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Library Management System

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Abstract
Manual library management requires a higher workforce for librarians and causes discrepancies during data encoding. The transaction history is too numerous and needs to be stored over a long period of time, requiring a lot of files for storage. With the advent of digital technology and the increasing complexity of library functions, traditional manual systems have become inefficient and time-consuming. In this work, an automated Library Management System (LMS) was developed specifically for education such as universities or colleges where users are students and admin to simplify the management of library resources, enhance accessibility, and improve overall efficiency. The system provides a user-friendly interface that enables librarians to quickly and accurately add, search, and update bibliographic information, ensuring a well-organized and easily searchable library collection. Also, it provides alternative methods for students to perform the borrowing process and check the current book availability at library through the system. The system also supports a range of user services, including patron registration, tracking borrowing history, and managing fines and penalties. The methodology used for this system is the Waterfall model, from the Software Development Life Cycle (SDLC). Overall, the LMS offers a comprehensive and efficient solution to address the challenges faced by modern libraries.

Keywords: Library Management System (LMS), Software Development Life Cycle (SDLC)

Introduction
This project is related to Library Management System (LMS). The system is produced explicitly for education, such as universities or colleges where users are students and admin. The system has a PHP framework (Hypertext Pre-processor) and HTML (Hypertext Markup Language) main programming languages, as well as JavaScript, jQuery, and CSS (Cascading Style Sheet). Use Xampp as a web server to connect databases, MySQL. This system can improve management and maintenance levels, making it easier for the librarian to manage incoming data in the library. Most of all, the library is still doing manual management, which requires a higher workforce. With this system, the workforce can be reduced and provide better online data storage places.

Since the data related to the affairs of both user and the library is fundamental, one of which is the proof borrowing and transactions of the user, the effect of the manual management will lead to discrepancies during the data encoding progress. This indicates that the data will be stored over a long period, causing required a lot of files for storage as the users are ambiguous and numerous. Therefore, within this system, it expands and increases the level of data management significantly, which makes it more systematic than the previous one. In addition, the librarian needs to update the report at any given time, which takes a while to research the data for the report. The system provides reports automatically and faster. This project building is to feed its purposes. One is to provide a library management system that facilitates data storage or user transactions. This ensures that the system runs

smoothly and gives the respective librarian advantages to upgrade their work performance. Besides that, this project offers alternative methods for the system users, especially students, to perform the borrowing process or make transactions. Furthermore, librarians can expand the data stored in their library management system besides offering students additional ways to borrow books. The ability to store more data will enable librarians to maintain more information on books and users, improving the library's and student services' management at once. Also, by investing in cutting-edge technology, librarians can quicken any procedure involving online libraries. This can entail investing in improving the library's website. The library's online materials will be more straightforward for students to access with the help of modern technology, saving them time and inconvenience. In short, this system helps librarians handle a library's day-to-day transactions. This also allows librarians to keep records of borrowed, returned and non-refundable books. On the other hand, for students, they can easily find the availability of the books they need. Additionally, it increases reporting and monitoring rates. Updated records with the automatic library management system allow dynamic reporting and surveillance. This system enables the admin to know more accurate data and avoid any negligence regarding data storage.

Literature Review

Library Management Systems have evolved significantly, pivotal in automating library operations, improving user experiences, and facilitating data-driven decision-making. This literature review highlighted the benefits, key features, challenges, and emerging trends in LMS. It is evident that LMS are essential tools for modern libraries, and their continuous development will contribute to the growth and effectiveness of library services in the digital age. The data relating to the affairs of the user and the library is critical, one of which is the proof of borrowing and transactions of the user. Manual management will cause discrepancies during data encoding. The user's transaction history is too numerous and needs to be stored over a long period, requiring a lot of files for storage. With this system, it can increase the level of data management. Furthermore, the librarian needs to update the report at any given time, which takes a while to research the data for the report. The system provides reports automatically and faster. This system helps librarians handle a library's day-to-day transactions. This also allows librarians to keep records of borrowed, returned and non-refundable books. On the other hand, for students, they can easily find the availability of the books they need. The importance of the project is to save the user time to do the borrowing and return process of books or any transactions. In addition, if any issues regarding the user can be identified and management can take action. This system can make library management more efficient and systematic. Increase reporting and monitoring rates. Updated records with the automatic library management system allow dynamic reporting and surveillance. This system enables the admin to know more accurate data and avoid any negligence regarding data storage. The process phase of the Waterfall model is used to develop this system and divided separately; the result of one step will act as an input in the next phase sequentially. In addition, the Waterfall model will help plan and schedule system development. The development process moves from planning, analyzing, designing, implementing, testing and maintenance.

Research Methods

This system uses the Software Development Life Cycle (SDLC), a series of development processes. It provides models for the development and life cycle of the application. For this system development approach, the developer uses one of the models of software development life cycle (SDLC), which is the waterfall method, which is the first process model to be introduced. According to the Waterfall model, each phase needs to be completed

first before moving on to the next phase. No phase embellishing will occur in this model. The development of successive linear flows is referred to as linear sequential life cycle models.

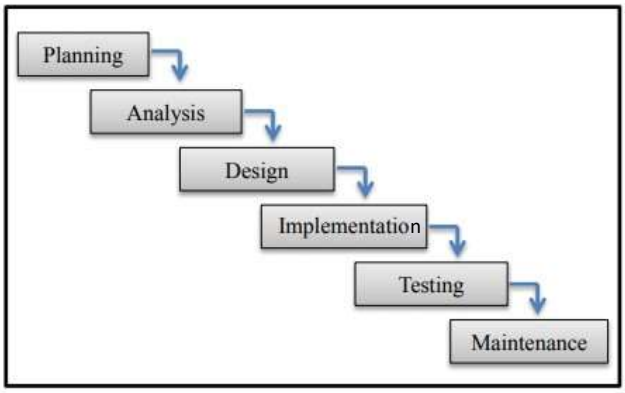

Figure 1. Waterfall Model

In addition, the Waterfall model will help plan and schedule system development. The development process moves from planning, analyzing, designing, implementing, testing and maintenance. The waterfall model is a traditional software development life cycle (SDLC) approach that follows a linear, sequential progression through various phases of software development. It is known for its structured and rigid nature. The key stages of the waterfall SDLC:

1. Planning: In this initial phase, the requirements for the software project are identified and documented. This involves gathering information from users and requirements to understand the desired functionality, features, and constraints.
2. Analysis: The system specifications are analyzed to generate product models and business logic to guide production. Functional decomposition is donned during the analysis phase to examine individual elements in the process shown in Figure 2:

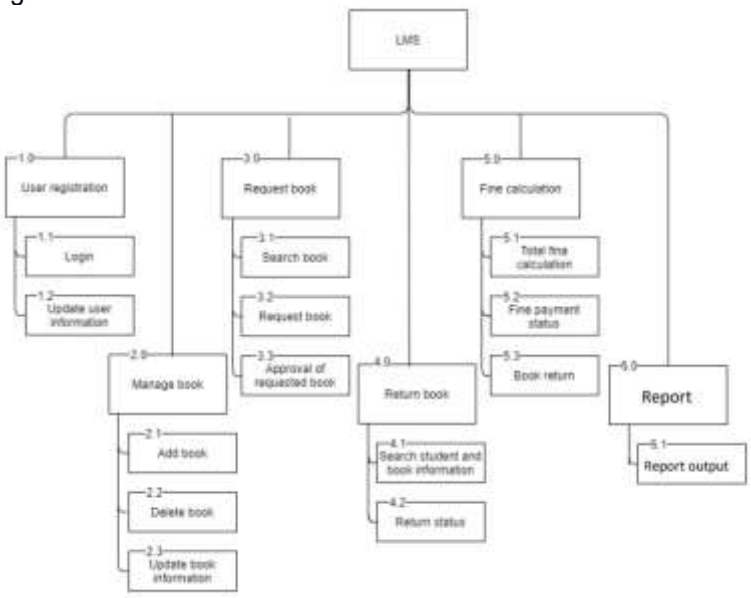

Figure 2. Decomposition Diagram

3. System Design: The requirements gathered in the previous stage are translated into a system design. This includes defining the software system's architecture, modules, interfaces, and data structures. The design phase focuses on creating a blueprint for the development process.
4. Implementation: Once the system design is finalized, the developer implements the software according to the design specifications. This phase involves coding, unit testing, and integrating different modules to build the complete software system.
5. Testing: After the software is developed, it undergoes thorough testing to identify and rectify any defects or issues. Testing involves unit testing, integration testing, system testing, and user acceptance testing (UAT) to ensure that the software meets the specified requirements and functions as expected.
6. Maintenance: After deployment, the software enters the maintenance phase, where it is regularly updated and maintained to address any issues, bugs, or feature requests that arise during its use. Maintenance can involve bug fixes, enhancements, and updates to keep the software running smoothly and up to date.

Results and Discussion

1. Planning

In this stage, the project developer collects the requirement needed for the project. It includes software and hardware requirements. Second, the system development approach is used to develop the system, as the mentioned developer uses the Waterfall model to build the project. Thirdly, regarding project planning and milestones, the estimated duration for this project development is eighteen weeks.

2. Analysis

a. Analysis of the existing system

The Developer researched the existing library management system or the manual version of LMS and identified the requirement and the improvement that be applied in the proposed project. The project description recorded in Table 1. below:

Table 1. Project Description

ID	Process	Purpose	Definition	Duties	Frequency
1.0	User Registration	Enlarging new users to register or existing to log into the system.	Login Update user information	Student Admin	Once per semester
2.0	Book management	Admin can add new books or delete old book records.	Add book Delete book Update book record	Admin	If there is any book add-on or deletion
3.0	Request Book	The process of borrowing books by students and getting approval from the admin.	Search book Request book Approval requested book	Student Admin	If there is a book fine process carried out.

4.0	Return Book	The process of returning books by students must be done based on the deadline by the admin.	Confirmation of book return Update number of books	Admin Student	If there is a book return process done.
5.0	Fine Calculation	Fines will be imposed on students who do not return the book by the deadline.	Calculation of fines Confirmation of fines Return book	Admin Student	Daily
6.0	Report	Allow admin and student to see the report on the library system.	Registered student by semester Requested book by faculty Total book available by faculty	Admin Student	Daily

b. High level requirement

This system uses Sublime Text 3 as a text editor to facilitate the coding process with its functionality with plugins. Xampp server and MySQL server were used to store the database for this project. XAMPP is a software package that includes Apache web server, MySQL database, PHP, and Perl. It provides a convenient way to set up a local web development environment on your computer. MySQL is a popular open-source relational database management system (RDBMS) that is included in XAMPP. The framework used is Bootstrap, which can simplify and speed up web development on the front end.

3. Design and development

a. Student and book list on admin site

Figure 3. below is the report of the student list that is registered. At this interface, admin can manage student, whether want to update student as inactive or delete the student. set as inactive.

Figure 3. Student List Report

Figure 4. below is the report of the registered book list. At this interface admin can manage books, whether admin wants to update the book as not available or delete and edit details of the books.

Figure 4. Book List Admin Site

b. Book list on student site

Students can see the available book on the page in Figure 5. interface. This page only displayed the available book for the student unless they searched for the books.

Figure 5. Book List on Student Site

c. Requested book on admin and student site

The status will be shown as pending or rejected. For admin, they can reject or cancel reject for the book. At the same time, the student can cancel the request. Both interfaces are shown in Figure 6. and Figure 7.

Figure 6. Pending and Reject List on Student Site

Figure 7. Pending and Reject List on Admin Site

If the request gets approval from the admin, then the list of the requested book will be recorded in both sites, admin and student. The student has to pick up their book, and admin will update the pickup status; else, the status will be 'unpick up'. Both will be shown in Figure 8. at the student site and Figure 9. at the admin site.

Figure 8. Approved List on Student Site

Figure 9. Approved List on Admin Site

After the book has been returned to the library, the status will be changed to 'returned'; otherwise, status will be 'expired' (due to the deadline). At the student site, the total fine will be shown in Figure 10. and for admin will be shown in Figure 11.

Figure 10. Returned and Expired List on Student Site

Figure 11. Returned and Expired List on Admin Site

After the 'expired' book is returned, the fine will be displayed on the fine page, like Figure 12. on the student site and Figure 13. on the admin site. The admin will change the paid status after the student pays the fine.

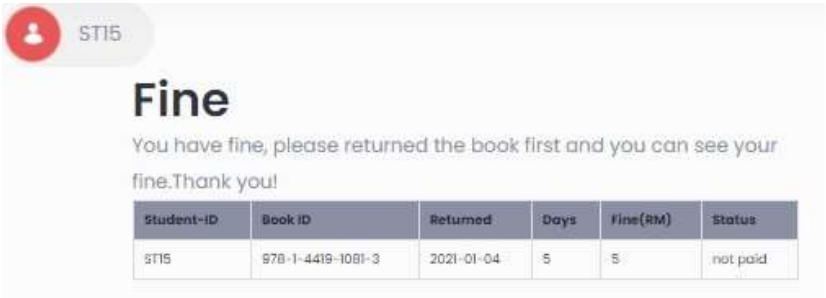

Figure 12. Fine List on Student Site

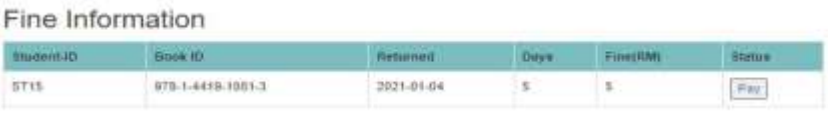

Figure 13. Fine List on Admin Site

4. Testing and maintance

Once the program is ready to be built and compiled, the testing process is carried out independently from any error. Testing was performed using data as a sample. If there is an error, it will be repaired and tested again until it succeeds. If the program produced does not meet the requirements or cannot solve the problems, then the program needs to be redesigned. The main objective of testing for each program, module

or unit is to ensure its code is available to implement the plan. If the system development requirements have been met, test acceptance must be specified specifically for each unit test.

Conclusions

In conclusion, the Library Management System has achieved its primary objective because this system has facilitated the process of borrowing and returning books to the library. At the same time, all the processes that take place will run smoothly and systematically. Next, the system has provided a platform for the librarian to detect the late return from the students and calculate the fine automatically. Therefore, the librarian can also administer the system by managing the books available in the office, borrowers, and subordinate librarians. As a result of the development of the Library Management System, this system has overcome some of the problems librarians and students face in borrowing and returning. With the system already built, manual systems that require a logbook to record data are no longer needed. Borrowing data will be stored neatly in the database, making it easier for librarians and students to refer to the data in the future.

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