Software Requirement Specification for Learning Management System Design

Eka Larasati Amalia[1], Vivin Ayu Lestari[2], Vivi Nur Wijayaningrum[3], Moch Zawaruddin Abdullah[4], Nabilah Argyanti Ardyaningrum[5], Widiareta Safitri[6]

[1,2,3,4,5,6] State Polytechnic of Malang, Malang 65142, Indonesia
[1] eka.larasati@polinema.ac.id
[2] zawaruddin@polinema.ac.id
[3] vivin@polinema.ac.id
[4] nargyanti@gmail.com
[5] vivinurw@polinema.ac.id
[6] wretasafitri33@gmail.com

Abstract. The need for online learning media is increasing during the pandemic to ensure the teaching and learning process continues to run well in vocational high schools. The variety of learning media used for a subject causes inefficient learning activity. Therefore, this research proposes a Learning Management System design using the Software Requirement Specification to meet all user needs in system development. The use of the Software Requirement Specification is necessary because of the complexity of the functions possessed by the developed Learning Management System. The Software Requirement Specification used in this development complies with IEEE standards. As a result, the LMS design created using SRS provides a complete picture of the required components and constraints according to user needs. The development of this LMS can facilitate the online teaching and learning process where students and teachers can carry out activities according to the conditions specified.

Keywords: Learning, Media, Online, Teaching, Vocational

1   Introduction

The development of information technology in the field of education has increased significantly. It can be seen from the variety of methods and learning media used by teachers during the learning process so that the quality of learning outcomes can be improved [1]. The problem that Vocational Schools have in the online learning process is how schools can establish an effective learning environment since the learning process in Vocational Schools is more of a practice to develop the competency of vocational students [2][3]. Furthermore, the online learning process necessitates the utilization of learning media, resources, or relevant teaching aids to help students grasp the information being taught [4]. Several online platforms are used as learning media, but WhatsApp Group is the most used since it is simple to use and has numerous capabilities [5]–[7]. On the other hand, however, students are not yet prepared to study actively,

collaboratively, and independently via WhatsApp Group [8], which makes WhatsApp Group less effective for online learning.

One way to overcome this problem is to develop a Learning Management System (LMS) to facilitate online learning activities [9]. An LMS may be an effective platform for the learning process, particularly while working on test sets. Previously, various tools such as Quizizz, Kahoot, and Google Classroom aided with the learning process. However, some features are not possible with the three systems, such as Quizizz, which cannot show multiple choice questions with more than one right answer, assesses replies in the form of essays, and cannot display quiz questions/exams starting automatically. The disadvantages of Google Form are that it does not have a processing time for each inquiry and cannot show quiz questions or auto-stop tests. For those problems, LMS can be a solution to overcome because LMS is very flexible and adapts to the needs of users, both students, and teachers. LMS refers to numerous systems that give students, professors, and administrators with online educational services [10]. Its primary role is to support, organize, arrange, and administer training courses [11]. With a variety of functions and features, the LMS has very complicated specifications that need the creation of a Software Requirement Specification (SRS). SRS is a formal document that specifies what developers must include in the software they create. SRS will be very beneficial in testing since it can locate documents relevant to user requirements and software controls [12][13].

The use of SRS has been widely used in previous research, one of which was done by Susilowati et al. The goal of this research is to understand the requirements for developing a citizen database information system, which will be accomplished by creating an SRS for a citizen database information system based on ISO/IEC/IEEE 29148-2011 [14]. Then, another study was conducted by Daulay et al, to improve the quality of E-Learning at Harapan University Medan by utilizing SRS according to IEEE standards [15]. System development using SRS is proven to ensure that the system is developed according to the user needs.

State Vocational High School 9 Malang currently uses Google Classroom, WhatsApp, and several other platforms as learning media used by students and teachers. The existence of several learning platforms causes inefficient learning activities, so LMS is needed as a learning portal to support various teacher and student activities. In this study, LMS was created using the SRS design to ensure that the system built meets user needs. SRS defines all the requirements that must be met for the system to function properly. These criteria often depict characteristics of underdevelopment systems [16].

2   Research Methodology

In developing LMS for State Vocational High School 9 Malang, methods, observations, and literature studies are used to obtain software requirements according to user needs.

2.1   Software Requirement Specification

Institute of Electrical and Electronics Engineers (IEEE) standards were used to create the SRS in this study. The IEEE standards are related to the preparation of the SRS and are an approach to implementing how the SRS is determined.

1) Introduction
    a) Purpose: Provide detailed information on the requirements for creating LMS for Vocational High School to match the standards and demands of current users. LMS for Vocational High School is a method that may assist students and teachers in effectively conducting online learning.
    b) Scope of the Problem: LMS for Vocational High School includes elements that can help students study more successfully, such as filling out attendance forms, accessing learning materials, accessing and completing assignments, viewing results, and working on exams. Each user will be registered in the system as a student or teacher by admin.
    c) General Description of The Document: There are four primary components in the SRS document's introduction, including an explanation of the SRS, the purpose of making the SRS, the scope of the software problem to be handled, and a whole explanation of the SRS design.
2) The Global Software Description
    a) Product Perspective: LMS for Vocational High School is a system that assists teachers and students with online teaching and learning activities. LMS may be accessible over the internet at any time and from any location.
    b) Product Function: The results of the developed LMS are divided based on actors who can access system as follows:
        • To use the LMS functionality, admin, teacher, and student devices must be linked to the internet
        • All users must be logged into the system so that the types of roles can be distinguished
        • Admin enters data into the system for students, teachers, classes, and subjects
        • The LMS function is accessible to teachers and students via the login option
        • Teachers can upload assignments and learning materials (files, texts, or links) into the system
        • Students can upload their assignments into the system
        • The database will hold learning materials (file, text, or link) as well as teacher assignments
        • Attendance forms filled out by students can be saved in database
        • Students can use the LMS to obtain resources and practice test questions

- Student grades recorded by the teacher can be saved in the database

Specifications for developing LMS are based on requirements that include the functionality of the system to be designed and the required environment. The software requirements specifications for LMS are shown in Table 1.

Table 1. LMS Functional Requirements

Actor	Description	Functional Code
Admin	Manage Study Period	SRS-F-A01
	Manage Department	SRS-F-A02
	Manage Question Types	SRS-F-A03
	Manage Teacher Data	SRS-F-A04
	Manage Student Data	SRS-F-A05
	Manage Subjects	SRS-F-A06
	Manage Class Data	SRS-F-A07
	Logout	SRS-F-A08
Teacher	Manage Student Attendance Data	SRS-F-T01
	Manage Learning Materials	SRS-F-T02
	Manage Assignments	SRS-F-T03
	Give Grades	SRS-F-T04
	View Grades	SRS-F-T05
	Manage Exam Questions	SRS-F-T06
	Create Exam Sessions	SRS-F-T07
	Manage Account	SRS-F-T08
	Logout	SRS-F-T09
Student	Fill in Attendance Form	SRS-F-S01
	Download Learning Materials	SRS-F-S02
	Download Assignments	SRS-F-S03
	Submit Assignments	SRS-F-S04
	Take Exams	SRS-F-S05
	View Grades	SRS-F-S06
	Manage Account	SRS-F-S07
	Logout	SRS-F-S08

In addition to functional requirements, several non-functional requirements must also be met in developing an LMS which is shown in Table 2.

Table 2. LMS Non-Functional Requirements

Description	Non-Functional Code
LMS can be operated for 24 hours	SRS-NF-N01
LMS has a response time of no more than 5 seconds	SRS-NF-N02
LMS can be accessed through several web browsers, such as Google Chrome, Mozilla Firefox, and Microsoft Edge	SRS-NF-N03

2.2   Detailed Description of Needs

In performing software development, several system designs are needed to provide an overview of the system specifications that must be used, so that system development runs optimally.

1) External Interface Requirement: Some interface descriptions are required when developing the system, such as user interface, hardware and software interface definitions.

    a) User Interface: In the LMS, the user interacts with the system through a user interface presented on a web page.

    b) Hardware Requirements: The following is a list of hardware used to develop the LMS, described in Table 3.

Table 3. Hardware Requirements

Hardware	Specification
Processor	Intel Core i3
RAM	4 GB
Harddisk	1 TB

    c) Software Requirements: Table 4 is a list of software used in developing LMS

Table 4. Software Requirements

Software	Specification
Operating system	Windows 10
Web Browser	Google Chrome
Main software	Visual Studio Code
Program Language	PHP, JavaScript
Framework	Laravel
Database	MariaDB
Text Editor	Visual Studio Code

2) Software Functional Description: Several requirements are needed for the functional system to know how the system will run according to its function. It consists of defining a use case diagram to explain the role of each actor in running the system. The use case diagram of the automatic assessment system in LMS has three actors, namely student, teachers, and admin [9], where each actor has their role.

In Fig. 1, students have a role to perform various actions, such as filling out attendance forms, accessing and downloading learning materials so that they can be studied offline, submitting assignments given by the teacher, viewing the assessment grades given by the teacher, taking exams, and managing student account. Meanwhile, teachers have a role in the LMS to perform various actions, such as managing student attendance data, managing learning materials for students, managing assignments, giving grades for students, managing exam questions, creating exam sessions, and managing teacher account. On

the other hand, the admin role is to carry out various settings in the LMS, such as managing data for teachers, students, classes, subjects, department, study period, and question types.

Fig. 1. Use Case Diagram

3   Result and Discussion

LMS for State Vocational High School 9 Malang is the implementation of system de-sign using the SRS method. This LMS developed using Laravel Framework which has several features according to the type of account used, such as student, teacher, and admin accounts. The user is required to log in using a username and password, as illus-trated in Fig. 2.
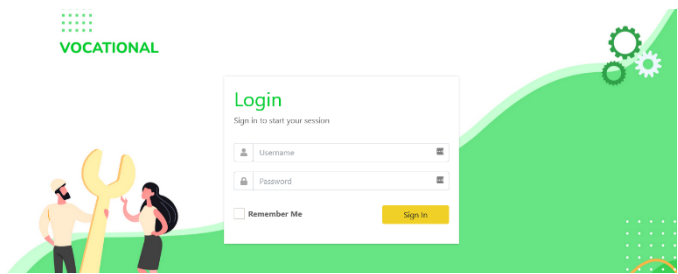
Fig. 2. Login Page

3.1 Student Role

1) Fill in Attendance Form: On the attendance page, students can see the history of the attendance of each subject that is followed. Students can also change their attendance status to present or absent, by pressing the presence button in the action column. This attendance page is illustrated in Fig. 3.

Fig. 3. Attendance page for student

2) Take Exams: On the exam page illustrated in Fig. 4, students can take the exam with various question types provided by the LMS, such as multiple-choice and essay questions. Students are required to answer questions correctly.
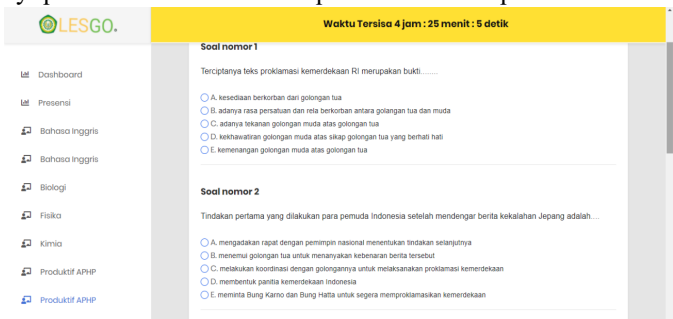
Fig. 4. Exam page

3.2   Teacher Role

1) Manage Student Attendance Data: On the attendance page illustrated in Fig. 5, the teacher can manage attendance for students in each class. Teachers can see a list of student attendance who joins the selected class.
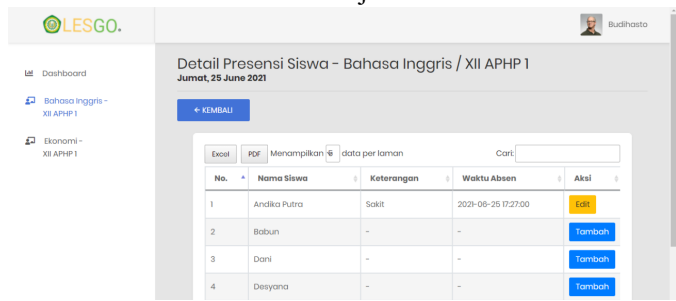
Fig. 5. Attendance form management page

2) Manage Exam Questions: On the exam page in Fig. 6, the teacher can manage the list of tests held in the selected class. Teachers can create new daily tests and create questions, both multiple choice and essay. Teachers can also enter answer keys on the LMS to facilitate reassessment.
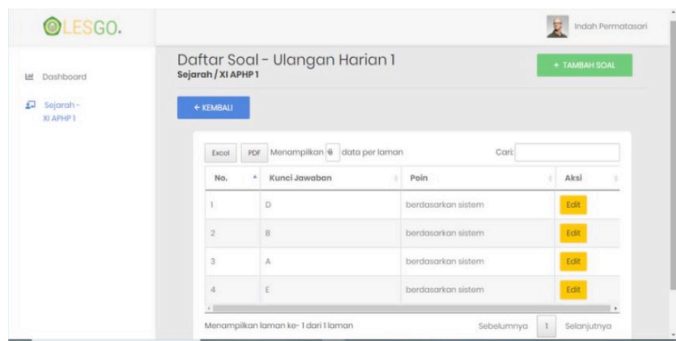
Fig. 6. Exam management page

3.3   Admin Role

1) Manage Teacher Data: On the teacher account management page, admin can manage teacher accounts. In Fig. 7, admin can see a list of active and inactive teacher accounts. On this page, admin can choose various commands to manage teacher accounts, such as create, edit, and delete teacher accounts. Admin can create teacher's data from importing data from file with .csv format.
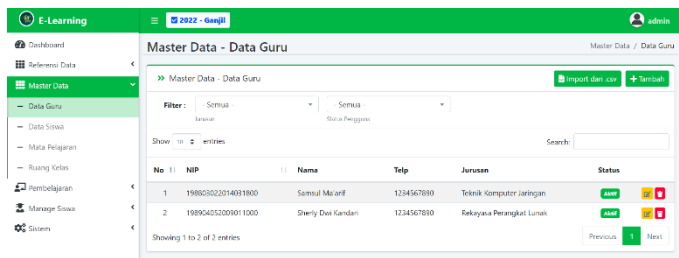
Fig. 7. Teacher account management page

When creating or editing an account, the admin is required to fill in the account creation/change form illustrated in Fig. 8, such as username, major, NIP or NIK (teacher ID), name, birthplace and birthdate, religion, email, and phone number, address, passwords, and status.
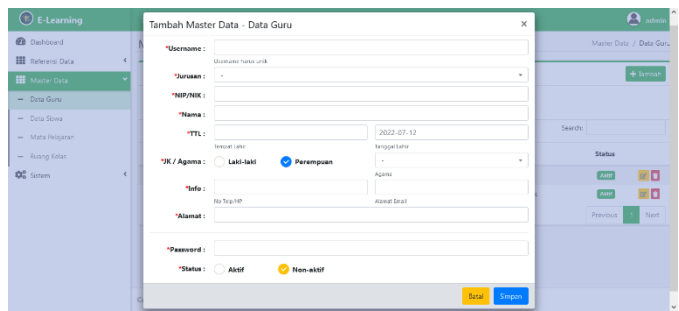

Fig. 8. Teacher account creation page

2) Manage Student Data: On this page, admin can manage student accounts. In Fig. 9, admin can see a list of student accounts, create student accounts, edit student account data, and delete student accounts. Admin can create student's data from importing data from file with .csv format.
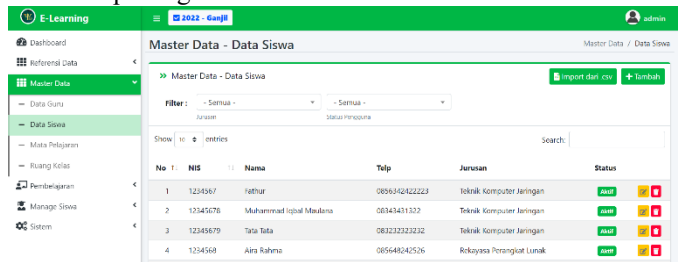
Fig. 9. Student account management page

When creating or editing an account, admin is required to fill in form illustrated in Fig. 10, such as username, major, NIS or student ID, name,

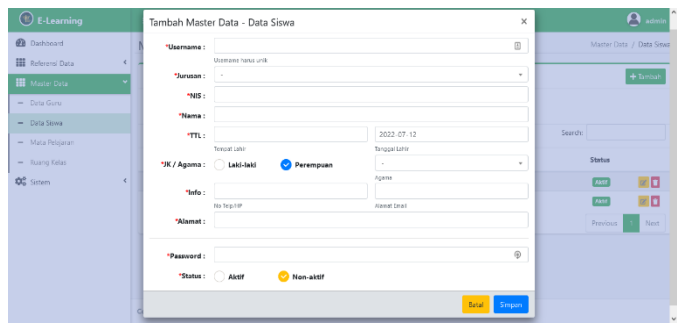birthplace and birthdate, religion, email and phone number, address, password, and status

Fig. 10. Student account creating page

3) Manage Study Period: Period management page illustrated in Fig. 11 contains the academic year. Admin can view, add, edit, and delete the list of available periods.
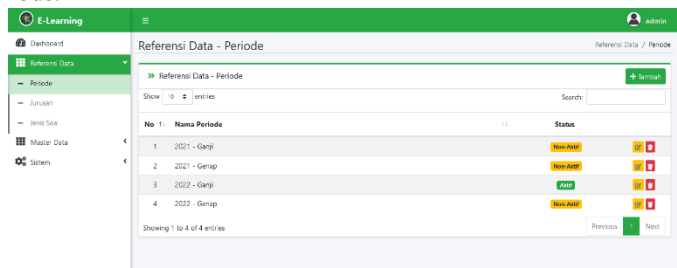

Fig. 11. Period management page

4) Manage Department: On the department management page illustrated in Fig. 12, the admin can see a list of majors, which consists of the code and name of the department. The admin can also add, edit, and delete the list of departments in the school.
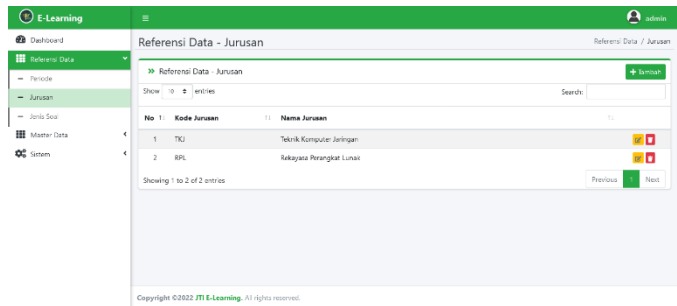

Fig. 12. Department management page

5) Manage Question Types: The question type management page illustrated in Fig. 13 contains the question types used in the LMS, for example, multiple choice or essay. The admin as a manager can add, edit, or delete question types.
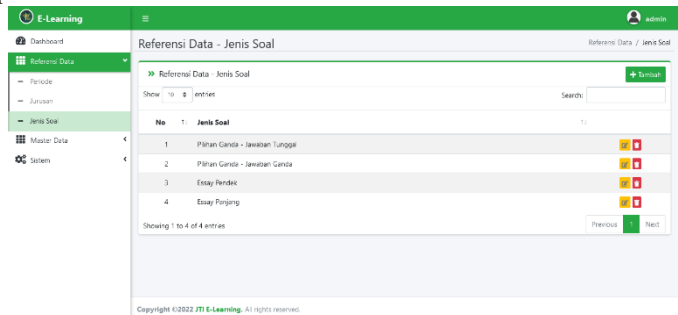

Fig. 13. Manage Question Type

After implementing the system, the next stage of testing is carried out to test the system that has been made whether the resulting application program has run as needed. The assessment criteria for the functional test validation instrument are given by providing two answer choices, namely "pass" and "failed". Below are table of functional test results, described as test case in Table 5, Table 6, and Table 7.

Table 5. Test Case for Admin Role

Test Case ID	Test Case	Expected Result	Actual Result	Status
SRS-F-A01	Manage Study Period	Successfully manage study period	Successfully manage study period	PASS
SRS-F-A02	Manage Department	Successfully manage department	Successfully manage department	PASS
SRS-F-A03	Manage Question Types	Successfully manage question types	Successfully manage question types	PASS
SRS-F-A04	Manage Teacher Data	Successfully manage teacher data	Successfully manage teacher data	PASS
SRS-F-A05	Manage Student Data	Successfully manage student data	Successfully manage student data	PASS
SRS-F-A06	Manage Subjects	Successfully manage subjects	Successfully manage subjects	PASS
SRS-F-A07	Manage Class Data	Successfully manage class data	Successfully manage class data	PASS
SRS-F-A08	Logout	Successfully do logout	Successfully do logout	PASS

Table 6. Test Case for Teacher Role

Test Case ID	Test Case	Expected Result	Actual Result	Status

SRS-F-T01	Manage Student Attendance Data	Successfully manage student attendance data	Successfully manage student attendance data	PASS
SRS-F-T02	Manage Learning Materials	Successfully manage learning materials	Successfully manage learning materials	PASS
SRS-F-T03	Manage Assignments	Successfully manage assignments	Successfully manage assignments	PASS
SRS-F-T04	Give Grades	Successfully give grades	Successfully give grades	PASS
SRS-F-T05	View Grades	Successfully view grades	Successfully view grades	PASS
SRS-F-T06	Manage Exam Questions	Successfully manage exam questions	Successfully manage exam questions	PASS
SRS-F-T07	Create Exam Sessions	Successfully create exam sessions	Successfully create exam sessions	PASS
SRS-F-T08	Manage Account	Successfully manage account	Successfully manage account	PASS
SRS-F-T09	Logout	Successfully do logout	Successfully do logout	PASS

Table 7. Test Case for Student Role

Test Case ID	Test Case	Expected Result	Actual Result	Status
SRS-F-S01	Fill in Attendance Form	Successfully fill in attendance form	Successfully fill in attendance form	PASS
SRS-F-S02	Download Learning Materials	Successfully download learning materials	Successfully download learning materials	PASS
SRS-F-S03	Download Assignments	Successfully download assignments	Successfully download assignments	PASS
SRS-F-S04	Submit Assignments	Successfully submit assignments	Successfully submit assignments	PASS
SRS-F-S05	Take Exams	Successfully take exams	Successfully take exams	PASS
SRS-F-S06	View Grades	Successfully view grades	Successfully view grades	PASS
SRS-F-S07	Manage Account	Successfully manage account	Successfully manage account	PASS
SRS-F-S08	Logout	Successfully do logout	Successfully do logout	PASS

4 Conclusion

The development of an LMS for Vocational High Schools needs to be supported by a clear and complete definition of functional and non-functional requirements. The features defined in the SRS are of primary concern during the design process. The LMS design created using SRS provides a complete picture of the required components and constraints according to user needs. The development of this LMS can facilitate the

online teaching and learning process where students and teachers can carry out activities according to the conditions specified.

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