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Library Borrowing System Using QR Code for SK Jelotong

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Abstract: Generally, every library borrowing system has the same main goal which is to gather, store, organize, access, and provide information to users. Library is commonly used in educational institution. School libraries are important for the students but the library in SK Jelotong still uses the manual system of borrowing book which is outdated and not secured. Therefore, this project proposed a library borrowing system using QR code approach. This system requires authentication through username and password, and it will be used by the librarians and administrators. This project is developed by the Waterfall model in a way to complete the findings and the language used are PHP, HTML, CSS, and MySQL. This project is designed to make borrowing books easier for students. Besides, it also helps the administrator in tracking the record. The book data can be fetched in one go by scanning the book QR code. By developing this system, it will replace the traditional way of borrowing method which is the record was hand-written and kept in a book. Lastly, a few security approaches are implemented to the system such as password hashing and login credentials, so it will secure the system user from the data breach of the physical record.

Keywords: Library, QR Code, Web-Based System

1. Introduction

A library is defined as a room containing collections of books, periodicals, and sometimes films and recorded music for use or borrowing by the public or the members of an institution. A school library is a vital source of information for students. [1] The school libraries give a positive impact on students' learning. Students can improve their academic achievement by reading a variety of literature. Therefore, the library management system is one of the important roles throughout the process.

SK Jelotong library is a library at the SK Jelotong, Parit Raja, Johor. The library is commonly used by the students, teachers, and fellow staff of SK Jelotong. The library is managed by one of the teachers in charge in SK Jelotong, Puan Nurazlin. According to Puan Nurazlin, the library SK Jelotong borrowing system still uses the manual way to record each time the students borrow the book in which the student's names will be written in the library record book.

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The existing borrowing system in SK Jelotong has a few problems found which are the system is outdated because the system still uses paper-based processes. It seems to be not very convenient due to it has limitations for the user. Besides, the system is hard to check the record and monitor the data. Apart from that the record also can be seen, changed, stolen, or altered by anyone. The information became less secure due to the easy access to the record by the unauthenticated user. Lastly, hard copy data is risky because it is easily misplaced, and others can view the student's data. Over the traditional approach, a computerized system offers significant benefits to solve all the problems stated.

Therefore, this project aims to help the SK Jelotong library in managing its borrowing system. This system will be developed in QR code implementation, so it is easy to use by the librarian. In addition, it also authenticates the administrators through username and password. Besides, for user forgot password two-factor authentication is implemented through email. As a result, this system could help to improve the functionality of the existing system and increase its data security. As a result, a library borrowing system with a QR code could help to improve the functionality of the existing system and increase its data security. This will make the system easier to use, thus increasing the library's engagement and the student.

The main objective of this project is to develop a web-based borrowing system that can improve the weaknesses based on the problem. First, objective is to design new library borrowing system for SK Jelotong based on a web application with an authentication approach. Secondly is to develop the library borrowing system using QR code approach for students managing the books and lastly, to evaluate the library borrowing system for SK Jelotong in terms of user acceptance and system functionality.

The target users for this system are librarian, and administrators. Administrators can perform the login, registration for librarian, student, and book. Administrators also can manage user such as view, create, update, and delete librarian, student, and books record. While librarian can perform log in, scan QR code to borrow book and to return book, manage borrowing book, and update their profile. Besides, librarian can view and delete the borrowing records.

There are nine modules in this system, namely login module, registration module, manage librarian module, manage student module, manage book module, QR code scanner module, manage borrowing record module, manage profile module, and change password module.

2. Related Work

2.1 Security of the System

Security in a system is usually used for lowering the probability of data breaches and cyber-attacks in IT systems. There are several countermeasures for this developed system such as authentication, password management and password hashing. The system will ensure security especially when the non-authorised user use and simply can view, edit, and delete the record. A situation such as losing the library book can be avoided by authenticating the device and the user, using a strong password, and implementing the password hashing in the system.

2.2 The authentication mechanism in Library Borrowing System

Authentication technology checks if a user's credentials match those in a database of authorized users or a data authentication server to offer access control for systems. [2] Multi Factor Authentication (MFA), which might include One Time Password (OTP), is used for user forgot password. This two-factor authentication is implemented through email, user will receive email to alter the password. Only authorized users can access the system. Users need to input valid usernames and passwords.

Login credentials such as username and password authenticate the users when signing up and logging into this library borrowing system. Practicing good password management is critical to maintaining the effectiveness of this line of defense. Without good password management, the system

might be vulnerable to various kinds of threats such as the shoulder attack, sniffing attacks and login spoofing attacks. A valid password is a password that contains at least ten characters, including numbers, upper and lower case. This method is to make sure the password is strong enough to be used.

Password hashing is a standard method of storing password-related data that is subsequently used for authentication. At the service provider's end, a hash for each password is computed and kept. The hash of the provided password is calculated and compared to the saved hash when a user logs in to the service. [3] The authentication is successful if the two hashes match. However, in many circumstances, the passwords are hashed using a cryptographic hash function or are saved in plaintext. These poor password protection practices have led to efficient attacks that expose the users' passwords.[4]

2.2 Comparison between Barcode, QFID barcode and QR code

Toyota subsidiary Denso Wave developed a QR code in 1994 in Japan. At first, it was developed to help track automobile parts. [5] A QR code is a type of bar code or two-dimensional (2D) code that can store data information and is designed to be read by smartphones. QR stands for 'Quick Response'. It can also not be read by humans because it can only be read by QR codes can contain different types of information. Dynamic QR code is trackable where it will record the locations, the number of scans, the time of the scans, and the operating system. [5] It can prevent any modification by an unauthorized user.

Figure 1: Simple QR Code [6]

Figure 1 shows a simple QR Code on a white background, the code is made up of black modules organized in a square pattern. This QR code will be used a lot in this library borrowing system in which will be put on the cover page of book. The purpose of the QR code is to keep the information and details of the student and the books. Many smartphones and devices have built-in QR scanners, QR codes are widely used to track information about products in a logistics system. [7]

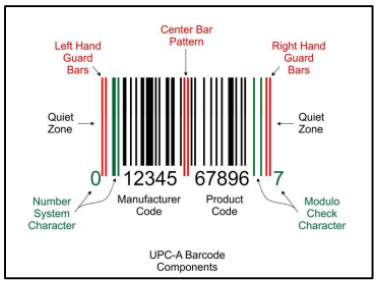

Figure 2: Barcode [8]

Barcode as shown in Figure 2 in definition a machine-readable code written on a commodity in the form of numerals and a pattern of parallel lines of variable widths, used primarily for stock control [9]. A barcode is read by an optical equipment such as a scanner and is made up of a series of parallel black bars that represent identification information. A barcode encodes information by altering the widths of the bars and the distances between each bar. Barcodes provide data information. A single barcode may be used for both inventory and pricing information, it is possible to collect data on both fast. Furthermore, barcodes can be altered to provide other pertinent information as needed. It delivers rapid,

reliable, and valid data for a wide range of applications. However, barcode only can store up to 25 characters.

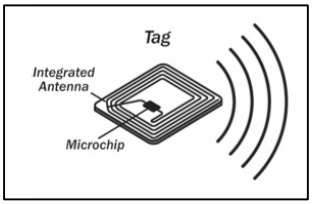

Figure 3: RFID tags [10]

The definition of Radio Frequency Identification (RFID) in Figure 3 is a method of tracking things using tags that send out a radio signal. [11] Since RFID tags use radio wave technology, they can be read without requiring direct line-of-sight, which means whole pallets or massive amounts of products can be read at speeds of up to 700 products per second. [8] The most significant barrier to using RFID technology is the expense of both the tags and the scanning equipment. To optimise the visibility provided by RFID tags, a corporation must not only prepare its facilities for readability, but also obtain user compliance from its suppliers, carriers, and customers. Maintaining all of the extra information may also prove to be difficult. RFID implementation requires meticulous planning and is best done in stages to allow for testing and validation that it fulfills the application's expectations. To assess whether RFID tagging is a good fit for the operation, a detailed ROI study is required. [12]

Table 1: Comparison between Barcode, RFID Barcode and QR code

Item	Barcode	RFID Barcode	QR code
Accuracy	Accurate	Accurate	Accurate
Cost	Low	Excessive	Low
Information retrieval	Fast	Advance	Fast
Data store	25 characters	2000 characters	7089 characters
Error correction margin	No	-	High
Implementation	Easy	Difficult and time consuming	Require installation

As comparison to the different code of use which are barcode, RFID barcode and QR code finding, it can be proven that QR code has more advantages than others. QR code provide low cost, fast and can store many data. Next, it also has error correction margin which that means qr code are able to restore data if the code is dirty or damage up to 30% of damage. In addition, for the disadvantage such as it requires installation, it can be encounter as the proposed system has the camera scanner installation embedded.

2.3 Comparison with Existing Systems

This section will review Koha Library System and Elibrary Software. Koha is an open free Library System.[13] Koha is an Open-Source project that is published under the GNU General Public License, so the system can be install for free. Register and login will be prompt before the user can access the system. The system does not need user authentication since the user may easily enter the system after logging in. However, Librarians can then enable 2FA for their account. It uses Barcode scanner as the implementation to the system. The borrowing reminders are common to the software because the system is widely used in school and university organizations.

E-library Software is a paid system that can be use on Windows, Linux and Mac OS platform. [14] Besides, the system manages in RFID technologies. The system offers membership module to the student. This modern integrated library management system (LMS) can export and import records. The system possible to add, update, search, and view library items online.

Table 2 shows the comparison table has been made to compare in between existing system and proposed system. There are five features will be discussed which are register and login, devices use to scan the book for the borrowing purpose. Next, the type of code use in each borrowing system. Other than that, the pricing and the borrowing reminder are the features.

Table 2: Comparison between two existing systems with the proposed system

Item	Koha library system	E-library Software	Proposed system
Register and login	Yes	Yes	Yes
Pricing	Free	Paid	Free
Borrowing reminder	Yes	No	No
Devices use	Barcode scanner	RFID reader	Device camera
Type of code use	Barcode	RFID Barcode	QR code
Multi Factor authentication (MFA)	Yes	No	Yes

Based on the comparison between E-library Software, Koha Library System, and the proposed system can be clearly observed that all the system has register and login. For the pricing, only E-library Software are paid, while Koha Library System and proposed system is free. Koha Library System provide borrowing reminder to student in email, while other is not. Besides, the comparison notified that all the system uses different scanning device and different way to keep the data. As for Koha Library System it uses barcode scanner, and the type of code is barcode. E-library Software uses RFID reader and RFID Barcode while the proposed system is use camera device to scan and QR code. Lastly, Koha Library system and the proposed system has Multi Factor authentication (MFA) while the E-library software do not uses MFA for their system.

Related works of this project are discussed. This chapter assists in determining the definition of each sub-topic connected to the system, it describes the case study of the library borrowing system and describes in in-depth the methods and strategies used to establish the library borrowing system. The capabilities and functions of the three systems are also outlined in the study of the three systems that resemble the systems to be developed. Finally, the proposed system is addressed in more depth, including a description of the system's features, as well as a comparison of the proposed system's features to those of the three current systems.

3. Methodology

The methodology used to develop a Library Borrowing System for SK Jelotong Using QR Code is waterfall model, which will be used throughout the project. The ultimate goal of any design review is to ensure that all stakeholders understand the design and can affirm that the project is understandable for their requirements and is on track. [15] The waterfall model is the Sequential development model, it is the oldest and most well-known of these: a series of phases in which each stage's result becomes the input for the next.[16] . The model is used as well as the division of tasks that will be made during the phases.

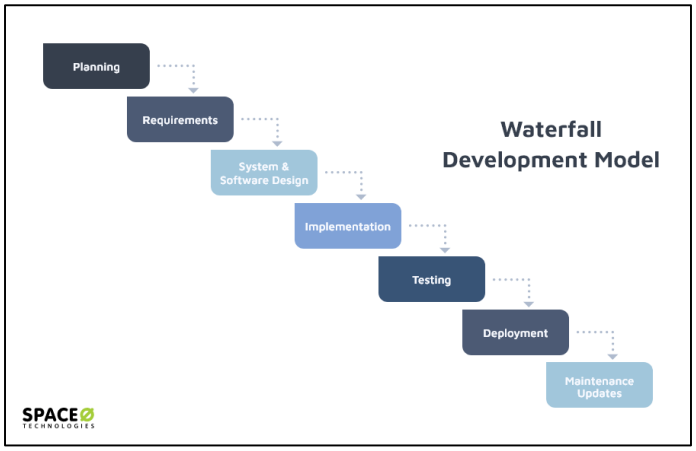

Figure 4: Waterfall model[17]

Figure 4 shows a graphical illustration of an iterative waterfall model with seven steps: planning, requirement analysis, system and software design, implementation, testing, deployment and maintenance.

Table 3: System Development Activity

Phase	Activities
Planning	1. Interview session with SK Jelotong teachers 2. Determine the objectives and scope of the project 3. Identify problems statement 4. State the importance of the project
Requirement Analysis	1. Identify system requirements 2. Identify weaknesses of existing systems
System and Sofware Design	1. Sketch the system interface 2. Prepare a Context Diagram 3. Prepare DFD Diagram 4. Prepare ERD Diagram 5. Make a design for a database 6. Prepare Data Dictionary 7. Prepare Test Plan 8. Refer the design phase to the supervisor
Implementation	1. Develop a system interface 2. Develop a database 3. Improving the system
Testing	1. Evaluate the functionality of the system to the user 2. Identify errors in the system 3. Fix errors in the system
Deployment/Product release	1. Host the product of system in a server
Maintenance	1. Maintaining the availability of the system 2. Any difficulties of system need to be repair

Table 3 shows system development activity based on the methodology chosen, which is Waterfall model. The methodology is very important to be able to standardize, structure, and organize all the work in the construction of the system project made. The activities conducted in each phase of the development of this system are also fully described, in the table.

4. System Analysis and Design

In this section, the process related to the system and software of proposed system will be discussed in detail to ensure that the function of the proposed system reaches and meets the requirements and specification of user from Library Borrowing System in SK Jelotong. The topics that will be discussed in this chapter include the analysis of requirements in the aspects of user, functional, non-functional that includes hardware, and software requirements, the design of proposed system that is going to be presented Data flow diagram consists of Context Diagram, Level 0 Diagram, Level 1 Diagram and Entity Relationship Diagram.

4. 1 Functional Module for the Library Borrowing System

The functional requirement for this Library Borrowing System is based on two aspects, one for the librarian, another for the system admin. On the librarian side, the system shall be capable of enabling librarian to use QR code scanner, which is the device camera to scan the QR code of the book. Moreover, the librarian must be able to login to the system to use other functionality as the librarian. Once the librarian logs in to the system, they shall be able to view the borrowing record and their profile in the system.

While on the admin side, the system must be able to make sure that the login is successfully for admin only by entering the username and password. The system should enable the admin to register the librarian, books, and student. The system also shall provide update function for the admin to view, create, update, and delete all the registered list such librarians, students, and the books. Most importantly, the system must be capable to retrieve from the database and display the registered list and borrowing list.

Table 2: shows the functional modules for the library borrowing system for SK Jelotong

Bil.	Modules	Function	User
1.	Login	Manage user login process	1. Administrator 2. Librarian
2.	Registration	Manage users and book registration process	1. Administrator
3.	Manage librarian	View, create, update, delete and store librarian information	1. Administrator
4.	Manage student	View, create, update, delete and store student information	1. Administrator
5.	Manage book	View, create, update, delete and store book information	1. Administrator
4.	QR code scanner	Scan the book to borrow and return	1. Librarian
5.	Manage borrowing records	View, create, and delete and store users' borrowing and return records	1. Librarian
6.	Manage profile	View and update profile	1. Librarian
7.	Change password	Update and stores users' personal password	1. Administrator 2. Librarian

4.2 Non-functional Requirements

Non-functional requirement is a specific criterion used to evaluate the operation of the proposed system. The operability of the system should be one of the non- requirements that must be achieved before release the final product to the user. The network bandwidth for both user and admin shall be sufficient to ensure smooth system performance. The minimum network bandwidth for the admin site shall be 50GB and for user side, 1GB should be enough to browse the system and borrow the book. Project

System is a complete web-based application. The software and tools that are used are HTML, XAMPP, MySQL, PHP, and CSS.

4.3 General System Architecture

Figure 5 shows the general system architecture for the proposed Borrowing System for SK Jelotong with QR code. There are two types of users which is admin and librarian. Firstly, the user the admin and librarian may view the main page for the borrowing system which will prompt the user to login into the system. After login, admin may the admin modules in the system such as managing librarian, managing student and managing the book. Manage here's refer to the admin can create, read, update and delete the database record. Meanwhile, the librarian may use all the librarian module such as managing the issued book and scan QR code module. Librarian will scan the QR code to borrow and return a book. The QR scanner that will be used is the device that access to the system. The camera device will scan the QR code from the book. Then librarian need to insert student full name to fetch the data. The details collected will be used in the borrowing record and the system will automated set the due date for the book to return. All the information will be stored in the database.

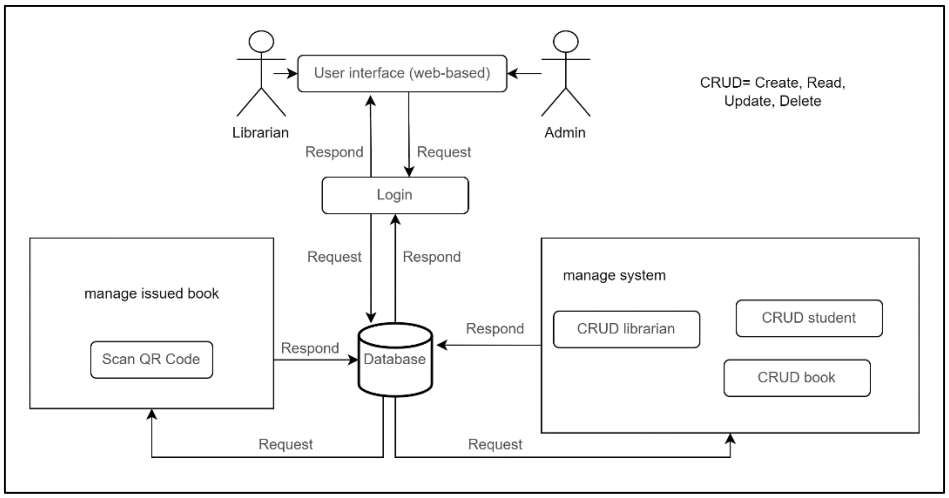

Figure 5: General system architecture

4.4 Data Flow diagram

Data flow diagram consists of Context Diagram, Data Flow Diagram Level 0, Data Flow Diagram Level 1 Diagram and Entity Relationship Diagram. Figure 6 shows Level 0 DFD for Admin of the proposed system. Figure 7 shows Level 0 DFD for Librarian of the proposed system. Figure 8 shows Entity Relationship Diagram (ERD) of the proposed system.

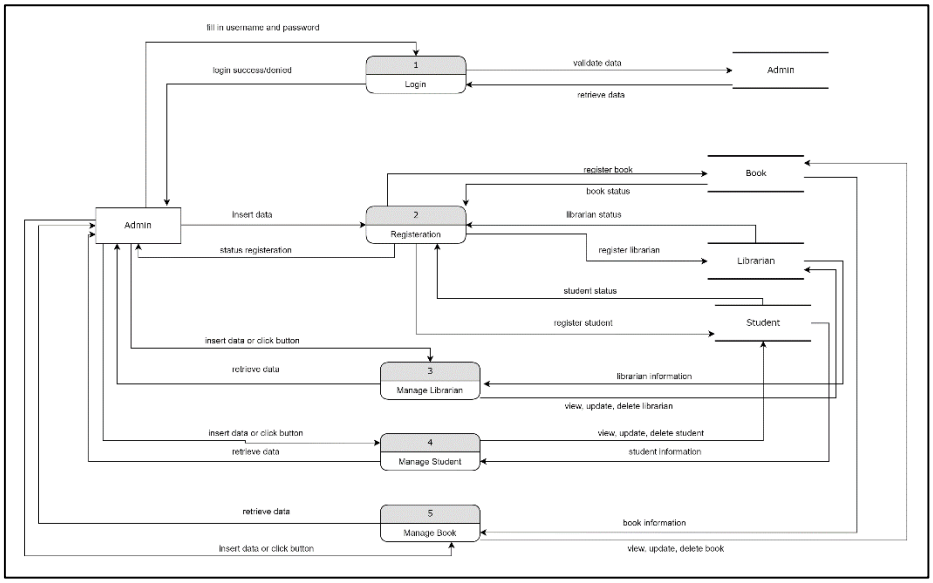

Figure 6: Level 0 DFD for Admin

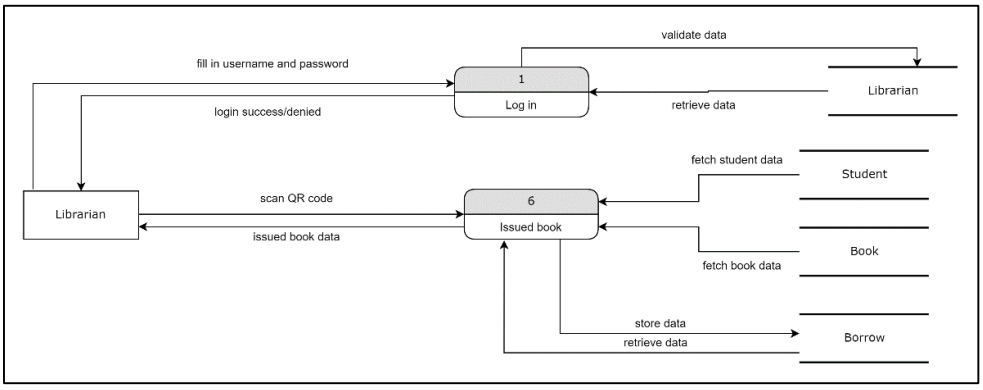

Figure 7: Level 0 DFD for Librarian

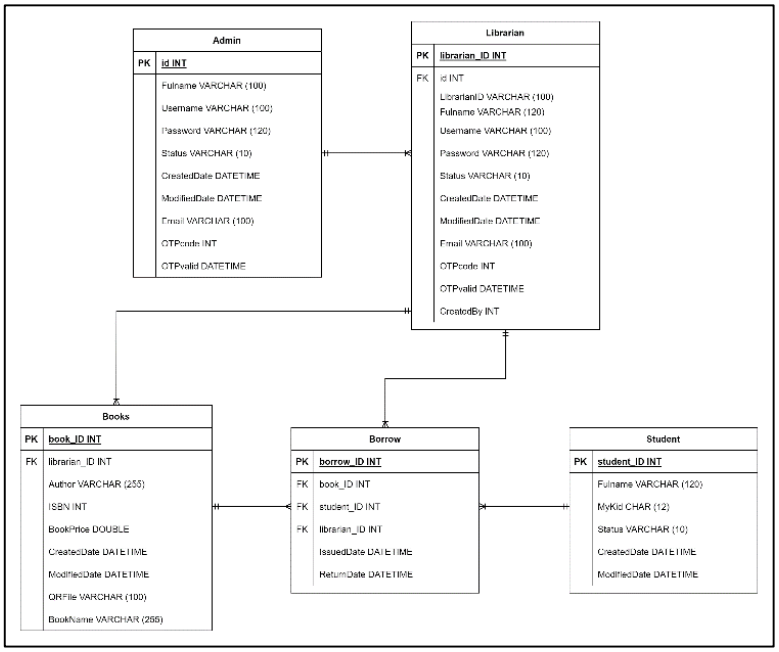

Figure 8: Entity Relationship Diagram

5. Implementation

The implementation starts from the interface design which is important to ensure the system work without fail. The coding uses for the system was PHP, HTML, CSS, Programming language and MYSQL for the database. The user can download the source and run the file, the readme file is given for guidance.

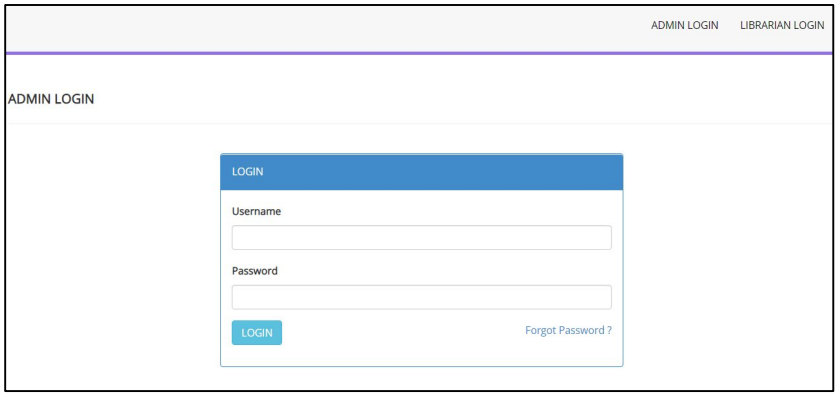

Figure 9: Interface of Login Page for Admin

```php
//set parameter
$uname = $_POST['username'];
$pwd = $_POST['password'];

$query = "SELECT Password FROM admin WHERE Username = ?";
$stmt = $db->prepare($query);
$stmt->bind_param("s", $uname);
$stmt->execute();
$stmt->bind_result($hash);
$stmt->store_result();
$count = $stmt->num_rows;

if ($count > 0) { //To check if the row exists
    if ($stmt->fetch()) {
        //To check if the row exists
        if (password_verify($pwd, $hash)){
            $_SESSION['alogin'] = $uname;

        header("Location: admindashboard.php");
        }
        else {
            echo "<script>alert('Oops! Something went wrong. Please try again later');</script>";
        }
```

Figure 10: Partial code for login page Admin

Figure 9 shows the interface of login page for admin while figure 10 shows it partial code. Admin needs to log into system by providing the correct username and password by using login interface. The system will then validate the username and password. If both username and password are correct, the system will redirect User to the main page. If one of the username or passwords is incorrect, the system will automatically display an error message.

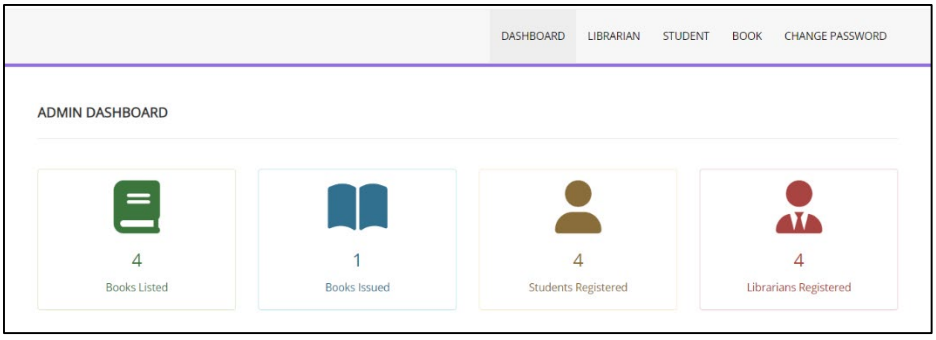

Figure 11: Interface of Dashboard for the Admin

```
    <div class="col-md-12">
        <h4 class="header-line">ADMIN DASHBOARD</h4>
    </div>
</div>

<div class="row">
    <div class="col-md-3 col-sm-3 col-xs-6">
        <div class="alert alert-success back-widget-set text-center">
            <i class="fa fa-book fa-5x"></i>
            <?php
                $sql ="SELECT id from books ";
                $query = $db -> prepare($sql);
                $query->execute();
                $query->store_result();
                $listedbooks=$query->num_rows ;
            ?>
            <h3><?php echo htmlentities($listedbooks);?></h3>
            Books Listed
        </div>
    </div>
```

Figure 12: Partial code for Admin dashboard

Figure 11 shows the dashboard for Admin page and figure 12 shows the partial code for the dashboard. After admin has successfully log in, the system will display the dashboard interface with active navigations bar. The active navigations bar contains dashboard tab, librarian tab, student tab, book tab and change password tab. All the tabs will lead to different function. Admin dashboard on the first tab will display the count of book listed, books issued, student registered, and librarians registered. Figure shows the dashboard interface for admin dashboard.

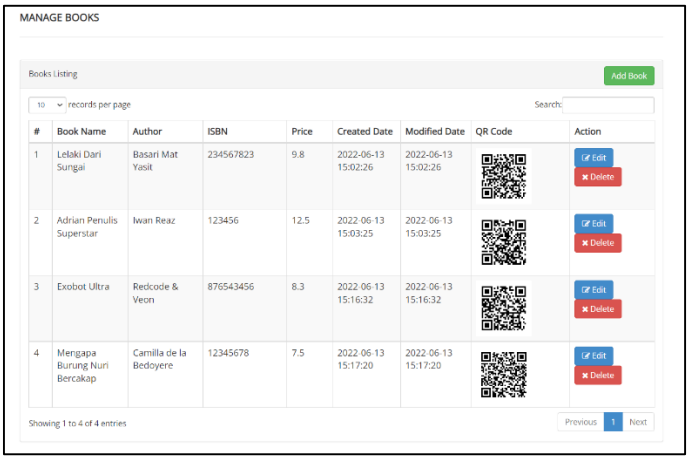

Figure 13: Interface of Manage Book for the Admin

```
<?php $sql = "SELECT * FROM books";
    $result = mysqli_query($db, $sql);
    $count=1;
    while($row = mysqli_fetch_array($result)){
        ?>
        <tr class="odd gradeX">
            <td class="center"><?php echo $count;?></td>
            <td class="center"><?php echo $row['BookName'];?></td>
            <td class="center"><?php echo $row['Author'];?></td>
            <td class="center"><?php echo $row['ISBN'];?></td>
            <td class="center"><?php echo $row['BookPrice'];?></td>
            <td class="center"><?php echo $row['CreatedDate'];?></td>
            <td class="center"><?php echo $row['ModifiedDate'];?></td>
            <td class="center"><?php echo '<img src="BookQRCode/'.$row['QRFile'].'" style="width:100px; height:100px;">'; ?></td>
            <td class="center">
                <button type="button" class="btn btn-primary " data-toggle="modal" data-target="#exampleModal-<?php echo $row['id'];?>"><i class="fa fa-edit"></i> Edit</butto
                <a href="manage-books.php?deletebook=<?php echo $row['id'];?>" onclick="return confirm('Are you sure you want to delete?');" ><button class="btn btn-danger"><
            </td>
        </tr>
```

Figure 14: Partial code of Manage Book for Admin

Figure 13 and figure 14 shows interface of manage book for admin and its partial code accordingly. Admin can manage book, by click on the book page tab, the list of registered books with their details will display. There are edit and delete button for any other action for admin to manage the book. The QR code displays on the page to hold all the book details. If the detail is updated the QR code also will be updated to the new one. This QR code will be used to scan the book in borrow book module. Librarian

are suggested to print the page and stick the QR code in front page of a book so that it can be easily used to perform borrow.

Figure 15: Interface of Issue book for the Librarian

```
<script type="text/javascript">
let scanner = new Instascan.Scanner({video:document.getElementById('preview')});
Instascan.Camera.getCameras().then(function(cameras){
    if (cameras.length>0)
    {
        // 0 open the front camera
        // 1 open the back camera
        scanner.start(cameras[0])
    }
    else
    {
        alert("No Camera Found");
    }
}).catch(function(e)
{
    console.error(e);
});
 // scan then qr code part
scanner.addListener('scan',function(c){

    let qrResult = c;
    const qrText = qrResult.split("|");


    var date = new Date();
    date.setDate(date.getDate() + 7);

    document.getElementById("title").value = qrText[0];
    document.getElementById("author").value = qrText[1];
    document.getElementById("isbn").value = qrText[2];
    document.getElementById("returndate").value = date.toLocaleString();

});
```

Figure 16: Partial code of Issue book for the Librarian for QR code scanner

```
if($_POST['input'] == "fullname"){
    $issuer = $_POST['fullname'];
    $query = "SELECT id FROM student WHERE FullName = ? ";
}
else if($_POST['input'] == "mykid"){
    $issuer = $_POST['mykid'];
    $query = "SELECT id FROM student WHERE MyKid = ? ";
}
$stmt = $db->prepare("SELECT id FROM books WHERE BookName = ? AND Author = ? AND ISBN = ? ");
$stmt->bind_param("ssi",$title,$author,$isbn);
$stmt->execute();
$stmt->bind_result($b_id);
$stmt->store_result();
while($stmt->fetch()){
    $bookid = $b_id;
}
```

Figure 17: Partial code of Issue book for the Librarian to fetch student data

Figure 15 shows interface of issue book for librarian, while figure 16 and figure 17 shows its partial code. QR code scanner is used by librarian every time student wants to issue borrow book. The librarian needs to scan the registered book QR code on the scanner to get all the book information details. After that, the librarian needs to fill in the student's Full name or Mykid to get the student's details. Then,

click the borrow button to confirm. Unavailable book will pop up the alert message to the user. The return book interface will also use QR code scanner, then it deletes the recorded data.

6. Result and Discussion

Testing has done by two parties which is the developer and the user. The user for this system includes SK Jelotong community. However, the testing is only involved the teacher in charge as the student are not able to join the testing event. As the resolve to this matter, the teacher in charge has assessed the librarian module and give her best comment and opinion. This method is to ensure that the developed system meets the requirements stated by the client. The developed system has prepared two modules for the client which are admin module and the librarian module.

6.1 Functional Testing

Functional testing is used by developer to inspect the functionality of the system developed. Every function has been made accordingly from the start until the target is achieved. Table below show the functional testing result obtained by the developer.

Table 3: Functional testing result

Test case	Expected result	Actual result
Connect database with the system	NO error message while connecting	Success
SESSION variable can functionally used	SESSION variable can be used after the correct username and password inserted.	Success
System Design	Refer the design phase to the supervisor	Success
Admin able to register student, librarian and book	The registered student, librarian and book are able to insert in database.	Success
Admin able to view, update and delete student, librarian and book	The registered student, librarian and book are able to update and delete in database.	Success
Login and Logout module can function properly	System able to login page by entering the username and password.	Success
Librarian can update their profile	System successfully updates librarian table.	Success
Admin and librarian are able to change password.	System successfully updates admin and librarian table.	Success

6.2 User Acceptance

The user acceptance result is collected using Google Form. The google form consist of two sections in which is A and B. Section A for interface question and section B for functional section. These two sections have scale from 1(Extremely dissatisfied) until 5 (Extremely Satisfied). The testing has been made to ensure the system was developed to meet the user requirement and satisfied the user. Besides, this testing would identify feedback from the user side. Through this, the user can help the developer to find out the existing problems and provide an overview of the availability of this developed system The user acceptance result is shown as the figure below.

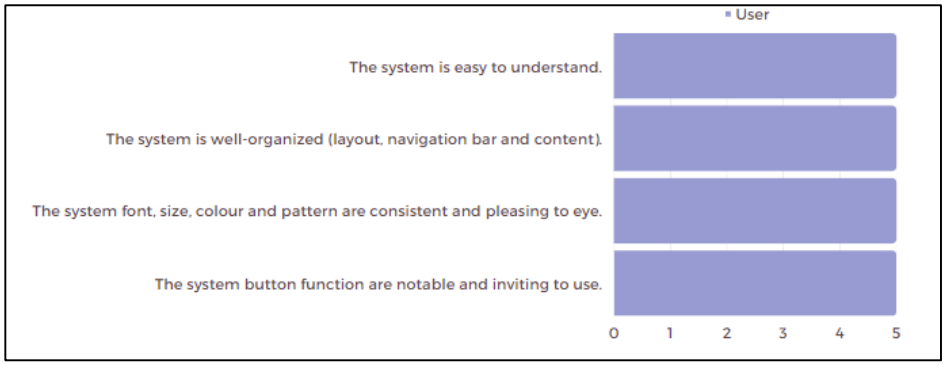

Figure 18: Google form user acceptance result for Section A: Interface

Figure 18 shows google form user acceptance result for Section A which is for interface of system. The statement for this section is the system is easy to understand, the system is well-organized, the system font, size color, and pattern are consistent and pleasing to eye and lastly the system button function are notable and inviting to use. The respondent rate 5 to all the question which indicates that user is extremely satisfied with the interface design.

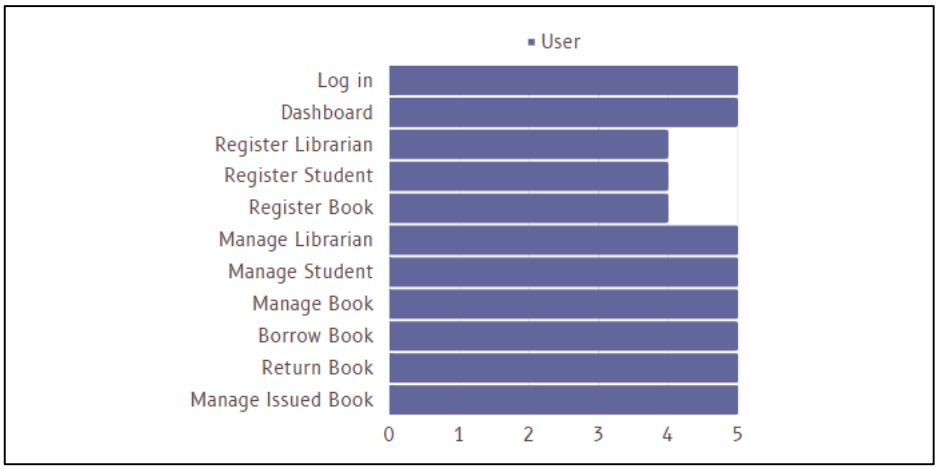

Figure 19: Google form user acceptance result for Section B: Functionality

Figure 19 shows google form user acceptance result for Section B which is for functionality of system. The respondent rated 5 to log in, dashboard, manage librarian, manage student, manage book, borrow book, return book and manage issue book which indicates that user is extremely satisfied with the functionality. However, respondent rated register librarian, register student and register book 4 which indicates only satisfy.

Respondent also drop some notable comment to developer for the functionality that developer may overlook. Firstly, when register librarian the LibrarianID is not automated. After that, when register student, the system requires to register manually for each person. Lastly, register book could be better with another two column which are book pages and publisher.

7. Conclusion

In a nutshell, the project objectives were accomplished. The library borrowing system in SK Jelotong by using QR code has archived all the objectives, scope and user requirements. It managed to use QR code scanner as the borrowing platform. The system can be implemented in the SK Jelotong Library. This system is expected to make it easier for the students to borrow any books from the library.

The advantage of the developed system is the system operate in web-based online library system which it can keep the data and record in the database. Thus, it is more secure in the authorized user's

handling. Next, admin and librarian are able to see record clearly and systematic. Therefore, the management will run smoothly. Lastly, the process of borrowing book become faster and time saving due to the hand-written record book is replaced by the uses of QR code scanner to borrow the book.

To make the system more advance in the future, future work is needed to keep the system on track, dependable, and convenient to borrow a book. Therefore, some future work needs to be done to improve and utilize the system. Firstly, auto deletion for student data after 6 years is recommended due to students usually has been graduating from the school. This is to ensure that there is no massive data in database but not in use anymore. Next, to implement the session timeout in the module of admin and librarian. Thus, the connection will be terminated automatically for an idle user. Lastly, this system would be so much better if the system is possible to import the data from the excel to register student and librarian.

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