Design of QR Code-Based Digital Teaching Resources Navigation System

Jin-Yong Li¹,* and Bing-Jian Li²

¹Huizhou University Library, Huizhou, Guangdong, China
²School of Mathematics, Huizhou University, Huizhou, Guangdong, China

*Corresponding author

Keywords: Digital Teaching Resources; QR Code; Navigation System; Development Design

Abstract. In order to solve the problems of orderly management, disclosure and evaluation of digital teaching resources, a QR code-based Digital teaching resource navigation system construction plan is proposed in this paper. As a new technology of data information coding, information storage, information transmission and information identification, QR code has become one of the most common information storage methods. The key function of QR code-based Digital teaching resource navigation system is initially realized, expanding the application field of the QR code. It is expected to realize more friendly, orderly and personalized management of Digital teaching resources, which is a beneficial attempt in the field of information resource management.

1. Introduction

The QR code technology is a comprehensive technology that is upgraded and transformed on the basis of QR code technology and then gradually developed to a comprehensive technology integrating data coding, information dissemination, information storage, image coding and data encryption and other technologies [1]. It realizes the storage of binary coding through different combinations of black and white, horizontal and vertical bars, blanks, etc. It cooperates with coding and decoding software or system to complete and achieve the writing, storing and reading of technology. As a new type of coding technology, the QR code has been widely used in various aspects such as mobile payment, information storage, login verification, etc., and has become one of the most common information storage methods.

Digital teaching resources are all kinds of resources stored in digital form. It combines computer, information processing, information storage, computer network and other technologies to form a sum of digital information resources displayed, stored and used in a digital form[2]. With the rapid development of Internet technology, the diversity, real-time and accessibility of Digital teaching resources and other characteristics, Digital teaching resource database has become an important source of information for users. Form the point of view of the trend, the absolute quantities of commercial resources, supporting collection resources and open and shared resources are increasing, and the management and evaluation of the Digital teaching resources a becoming increasingly prominent. As one-dimension code, bar code and other coding graphics can no longer meet the application requirements of modern information resource management, which promoted the birth and use of QR code. QR code is a new type of data information coding, information storage, information transmission and information identification technology. Due to the strong encryption, high accuracy, good storage, low cost and other characteristics, QR code is applied to the Internet, intelligent terminals and other platforms as an advanced technology, and has been widely popularized and rapidly developed along with the mobile Internet, the intelligent terminal and other platforms. This study intends to put forward a QR code-based Digital teaching resource management solution, and propose a set of feasible solutions and platforms for unified and standardized management of Digital teaching resources with QR code as a unified access portal for Digital teaching resources.
2. Concept Definition

2.1. Digital Teaching Resources

Digital teaching resources refer to digital learning resources. Generally speaking, Digital teaching resources mainly include three types: one is the various commercial database purchased by the library; the other is the digital collection corresponding to the paper books formed by the processing of the collection (or some distinctive collections); the third is the resource provided by online public and sharing programs at all levels, OA open access resources and so on[3].

2.2. QR Code

The Quick Response Code, also known as QR code, uses some special and regular coding graphics to record data information on a plane, distributed black and white horizontal bars and blank graphics in accordance with a certain law; encoding, storing and recording information with such regular pattern, the QR code can not only achieve the effect of encoding, but also achieve the function of storing information. In particular, its coding, confidence storage, durability and reliability make it widely used and applied in many fields.

3. System Design

The construction of QR code-based Digital teaching resource navigation system is aimed at integrating Digital teaching resources, achieving the unified management of Digital teaching resources, and storing the core information of Digital teaching resources in the form of QR code, effectively revealing Digital teaching resources and expanding the application fields of QR code.

3.1. Key Technology

3.1.1. RESTful API

Restful is a style of api architecture, a software development network request, and the api design style, instead of an api standard. This style is suitable for common api interfaces. Generally speaking, the client needs to request the server. There are various kinds of requests, but they are also inseparable from some common requests, such as get, post, delete, put, head and so on. And these requests are written and implemented in a better style, which is restful, making the code look more concise, easy to read, and reusable, greatly speeding up the development efficiency.

3.1.2. Reactjs

Reactjs is a front-end framework of JAVASCRIPT ui used for building web interfaces. It adopts the new generation of javascript standards and the es6 standard. Now its popularity has slowly caught up with vue.js, angularjs, bootstrap and other front-end development frameworks. React is a set of interface component libraries for interface development that is open sourced by facebook. That’s right, it is essentially a set of ui components, and the buttons, lists, cards, tree structures, forms, drop down lists, navigation bars and so forth are all encapsulated in the native html, css and javascript using the esc standard.

3.1.3. Parse Background Data API

Parse background data api is a back-end data service, and its underlying layer is developed using nodejs. Nodejs is also called javascript running on the server. In fact, it is to realize the back-end technology development with nodejs. The common database operation, document upload and other functions such as user login, mailbox registration, database query, add, delete, modify, combination query, comprehensive query are well implemented. For less complex business system, the use of parase data service can save much development time and development cost.

3.1.4. Jquery

Jquery is a language based on native javascript encapsulation, which makes the development of
javascript more flexible and the code more concise. Because of its excellent encapsulation, it has been widely used in the development of Web software, and its function basically covers all functions that can be implemented by javascript. As a result, it can basically replace the native javascript.

### 3.1.5. Mongodb

Non-relational database has very good performance. The current technology changes with each passing day, and the application of non-relational database has also been rapidly improved. The system uses mongo is because of the consideration of performance enhancement. MongoDB is a kind of non-relational database, which belongs to the database of distributed file storage. MongoDB provides a database with extremely high performance for WEB software.

### 3.2. Foreground Architecture

The foreground system mainly provides a UI user interface, which displays the list, overview and resource details of Digital teaching resources, and provides comments, likes and integrated user interface. The core technology adopted by the foreground of the system is the h+ framework, whose underlying layer is written by native html, css, javascript, jquery and other technologies. The reason for using this ui framework is that (1) h+ framework pre-made a large number of interactive functions for developers, making development more efficient; (2) the h+ framework has beautiful and elegant ui control, and has good user experience; (3) h+ framework code is well optimized, concise, easy to understand, and easy to use.

| Function name                  | Use case of function                                                                 | Remarks                                      |
|-------------------------------|--------------------------------------------------------------------------------------|----------------------------------------------|
| Login                         | The user who registered the account password logs in.                                |                                              |
| Check the Digital teaching resources | Check the Digital teaching resources exposed by the system                           |                                              |
| Resource reviews              | Support the user to comment on Digital teaching resources and user comments          |                                              |
| Likes                         | Support users to like Digital teaching resource or user comments                     |                                              |
| Digital teaching resource QR code jump | Digital teaching resource library entry jump                                      |                                              |

### 3.3. Background Architecture

The technology mainly adopted by the system background includes react, parse and ant-design. Considering that the system has no complex business logic and the current api data interface technology develops rapidly, the background architecture uses the parse data service which meets the restful interface standard. The reason of using the react technology is that the front-end framework technology and the development model are in transition in recent years, and the front-end development may follow new development standards in the future. In order to adapt to the development direction of technology, it is decided to use react in the latest es6 standard for development, and ant-design is the front-end development scaffold implemented on the basis of react.
Table 2. General Table of Background System Requirement Design.

| Function name             | Use case of function                                                                 | Remarks                                                                                   |
|---------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| Login                     | The administrator logs in to use the system.                                         | The classification of Digital teaching resources is the sector.                           |
| Sector management         | The administrator can view all the sections on the current system, manipulate the data, and can release the data. | The maintenance, addition, deletion, modification and query of Digital teaching resources, |
| Digital teaching resource management | The administrator can check the detailed information of the data resources under all the sectors of the current system, and can maintain and publish them accordingly in the background. |                                                                                           |
| Comment management        | The administrator can view all comments on the current system, and delete some malicious comments. | To understand some situations when the system runs.                                        |
| Like management           | The system administrator can view all the likes posted to the system.                 | To understand some situations when the system runs.                                        |
| QR code management        | The system administrator can view and manage the profile of all the corresponding Digital teaching resource QR code posted to the system. |                                                                                           |

4. Function Design

The function module of the QR-code Digital teaching resource navigation system includes Digital teaching resource management module, a column management module, a comment management module, a like management module, a service login module, a user login module and so on. (as shown in Table 3)

4.1. Main Function of Foreground

4.1.1. List of Digital Teaching Resources

The main interface of the client can be accessed to after logging into the system. The main interface of the system shows a brief introduction list of Digital teaching resources for the user, and highlights the display of Digital teaching resources more friendly. In the client interface, users can see the list of Digital teaching resources organized by the system and their detailed introductions, search for common resources and click on the corresponding resources to enter the page of resource details.

4.1.2. Details of Digital Teaching Resources

On the detail page of Digital teaching resources, users can view detailed information about Digital teaching resources, including likes, comments, QR code jump and other functions. The user can give a like to Digital teaching resources or comments, and can cancel the like to the Digital teaching resources and comments. The comments are divided into two types. The first is the comment on Digital teaching resources, and the second is the comment on users’ comment. The QR code jump function is implemented by the plug-in qrcode of Jquery, and stores the Digital teaching resource entry information by QR code. By scanning the QR code with an the app (software) that can recognize the QR code using Wechat or alipay, it can pass the validation, and the mobile phone will automatically jump to the corresponding Digital teaching resource site.
Table 3. Overview of the Function Module of QR Code-Based Digital Teaching Resource Navigation System.

| Function Name                        | Main User                          | Operation Involved                                                                 | Remarks                                                                                     |
|--------------------------------------|------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Digital teaching resource management module | System administrator and client user | Administrator: publish, add, delete, modify and query Client user: view, search and comment | The client user has the right to view, search and comment on Digital teaching resources, and system administrator can perform data maintenance on the table. |
| Column management module             | System administrator and client user | Administrator: publish, add, delete, modify and query Mobile phone user: publish and apply | The second-hand transaction information of mobile phone users must be officially released with the approval of the administrator. |
| Comment management module            | System administrator and client user | Administrator: view, delete and query Mobile phone user: comment and view             | The system administrator can delete user comments, while client user can comment the Digital teaching resources and comments of other users. |
| Like management module               | System administrator and client user | Administrator: view and query Mobile phone user: give a like and modify               | The client user can give a like and cancel the like giving function, while the administrator can only check the situation of likes. |
| Server login module                  | System administrator               | Administrator: login                                                                | Only the administrator have access to the server system, while the client user does not have access to the module of server. |
| User login module                    | Client user                        | User client: login                                                                  | The client user logs into a module of the system.                                            |
| Exit module                          | System administrator               | Administrator: logout                                                               | The system administrator modifies one of his login states.                                   |

4.2. Main Function of Background

4.2.1. QR Code Management Module

In this module, the ui component encapsulated in ant-design is used for the development of corresponding pages and interaction. In addition to the basic operations of adding, deleting and modifying Digital teaching resources, it is necessary to fill out the address information of the Digital teaching resources in the process of adding Digital teaching resources, and click it to generate a QR code, that is, generating QR code graphics for the jump for current Digital teaching resources.

4.2.2. Comment Management Module

All the comments of the system are managed in the comment management in a unified manner. In this module, whether it is the comment for Digital teaching resources, or the comment for user comments, they are managed in this module in a unified manner. Some illegal or malicious comments
will be displayed in this module. In this module, only system administrators can delete the comments, and cannot add or modify comments.

4.2.3. Like Management Module

In this system, all likes are divided into two types. One is the like for Digital teaching resources and the other is the like for comments. They will all be displayed in the form of graphics. In this way, which Digital teaching resource is more hot and which resource is more popular can be understood intuitively through this module.

5. Conclusion

As a new technology of new data information coding, information storage, information transmission and information identification, the QR code is applied to Internet, intelligent terminals and other major platforms as an advanced platform because of its strong encryption, high accuracy, good storage, low cost and other characteristics. As the mobile Internet, intelligent terminals and other platforms have been widely popularized and developed rapidly, the author proposed the QR code-based Digital teaching resource integration management solution to store the entry information of our Digital teaching resources with QR code, and improve the Digital teaching resource acquisition and evaluation efficiency using QR code. This study expands the application field of QR code, and it is expected to realize more friendly, orderly and personalized management of Digital teaching resources, which is a useful attempt for the management of information resources.

Acknowledgement

This research was financially supported by the philosophy and social science planned project in Guangdong Province, Applied Colleges and Universities’ Construction Research of Subject Service System in Big Data Environment. (Project Code: GD16YTS01).

References

[1] Fu Guodong and Yan Zheng. Research on the Application of QR Code Technology in University Outsourcing Management. [J]. University Logistics Research, 2018.

[2] Yan Bing, Shan Congkai. Digitized Learning Resources. [M]. Beijing: China Central Radio and Television University Press, December 2015.

[3] Li Youcheng and An Yueying. Research on Digital Library. [M]. Xi’an: Xi’an Map Press, September 2008.