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PIECES Model Implementation Analysis and Design of Hybrid Edu Smart Learning Management System

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Abstract

The change in the learning paradigm during the current COVID-19 pandemic is absolutely necessary, this is an effort to prevent the transmission of the virus. Face-to-face learning activities that are usually carried out in class must change to a hybrid model or limited face-to-face. The research objective to be achieved is to produce an Edu Smart Learning Management System (LMS) design complete with requirements specifications for the development of the Edu Smart LMS in order to facilitate the management and presentation of information on distance learning activities and learning management carried out with the Edu Smart LMS. The needs in this study are Functional Requirements which are requirements related to the function of information system products and Non-Functional Requirements. The PIECES model analysis was used to determine the requirements of the Edu Smart LMS. The results of this study indicate that the PIECES model can be used in analyzing the problem so that the main problem is specifically obtained to design an Edu Smart LMS. The Learning Management System was built to show easy access for users with web-based or mobile (Hybrid) platforms, its features are capable of processing data and information in the distance learning process.

Keywords: PIECES model, Learning Management System, Edu Smart, Functional Requirements, Non-Functional Requirements, Distance Learning.

INTRODUCTION

The impact of the covid-19 pandemic that is currently happening is that educators are starting to implement and transform knowledge in a virtual way [1]. Information Technology is a solution to overcome this. Technology is the design of important steps to minimize doubts about the causal relationship in achieving the expected results [2]. Information is data that has been processed into a form that has meaning for the recipient and is useful for current or future decision making [3]. Information Technology is a technology that helps humans to create, change, store, communicate and/or disseminate information [4]. Learning Management System is one of Information Technology in the field of education. LMS is a system used to manage web-based learning resources or better known as e-learning [5].

The research objective to be achieved is to produce an Edu Smart Learning Management System (LMS) design complete with requirements specifications for the development of the Edu Smart LMS in order to facilitate the management and presentation of information on distance learning activities and learning management carried out with the Edu Smart LMS. The needs in this study are Functional Requirements which are requirements related to the function of information system products and Non-Functional Requirements which are the needs of supporting information system products such as hardware, tools used for system development, performance and others [6].

METHOD

The method used in this research process can be presented in Figure 1 below.

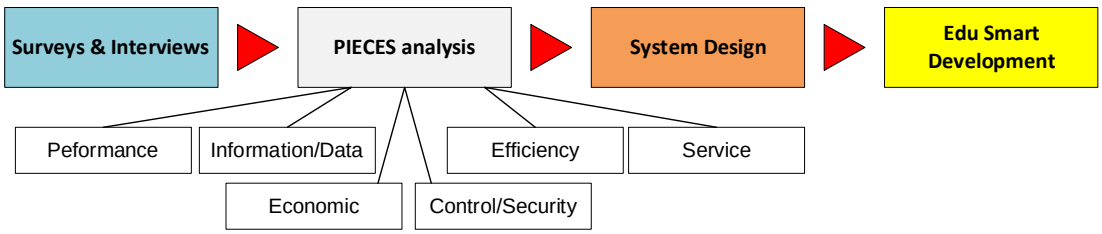

Figure 1. Research Method

The research started from conducting surveys and interviews with stakeholders to obtain data to be analysed in this case the principal, subject teachers and students. PIECES analysis is carried out to correct or improve the system in terms of problems that exist in the current system procedures, carried out using six evaluation variables, namely Performance, Information/Data, Economic, Control/Security, Efficiency, and Service [7]. The PIECES analysis carried out, obtained a scenario of technology needs. The next step is to determine the information system requirements by identifying information requirements and identifying functional and non-functional. After all functional and non-functional requirements are obtained, the system design process is carried out using an object-oriented approach and a Hybrid-based Edu Smart LMS is developed.

RESULTS AND DISCUSSION

In the results and discussion section, we will explain the application of PIECES analysis, the results of the analysis, and the proposed technology needed for the Edu Smart LMS.

1. Analysis of the current system

   At this time of the current pandemic, the learning process is generally carried out remotely with various considerations, especially preventing the transmission of the Covid-19 virus. The distance learning process is constrained by several factors, both technical and non-technical, including tools, learning media and learning administration. The management of distance learning that has been carried out has not been accommodated properly so that various problems are faced by schools, teachers and students. Table 1 shows the classification of problems that can be identified with the PIECES model.

Table 1. Classification of Problems with the PIECES Model

Factor	Current System
Throughput	The number of school students doing distance learning during the current COVID-19 pandemic at the same time in different places causes a high risk of human error in learning management.
Response Time	The conventional distance learning activity data management process affects requests for information which may take time
	The amount of data that is managed is not accommodated with easy search facilities
Output	Lack of relevant and necessary information/reports on distance learning activities
	Inaccurate information
Data	Student data, teachers, materials, attendance, assignments, learning activity journals are not well organized
	Data access is not flexible to meet the desired information needs.
Costs and benefits	Costs in the use of paper and stationery used in the learning process, assignments and assessments. The more data is stored the more paper is used, this costs more from students and schools.
Control	The distance learning process is currently not accommodated using a good system to manage activity data properly and get the information needed
	The control that the teacher does to process large amounts of data in distance learning activities can cause errors in inputting
Security	Storage of files in the form of documents can cause loss or even damage if there is no storage on the system
Efficiency of time, effort and cost	The time needed to process subject data, student data, teacher data, schedules, assignments and exam results requires more time
	The conventional data search process can take more time, causing a decrease in the quality of the operational process

Factor	Current System
	Excessive use of paper can affect spending
Service	The process of distance learning and sharing of materials and learning media has not been well organized.
	The attendance process, assessment of assignments, assessment of test results, sharing of learning materials, collection of assignments, collection of test results was not well organized.

2. Problem Analysis and Proposed Technology

From the analysis and scope that has been classified using the PIECES model, the problems and impacts as well as the proposed new system, which are presented in Table 2.

Table 2. Table of Problem Analysis and Proposed Technology

Problem	Impact	New system proposal
Remote learning management process that is still conventional	High risk of human error in data management and data and information search process takes time	The system provides a search feature and a track record of distance learning activities for teachers and students
Lack of relevant information/reports	The resulting information is less accurate and there is no information control	The system provides information control and validation features
Teacher data, students, subjects, materials, assignment results, exam results, attendance are not well organized	Data access is not flexible, so it slows down the handling of data collection and information recap	The system provides data collection features that are stored in a good database for easy access to information
Running processes are only handled by one actor	Human errors often occur and high waiting times when demand is high	The system provides data access features according to the access rights of each actor (Admin, Teacher, and Principal)
The current process has not accommodated data integration between teachers, students and principals	Reports on distance learning activities take a lot of time	The system can integrate each actor so that they can access data and information so that teachers can input grades online, students can collect assignments, take exams online, school principals can monitor online learning activities.

3. Analysis of Data Requirements and Information Purpose

The following is the definition of data sources and information objectives defined by the actors involved in system operations, which are presented in Table 3.

Table 3. Data Requirements and Information Purposes in the System

No	Actor	Description Actor	Data and Information
1	Admin	The admin is the person who has full access to the Edu Smart LMS, in this case the principal	RPP data Student Data Teacher Data Material Data Presence Data Learning Data Task Data Exam Data Gamification Data RPP Information Material Information
2	Student	Students are users who can access the system to view lesson plans, view and download materials, upload assignments, input attendance, upload UTS/UAS, input learning journals.	Exam Data Learning Journal Data Presence Data Task Data RPP Information Material Information
3	Teacher	Teachers are users who have access to the system to edit profiles, manage lesson plans, manage materials, manage assignments, manage learning, manage exam questions, attendance settings, and gamification settings.	Teacher Data RPP data Material Data Learning Data UTS/UAS Question Data Presence Data Gamification Data

4. Analysis of Functional and Non-Functional Needs

1. Functional Requirements

Functional requirements are important things that must be fulfilled so that the system can run as proposed. Below is the functional software that must exist in the Edu Smart LMS.

a. System provides data management for Administrator

1. Admin can login to LMS Edu Smart, Admin can add data to the system such as admin data, RPP data, student data, teacher data, material data,

attendance data, learning data, assignment data, exam data, gamification data

2. Admin can edit existing data in the system such as admin data, lesson plans data, student data, teacher data, material data, attendance data, learning data, assignment data, exam data, gamification data and others.
3. Admin can delete all data such as admin data, RPP data, student data, teacher data, material data, attendance data, learning data, assignment data, exam data, gamification data and others

b. The system provides features for teachers

1. Teachers can login
2. Teachers can manage lesson plans
3. Teachers can update profile
4. The teacher can manage the material
5. Teachers can manage assignments
6. Teachers can manage learning
7. Teachers can manage exam questions
8. Teachers can manage attendance
9. Teachers can manage gamification

c. The system provides features for students

1. Students can login
2. Students can see the lesson plans
3. Students can view & download materials
4. Students can upload assignments
5. Students can make attendance
6. Students can upload UTS/UAS answers
7. Students can input learning journal

2. Non-Functional Requirements

Non-functional requirements are requirements that emphasize the behavioural properties of the system. Non-functional requirements consist of:

1. Data input can be done 24 hours from anywhere
2. Response Time in terms of validation is less than 1 second
3. The information presented by the system can be viewed every day 24 hours from anywhere according to the access rights of each actor.

4. The system can be designed with UML and built with PHP programming language and can be run by several web browser software including Internet Explorer, Google Chrome and Mozilla Firefox.
5. The system is able to run on a minimum server with 4GB memory specifications, Xeon Processor and operating system either Linux or Windows.

Based on the research that has been done by Farhan in the analysis of the use of technology for new student registration, the results show that there are three functional needs which include student data input, validation and displaying registrant quotas and 3 non-functional requirements which include response times, input time and information viewing time [8]. Research conducted by Ariel Ridsa focuses on functional requirements for searching files to solve file stacking problems and research conducted by Nurjamiah classifies functional requirements for users and administrators according to their respective access rights and required hardware and software requirements [9].

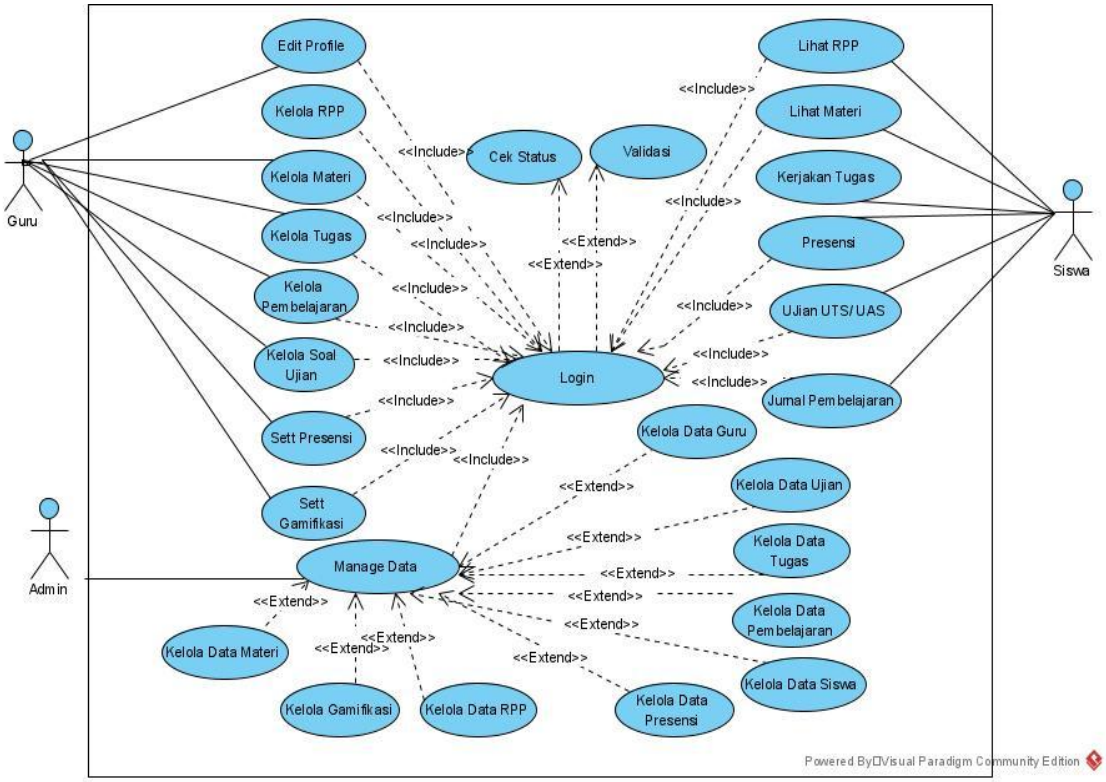

Figure 2. Use Case Diagram

In the use case diagram design that is formed there are three actors who play a role in the use of the Edu Smart LMS. The role of each actor can be seen clearly in Figure 2.

The access rights of each actor are restricted and checked in the login case. The management of data and information is fully handled by the administrator.

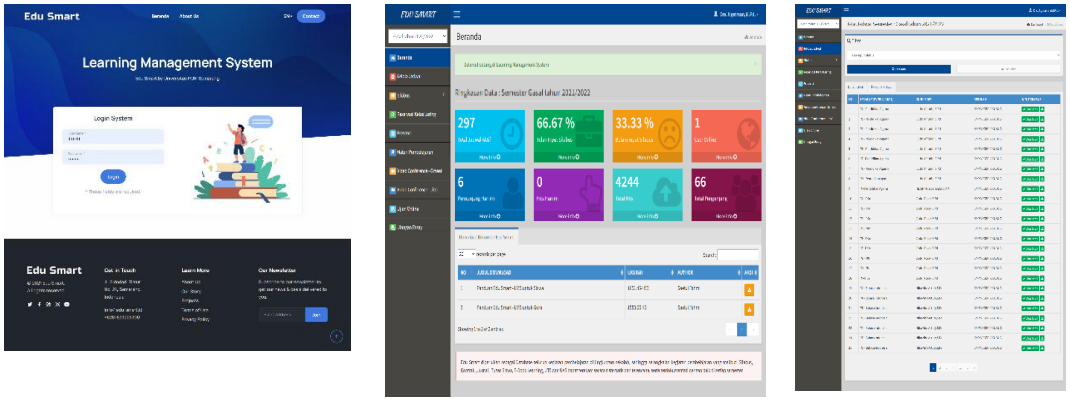

Figure 3. User Interface Edu Smart

Figure 3 is the result of the implementation of the Edu Smart LMS design, several features are presented in the Edu Smart LMS according to the design of the Use Case diagram. Edu Smart LMS can be accessed via https://edu-smart.id. Access to the Edu Smart LMS begins with entering the username and password to be able to access the features according to the access rights of each user as described in the use case diagram design which is the implementation of the results of functional and non-functional requirements analysis using the PIECES method.

CONCLUSION

PIECES can be used in analyzing problems, especially in processing student data, teachers, assignments, learning materials, attendance, midterm exams, final semester exams and gamification criteria, the proposed technology makes it easier for schools to manage learning during the COVID-19 pandemic both in terms of administrative or technical learning and functional and non-functional requirements that have been determined can provide the right roadmap in building an Edu Smart LMS which can be accessed via https://edu-smart.id.

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