

The design of expert system to determine the university majoring based on multiple intelligence using forward chaining method

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Abstract: An expert system is a form of artificial intelligence that uses a computer to perform tasks in a way similar to that of humans. It is designed to possess the reasoning and problem-solving abilities of an expert in a particular field. However, an expert system cannot replace an actual expert, such as a psychologist acting as a consultant for students seeking to recognize their potential and abilities. Rather, the expert system should be viewed as a tool with limited capabilities. The challenge lies in designing tools to aid students in identifying their potential and abilities, enabling them to make informed decisions when choosing a department at university. The expert system designed to assign departments at university based on multiple intelligence uses the Visual Basic programming language and Microsoft Office Access as a database.

Keywords: Expert systems; Artificial intelligence; Multiple intelligences; University, Choice method

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1. Introduction

Education is an effort made by students to create a learning process so that students can develop their potential to be useful for themselves, the nation, the state and society. Education as stated in the GBHN (1973) is a conscious effort to develop personality and abilities inside and outside school that last a lifetime. One of the educational pathways in Indonesia is Middle School. Middle School is an integrated part of the national education system, where Middle School also has an important role to form competent students. Middle School is one of the education division groups that also participates in shaping their students so that these students have a high level of expertise in their field.

Based on the writer's experience when he was in high school, there are students who choose majors based on the wishes of their parents or sometimes based on the desire to be with friends. Without knowing the potential and abilities possessed by him, so that the abilities possessed by these students are not in accordance with the majors they choose.

That's why intelligence consultation to determine majors in tertiary institutions is one of the important things for students, so that through this intelligence consultation students can find out which major is right for them. But sometimes students feel lazy to come to psychologists and feel there is no need to consult about their intelligence and abilities, so students only choose majors based on fun and students are stuck with majors that sometimes do not match their intelligence abilities ([Wulansari et al., 2022](#)). For this reason, the author feels the need to contribute to finding a way out of this problem. By taking advantage of advances in information technology that is happening now, the author wants to design an application that can assist students in conducting consulting services for selecting majors in tertiary institutions. So that

these students can find out which majors are suitable for themselves through the identification of intelligence earlier.

2. Methods

This research was conducted at SMK Negeri 3 Sungai Penuh, with the research object being students of class X even semester (2). In designing an expert system for determining majors, the authors use the System Development Life Cycles (SDLC) research framework, which consists of the stages of identification, initiation and project planning, analysis, design, implementation and maintenance (Fatta, 2007).

2.1 Identification

The steps in this identification stage are:

1. Determine the scope of the problem

There are many problems that the writer found in the field, such as problems regarding intelligence. Many students do not know their abilities and potential, so they find it difficult to choose a major when they enter college. For this reason, the authors try to limit the scope of the problem in this study is about determining the selection of majors in tertiary institutions based on the abilities and intelligence potential possessed.

2. Specifies the method to be used in the system

The method used is the rule-base method by representing the problem into the knowledge base and the inference rules used are forward chaining. In this method, tracking starts from input information and then tries to draw conclusions.

2.2 Project initiation and planning

On this stage is determined in detail the work plan that must be done, the duration required for each stage, software, and hardware. Usually these things are stated in the project implementation schedule (Hung et al., 2015). Figure 1 illustrates the expert system workflow. When a user enters or logs in to the expert system and then fills in the data, the data filled in by the user will enter the user list and can be accessed by the administrator. Then the user can diagnose the symptoms by answering the questions given by the program. After the recommended question has been answered, the program will send the solution to the user. Experts function as providing knowledge to the admin and the admin inputs it into the system.

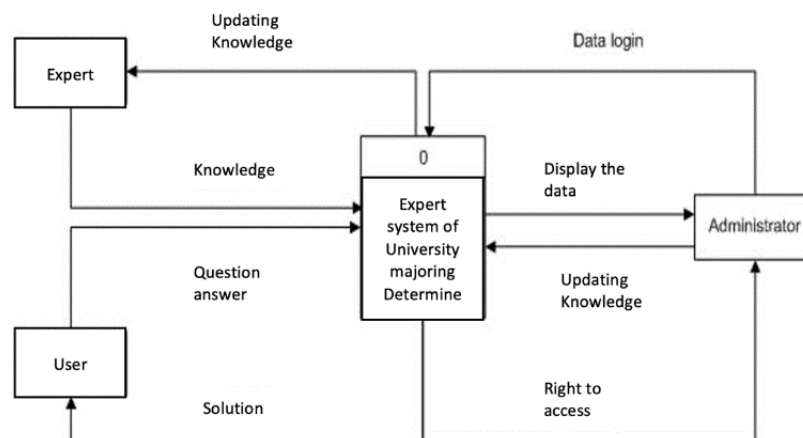


Figure 1. Context expert system design diagram

2.3 Analysis

The steps in the analysis phase are:

1. Analyze problem

This stage is the stage to understand the problem that has been formulated. At this stage it is also necessary to understand the problem to be studied. In the problem that the author raises, namely about determining majors in tertiary institutions based on intelligence ability. The author uses the theory of multiple intelligences as a guide in identifying students' intelligence abilities. These types of multiple intelligence will be used as indicators and will be entered into the system as a knowledge base ([Lin et al., 2016](#)).

2. Setting Goals

The target to be achieved from this research is to design this system to assist students in determining majors in tertiary institutions based on their potential or intelligence abilities.

3. Studying Literature Related to the Title.

After determining the objectives, the next step is to study the literature related to the problem.

2.4 Design

After the analysis step is done, the next step is the system design step. It is at this system design step that researchers and experts determine the concepts that will be designed into the expert system (Rahimova A & Hacimahmud, 2020). The results of the needs analysis will be implemented in the form of data relations and then implemented in the system. This expert system will be designed in a user friendly manner, meaning that this expert system is easy to understand and easy to use ([Collins & Knoetze, 2014](#)).

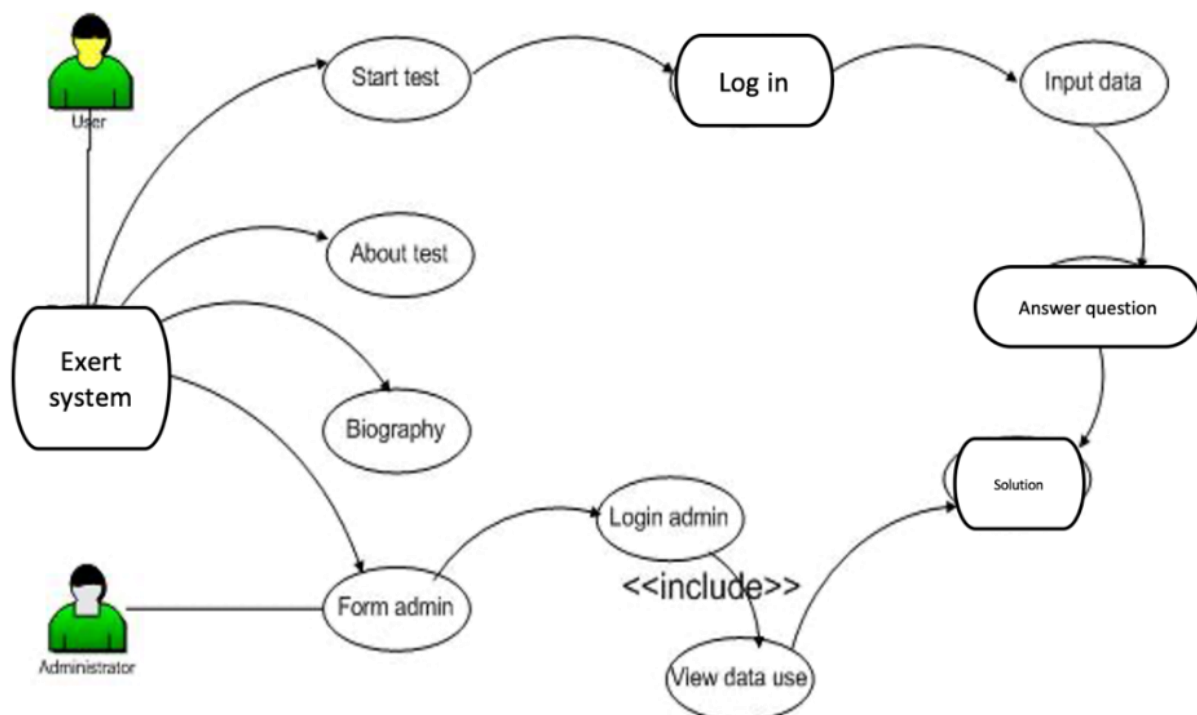


Figure 2. Design use case diagram of an expert system

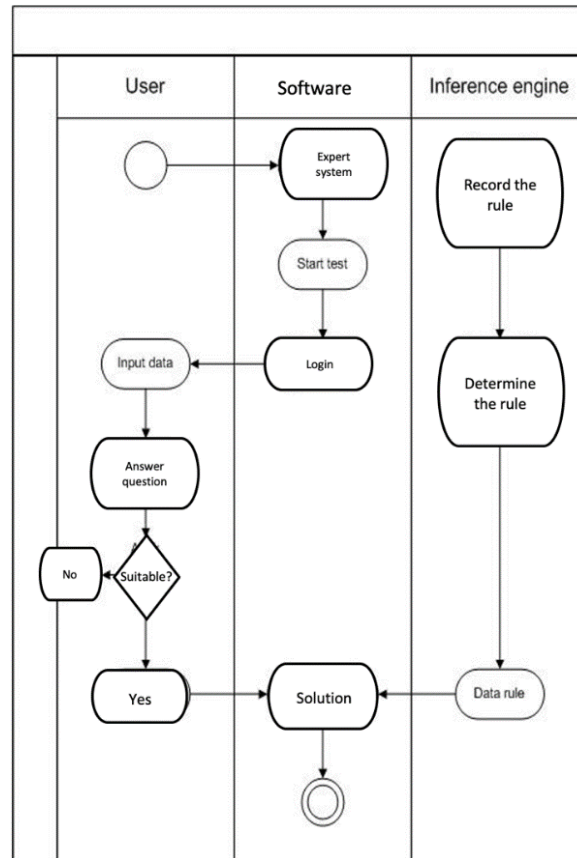


Figure 3. User activity diagram design and inference engine

Figure 3 shows the design of expert system activity diagrams between users, applications and inference engines and users. The user accesses the application, fills in the data and then answers the questions given by the system. Then the questions answered are recorded by the inference engine, then the system will issue a diagnosis based on the answers to the questions. While the admin can change, add and manage all data in the system (Hayadi et al., 2017).

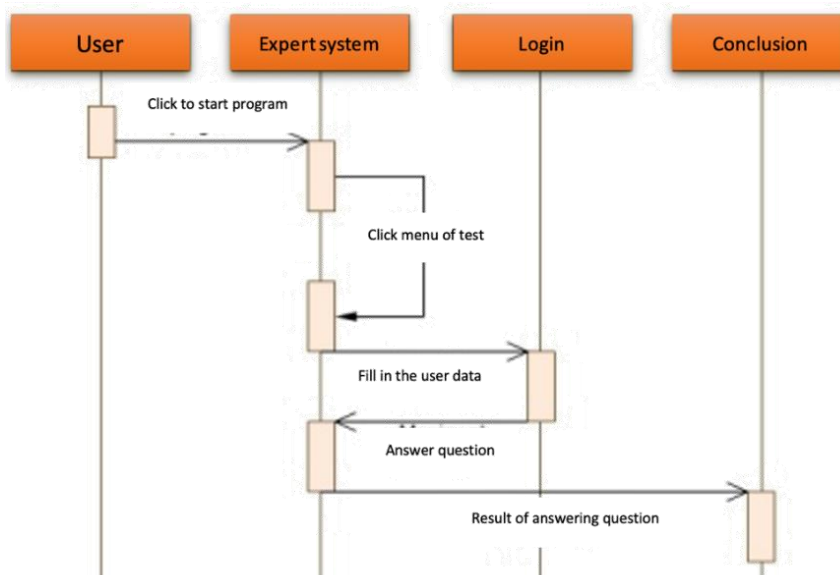


Figure 4. User sequence diagram design

Knowledge base component of an expert system consisting of two elements, namely facts and rules. Facts are information about objects in a particular problem area, while rules are information about how to obtain new facts from existing facts (Sánchez et al., 2016). In this system the database is created using Microsoft Access 2007 and then accessed or connected with Visual Basic 6.0. In this case, Visual Basic is used to design the User Interface. The data base created in this system is a data base that contains user data, admin data, symptom data, solution data, and knowledge base (Hayadi et al., 2018).

2.5 Implementation

At this implementation stage, implementation focuses on the software logically and functionally and ensures that all parts have been tested. This is done to minimize errors and ensure the resulting output is as expected (Różewski et al., 2019). At this testing stage, system feasibility testing activities will also be carried out. Where in the feasibility test of this system, the system that has been made will be tested on an expert or psychologist based on a comparison of intelligence indicators as a reference (Van, 2011).

2.6 Maintenance

This stage is the stage of handling the software that has been completed so that it can run smoothly and avoid disturbances that can cause damage (Sánchez et al., 2016).

3. Results and discussion

3.1 Output design

Page This initial display is the initial appearance when opening this expert system application. On this initial page there is general information about the potential that students must recognize.



Figure 5. Start page forms

Forms question, this is a student consultation form.



Figure 6. Inquiry form

Forms results diagnosis is a form that displays the results of the diagnosis from the results of student consultations.

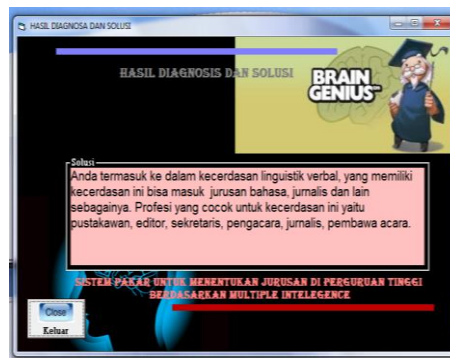


Figure 7. Form of diagnosis results

Forms knowledge base is a form that contains settings about the knowledge base.

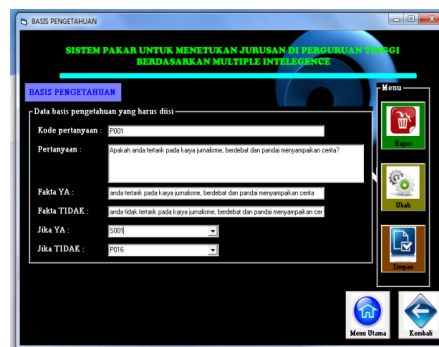


Figure 8. Knowledge base form

Report Form is a form that contains the results of the diagnosis after students consult their potential and abilities.

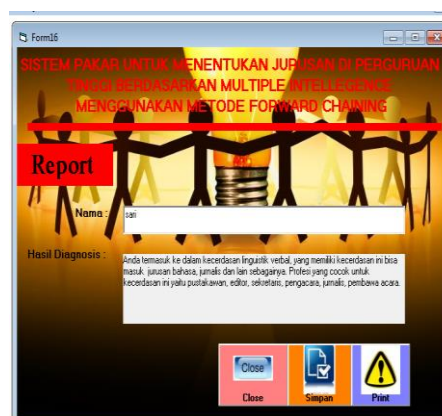


Figure 9. Form reports

3.2 System feasibility data analysis

3.2.1 Knowledge validation data analysis

From the results of the questionnaire that has been filled in by the expert, the analysis of the knowledge base validation data is as follows:

Average Value = 3.7

Max value = 1 x 5 = 5, because there is only one expert, the value multiplied by the highest score is 1.

$$\begin{aligned} \text{Validation} &= \frac{\text{Avarage score}}{\text{Max.Score}} \times 100 \% \\ \text{Validation} &= \frac{3.7}{5} \times 100 \% \\ \text{Validation} &= 73 \% \end{aligned}$$

From the results of the calculation of the validation value above, a value of 73% is obtained, so the knowledge base for this expert system for determining majors is valid.

3.2.2 Data analysis of acceptance of student responses to the system

From the results of the questionnaire that was filled in by three respondents, the acceptance value of the student's response to the system was obtained as follows:

Total Average Value = 13.6

Max value = 3 x 5 = 15, because the respondents consist of three people, the maximum score is multiplied by 3.

$$\begin{aligned} \text{Validation} &= \frac{\text{Avarage score}}{\text{Max.Score}} \times 100 \% \\ \text{Validation} &= \frac{13.6}{15} \times 100 \% \\ \text{Validation} &= 90.667 \% \end{aligned}$$

From result the calculation of the response value above obtained a value of 90.667%, so this expert system for determining majors was very well received by students.

4. Conclusions

Based on the research and design that has been done, an expert system has been produced to determine majors in tertiary institutions based on multiple intelligences using the forward chaining method that is feasible to use. This expert system meets the knowledge base validity criteria with a value of 73%, and this system is highly accepted by meeting the acceptance response value criteria of 90.667%.

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Declarations

Author contribution

Fan Fokloun wrote the original draft and provided review and editing, while Su Rizki Hardian Sakti contributed to the conceptualization, visualization, investigation, and supervision of the project.

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Conflict of interests

The authors declare no conflict of interest.

Ethical clearance

The involvement of human (students) as subjects in this research is in accordance with the Declaration of Helsinki.

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