

# Quality Analysis and Web-Based Library Information System Development Using ISO 9126 Standard

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## ABSTRACT

Management of book collection at the Department of Electrical Engineering, State University of Malang is less effective and efficient because the management process is carried out manually and centrally on a single computer (stand alone). This research purposes is to describe, develop, and test a reference book management information system based on Model View Controller (MVC) in the Department of Electrical Engineering, State University of Malang. The development model that used in this research is waterfall model which consists of analysis, design, implementation, and testing step. Testing is carried out to determine the quality of the developed system. Testing of the product in this research is using ISO 9126 indicators with aspects of functionality, and usability. The results showed that: (1) the reference book management information system was developed using the Codeigniter framework and the waterfall development model consisting of the needs analysis, design, implementation, and testing step, and (2) the test results on the functionality aspect obtained a value of 1 (good). Usability testing obtained a result of 4.03 (very feasible) obtained from the results of the average assessment of students and librarian responden.

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## I. INTRODUCTION

The development of science and technology presents new events in human activities. The speed of information has had an impact on human activities including the need for technological capabilities to process and store all information, so that from this stored information can be retrieved quickly and accurately [1], [2].

The library as a place for managing sources of information and knowledge must be able to optimize the maximum use of information technology in order to achieve various needs. There are several considerations for using information technology in libraries, including demands for service quality, demands for resource utilization and demands for efficient time and management of various information [3].

The library in the Department of Electrical Engineering, State University of Malang has a large collection of reference books. From the data available in November 2020 there were more than 3500 collections of books in the library. Based on the results of interviews with a staff who is a librarian at the Department of Electrical Engineering, State University of Malang, it is known that there are obstacles in the process of

searching for books, data collection and coding of reference book collections, all of which are still done manually with the Microsoft Excel application and are carried out centrally on one computer (stand alone) which has an impact on the ineffectiveness and inefficiency of the book collection management process.

The development of a library information system is expected to assist officers in the process of managing reference books and user services. Implementation of a website-based library information system can be applied in various types of libraries, one of which is the library at the Department of Electrical Engineering, State University of Malang

The non-optimum service in the library of the Department of Electrical Engineering, State University of Malang was also due to the fact that there was only one officer in charge of managing the books and serving visitors so that if difficulties in finding books disturbed the performance of librarians. Students also have to come to the location to find out and look for a collection of books in the library, this method takes a relatively long time to find a collection of books. So from this the role of a system is needed in overcoming these deficiencies for the future.

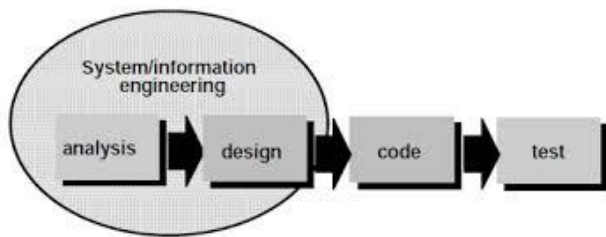


Fig. 1. Waterfall development model

The same thing was done by Sulastris in 2013 with his research entitled "Development of Library Information Systems in Middle School (SMP) Negeri 4 Karangtengah". Sulastris put forward the problem of data management in the library so that an information system was developed [4]. The results obtained in this study are the information system that is created to make it easier for librarians to make daily reports.

Therefore the researchers thought of developing an information system for managing reference books as academic support and efforts to improve services at the Library of the Department of Electrical Engineering, State University of Malang. In developing this information system using the waterfall model. The waterfall model was chosen because this model is an orderly and sequential model in developing tools starting from requirements analysis, design, implementation, and testing [5].

Besides that, the waterfall development model is the most complex and suitable when applied to a reference book management information system. This is because with the waterfall model, users and developers can determine the initial goals of system development so that the development of information systems becomes more effective and efficient.

In product development, the model view controller (MVC) method is used. The use of a model-view-controller (MVC) architecture can simplify system maintenance.

4 JKTP Journal of Continuing Educational Technology Studies. As according to Satish in Hidayat and Surarso that the MVC architecture is the most common method of dividing logic and interface code into different sections [6]. This method is widely accepted and has the advantage of re-using program code.

In order for the quality of the software to be said to be good, it is necessary to carry out quality testing to determine the feasibility of the information system being developed. Software testing is not only to obtain proper software, but also to find out that the software is free from errors from all aspects [7]. Software testing refers to several aspects of testing in ISO 9126 such as aspects of functionality and usability. The reason for identifying these two aspects is based on the scope of the system being in the academic field where the user orientation is important [8].

In accordance with the formulation of the problem, the purpose of this research is to develop and test a Model View Controller (MVC) Based Reference Book Management Information System in the Department of Electrical Engineering, State University of Malang.

The research conducted is a study or development of previous research. Research continues to be carried out in order to seek new truths, including research in fields relevant to this research. One of them is research conducted by Perwira entitled "Development of a Web-Based Library Information System at SMK Muhammadiyah 1 Yogyakarta" [9]. In his research, software testing was carried out with the ISO 9126 standard with development using the Laravel framework. It was found that it produces good quality software in terms of functionality, efficiency, reliability, and usability. The officers' research is relevant to note in this research, even though the test indicators and framework used are different. Officers' research examines 4 indicators, while this research focuses on functionality and usability aspects whose important orientation is the user.

## II. METHOD

### A. Development Style

This study uses the waterfall model as a model for developing a reference book management information system. Figure 1 is the stages in the waterfall model.

### B. Development Procedure

#### 1) System Requirements Analysis

In this stage the software requirements are adjusted to the needs of the user or users. In addition, needs analysis is also to identify existing requirements in the system. The data collection process was carried out by conducting interviews and direct observations with librarians at the Department of Electrical Engineering, State University of Malang. Observations were made by directly observing regulations in the library. The results of this stage are obtained in the form of software requirements specifications in developing software.

#### 2) System Design

This system design stage will translate from the system analysis stage. The system design stage focuses on creating the Unified Modeling Language (UML), database, and user interface.

Making UML will focus on 2 actors namely from the side of admin and guests. As an admin, you will have full access rights to the features of the system being developed. Meanwhile, guests as users can only access the information system and have limited access rights [10].

#### 3) Implementation/Coding

The next stage is the implementation of the previous design or design stages. Implementation or coding is done using the PHP programming language and integrated with the MySQL database. The implementation of the Model View Controller (MVC) directory concept is implemented with the help of the CodeIgniter (CI) framework. In addition to the CI framework used to assist system development, the Bootstrap framework is also used to implement user interface designs easily and according to user requirements.

#### 4) Testing

The product that has been developed according to the previous design is then tested according to the ISO 9120 standard. This type of test was chosen because it has the advantage of having parameters to be able to identify the quality

of the software both internally and externally [11]. Testing is carried out with reference to the aspects of functionality and usability in accordance with the ISO 9126 model. Testing is carried out in two stages. The first part of the feasibility test on the functionality aspect is carried out using the test case method for each system function. Subjects who carry out due diligence on this aspect are carried out by web development experts. Meanwhile, the feasibility test on the usability aspect was carried out using a questionnaire that refers to the Arnold questionnaire [12]. Subjects in the due diligence on this aspect will be carried out by users on student actors.

C. Data Collection Instruments and Techniques

1) Functionality Aspect

The functionality aspect is tested by programming specialists (programmers/developers) by using a questionnaire in accordance with. The research instrument used in this aspect is a checklist which contains all the functions developed in the application which are adapted to the sub-characteristics of ISO 9126 aspects of functionality namely suitability, accuracy, interoperability, security. Thus, it can be known which functions are running and which are not running (errors).

2) Usability Aspect

The usability aspect is the ability of the software to provide convenience, satisfaction in use and provide assistance regarding errors that occur according to conditions and needs (ISO/IEC 9126 in Officer 2015). The usability aspect is measured using a questionnaire. The instrument used is a questionnaire adapted from Arnold M Lund, namely the USE (Usefulness, Satisfaction, and Ease of Use) Questionnaire developed by the STC Usability and User Experience Community. The questionnaire is adapted to the characteristics of the usability aspect of ISO 9216.

This usability questionnaire uses a 5-point Likert scale in the form of a checklist. This scale is divided into 5 sections, namely Strongly Agree (SS), Agree (S), Undecided (RG), Disagree (TS), and Strongly Disagree (STS).

D. Data Analysis Technique

1) Functionality Aspect

Functional quality factor testing is done by testing each function of the software by web development experts. Functionality testing is categorized as testing

2) JKTP Journal of Educational Technology Studies

functional blackbox. Testing is done in writing to check whether the application is running as expected (Simarmata 2010). The test uses a test case in the form of a checklist with a firm answer, namely "Yes-No". The standard used in determining whether the software has passed the test is by using the standard interpretation used by ISO 9126 with the following data analysis formula:

$$X = 1 - \frac{A}{B}$$

Information:

X = Functionality

A = Number of functions that failed the test

B = Sum of all functions

0 ≤ X ≤ 1.

Functionality is said to be good if it is close to 1.

E. Usability Aspect

In this aspect data collection was carried out using the questionnaire method. Of course, the questionnaire used will be adjusted to the sub-characteristics of the ISO 9216 standard.

Because this system has two actors consisting of admins and general users, in this study a sample of students and librarians was taken. Admin is represented by librarians and general users are made up of students with a minimum of 20 people. According to Neilsen, for quantitative research, the number of respondents to test the usability factor is at least 20 people.

The scale used in testing the usability factor uses a Likert scale so that later it can be concluded about the feasibility of the software from the user's point of view. The Likert scale is used to measure attitudes, opinions or perceptions of a person or group of things, in terms of user opinions of the software being developed [10]. There are 5 kinds answers in each questionnaire item.

This usability questionnaire uses a 5-level scale. The scale is in the form of a checklist or can be said to choose a choice from the 5 existing scales. The scale is divided into 5 sections, namely Strongly Agree, Agree, Undecided, Disagree, and Strongly Disagree [10].

The score obtained on each of the questionnaire results is then taken as an average value. The average of each respondent is added up and then the total average value is calculated. With this data, it is then converted to qualitative data on a scale of 5. Converting quantitative data to qualitative data on a scale of 5 uses rules which are modifications of the rules developed by Sudijono in Cahyaningrum [11] as in Table 1.

F. Product Description

The product developed is a reference book management information system which is an information system used to manage matters related to book collections and theses or final assignments at the Department of Electrical Engineering, State University of Malang. In its implementation the product is named the Library Information System (SIPERPUS). The information system developed uses the Model View Controller (MVC) method to provide convenience in the process of product development and maintenance. This information system can be accessed via the following page (<http://elektro.um.ac.id/siperpus>).

TABLE I. USABILITY QUALITY FACTOR ASSESSMENT CATEGORY

Intervals		Descriptions
X > Mean + 1.5 SDi	X > 4.00	Very Feasible
Mean + 1.5 SDi < X ≤ Mean + 0.5 SDi	4.00 < X ≤ 3.34	Eligible
Mean + 0.5 SDi < X ≤ Mean - 0.5 SDi	3.34 < X ≤ 2.67	Adequate
Adequate - 0.5 SDi < X ≤ Mean - 1.5 SDi	2.67 < X ≤ 1.99	Not feasible
X ≤ Mean - 1.5 SDi	X ≤ 1.99	Very Ineligible

### III. RESULT

The access rights contained in this information system are divided into 2 users, namely librarians and students. Each access right has different features. Following are the features in Siperpus for each access right.

#### 1) Library Officer Access Right

Features that can be accessed by librarians are: (a) view statistics on book collections and theses or final assignments; (b) adding data on book collections and theses or final assignments; (c) print the book collection code and thesis or final project; (d) provide verification of receipt of thesis collection or final project; (e) perform a data search for book collections and theses or final assignments.

#### 2) Student Access

While features that can be accessed by students are searching data for book collections and theses or final assignments.

### B. Product Implementation

The implementation of software development is a continuation of the design stages that have been previously designed which are then implemented in the program code so that the software can be used.

The development of this product is carried out using the help of a framework to facilitate development. The Codeigniter framework is used as an implementation of the model-view controller (MVC) concept.

### C. Test result

#### 1) Functionality Aspect Feasibility Test Results

Testing the functionality aspect is carried out by an information system expert. Testing by system experts is used to test and determine the performance and functionality of all the features in the information system. The results of the feasibility test for information system functionality are shown in Table 2 to get a maximum score of 1 (one).



Fig. 2. View of Student Access Rights Page



Fig. 3. Display of Library Officer Access Rights Page

TABLE II. FEASIBILITY TEST RESULTS FOR THE FUNCTIONALITY ASPECT

No	Hak Akses	Penilaian		
		∑test	∑success	∑fail
1	Library Officer	22	22	0
2	Student	5	5	0
Total		27	27	0

Based on the results of functionality testing using test cases, the results are as shown in Table 2. The test results in the table are calculated using the following formula.

$$X = 1 - \frac{A}{B}$$

$$X = 1 - \frac{0}{27}$$

$$X = 1 - 0$$

$$X = 1$$

Based on ISO 9126 on the aspect of functionality, it can be said that software is said the better if the calculation results are close to 1 [12]. Because of the test results has a maximum value of 1, then the software meets the functionality aspect.

### D. Usability Aspect Feasibility Test Results

Testing of the reference book management information system on student access rights was carried out to measure system performance in terms of usability at the student access level. Testing conducted by 37 respondents came from students in the Department of Electrical Engineering, State University of Malang. Results usability trials on student access rights were shown to get a result of 3.94 out of the average total score obtained.

Testing the reference book management information system on librarian access rights conducted to measure system performance from usability at the access level of librarians. The test was carried out by two respondents who were librarians and laboratory assistants at the Department Electrical Engineering, State University of Malang. Usability test results on librarian access rights get a result of 4.12 from the average total score obtained.

### IV. DISCUSSION

Based on the results of trials conducted on the reference book management information system for each access right, the results of the eligibility of the information system in terms of functionality are shown in Fig 4. Based on the graph shown in Figure 4, it was found that the test case results in each access right there is no functionality failure in each of its features. Based on the results the calculation shows a result of 1 which means that it is in accordance with ISO 9126 on the aspect of functionality that the software is said to be getting better if the calculation results are close to 1. Because of the test results has a maximum value of 1, then the software meets the functionality aspect of ISO 9126, so that the developed reference book management information system can be used in the Department Electrical Engineering, State University of Malang.

### Hasil Uji *Functionality* Sistem Informasi Pengelolaan Buku Referensi

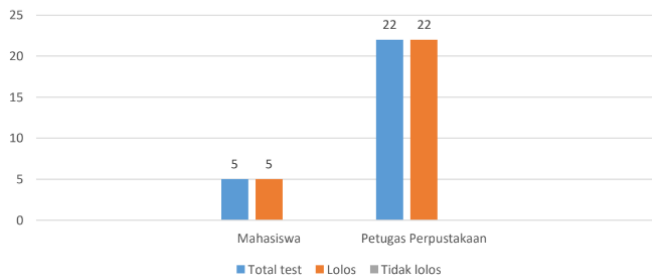


Fig. 4. Graph of Test Results for Functionality Aspects

### Hasil Uji *Usability* Sistem Informasi Pengelolaan Buku Referensi

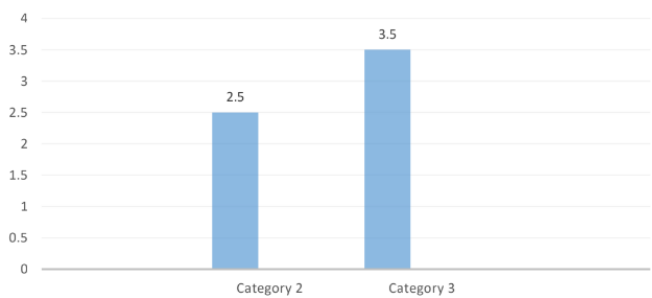


Fig. 5. Graph of Usability Aspect Trial Results

Furthermore, based on the results of trials conducted on information system users management of reference books for each access right, the results of the information system due diligence in terms of usability shown in Figure 5.

The percentage of eligibility shows an increase in the effectiveness of services in the TEUM department. Matter similar to the research conducted by Susanto et al. entitled "Development Management Information System for Educators and Education Personnel" [13]. Level of effectiveness and efficiency of the product developed shows the maximum percentage of results, usefulness of the application can be seen from the ease with which the school can access information.

Based on the graph shown in Figure 5, the average percentage of test results is obtained test reusability of all permissions or test subjects of 4.03. Based on criteria the validity of the system shown in Table 2, the average result of this value is classified as "Very worthy". It can be said that the reference book management information system complies characteristics of ISO 9126 on usability aspects namely Understandability, Learnability, Operability, and Attractiveness, so that the developed reference book management information system is feasible used in the Department of Electrical Engineering, State University of Malang.

In the graph of Figure 5 some access rights have a lower percentage compared with other access rights, for example on student access rights. This can happen because of the system reference book management information is still not able to provide a responsive display for certain devices or devices,

other than that the use of fonts in the information system is still considered too small and difficult to read by some users of this information system.

The percentage of results is also due to the tap on the validation results on student access rights there are several displays that are less responsive such as no character cutting when there are book titles that are too long so that they appear to fill the table. The reason for this is during the system development stage the developer performs debugging or testing using short titles so don't consider book titles that are long or exceed 20 characters so that it fulfills the existing book description table. This is in accordance with the findings in a research that the design of a good learning system that supports scientific learning can increase students' creative thinking at school [14], [15].

## V. CONCLUSIONS

Based on the results of the discussion on the research that has been done, the following product review have answered the formulation of the problem created or designed for the development purposes. Can it can be concluded that the development objectives that have been fulfilled are as follows. Reference book management information system based on Model View Controller (MVC) developed using the Codeigniter framework with a system development process or stages This information refers to the waterfall development model which consists of the stages of analysis, design, coding, to testing. This product is described through the unified modeling language (UML) as product documentation. Feasibility testing on this information system refers to several aspects of existing testing in ISO 9126, namely aspects of functionality and usability. The test results on the functionality aspect get a value of 1 (good) and the software is declared to have fulfilled the functionality aspect. Testing on the usability aspect by users is carried out by all access rights to the information system namely: (1) students with a total of 37 respondents were declared "Eligible" and gave a value of 3.94. (2) Librarians with a total of two respondents got a value of 4.12 and stated "Very worthy". Usability test average results of all access rights (students and librarians) of 4.03. So it can be concluded that the reference book management information system can declared "Very feasible" and can be used in the Department of Electrical Engineering, State University of Malang.

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