

On development of the WWW-version of Computer Aided Curricula Planning System for Higher Education

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Abstract

The article describes the Computer Aided Curricula Planning System (CACP) being developed at the Computer Science department of the Petrozavodsk university. The history, structure and usage environment are emphasized.

1 Introduction

The necessity of development of Computer Aided Curricula Planning System is caused by plenty of reasons that are not well treated by current not automated technology. Changes are constantly emerging in developing disciplines, e. g. in Informatics. The structure and the organization of higher education are being changed; multilevel study, postgraduate and distance education emerged. Thus there is a need for variable curricula that conform to the state educational standard and correspond the features of university and region. It becomes common to offer to a student the ability to study his own individual curriculum that conforms his interests.

Nowadays the electronic versions of curricula and study courses are sometimes available at Web pages of universities and their departments,

as it is at the Petrozavodsk State University WWW server. But usually they have essential lacks of apparent relations between disciplines and of ability to support consistency while dynamic editing. In Russia and in other countries there is on-going elaboration of consulting systems for selecting courses to study and for developing disciplines' contents [1, 2]. Usually they are designed for nondistant use and are not oriented for WWW.

In the department of Computer Science of the Petrozavodsk State University there goes development of systems for intellectual support of design of curricula and disciplines [3, 4, 5, 6]. The prototype of the Computer Aided Curricula Planning system was created in DBMS Paradox environment for the Applied Mathematics and Informatics area. The system uses database of Informatics subject area knowledge units and allows to design courses' contents. Later the prototype of the WWW version of the system was developed using the proposed SNLIB environment described later destined to design applications using semantic nets of knowledge units. Both SNLIB and the applications use remote user access via Web-browser.

These elaborations showed that the chosen approach is successful and it is possible to formulate the requirements of functions and features for the complete system that intellectually provides all stages of building, modification and supporting curricula.

2 Architecture of the SNLIB System

The main components of the complete CACP system for curricula design are knowledge base (KB) of subject area, specialized DBMS SNLIB based on SNLIB library, inference engine and user interface. The parts except KB form empty shell of knowledge based system. The shell may be used to develop new intellectual systems. A developer has two options to do it—to create an application using any language and proposed library SNLIB, that contains DBMS procedures and inference engine, or to use Prolog-like language SNL embedded in SNLIB system and designed to handle semantic networks, to launch inference and to support user interface. Compiled SNL-program is a semantic net that describes algorithm of processing other semantic nets. This program may be run by special inference procedure from SNLIB.

KB contains algorithms for curricula design, descriptions of education

standards and disciplines' structures. Data model in KB is "semantic networks". Specialized DBMS uses this data model and controls access of inference engine to KB. Each semantic network is kept in the separate file of special structure with .SNF file name extension. For data access of the file the set of procedures of the library SNLIB is used which should be linked to programs working with KB. A program can work with several simultaneously interacting semantic networks; in this case KB is composite. For support of interaction of semantic networks the special procedures from SNLIB are used. Such decomposition of KB allows to apply the modular approach in constructing of new KB.

Inference engine is a part of the library SNLIB and provides operation of the following algorithms of processing semantic networks:

- a) Navigation on the semantic network is search of arcs and nodes with the indicated properties. For example: taking of the first arc in the list of arcs of the indicated node, taking of the following arc, search of a node connected with the indicated node by an arc of the indicated type, sequential and binary searches of nodes on their string names.
- b) Inference on the semantic network is a procedure of search on the semantic network of paths of arcs of the indicated types. The following modes of this procedure are possible:
 - forward construction of a chain of reasoning or backward one or both, i. e. bidirectional;
 - depth first strategy of search or breadth first;
 - the mode of the proof of predicates met at search, with the purpose to clarify, whether they are true and by that is it possible to use them as nodes to create chains of reasoning. The predicates can have arguments and the algorithm of their unification can be used at the proof.

The inference engine is constructed so, that it becomes unnecessary to write semantic networks processing programs using any languages with the library SNLIB. The algorithm of processing of semantic network can be written as a semantic network logically similar to Prolog program. For execution of this program the mode of the inference with the proof of predicates, unification of arguments, backward

chaining and strategy of depth first search is used. Such approach facilitates and accelerates programming, since:

- the compact and clear Prolog-like language of operation with graph structures is used;
- it is not necessary to distract on extraneous programming environments, it is possible to concentrate entirely on semantic networks;
- it becomes unnecessary to write text of a program, it's enough to generate a program as a semantic network in the graph editor.

However there is a possibility to write programs as texts on the Prolog-like language SNL, with the subsequent compilation into semantic networks using the program SNL2SNF. For execution of a program in the semantic network the program SNFEXEC is used which searches in the SNF-file for predicate indicated by the user in the command line, and tries to prove its truth. In the language SNL there is a set of the built-in predicates, sufficient for writing algorithms of processing of semantic networks. The majority of these predicates are simply calls of appropriate procedures from the library SNLIB.

3 The use of the CACP System

The user interface is created to be most portable. It is based on WWW therefore user needs only Web browser with access to Internet. On the server the standard HTTP-server works and interacts with offered DBMS SNLIB. The user uses usual Web browser and does not require any special software.

The Web pages of user interface are generated by SNL-program from KB that supports the following:

- intellectual Java-applet for low level editing of semantic networks;
- presentation Java-applet for natural operation of the user on designing the educational schedules with the interface, close to the paper technology;

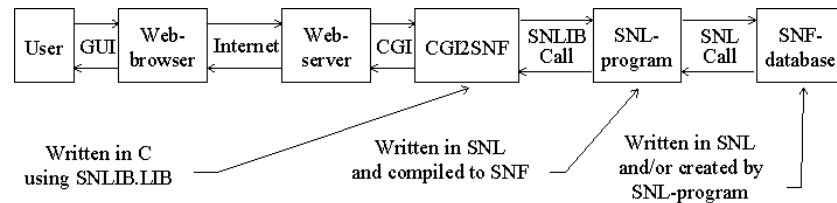


Figure 1. Remote access to CACP System using WWW

- authentication of the user for support of privacy of the personal information;
- help pages for the beginning users.

Writing of the texts of SNL-programs also may be considered as user interface. This possibility is intended for operation on the server and is used only at initial stages of implementation of the project. In further writing of SNL-programs is supposed to fulfill distantly using special Java-applet, convenient for creation of the semantic network of the program.

Using the described above software on languages C, Java and SNL, it becomes possible to fill KB with knowledge about educational standards and implementation of algorithm of construction of the study plans. The operation of the user with the study plans is carried out using Java-applet in Web browser in pair with SNL-program in KB. It is supposed the depositing into KB of two educational standards (Russian educational standard on applied mathematics and computer science, and American Computer Curricula 91 standard), and also of current educational schedule of mathematical faculty for check of its correspondence to the two standards. In completion some individual study plans on different specializations in Computer science will be created.

So, the proposed system will have integrative character combining several levels of usage:

- Presentation level (presentation of hypertext information about existing curricula and disciplines).

- Generation level (generating of curricula and combining disciplines contents while interaction with user).
- Edition level (presentation and edition of semantic net of knowledge modules of subject area).

Proposed system may be used by several kinds of users:

- by anyone to acquaint with educational specializations and their curricula and disciplines existing in the university;
- by students to get to know the curricula and disciplines thought, to elect optional courses, to design own curriculum;
- by teachers to get information about curricula and disciplines, to edit course contents and structure of semantic networks of knowledge units;
- by university and faculty administration to observe, edit and coordinate current curricula, to design new curricula.

4 Conclusion

The paper briefly describes the Computer Aided Curricula Planning system, that is being developed at the Computer Science department of the Petrozavodsk State university. The structure and user interface are emphasized. Currently the SNLIB environment is in the testing stage and the prototype of the CACP system is under construction. By the end of 1999 we plan to finish the complete version of CACP. The CACP system is supposed to be used by departments and administration of the university.

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