

Intelligent Tutoring System Design for Computer Network Learning

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Abstract— There is a gap in the learning process of Computer Network in Informatics Education, Sebelas Maret University between Students from High School and Vocational High School. Some students with high school backgrounds do not have the basic concepts of Computer Networking, while students from SMK are already at a much more advanced stage. To bridge the thing then one solution that can be implemented is e-learning that offers independent learning system. E-learning developed will provide complete material, practice and video tutorials. In these research, unlike E-Learning that is the same (flat) for each user, E-Learning will be developed equipped with Machine Learning Naïve Bayes method. Machine Learning will help the learning process with a one-to-one approach, where the system will have the ability to detect the ability of students using E-Learning. The system adapts the material and exercises according to the user's ability in the independent learning process. In this development, it is still at the functional testing stage with the Blackbox method by the developer. Based on the testing conducted by the researcher, it resulted that all functions in the Value Processing Information System were running well. With a step-by-step tutorial and a different approach in the learning process, each student is expected to be able to improve students' understanding of Computer Network courses in PTIK, FKIP, UNS.

Keywords— *Intelligent Tutoring System, Computer Network, Naïve Bayes.*

I. INTRODUCTION

A. Background

The input of Informatics Education students, FKIP, UNS, is almost balanced from High School (SMA) and Vocational High School (SMK). From the results of the initial research using E-Learning in the first semester, there is a gap about basic concept between students from high schools and vocational schools. Some students with a high school background do not have an understanding of the concept of basic IT courses such as Introduction to IT, Computer Networks, Multimedia, and some other courses. While

students from Vocational High Schools are already in a much more advanced stage.

To bridge this, the need for a Self-directed learning method or media for students. Self-directed learning is the process of learning without the help of others and does not depend on the teacher, mentor, friend, or others. The teacher functions as a facilitator.

A. Student is free to determine or choose learning material learned.

In this study, we propose an E-Learning developed with Intelligent Tutoring System (ITS) using the Naïve Bayes method. Unlike conventional E-Learning which is the same for every user, ITS uses a smart system with a one-to-one approach. The ITS system will recognize each user from the initial test results provided. From the values obtained, then the system adjusts the material and training according to the user's ability in the independent learning process. With tutorials that are gradual and, different approaches in the learning process can improve students' understanding of the subjects in the PTIK Study Program FKIP UNS.

B. Intelligent Tutoring System

Definition of Intelligent Tutoring System (ITS) according to [1], is a computer system that aims to help students learn the material, provide instruction, an exercise or feedback to students (students) without intervention from humans. ITS was developed from three fields of science, namely: Computer Science (Artificial Intelligence), Psychology, and Education. By using this system, effectiveness in each teaching and learning in the classroom will be directed and systematic [2].

C. Intelligent Tutoring System Architecture

In the development of ITS, we use [11] and [4] model that is shown in Figure 4; there are four models consisting of:

1. Model Author / Teacher
2. Student / Student Model
3. Expert / Pedagogical Model
4. Model Interface

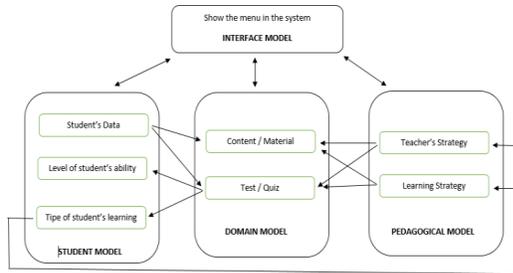


Figure 1. ITS Architecture [3]

D. Literature Review

There have been many studies on Intelligent Tutoring System (ITS) conducted. [7] Research on ITS for the first time in 1960 aimed at replacing human tutors. Furthermore, research in ITS implemented in the field of information technology has been widely carried out, among others: [7] in the Oracle Database 12c database learning process: SQL Fundamentals I. The system developed was named OITS. The system developed is equipped with exercises that must be completed by students. OITS has adaptive abilities to dynamically adjust progress for each. OITS is dynamically adapted at individual student-run times. The results of the study recommend implementing a system on all Oracle Materials.

Research conducted by [16] using the ITS application for C # programming language courses. The background of this study is the number of students who have failed in learning C # programming languages. Researchers argue that traditional learning methods cause students when the learning process has more pressure than understanding the material. For some students, this teaching model may not interest them. Researchers offer to learn C # using an Intelligent Tutoring System with the name ITSB. The results showed a positive response that the ITSB system helps students learn programming languages better.

While Research conducted by [8] uses the ITS application for the Mongo Database learning process. The ITS system is used to teach the basics database system using MongoDB (MDB) application. MDB contains database learning material for beginners that includes relational database systems and lessons in the process of installing and creating databases. The system has an exam for each level of learning. Evaluation is done to see the effectiveness of MDB among students and instructors. The final evaluation results are promising.

II. RESEARCH METHOD

This research uses research and development (R&D) methods. According to [9], R& D methods are research methods used to produce certain products. R & D research produces certain products that are used in research that is needs analysis and to test the effectiveness of these products so that they can function in the wider community; research is needed to test the effectiveness of these products.

The stages of system development in this study are as follows:

A. Communication

The communication phase begins with collecting data according to the needs of the user. Communication is done by conducting interviews, observations, and literature studies. The purpose of this stage is to plan a new system that is more efficient. From the results of the initial research using E-Learning, there is a gap in the initial understanding of students from those mentioned above. Then it needs an intelligent system that can detect the level or level of understanding of users.

B. Planning

After the communication phase, proceed to the planning stage. At this stage, the researcher designs the system requirements, system design, and work schedule. In the planning stage, the needs analysis for system development is carried out. We plan a special architecture Intelligent tutoring system like Figure 2 below:

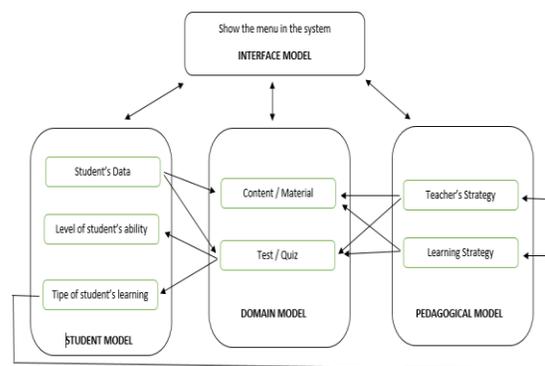


Figure 2. ITS Architecture

The system developed adopts a system according to [3] and [1] which consists of 4 models. The student model consists of three parts, such as student data, student ability level, and type of student learning.

Three components are related to the domain model to carry out learning and test activities. In the domain model, it consists of two parts such as material and tests or quizzes. The relationship with the student model is to provide an assessment to measure the level of student ability and type of student learning after participating in learning activities. The relationship with the pedagogical model is the teacher plans learning strategies to formulate material and quizzes that will be displayed on the system.

Users in this system are divided into three categories including administrators, teachers, and students. Each category has a different function, here are the functions of each category:

1. Administrators, a person who regulate and monitor all menus on the system to run smoothly, including adding teachers and students to the system.
2. The teacher is the user who manages the learning strategies that exist in the system, the teacher can manage the class, add material, conduct tests and can see the progress of students' understanding.
3. Students, the role of students in the system is that they can learn the material, do the tests and can see the results of the tests that have been done.

This system has some material/concepts that will be explained about Computer networks such as:

1. Computer Network Hardware
2. Types of Computer Networks
3. Computer Network Architecture
4. IP address
5. VLSM
6. Routing

To deliver computer network material, this system provides several learning media namely ppt, pdf, image, video, and packet tracer.

C. Modeling

At this stage focuses on the design of the system and the ability of the system to process information. Activities at this stage consist of making a system design that will be realized into an information system. The designs made include making a use case diagram design, flowchart design, DFD design, ERD design, database design, as well as making display designs.

1. Use case Diagram Design

The use case diagram design describes the access rights possessed by the user to the system. In this system, there are three system users, including admin, lecturer, and students. Use case system diagram can be seen in Figure 3.

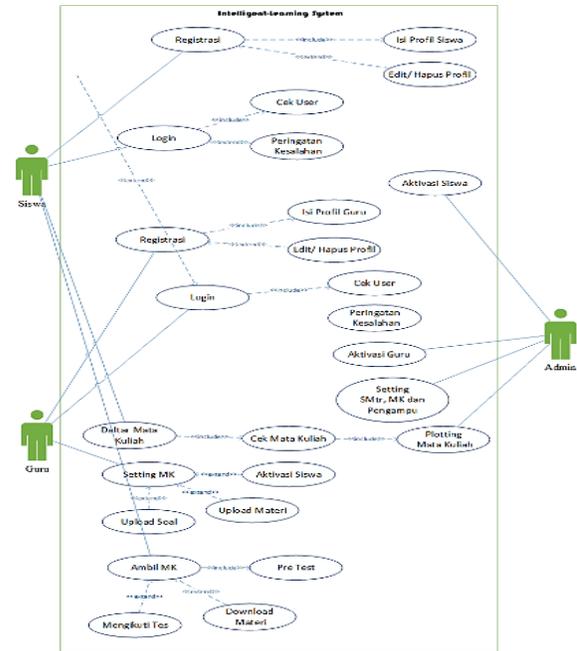


Figure 3. ITS Use Case Diagram

2. ERD design

ERD is an abbreviation for Entity Relationship Diagram. ERD describes the conceptual structure and relation of data contained in the value processing information system as shown in Figure 4.

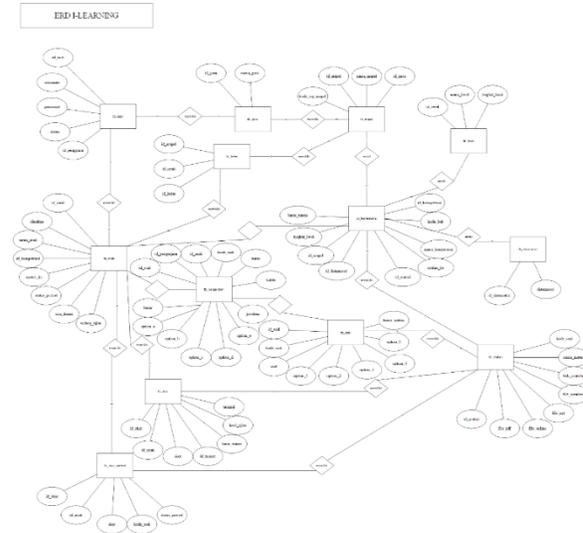


Figure 4. ERD design

3. Display Design

The display design needs to pay attention to the composition of the colors used, the level of comfort (user-friendly) and the level of dynamism of the display. The following forms of web-based value processing information systems are developed. Home and Dashboard system is shown in Figure 5.

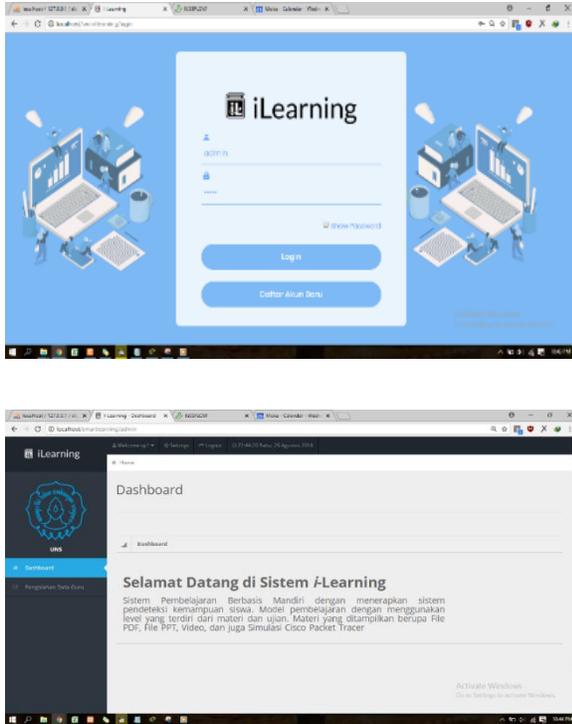


Figure 5. Home and Dashboard System

D. Construction

In developing the system using the waterfall development model [10], as shown in Figure 12. The waterfall model is a classical model that is systematic, sequential in building software. The steps of the waterfall method are (1) communication, (2) planning, (3) modeling, (4) construction, and (5) deployment.

E. Deployment

At this stage also tested the system using the Blackbox method and referred to the suitability of the system made with the needs that have been designed. Testing is done to determine the feasibility of the system that has been designed.

III. RESULTS AND DISCUSSION

The last stage in developing the I-Learning System is testing. The test was carried out by researchers using the Blackbox method, expert testing, and system user testing. In this study is still in the testing phase of Blackbox. Testing with the Blackbox method is a test conducted to determine the functionality of an information system. This method tests various functions in the system that are developed. Based on the tests carried out, all functions in the Information System are running well, and the

information system is ready to be tested by experts and users. Tests conducted include testing new student registration, teacher registration, uploading material, adding questions and tests on the system. Our test results are attached as shown in Figure 6 and Figure 7.

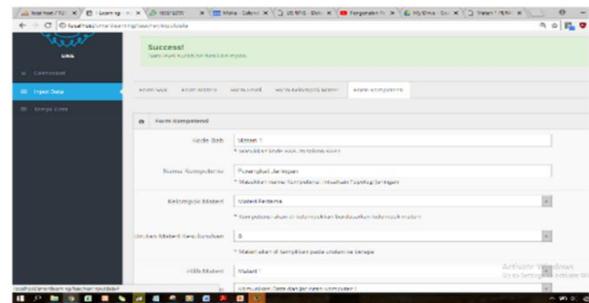
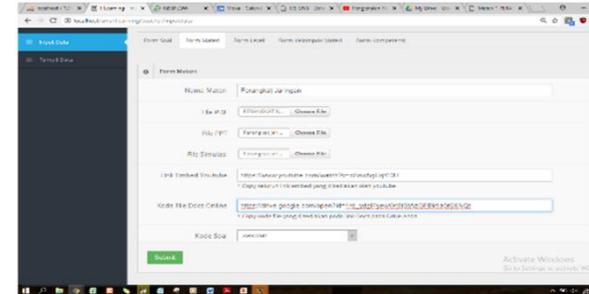


Figure 6. System Configuration

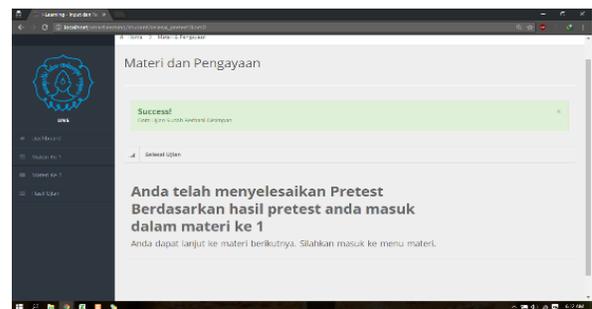


Figure 7. System Function Test

IV. CONCLUSION

Intelligent Tutoring System is a new system that helps the learning process interactively. This system helps the teacher to know the abilities and types of learning of each student by using more practical ways. Students can also use this system to study material independently, specifically and directed

In this paper, making intelligent learning guidance systems for computer networks can facilitate students to understand the material and evaluate learning outcomes easily and systematically with the facilities already provided on the system. Domains contained in intelligent guidance systems are interrelated so that the system can work properly.

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