Development of Library Information System Web-based of SMA Negeri 1 Mojolaban Sukoharjo

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Abstracts-SMA Negeri 1 Mojolaban has a library with several librarians. The library system used by SMA Negeri 1 Mojolaban still uses conventional methods, which results in less optimal library services. Based on the obstacles experienced by SMA Negeri 1 Mojolaban, a library information system is needed that can make it easier for librarians to manage data. This study aims to assist librarians in managing library administration, reporting, and free letter libraries. This research was developed with the waterfall method which consists of several stages, namely System Requirements Gathering and Analysis, System Development, System Implementation and study coding, program testing, Deployment, and Maintenance. Program writing combines several languages such as HTML, Bootstrap, and the Codeigniter framework. After being developed, the system will be tested using a Blackbox and then Deployment using User Acceptance Testing (UAT). The system is considered valid and according to its function from the results of the Blackbox assessment. The UAT test results get an average value of 88.63% of the 52 participating respondents, so the system is good enough. The result is that it is easier for librarians to manage library data and book loan transactions.

Keywords: Library, Library Information System, Waterfall

I. INTRODUCTION

Science is an important element that can not be separated from human life both education, work, and daily life. The higher the level of education, the higher the need for science. Knowledge is obtained from information sources such as books, literature, and scientific works. The information is expected to be a weapon for the community to go through the development of The increasingly advanced era. One way to get it is by going to the library.

Educational institutions have at least one library and have librarians as managers. The Library is a media that provides a variety of information to improve human resources [1].In general, the library is useful for increasing insight and knowledge, but specifically, the library is also useful in supporting the learning provided by the teacher.

The Utilization of libraries in educational institutions still uses manual methods and will take a lot of time in their transactions. All activities from book data collection, member data collection, loan and repayment transactions, and reports are still using the manual method using paper. The impact of the Librarians is having difficulty finding data of books that

the process of having to open the book on previous pages, of course, is very time-consuming especially when the students' time is not long [2]. Students and teachers will also experience difficulties in finding the books they need because there are no search engines and only rely on rack numbers or search one by one[3]. Librarians will also have difficulty in making a recapitulation of library reports on borrowing and not a small amount of book data[2]. Data collection and history errors often occur in libraries that still use books as data storage media [3]. Librarians have difficulty making transactions when the ledger(the place to store transaction data) is lost and does not have a copy of the ledger [4]. Some of these things are certainly very detrimental to students and librarians themselves.

Researchers took several journals as a reference in developing a system to facilitate the Librarian in managing library data. Rahmadi, (2020) in his research faced obstacles to search for library data collection information because the management of the Library is still manual, therefore a Library Information System Based on WEB was built. His research aims to help library services become easier with a short instructional time. This information system has several features for managing data such as user management, book management, member management, transaction management, and reports. the result is this library information system can make it easier for librarians to manage data as well improving the quality of performance of librarians at SMP-IT Nur Hidayah Surakarta.

Jaya (2019)in his research having problems in adding a book catalog with a manual system is considered less efficient with the increasing number of books added because it is made a Library Information System in a Website-based Polytechnic. His research aims to build a web-based system to help process library book data by utilizing a Codeigniter framework. This system has several features that support the library data management process, such as Member Input, Book Input, and Transaction Form. The result of this system can simplify the process of managing books and members with a maximum and practical.

The same case occurred in SMA Negeri 1 Mojolaban, the Librarian still used the conventional method of paper as the data storage medium. All types of recording transactions for loans, returns, and data collection of books written on the

paper result in less than optimal library services, this will also take a long time in service. The data collection of lending transactions is carried out using a Borrowing Paper for each student, which can make it difficult for Librarians to find the names of Students from the hundreds of Students and Teachers who participate as library members. Storage of large amounts of paper can increase the risk of data loss which will consequently increase the work of the Librarian. Besides the use of paper will also increase the expenditure of more funds for buying paper, books, and ballpoints. Librarians will also be troubled in checking books that have not been returned by Students because they have to check one by one between books and Borrowing Paper, this can cause errors in the collection of books borrowed and returned. The librarian also found it difficult to check the data and write down the names of the students one by one to make a library-free letter. Based on these problems the researchers took the initiative to create a Web-based Information System that is easy to use to help the Librarian of SMA Negeri 1 Mojolaban in organizing and processing the data so that it is faster and more efficient without reducing the level of data accuracy. The system will replace paper media with website-based computerized technology, this will make it easier to store and access transaction data, membership, book lists, and reporting. This system will save storage space, no need to use paper to store transaction data. This system also provides good security without worrying about being lost, torn, or wet because it has no physical form (stored in computer memory).

The Website-based Library Information System is expected to can help alleviate the work of the Librarian of SMA Negeri 1 Mojolaban in carrying out Library Administration in the form of recording borrowing and borrowing transactions, structured book data collection, helping the Librarians and Students in searching the location of books, and reports to determine the chart of books borrowed by students, this can indicate the level of interest in reading students so that the Librarian can work on adding to the same type of book. Besides, it also assists in the making of temporary reports and the creation of library-free letters.

II.   METHOD

The method used in this study is the Waterfall Method. The waterfall model is a generated SDLC model that has special features that consist of sequential steps and can manage design flaws before product development [7].

Researchers chose the Waterfall method because the method with this approach is easier to understand and implement and works well on mature products [8]. This method has several stages, see Figure 1. The stages in the Waterfall method consist of requirements gathering and analysis, system Development, System Implementation and coding study, program testing, Deployment, and Maintenance[9].
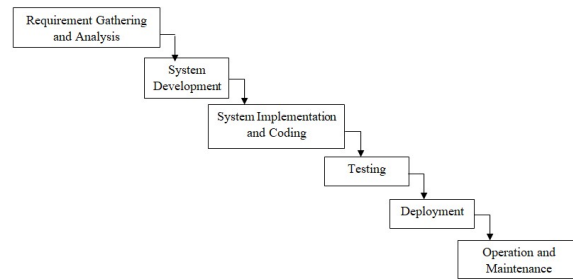

Figure 1. Waterfall Method

A. Requirements Gathering and Analysis

The initial stage in making a system is analyzing user requirements. This stage is needed to determine the user's needs which will later become a function of the system itself.

Researchers conducted a needs analysis using the method of observation and interviews with the library officers of SMA Negeri 1 Mojolaban (User). Obtained the following data:

1. Functionally

- The system can display data and make transactions such as borrowing books and returning books.
- The system can save and display book data and library members.
- The system can calculate and report the number of transactions each month.
- The system can provide library-independent reports to users such as temporary reports and library-free letters.

2. Non-Functional:

a. Operational

Operational Requirement is a minimum target of hardware and software that supports the running of a system.

- Windows 10
- RAM minimal 2GB
- Hardisk 1Tb
- XAMPP Version3.2.2.0

b. Security

This system is equipped with security in the form of using a password to log into the system.

c. Information

The system can display ID or Password error information when logging into the Admin menu. Besides the system will also provide information on the success or failure of data that is entered, deleted, and edited.

The use of the Waterfall Method needs to be clear before entering the Design phase because its sequential nature will make it difficult for programmers to change their previous needs [10].

B. System Development

The system development or design is done after the researcher gets the data in the form of user needs that support in making the library system.

1. Usecase Diagram

Researchers use Use Case diagrams to facilitate the reading of user needs. Usecase describes the interaction between the user (admin) and the system in natural language [11]. In this library information system, researchers use 1 actor as the main user who is directly related to the system, namely the user(admin). See Figure 2.
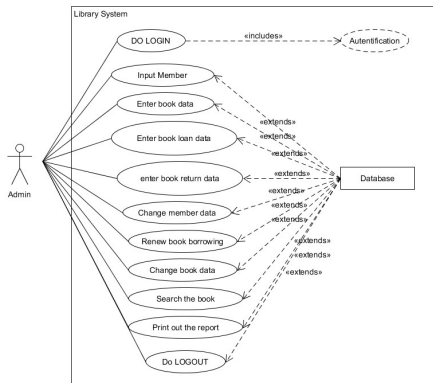

Figure 2. Usecase Diagram

Figure 2.This shows that the admin can perform activities such as website login, then the system will authenticate user requests, users can input member data, users can input book data, users can enter borrowing and returning books, users can change book data, and member data, users can update Borrowing books, users can search books, users can print reports, and library free letters and users can log out.

2. Relationship Diagram

Relationship Diagram serves to facilitate the Researcher in analyzing the database on which the basis will be used for the Library Program. See Figure 3.
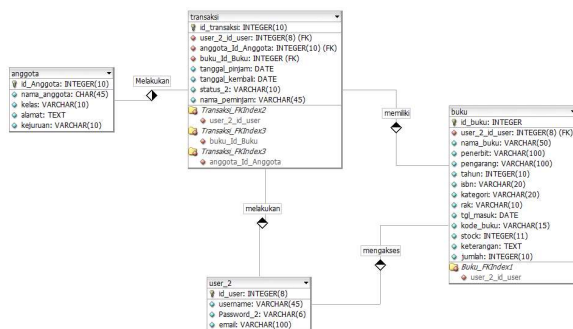

Figure 3. Relationship Diagram

Figure 3.Shows the database of the system, the database consists of 4 tables with the name user_2, members, books and transactions. In Table user_2 has a primary key id_user with the attributes: username, password_2, and email. Table anggota has a primary key id_anggota with the atribut: nama_anggota, kelas, kejuruan, and alamat. Tabel buku has a

primary key id_buku and foreign key user_2_id_user with the atribut nama_buku, penerbit, pengarang, tahun, isbn, kategori, rak, tanggal_masuk, kode_buku, stock, jumlah, and keterangan. Table transaksi has a primary key id transaksi, and foreign key: buku_id_buku, anggota_id_anggota, user_2_id_user with the atribut: tanggal_pinjam, tanggal_kembali, nama_peminjam, and status.

C. Program Implementation and Coding

Program Coding is done after the researcher understands the needs of the user and has a simple picture of the system design that will be made. Writing programs combine several languages such as HTML, Bootstrap, Javascript dan PHP with the framework Codeigniter.

Researchers use XAMPP as their Web Server and MySQL as their Database. XAMPP is an instant web server application that can be used both in the Linux operating system and in the Windows operating system [12].

D. Program Testing

After the system has finished being a program, testing is needed to see whether or not a feature with the expected function. Testing will be done using the Blackbox Testing method. Black box testing is a method of testing an application that discusses the outside of a software application, which starts from the display to the input action [13].

E. Deployment

After testing and verifying the library system, the system is ready to be deployed. The end-user needs to make sure that the product meets their needs and that the specifications were correct from the start[9].

At this stage, the researcher will validate the system using the User Acceptance Testing (UAT) experiment, which is a test carried out by several respondents who want to obtain a test result document on the system built and accepted by the system and have met user needs[14]. If the function is not appropriate, the researcher must change and revise the programming code to suit the expected function. If the function is appropriate, the researcher can proceed to the next stage.

F. Operational and Maintenance

Maintenance is done after the researcher gets data where the system does not match the expected function or the features provided do not match the user's expectations. Besides, maintenance also has the main objective of maintaining system performance over time [15].

III. RESULT AND DISCUSSION

Researchers will show the User Interface/display and briefly explain the Library Information System of SMA Negeri 1 Mojolaban.

A. Login

User interface Login is the initial display before the user enters the main menu of the Library System. Users are expected to fill in the available fields such as username and password then the system will check whether the user has

access to enter the main menu or not. If the Username and Password match, the User will be taken to the Main Menu (DASHBOARD), and if it does not match, he will remain in the Login menu.
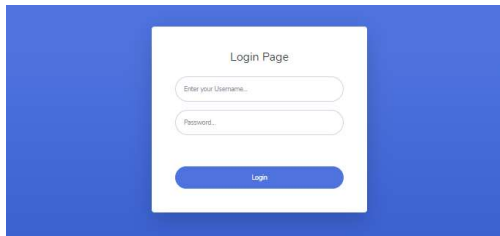

Figure 4. Interface Login

Figure 4. This page displays fields for entering a username and password.

B. Dashboard

The dashboard is the main menu display of the Library Information System. On this menu is a summary of several calculations in the system such as bookkeeping, members, transactions. See figure 5.
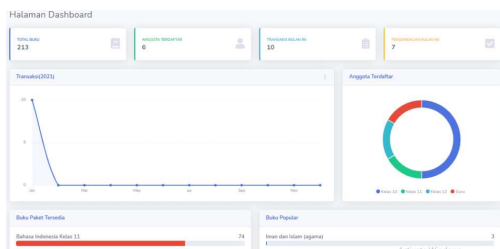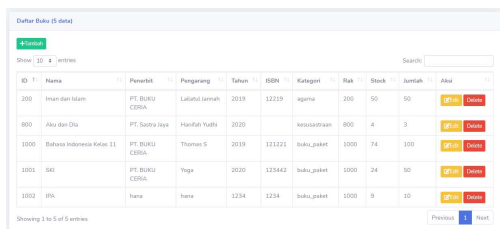

Figure 5. Interface Dashboard

Figure 5. This page displays the important points of the system such as the total number of books, the number of members from grade 10 to 12 as well as teachers, the number of transactions that occur in the library in a month, the number of books returned per month, the chart of transactions in a year, the distribution chart of members, stock the rest of the textbooks and the 5 most popular books.

C. Books

The Books menu displays a list of books stored in the database. Users are given the option of adding to add books or edit to edit and delete to delete books. See Figure 6.

Figure 6. Book Interface

Figure 6. The system book interface shows book information in a table with the contents of the book ID, name of the book, publisher from the book, author that made a book, published years, ISBN, category, shelf of the book in the library, stock of book, quantity, and description about the book.

D. Transaction

Transactions are the main menu for making transactions in the form of borrowing books at the SMA Negeri 1 Mojolaban library. See Figure 7 for Lending Interface and Figure 8 for Return Interface.

Figure 7. Lending Interface

Figure 7. This image shows you detailed information about borrowing books such as student identification number (NIS), name of borrower member, the title of the book being borrowed, the admin who is responsible for the transaction, status of the loan, date of the loan, and date of repayment.

Figure 8. Return Interface

Figure 8 shows the details of members who borrow books such as student identification numbers (NIS), student/teacher names, and student classes. Librarians can check data to make a return transaction, the librarian also performs searches in the provided search table.

E. Library Free Letter

This menu was created to help library staff to make Library Free Letters (SBP) which will later be used for graduation requirements for SMA Negeri Mojolaban students. This menu will calculate student loan data, if students do not have book debt (loan), the officer can immediately print out the SBP. See figure 9.
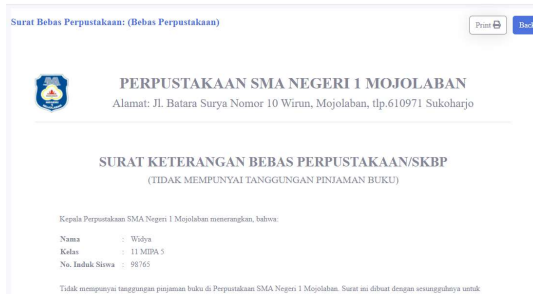
Figure 9. Library Free Mail Interface

Figure 9. Shows a conditional free letter library. Students are required to return books that have been borrowed while studying at SMA N 1 Mojolaban. If the student still has book debt, the system will not allow the user to print out and will be directed to record the menu of student transactions.

F. Interim Report

This menu aims to display the details of transactions for one year. See figure 10.

Figure 10. Temporary report

Figure 10. Shows a temporary report in the form of the number of additional books, the number of members added, the number of borrowing transactions, the number of book returns, and the late return of students in one year divided into each month.

G. Member List

This menu serves to store library membership data. See figure 11. Figure 11. shows the detailed data for library members, such as student identification numbers(NIS), member names, class, and address of a member. In this interface we can also edit member data by clicking the edit button and if you want to delete click the delete button.

Figure 11. Member Interface

H. User / Admin List

This menu displays admins who can access the Web Library. See Figure 12.

Figure 12. Interface User/Admin

Figure 12. This interface displays user (admin) data on the number of users who can access the website. This interface allows users to add new users (admin), change user's (admin) information such as username, password, and email, and remove user permissions (admin).

I. Black Box Testing Results

Researchers will perform Blackbox Testing to see if the system is functioning properly. Blackbox testing is done by checking each function from the menu, button, and user interaction with the system itself.

Blackbox testing is carried out based on the perspective of the end-user. The main importance of black-box testing handles both valid and invalid inputs from the customer's perspective[16]. See Table I.

In Table 1. You can see four columns containing scenarios as to what the system does, test scenarios as a way to perform test scenarios, expect results as expectations of how the system works, and finally, the results of the system, whether valid or invalid.

The results of the Blackbox test shown in Table 1 have a valid overall value, it shows that the system performance is following the expected function.

TABEL I. TABLE BLACKBOX TESTING

NO	Scenario	Test Scenarios	Expected results	Result
1	**Menu Login**			
	User Login	The user enters ID and Password then clicks a button.	If the username and password are in the database, the user can enter the main menu, otherwise, the user will remain on the Login menu	Valid
2	**Menu Logout**			
	User Logout	The user presses the Logout.	The user will return to the login.	Valid
3	**Menu User**			
	The user adds, change, and delete user data	The user presses the add, edit, delete button in User data.	Saved user data or modified data will appear in the user menu, and deleted data will be lost.	Valid
4	**Menu Buku**			
	Users add, edit, and delete book data	Users add books via the add book menu or the add button in the book list, edit, and delete.	Book data is stored in the database, changed, deleted and the data will be displayed in the Booklist menu.	Valid
5	**Menu Member**			
	The user adds, edits, and deletes Member data.	Users add members via the add member menu or the add button in the member list, edit, and delete.	Member data is stored in the database, changed, deleted and the data will be displayed in the member list menu according to the class.	Valid
6	**Menu Report**			
	User displays calculation reports for 1 year in that year and print report	The user presses the Report menu or presses the print button	A year's calculation report is displayed. If presses print The user will enter the print preview menu or download the pdf.	Valid
7	**Menu Bebas Perpustakaan (Library Free)**			
	User search for Member name with Search	The user enters Member name then clicks a button	The names with the criteria written will appear in tabular form.	Valid
	The user checks the status of the loan and print Library Free Letters	The user presses the Data button on the Member and presses the print button.	If the User does not have a loan status, it will display a free loan letter and you can print that report. But if the user has a loan status, it will display a list of loans.	Valid
8	**Menu Transactions (Borrowing)**			
	Displays the lending user interface	The user presses the loan option in the menu	The user enters the lending interface which contains a list of borrowers	Valid
	Users search	The user enters a data transaction.	A book is written will appear.	valid
	The user adds a list of loans	The user enters the member's name then clicks the search image.	The names with the criteria written will appear in tabular form.	valid
		The user presses the add list button	The user will be directed to the add list menu	Valid
		The user fills in the required data then presses the input button	The entered data is stored in the database then data will be displayed in the transaction list/record/add.	Valid
		The user presses the delete button	Permanently deleted data	Valid
		The user presses the extend button	Users can edit the grace period for loans and stored data.	Valid
	The user checks the member loan list (a record)	The names with the criteria written will appear in tabular form.	The names with the criteria written will appear in tabular form	Valid
		The user presses the delete button	Permanently deleted data	Valid
		The user presses the extend button	Users can edit the grace period for loans and stored data.	Valid
9	**Menu Transaction (Refund)**			
	Displays a list of borrower names	The user presses the return option in the menu	The user enters the return interface which contains a list of borrower names.	Valid
	User checks data	The user presses the check data button	The system will display a list of loans from the selected name	Valid
	User deletes data	The user presses the delete button	Permanently deleted data	Valid
	User changes the status of the loan to return	The user presses the return button	The user will be directed to the User Interface to edit the return	Valid
		The user presses the update button	The user will be directed to the User Interface to record the return and the changed data is stored	Valid
10	Returns to the previous menu	The user presses the back button on each menu	The user will return to the previous menu	Valid

J. User Acceptance Test(UAT) Results

User Acceptance Test (UAT) is the choice of researchers to test the feasibility of the system. The results of UAT measurement can show whether the system created is by user needs and the level of user satisfaction in using this system[17].

This study took 52 samples of users from the student to adult level using a questionnaire. Participating users will be asked to answer 12 questions by choosing one of the five answer choices provided. Each one of the five choices has a different weight, see Table II. Then after getting the data, the data will be processed into information in the form of a percentage of the value of each question and the average percentage of the whole, see table III.

TABEL II. ANSWER OPTIONS TABLE AND QUALITY SCORES

Options	Score	Quality
A	Very: Easy / Good / Suitable / Clear	5
B	Enough: Easy / Good / Suitable / Clear	4
C	Neutral	3
D	Sufficient: Difficult / Ugly / Unsuitable / Unclear	2
E	Very: Difficult / Ugly / Incompatible / Unclear	1

Table II. Shows the options in the form of letters A-E with different scores and quality, this table is a description of the choices in the questionnaire.

The formula below will be used to calculate the percentage value of each question provided by the researcher.

TABEL III. QUESTION AND RESPONDENT ASSESSMENT OF UAT

No	Question	Result					Score					Total (∑nP)	Y
		A	B	C	D	E	A*5	B*4	C*3	D*2	E*1		
1	Is the appearance of this website good enough?	28	21	3	0	0	140	84	9	0	0	233	89,62%
2	Is this website easy to use?	23	27	2	0	0	115	108	6	0	0	229	88,08%
3	Is the level of accuracy of the data provided good enough?	25	23	4	0	0	125	92	12	0	0	229	88,08%
4	Does this website fulfill the expected functions?	24	24	4	0	0	120	96	12	0	0	228	87,69%
5	Does this website make it easy for you to make book borrowing transactions?	19	29	2	2	0	95	116	6	4	0	221	85,00%
6	Does the menu provided can meet your needs?	21	27	3	1	0	105	108	9	2	0	224	86,15%
7	Is the menu provided easy to understand?	26	22	3	1	0	130	88	9	2	0	229	88,08%
8	Does this website help you in book search?	32	14	5	1	0	160	56	15	2	0	233	89,62%
9	Can this system help meet your reporting needs?	22	24	6	0	0	110	96	18	0	0	224	86,15%
10	Can this website help you in finding transaction information?	23	27	2	0	0	115	108	6	0	0	229	88,08%
11	Are the buttons working properly?	32	18	2	0	0	160	72	6	0	0	238	91,54%
12	Are the available menus easily accessible?	28	21	3	0	0	140	84	9	0	0	233	89,62%
	Percent Average Value												88,14%

Formula: Y   = Percentage

$$Y = \frac{\sum nP}{n} \times 100\% \quad (1)$$ ∑nP   = Total score/value

nT   = Number of respondents x5

Table III. Shows the questions and the results of the questionnaire given to the respondent. In the Question table contains the questions given, the results table shows the number of respondents who chose the options from numbers A to E, the score table shows the calculation of the total value obtained by the quality formula from the options multiplied by the number of respondents who chose, the total table (∑nP) is the number the whole score table, then table Y is the calculation result of the total value divided by the number of respondents multiplied by 5 multiplied by 100.

The table above shows the percentage obtained from calculating the value for each given question. The first question gets a total value of 233 and the resulting percentage of the calculation is 89.62%. The second question gets a total score of 229 and the resulting percentage of the calculation is 88,08%. The third question gets a total score of 229 and the resulting percentage of the calculation is 88.08%. The fourth question gets a total score of 228 and the resulting percentage of the calculation is 87.69%. The fifth question gets a total score of 221 and the resulting percentage of the calculation is 85%. The sixth question gets a total score of 224 and the resulting percentage of the calculation is 86.15%. The seventh question gets a total score of 229 and the resulting percentage of the calculation is 88,08%. The eighth question received a total score of 233 and the resulting percentage of the calculation was 89.62%. The ninth question gets a total score of 224 and the resulting percentage of the calculation is 86.15%. The tenth question gets a total score of 229 and the resulting percentage of the calculation is 88.08%. The eleventh question received a total score of 238 and the resulting percentage of the calculation was 91.54%. The twelfth

question gets a total score of 233 and the resulting percentage of the calculation is 89,62%.

The conclusion obtained from the average percentage of the twelve questions by adding the percentage of numbers one to twelve divided by twelve questions is 88.14%. Based on this percentage value, it shows that the system created is good enough from the display. The system functions well, the user is quite easy to use this system, and the part of interaction with the system such as pressing buttons is quite easy and responsible.

K. Validity Result

Based on table 3, the researcher conducted a validity test to determine whether the content validity indicated that the instruments were arranged following the expected curriculum, material, and learning objectives[18].

Figure 13. Questionnaire Validation

Figure 13. Shows the correlation calculation of the 52 respondents involved with a questionnaire consisting of 12 questions. First, it was taken from the number of respondents as many as 52 from students to adults, and got a rTable of 0.273. Then the researchers calculated the correlation which was assisted using Ms. Excel, with the formula:

Correlation = CORREL (number of respondents; All Total)   (1)

This questionnaire will be considered valid if the value of rHitung is greater than rTable (0.273). See Figure 13. Judging from the calculations in Figure 13. Of the 12 questions overall get a valid value because rHitung is higher than rTable.

L. Implementation System

After the system has been created. The researcher implemented the library system in SMA Negeri 1 Mojolaban with the permission of the library and school administrators. As requested by the school and library, this system will be run offline without using an internet connection.

Furthermore, the researchers installed the system and several tools to support the work of the system on the library computer. The tools needed are XAMPP version 3.2.2.0, which is integrated with the Apache web server and MySQL database server, this application functions for offline web simulation or locally before being launched online[19].

Installation is carried out on one computer which will later function as a library data storage center such as loan transactions, return transactions, book data collection, member data collection, and reporting. After installation, the user(librarian) can immediately try and use the library system.

The benefit after using the library system is that the librarian is easy in managing the library such as borrowing transactions, returning books, registering books, registering members, and making temporary reports and library free letters.

IV.　CONCLUSION

This study aims to assist librarians in managing library administration such as book data collection, recording borrowing, and returning transactions, book search location, making temporary reports, and library free letters. After the system is complete, the system immediately goes through several stages of testing conducted by researchers, managers, and several respondents. The test results show that the system is working according to the expected function. Besides, the system also has a pretty good appearance, the system is also easy to use and has a good level of data accuracy.

The system makes it easy for librarians to manage library administration, namely storing data related to book lending and returning transactions, book data collection, library members or members, and makes it easier to find out about the development of the library in one year. Also, this system helps library managers in making Free Library Letters which is a mandatory requirement for postgraduate students at SMA Negeri 1 Mojolaban, making it more practical without having to write letters one by one.

Based on the test for the use of the Library Information System of SMA Negeri 1 Mojolaban, suggestions are given to improve the quality and benefits of the system, namely improvements in the interface such as less attractive buttons, adding special features, and adding configuration to the system.

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