faculty’s records, student’s history of issue and fines.

The Librarian can easily update, delete and insert data in the database with this project. The

following are some of the features provided by this project:

- The issue of books by online mode.
- Columns provided to search book online.
- Requests to the librarian can be sent to provide new books in the column.
- Login portal for a student for security purpose of the library.
- Homepage for the student which has different buttons to navigate to pages containing the date of issue, date of return, fine charges etc.
- Columns for staff member to get book issued if desired.
- Requests column for staff member to ask for the introduction of new or essential books in the library.
- Maintaining records of the librarian and other library staff.
- Feedback page to be viewed and monitored by the college authority.
- The staff members can give their feedback about the functioning of library system, mention any misbehave of students and feedback about the librarian.

This library system provides the following features/applications for users that access the system:

- Issue books & Return books
- Explore books
- Check book status
- Manage book status

General working flow of Library management system is shown in two different figures.

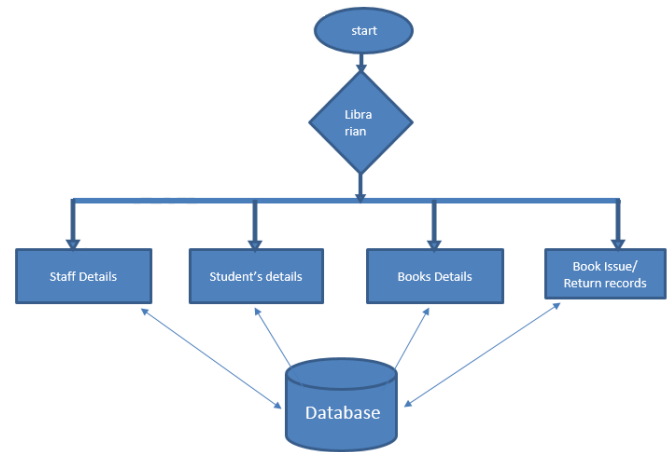


Fig.2

#### Duties of Librarian:

- Fig.1 shows the duties of Librarian.
- Librarian in admin account will maintain Homepage for the app.
- Librarian in admin account enters staff data, student's data the new books and its details in the database.
- Librarian in admin account decides the authorities of staff and students accounts.
- Librarian accesses the book issue and return transactions along with daily backup.
- Librarian also sees the requirement of the book and ordering of new books if any.

#### General procedure of Library:

- Fig.3 shows the general procedure of Library.
- Staff / students are required to install the library app in their smart phones.
- Staff / student will sign in and sign Up to this app through their login ID provided by Librarian.
- Staff / Student search the books present in the library and selects the requisite book.
- Staff / Student will go to library to issue the selected book.
- Librarian upon checking the details of Staff / Student will issue the book.
- Transactions of issue and return of books can be accessed by users and Librarian with the help of log in IDs provided.

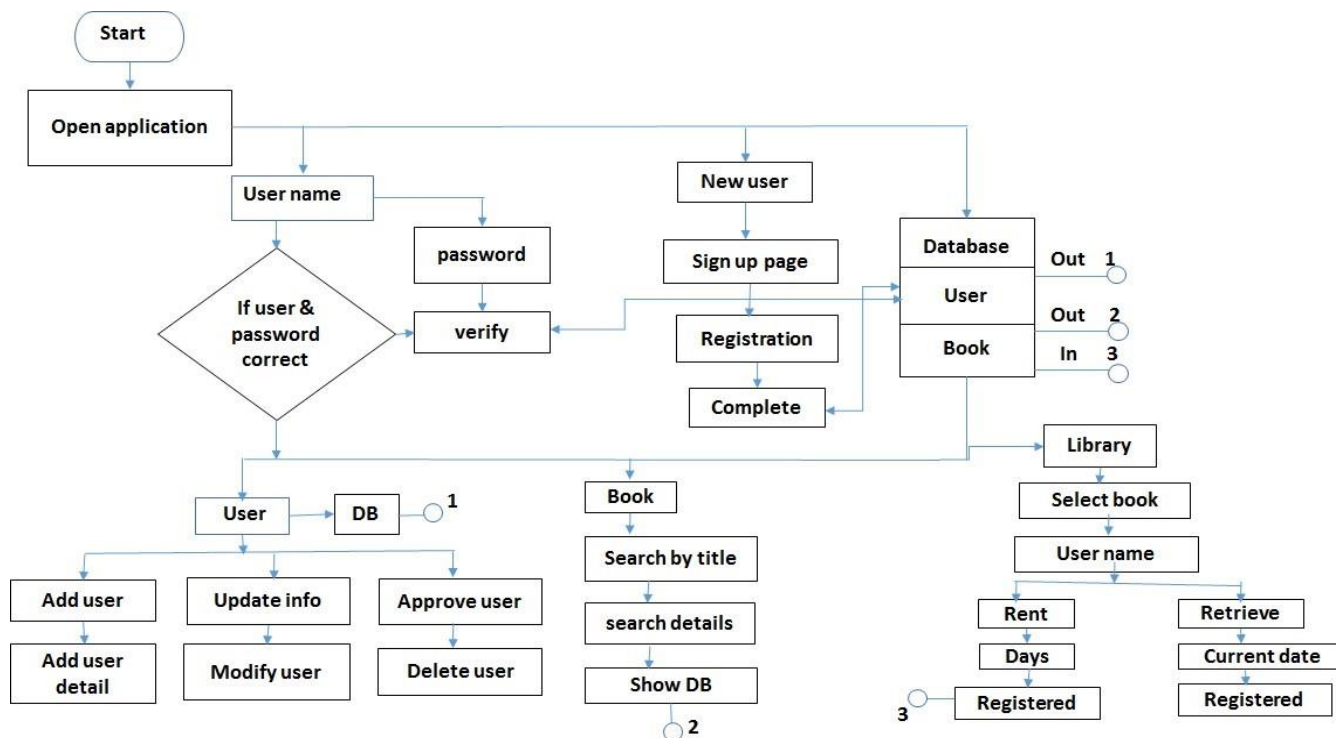
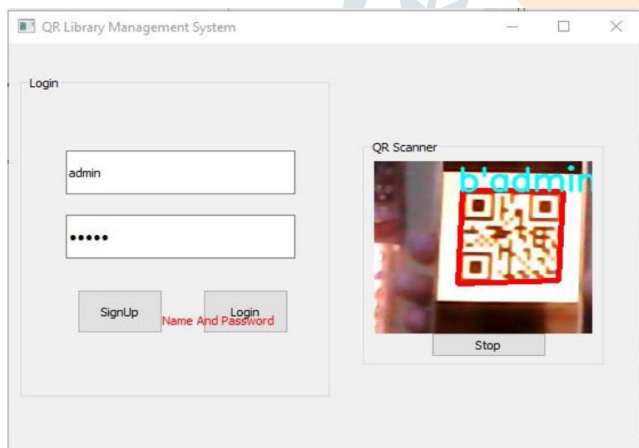


Fig.2: General procedure of Library

#### IV. RESULT AND DISCUSSION

The result of project execution in PyQt5 and QR code based library management system are derived and some of the screen shots showing the results of execution.



#### V. CONCLUSION

This Libraries are now being very challenged by development of various technologies. In this present challenging world of emerging technologies like QR code demands the exchange of information handling for various users of library. Python Qt5 provides the platform for the database of Library. Librarian with the use of QR code adds books in the database and user’s IDs. Presently most of the students and faculties are using smart phones which will ease the use of QR codes for scanning, searching, exploring and finalizing of

books in turn reducing the book issue time from Library. This will reduce the efforts of user and Librarian both. It will increase the efforts of Librarian for generation, printing and sticking the QR code on the books and on the IDs of users. Also it will increase the initial cost required for QR code. Also in view of Covid-19 platform it will reduce the interaction of User and Librarian for finalizing of intended book.

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