CAI IN ENGINEERING : AI APPROACH

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ABSTRACT :

This paper presents the use of Artificial Intelligence in Computer Aided Instructions (CAI) for Engineering domain. We discuss the context followed by an example of trouble shooting of equipments. A short survey of some intelligent CAI systems for engineering applications is also given.

INTRODUCTION :

The future computing trend is based on Artificial Intelligence (AI) theory. AI has encompassed many application areas which include expert systems, natural language processing, speech recognition, vision systems, robotics, automatic theorem proving knowledge based tutoring, etc. [1] These applications have become thrust areas for scientists and engineers. Some of these, particularly knowledge based tutoring, have had an everlasting impact in education. The knowledge based systems which are used for instruction (tutoring) are also termed as Intelligent computer-Aided (Assisted) Instruction (ICAI) systems. The ICAI systems have gained significant popularity in both sense i.e. application wise and research wise over last two decades. The early developments in ICAI resulted in organised course material and presented lessons to the students in relatively rigid sequences. These systems adhered only to simplified approach of presenting text material and questions about the material. The creation of such course wares required many hours of authors to completely produce the material. The qualifying term intelligent prefixing CAI was created for a resurgence of interest in CAI during early 70's. One of the first application of ACAI was in generative CAI in which the problems were generated from a database predicated

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problems were generated from a database predicated from the need of the student. Following the numerous examples of AI based CAI systems were developed in example domains which included games, geography, computer programming, electronic design and trouble shooting, and mathematics. The AI techniques for developing intelligent system of this sort include frame-based approach, production rules and logic-based systems. [2] . A lot of examples of ICAI in engineering have been reported in the literature. The systems SOPHIE (I,II,III) create a tutoring environments for electronic trouble shooting [3]. Many other ICAI systems were created for simulating models of engineering systems, design methodology and repair activity.

'CAI' in Engineering : Context

The major components of any ICAI system are (i) tutoring paradigms (ii) student model and (iii) knowledge being tutored [4]. The tutoring paradigm incorporate plans and strategies for imparting knowledge to the student. The examples of tutoring paradigms include drill and practice, on-line tutorials, tutorial instruction tools and simulation environments. The student model represents what the student has been tutored and what the student knows. The previous experience of interaction with an ICAI may or may not be the criteria for students model. The domain knowledge component of the ICAI system requires a suitable representational scheme for storing in the computer memory.

The field of engineering and technology is basically the outcome of applying scientific knowledge to practical situations. Tutoring, the topics of design, analysis, synthesis and simulation of systems and devices, is a significant aspect of training students in the field of engineering. typically, students must learn about complex interconnection schemes of the engineering systems and their operation. Here, the simulation model of the engineering system shall be appropriate for experimentation by students. Qualitative reasoning techniques are useful for developing simulation models of physical systems which is essentially an ingredient in a tutorial system for engineering domains [5].

The engineers learn and have to design, fabricate, operate, diagnose and simulate physical systems in the course of their education. It means that the major requirement of any ICAI is the knowledge of assisting and

training a student in these general engineering topics. It may be postulated that any ICAI in engineering domain shall ultimately need some type of mechanism model. The mechanism model will include two components : one a representation of the system which is to be understood and secondly, the interaction for the student with the represented model.

'ICAI' in Engineering Education : An Example :

In this section, we exemplify the evolution of ICAI for maintenance engineering. The problem of maintenance engineering is addressed by troubleshooting and diagnostic training., The training and education in maintenance is an important area whose need has always been faced in the industry after commissioning of the equipments. This field seeks the attention of artificial intelligence approach for dealing with maintenance problems. The increasing sophistication is the concern of the industrial community. It is desired that the equipments in the industries perform non-stop functioning. Therefore, the techniques of ICAI for local engineers and technicians shall be readily available for diagnosing purposes. A total maintenance support system consists of engineering reliability techniques, equipments self diagnostics, job contribution and training of technical personnels.

Traditional training and education methods, including class room teaching and the on-the-job training, play an important role but these methods are inadequate for training of complex diagnostic and repair skills. The new methods of bringing realism include supporting graphic aids, and video sequences. Computer aided instructions (CAI), which include the interactive videodiscs, offers greater instructional flexibility and trainees interaction than other training methods. However, CAI packages don't typically contain knowledge needed to perform troubleshooting and diagnostic tasks and unable to simulate a complete range of malfunctions and symptoms. Whereas, ICAI provides the opportunity to integrate system functions, subject matter expertise and the learner states to present individualized tutorials.

'ICAI' in Engineering : A Survey

The field of ICAI has been experiencing drastic changes day by day. A

large number of research projects have been developed and are being materialised in the application domain. PROUST [6] is a computer programme which automatically finds the bugs in the pascal programmes written by the students of computer engineering discipline. STEAMER [7] is an interactive inspectable simulation based training system which helps the trainee to understand the designed system and their physical mechanisms for steam cycles. This STEAMER incorporates the graphics display system for demonstrative of basic steam cycle. EXPEDITE [8] is an expert system to help hardware engineers to troubleshoot the problems in the personal computers.

Concluding Remarks :

Intelligent CAI packages for engineering domain are fundamentally concerned with helping the engineers or technicians to achieve a convenient understanding of a specific process of operation and maintenance of instruments. ICAI packages bring a new method of learning and training. The engineering personnels can get first trained by own simulated system before they attack the actual problems in real systems.

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