A Study on Expert System and Applications in Education Field

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ABSTRACT: Expert systems are part of the Artificial Intelligence and it has a huge impact in various fields of life. An expert system which is used to solve the complex problems that would otherwise require extensive human expertise. To do so, it simulates the human reasoning process by applying specific knowledge and interfaces. This Expert systems also use human knowledge to solve problems that normally would require human intelligence Education system will be revolutionized with the introduction of expert systems in this field : (1) education planning and decision making abilities by expert systems, student counseling, and special education programs; (2) training for teachers and identifying training needs and using computer assisted instruction to teach information and skills; and (3) intelligent tutoring systems that guide students through instruction according to their individual strengths and weaknesses. Expert system are beneficial as a teaching tools because it has equipped with the unique features which allow users to ask question on how, why and what format. It is concluded that while expert systems in education have great potential, they remain un-established as a useful technology due to a lack of research and documentation.This paper argues that the concepts should be applied in education field and in the field of intelligent tutoring systems.

KEYWORDS: Artificial Intelligence; Expert System; CAI;ITS;IPTS; inferenceengine; knowledge-base

I.INTRODUCTION

Expert systems are one of the most exciting applications of computers to emerge .they allow a computer program to use expertise to assist in a variety of problems. These are part of artificial intelligence. They have become commercially successful.

A.   What is expert system?

Expert systems are knowledge based systems. Expert system was introduced by the Stanford heuristic programming project led by Edward Feigenbaum. Who is sometimes called as the "father of expert system". The first expert system was developed in 1965 by Edward Feignbaum of Stanford University in California. Expert system is a software company founded in Modena, Italy in 1989.

This systems are capable of making decisions and by solving the complex problems by reasoning. in the field of artifical intelligence expert systems were first successful. Inference engine and knowledge-base are subsystems of a expert systems. Explanation and debugging abilities are addition to inference engines.

B.   Need of expert system

Expert systems have an ability to solve complex problems.

Expert systems provide us consistent decisions.

It helps in enhanced problem solving.

It helps in improved decision quality.

II. ARCHITECTURE OF EXPERT SYSTEM

First commercial systems to use a knowledge based architecture. Knowledge-base will be representing the facts about the world.Long ago the systems like myc in and dendral will represent facts on flat assertions about variables. Later when expert systems developed as a commercial, the knowledge-based expanded its structure. Knowledge-based uses

the concepts ofobject oriented programming. Hence the world was represented as classes,subclasses and instances but assertions had got replacement with the values of object instances.Inference engine is an automatic reasoning system. Where the current state of knowledge base is evaluated.
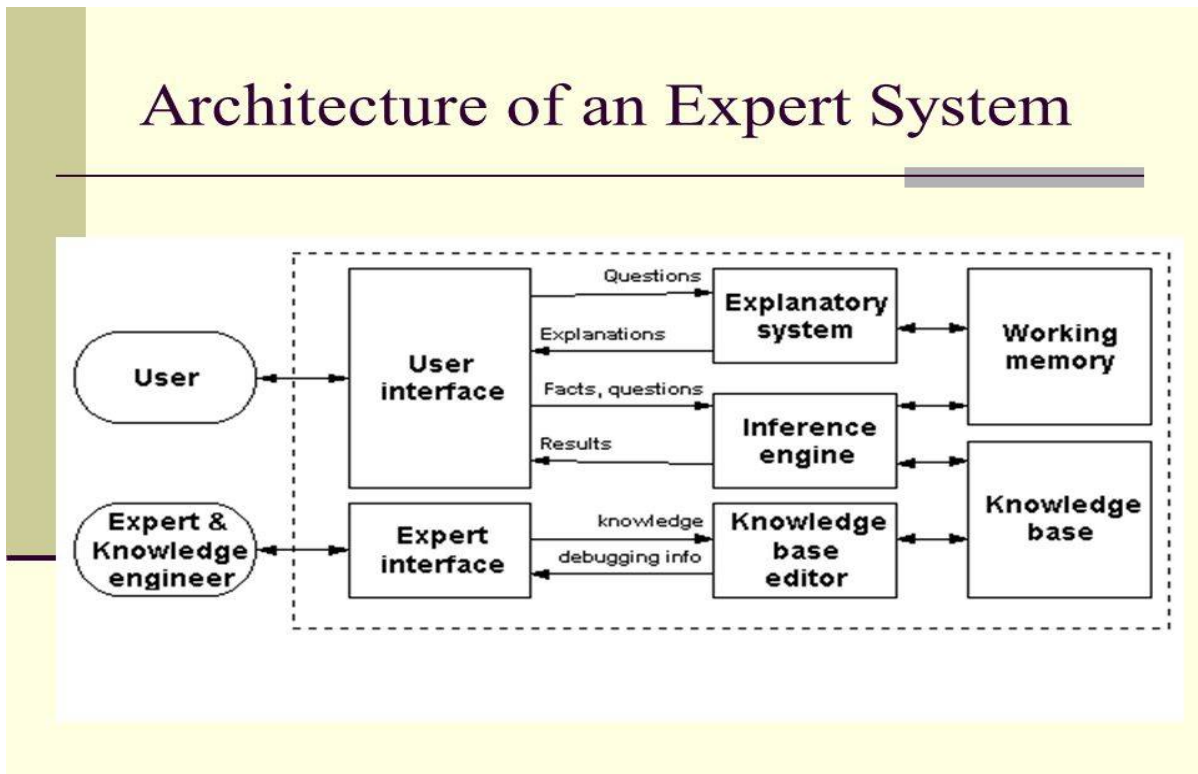

Fig1:architecture of an expert system

A. Forward chaining

It's an expert system strategy to answer the question "what can happen next?"Inference engine follows the chain of conditions and derivations and finally deduces the outcome. It considers all the facts and rules,and sorts them before concluding to a solution. This strategy is used for conclusion and result.

Ex: - prediction of share market status as an effect of changes in interest rates.
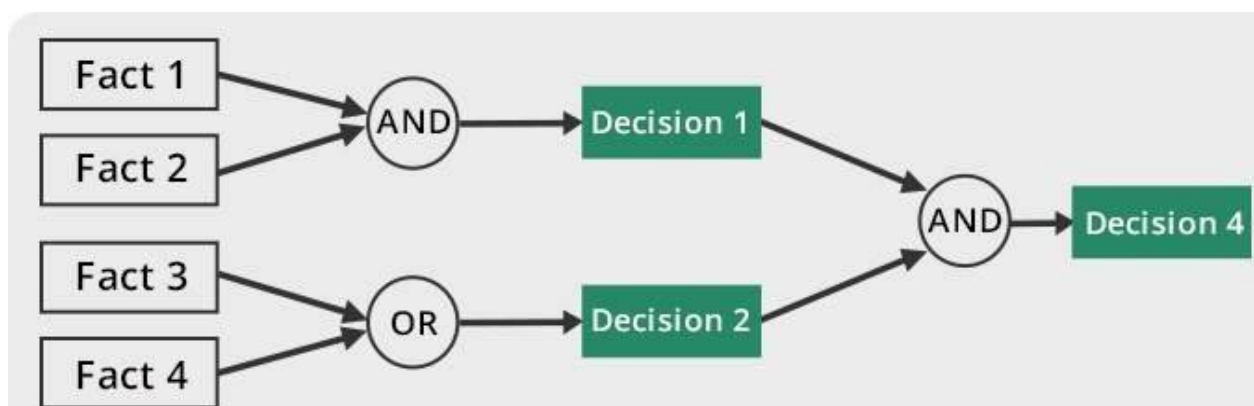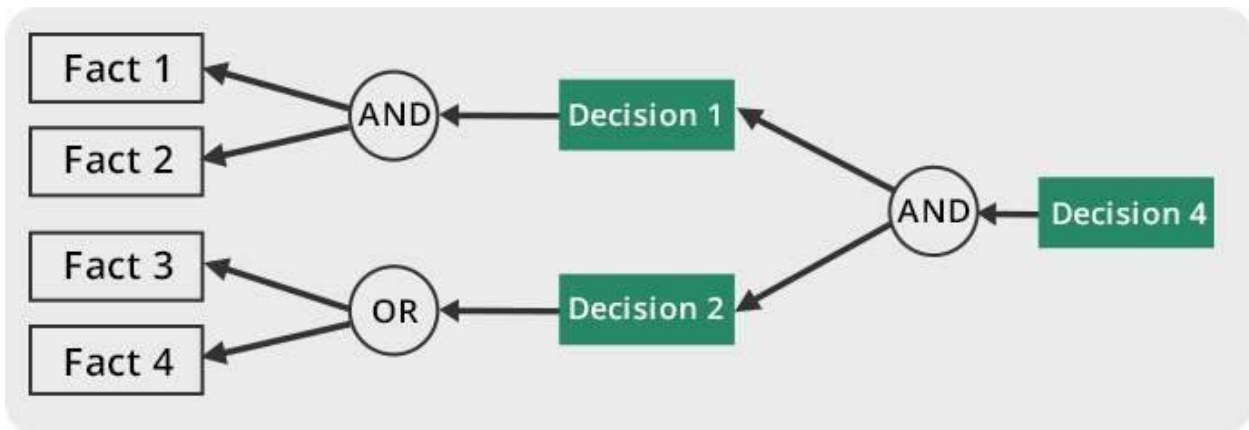
B. Backward chaining

It's an expert system strategy to answer the question,"why this happened"?On the basis of what has already happened,the inference engine tries to find out which conditions could have happened in past for this result. This strategy used to find reason.

Eg: -diagnosis of blood cancer in humans

As evolvement took place in expert systems,some new techniques were added into various types of inference engines. The most important of these were

- Truth maintenance.
- Hypothetical reasoning.
- Fuzzy logic.
- Ontology classification.

III. APPLICATIONS OF EXPERT SYSTEM

This table shows where expert system is applied.

APPLICATIONS	DESCRIPTION
Design domain	Camera lens design, automobile design
Medical domain	To know the cause of disease conduction medical operation humans
Knowledge domain	Computer faults, find the faults in vehicles
Finance / commerce	Detecting the fraud, stock market trading, cargo scheduling
Monitoring systems	Comparing data continuously with selected systems
Process control systems	Controlling a physical process based on monitoring

IV. WHY EXPERT SYSTEM IS NEEDED IN EDUCATION

With the development of Artificial Intelligence and expert systems, their usage in various fields like education. Some popular expert systems implemented for education are as follows: Computer Aided Instruction (CAI), Intelligent Tutoring Systems (ITS), and Intelligent Pascal Tutoring System (IPTS).

Computer Aided Instruction (CAI) - This deals with solving the problems. The most popular expert system in the world is Computer Aided Instruction (CAI). The brilliant idea of CAI is since 1950s and was founded in USA and UK. CAI is still present in European and Asian countries and gaining popularity. CAI simulates the approach of teaching of an experienced teacher but still it is not regarded as a true expert system. it will teach for the individual students according to their learning speed andcapabilities. They are mostly used for independent study and distance learning. Depending on the usage, CAI will be in two ways. The first way is supplementing the classroom teaching where the sessions are small in duration and dependent on the teacher only. Other approach will be acting as a substitute for the teacher and the sessions are normally bigger than the duration. This way is recognized as Primary CAI and it is independent of the teacher. The CAI system has three stages. Conceptual, Design and Implementation.

A. Conceptual Stage - its an innovative idea or concept to meet a need. The CAI system they are goal-oriented, while need, curiosity and establishing the goals. Every goal determined refers to a group of people to whom it is related. A considerable outcome of this stage is the project grounds. After requirements are known and goals are identified,we have to convert this conceptual design into reality.

 B. Design Stage – It has involvedin the development of objectives, choice of instruction model and choice of coding language to bring the concepts to reality. The purpose of design stage is to review design decisions independently as well as their impact on other components of the model in terms of expected goals.

 C. Implementation Stage – After the design stage, system is ready for coding in any selected language. After coding,the various components of system like system output, working logic, branching strategies and student interface are tested individually and integrated to meet system requirements. CAI is vastly popular because of motivation that it provides for the students to learn. CAI will be using games, puzzles and sounds to keep the student attentive until the end of session. CAI provides opportunity to track individual learning records as intelligent students may take on more challenges while dumb students can do more learning before proceeding on. CAI system uses multimedia to speed up the learning process in a friendly way. Moreover, CAI is also economical than traditional teaching.

Intelligent Tutoring System (ITS) - Although CAI offers interactive learning and individually emphasis on students but still it is not that effective as the human tutoring, that is where IntelligentTutoring System (ITS) comes into picture. This expert system was primarily developed to help first year engineering student gain deep understanding of fundamentals to be able to follow the more advanced topics in the engineering fields. This expert system is based on fuzzy logic and it gives significant flexibility in presenting the information and responding to individual student needs. ITS is highly useful for motivating students and enhancing their performances. Learning time of students for any topic is decreased dramatically by using ITS. ITS 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. Moreover ITS will keep a check on student's progress and also guides the next step in training for individual students. Another unique feature of ITS is its 24*7 availability to students that is they can learn anytime and anywhere Typically, ITS consists of four major components namely the student model, the pedagogical module, the domain knowledge module, and the communication module. However, one additional component named as expert model is also considered to be indispensable part of ITS.

 Components of Intelligent Tutoring System,the Student model is responsible for storing individual performance records of every student to keep track of his/her learning. which include detailed information about when to review, when to present a new topic, and which topic to present next time. Domain Knowledge is the knowledge the tutor is sharing with the students. It also finds out a suitable way to represent explicit and implicit knowledge so that it easily scales up to larger domains. Communications Module is accountable for interactions with the learner, in, are controlled by this component. Expert Model is an extension of the domain knowledge. It also includes information like modeling

how someone skilled in a particular domain represents the knowledge. The popular ITSs are those who teach procedural skills; the goal is for students to learn how to perform a particular task. These ITSs that are designed according to these doctrines are called cognitive tutors.

Other ITSs concentrate on teaching concepts and ``mental models'' to students. These ITSs require a larger domain knowledge base and are generally known to as knowledge based tutors. Usually, tutors that teach procedural skills use a cognitive approach, while tutors that teach concepts and frameworks use knowledge based approach where a superior knowledge base and better communication with users are required. The major drawback of designing ITSs is the time and cost required. Moreover, a large team including computer programmers, domain experts, and educational theorists, is needed to create just one ITS.

Intelligent Pascal Tutoring System (IPTS) - when the first development of CAI program, a lot of research has been done on CAI to build up expert systems which are more efficient and fast. In 1970s, the new CAI became popular. Intelligent Computer Aided Instruction (ICAI) which is widely used for educational purpose. One of the ICAI that is particularly used for teaching Pascal computer language is Intelligent Pascal Tutoring System (IPTS). This expert system is used for independent teaching of Pascal to computer scholars. IPTS not only teaches students in a brilliant way but also checks the learning ability. It also provides the student an exercise environment to adopt a more practical loom towards learning Pascal. IPTS also solves queries while learning. Components of IPTS Instructing Module classifies and execute tutoring process including learning, review and evaluating. Exercising module is liable for providing a learning and convenient way for students to widen their programming skills. Diagnosis module does diagnosing, analyzing and explaining student causes and types of errors in Pascal programming. Student data handles the record of students and track of student's learning. Dialogue system is same to the user interface which helps better interaction of system with the learners. IPTS uses a new teaching method i.e. Tutor around Students, which combines dialogue between system . Moreover, IPTS also provides an opportunity for students to find errors in the program and also debug too correct those errors

V. CONCLUSION

The paper shows that expert systems are gaining importance in the field of education.
They are part of engineering education and there are some course like accounting and management are also accepting them as a better way of teaching. Expert systems which are in the market present a lot of opportunities for the students look forward for time to learn the subjects. They present a friendly and interactive
Environment for students which motivate them to study and adopt a more practical approach towards learning.
Expert systems focus on each student individually and also keep track of their learning . This behavior of expert system provides independent learning procedure for both student and teacher, where teachers will be as mentor and students can judge their own performance. Expert system is not only beneficial for the students but also for the teachers which help them guiding students in a better way.

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