

Universiti Teknologi MARA

**Development of Web Based Tutorial System
using Fuzzy Expert**

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APPROVAL

DEVELOPMENT OF WEB BASED TUTORIAL SYSTEM USING FUZZY EXPERT

BY

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This thesis was prepared under the direction of thesis supervisor, PN. Azlin Ahmad. It was submitted to the Faculty of Information Technology and Quantitative Sciences and was accepted in partial fulfillment of the requirements for the degree of Bachelor of information technology.

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Date: APRIL, 27, 2006

DECLARATION

I certify that this thesis and the research to which it refers are the product of my own work and that any ideas or quotation from the work of other people, published or otherwise are fully acknowledged in accordance with the standard referring practices of the discipline.

27 APRIL 2006

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ABSTRACT

Nowadays, education is the most important for everyone because it is the essential for economic growth and happiness live. Web based tutorial system is one of the environment that create from the WWW, and it has been forming one of the fastest growing area in education technologies. Beside that web based tutorial system is expected to be used by very different group and level of users with minimal assistance from human teachers. The objective of this project are to develop the intelligent tutorial system that can used to classify the range of student performance, then provide them a set of quizzes base on their performance in the last quizzes. However, comparing to the real live classroom, web based tutorial system provide an alternative to private tutoring at anytime and anywhere where internet is provided, but it still have shortcoming such as lack of presentation and feedback. Therefore web based tutorial system with using fuzzy expert had been introduce to solve this problem. Fuzzy expert is the combination of fuzzy logic and expert system. When the expert system is used in the web based tutorial system because had more beneficial such as allows user to ask questions on how, why and what and also was able to give reasons toward the given answers. This fuzzy logic element has been employed in this web based tutorial system which able to define student achievement is according to student's quizzes performance. Therefore, by using this fuzzy expert in this web based tutorial system it will become more useful and flexible in defining appropriate question for student base to their performance.

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LIST OF ABBREVIATION

ABBREVIATION

μ	membership function
mA	membership function of A
E-Learning	Electronic Learning
ITS	Intelligent Tutorial System
PHP	Personal Home Page
CD ROM	Compact Disc Read Only Memory
AI	Artificial Intelligent
DSS	Decision Support System
GIS	Geographic Information Systems
CFML	ColdFusion Markup Language
ESDLC	Expert System Development Life Cycle
COG	Centre of Gravity

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CHAPTER 1

INTRODUCTION

1.0 Introduction

The Internet is now becoming more and more important and is being integrated into all kinds of education and training. A large number of learners with all age and background are using computer networks for different interests and motivations. Internet has generally been successful in keeping up with these motivations and interests by providing useful information and a greater sense of enjoyment through new ways of cognition. In the current educational environment the available resources to the traditional education sectors are constrained. But the demand on educational opportunities is increasing. This makes alternative approaches such as web-based education even more attractive for academic institutions.

E- Learning can be considered the latest product of web-based education technologies. E-learning is an interactive experience with access to online tutors and can be done from any computer at home, school or anywhere. The access is through web browsers such as Internet Explorer or Netscape with course material and access to tutors streamed over the internet. There are many definitions of e-learning in the literature and on the Web. According to Rutenbur B. W. et al (2000) E- learning is the ability to provide information to anyone, anytime, anywhere. For Block and Dobell, (1999) E- learning is the learning by products from the marriage of the Internet and education. The technologies currently implemented in e-learning systems can be classified in five main categories

(Brusilovsky, 1999): intelligent tutoring system (ITS), adaptive hypermedia, user modeling, Web-inspired and testing technologies.

1.1 Background of the Project

Internet is now generally used by any organization whether private and government sector. It is especially true and important in the educational sectors such as schools, colleges and universities. It is now possible for students to learn without having to attend classes physically, but via the Internet from the comfort of their home, learning at their own paces.

Intelligent tutoring systems are part of a new application that used the computer programs and through the expert system technology and artificial intelligence, they are able to carry on intelligent action and flexibly adjust to the knowledge and performance of individuals, as well as provide a variety of methods of representing and accessing information. They are able to make inferences about a student's performance and based on that performance, system will produce a set of question that the student is ready to take.

This project is written using the PHP language. And at the end, the project should produce the web based tutorial system. This web based tutorial system is design for standard 4 students and covered the basic operation of mathematic.

1.2 Problem statement

Education is essential for economic growth and happiness live for every state in the world. However today's, current education does not reach everyone on the earth because economic problems. From this situation some of parents do not able to send their children to the tutorial class because tutorial learning with

human is more expensive. Introducing of web-base tutorial system will make all people in the world have affordable to use it because it is cheaper than tutorial class.

The main reason of developing tutorial system because in a classroom a teacher has to follow a number of students and his/her time for everyone is much less than in an individual tutoring situation. Teacher also need much time to evaluate the student performance in the class, and student must wait one to two weeks for to know their result. The web-base tutorial system will be usable 24 hours access and can receive their result immediately. This system will provide students everywhere with individualize personalized learning.

In a classroom the teacher has his/her own teaching style and students have to adjust themselves to it. Some people learn much slower if the teacher style does not match their learning style. The situation become pressure for weaker student will not happened, because by using ITS, if students started out with poor calculation the system will guide the students in the right track with hint or explanation.

1.3 Project objectives and scope

1.3.1 The objectives of this project

The objectives of this project are:

- I. To develop an intelligent tutoring system that can help the students individually
- II. To classify the range of student performance, then provide the m a set of quizzes base on their performance in the last quizzes.

1.3.2 Project scope

This project will focus on mathematic subject in standard 4. This system was covered to basic operation in mathematic which is containing the operation of addition, subtraction, multiplication and division operations.

1.4 Project Significance

1.4.1 Help with individual problems

This system offering individual help, which is able to make inferences about a student's performance and based on that performance, system will produce a set of question that the student is ready to take.

1.4.2 Anytime anywhere

This tutorial system will be usable with distance learning in any location and any time since that place have connection to internet with or without teachers. No fix schedule will necessary.

1.4.3 Less costly learning

This system will be required learning affordable for everyone. This system will lead lowest cost for each student's hour and money, compare to attend the tutorial class where it is more expensive

1.5 Summary

This chapter explains an overview of the project that is going to be developed. The title of this project is defined. Objectives are derived from the current problem investigated. The scope project is been determined and the significances of this project have been explained as well.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Now a day, computer technology and education are moving toward with the trend of economy development in the world. Today, both are an important asset for country to achieve their goal and vision. Because of that, the new way of learning must be develops for people especially students to keep up their performance to run together with the technology. They must have a fast learning concept to gather the information and knowledge that have today.

The concept, known as intelligent tutoring systems (ITS) has been continuously for more than three decades by researchers in education, psychology, and artificial intelligence. Today, prototype and operational ITS systems provide practice-based instruction to support corporate training, college education, medical training and military training. The goal of ITS is to provide the benefits of one-on-one instruction automatically and cost effectively.

2.1 Intelligent tutorial system

Intelligent Tutoring Systems are teaching software. According to George and John (2002) the ITS can provide high quality, active learning that approaches the experience a student would receive working one-on-one with an expert instructor, who uses sound teaching strategies and is working with all necessary

training resources. An ITS enable simulations and other high level interactive learning exercises, which are excellent teaching aids, to be used without a human instructor being present. An ITS may be used in a classroom or for distance learning, delivered through a CD-ROM or through the Internet. ITS treat each student as an individual and can make "how to teach" decisions while teaching is in progress. This differentiate them from even the best conventional computer-based training software, which is programmed only to anticipate likely responses from typical students.

According to Kelly and Tangney (2004) ITS for which a set of learning resources has been developed using the principles of Multiple Intelligences. It can dynamically identify user learning characteristics and adaptively provide a customized learning material tailored to the learner. The multiple intelligence concepts defines intelligence as the capacity to solve problems that are of value and states that there are different ways to demonstrate this intelligence. It is a concept that offers a framework and a language for developing a broad range of content that supports creative, multi-modal teaching.

ITS can also be classified by their underlying algorithm. One well-known category is the model tracing tutor, which tracks students' progress and keeps them within a specified tolerance of an acceptable solution path.

2.2 Web Based Intelligent tutoring system

With the development of WWW technology, web-based ITSs are becoming ordinary area of research and development. The web-based ITSs installed and supported in one place can be used by thousands of learners all over the world. Although many web-based educational systems appeared recently, most of them emerged from their predecessor legacy stand-alone systems. Therefore, they not

only restrict themselves in functionality, but also fail to take advantage of distributed nature of Internet (Yang A., Kinshuk & Patel A. 2002).

One of the characteristics of web-base education system should have adaptability. The example is the ability to be aware of user's behavior, so that it can take into account the level of knowledge and provide user with the right kind of document.

The web base system must be dynamic interaction. The dynamic in the system requires consideration of following criteria (Hong and Jesshope et al., 2000):

- I. Adaptation with respect to the current domain competence level of the learner.
- II. Suitable with respect to domain content.
- III. Adaptation with respect to the context in which the information is being presented.

Web-based educational systems have been forming one of the fastest growing areas in educational technology research and development. Comparing to a real-life classroom, most Web-based educational systems still have several shortcomings, such as lack of contextual and adaptive support, lack of flexible support of the presentation and feedback, lack of the collaborative support between students and systems, lack of guidance and incentive functionalities. The main objectives of this project are to personalize online educational systems.

2.4 Example of intelligent tutorial system

Since those early implementations, ITSs have been developed for a widening variety of training applications. Here are some notable examples

- I. The knowledge about the domain and about the textbook content is used by InterBook to serve a well-structured hyperspace. In particular, InterBook generates contextual links between the glossary and the textbook. Links are provided from each textbook section to corresponding glossary entries for each of the involved background or outcome concepts. Similarly from each glossary entry which describes a concept InterBook provides links to all textbook units that can be used to learn this concept. This means that an InterBook glossary integrates features of an index and a glossary (Eklund and Brasilovsky, 1999)
- II. The Task Tutor Toolkit (T3) is a set of Java software applications and libraries that lets trainers enhance training simulators with automated hinting and performance evaluation quickly and easily, without programming. The Task Tutor Toolkit coaches students in technical training areas such as using software, operating or maintaining equipment, and following organizational procedures and guidelines. (Domeshek and Ong, 2003)
- III. Carnegie Learning developed a suite of ITS-based "cognitive tutors" in secondary-level math subjects. The systems, based on earlier research carried out by John Anderson and Ken Koedinger at Carnegie Mellon University, were tested in a Pittsburgh public high school, where students showed 50 to 100 percent improvement in problem solving and use of equations, tables, and graphs (Ong and Ramachandran, 2000).

2.5 Expert System

Expert systems are the most practical application of AI today. An expert system is a computer program that emulates the behavior of human expert in well specified, narrowly defined domain of knowledge (Medsked and Liebowitz, 1994). An expert system also can be described as a narrow slice of computer intelligence and knowledge-based application. Its program designed to try to be like human decision-making expertise in a particular domain. Expert systems belong to a group of systems known as knowledge-based systems. Knowledge-based systems contain the facts and procedures representing the rule of thumb (heuristic) decision-making processes of an expert. That collection is kept in a knowledge base that is separate from a control program (Brown, 1995).

According to Robert and Edwerd (2004) expert systems are computer programs that are derived from a branch of computer science research called Artificial Intelligence (AI). AI programs that achieve expert-level competence in solving problems in task areas by bringing to bear a body of knowledge about specific tasks are called knowledge-based or expert systems. Often, the term expert systems are reserved for programs whose knowledge base contains the knowledge used by human experts.

According to Negnevitsky (2002) in general there are five members of the expert system development team:

- I. Domain Expert – is a knowledgeable and skilled person capable of solving problems in specific area or domain
- II. Knowledge Engineer – is someone who is capable of designing, building and testing an expert system.
- III. Programmer – is the people responsible for the actual programming, describing the domain knowledge in term the computer understand.
- IV. Project manager – is the leader of the expert system development.

V. End user – is the person who used the expert system.

The rule-based expert system is based on the idea that humans solve problems by applying their knowledge to a given problem represented by problem specific information (Negnevitsky, 2002).

A rule base expert system has five components:

- I. Knowledge Base – contain the domain knowledge useful for problem solving. Knowledge is representing as a set of rule. Each rule use IF (condition) THEN (action) structure.
- II. Database – include a set of fact used to match against the IF (condition) part of rule stored in knowledge base.
- III. Inference Engine – carry out the reasoning and link the rule with the fact provided in the database.
- IV. Explanation Facilities – enable the user to ask the expert system how a particular conclusion reaches and why a specific fact is needed.
- V. User Interface – the communication between user and an expert system.

There are several major application areas of expert system such as agriculture, education, environment, law manufacturing, medicine power systems etc. Four applications widely use among the practitioners due to the maturity of the field by revealing the acceptance of the technology by the commercial sectors.

2.5.1 Expert System in Agriculture

According to Kiong and Abd Latif et al (2006) the Expert System for Agriculture is same as others knowledge based system, its use the rule based which the experience and knowledge of a human expert is captured in the form of IF-THEN rules and facts which are used to solve problems by answering questions typed at a keyboard attached to a computer on such diversified topics, for

example, in pest control, the need to spray, selection of a chemical to spray, mixing and application, optimal machinery management practices, weather damage recovery such as freeze, frost or drought, etc.

There are few advantages that the expert system being use in the agriculture field. First, it has the ability to imitate human thought and reasoning. Second, the expert system makes modification of knowledge very convenient. Third, it has the ability of interpretation and transparence makes interaction more users friendly. Fourth, it can provide expert level recommendations understandable to users (farmers). And lastly, it has the ability to handle uncertain information.

2.5.2 Expert System in Education

In education field, many of the expert system's application are embedded inside the Intelligent Tutoring System (ITS) by using techniques from adaptive hypertext and hypermedia. Most of the system usually will assist student in their learning by using adaptation techniques to personalize with the environment, prior knowledge of student and student's ability to learn.

In term of technology used, expert system in education has expanded very consistently from microcomputer to web based and agent-based expert. By using web-based expert system, it can provide an excellent alterative to private tutoring at anytime from anyplace (Kiong and Abd Latif et al, 2006) where Internet is provided.

2.5.3 Expert System in Environmental Management

The most successful application of Artificial Intelligence (AI) so far is the development of Decision Support System (DSS), particularly expert system, which is a computer program that act as a 'consultant' or 'advisor' to decision makers (Kiong and Abd Latif et al, 2006). Expert system has been a new