The Virtual Campus Prolog Learning Environment

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1 The Virtual Campus Project

The *Virtual Campus Project* is a joint project of the universities of Hannover, Osnabrück and Hildesheim, launched in July 1997 as a three year research project. Its aim is to integrate Internet technologies into education and to develop lectures and environments for several courses accessible through the Internet. The current current courses are on „logic programming“, „introduction in computer science“ and „human and machine interaction in machine translation“. These courses are mutually interchanged between the project partners.

The course on „logic programming“ is developed by the Institute for Semantic Information Processing, an institute located at the University of Osnabrück.

2 Characteristics of our approach

A main characteristic of our approach is that the initiative is left to the user. We do not force the user onto a path through several lessons nor do we oblige him to undergo tests as precondition for entering further lessons. Instead, we want to foster an attitude of self directed, explorative learning and encourage the initiative of the students. So, we provide a learning environment which contains all necessary information a learner needs during his first steps in a

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programming language or to solve a given assignment related to the *Prolog* course.

Another focus lies on the support of the tutor's work, we try to take load off his daily work, i. e. to ease the communication with the tutor and to prepare the correcting of the solved assignments.

3 Logic Programming in the *Virtual Campus*

One task in the *Virtual Campus* is to develop a Prolog learning environment which is accessible through the Internet. Up to now, a prototype has been implemented which does not only provide the means for learning Prolog, but may be regarded as a general framework for courses accompanied by assignments. The present system provides facilities with respect to:

User Environment: The system manages user data and application processes on a server and provides remote access via the internet.

Classes: The system supports data exerchange between learners and teachers. This is accomplished by a graded system of privacy ranging from *secret* to *public accessible* data.

Open Environment: The user environment may be enriched and broadened by integrating manuals, lecture notes and related material from remote facilities.

Application Interface: The system supplies a general application interface. Therefore a large number of *UNIX* applications may be integrated. This has, so far, been accomplished for Prolog and *Lisp*.

Online Tutor: An online tutorial system assists students during the assignment solving process to avoid typical mistakes and to grasp underlying principles more easily.

4 Technical Background

The system is designed as a *client–server* application with a *Java applet* embedded in a WWW–browser as the user front end. Although the application (e. g. the Prolog process) runs on a remote system, the user may interact with it. This is achieved by a mediating server which encapsulates the access to both the application and the database. The system may be used from any workstation with a Java capable browser, either within the

university Intranet or via the Internet. The user has a common user interface on all workstations he may use, additionally he can access his files from all these systems.

5 The Prolog Learning Environment

The present system is designed for accompanying courses on logic programming. The lectures are held at the University of Osnabrück and are accompanied by a seminar in which assignments are solved. The Prolog environment may be used by the students either to accomplish their assignments or to explore the realms of Prolog in a self directed manner. It consists of three components:

The Interactive Tutor The Interactive Tutor is the user interface for the Prolog process. It contains a control panel and an editor as basic components. The control panel is the interface to the application process on the server, to which it is connected through the internet. It manages the user interactions with the server, e.g. executing programs and viewing the execution results and changing user preferences.

The editor offers means for file access, to compile code and to save assignment solutions and comments to special partitions of the database. These partitions are different with respect to their access rights, i. e. the tutor has access to the solutions and coments. As already mentioned, additional online resources may be used simultaneously while working on assignments. Such activities include browsing lecture notes, former solutions and tutorials or contacting the tutor via mail.

The Online Tutor The *Prolog Learning Online Tutor* (*PLOT*) has been developed during a students project. *PLOT* is built up of several components for syntactic and semantic analysis of the user's code, including a knowledge base of example solutions for given problems. For every error found in the user's Prolog code a comprehensible message is displayed in a window with links to the corresponding parts of the script or manual. This is to point to faults due to misunderstandings and wrong concepts as soon as possible.

Another area of application is the process of marking exercises, where the system can pre-mark given solutions. These pre-marked solutions only have to be reviewed by the tutor instead of manually marking the given solutions.

The Prolog lecture notes Understanding the principles of a programming language involves a huge number of underlying concepts, e. g. recursion and backtracking. A student who has never been involved in programming tasks may have great difficulties to relate concepts to each other in a sensible way. In order to help the user to understand the basic structure of the logic programming domain, we provide Prolog lecture notes as a kind of semantic net which represents the basic concepts of programming and their relations to each other. The topology of the net forms an ontology which models the domain in a meronymic way. Thus it provides a well-founded structure in which related domains may be integrated without violating the consistency of the model.

6 Work in Progress

Presently, we are integrating a user modelling component which traces user activities through the system and will provide him with hints according to his knowledge level and learning style.