AUTOMATED SYSTEM FOR PERSONAL LEARNING AND CONTROL OF STUDENTS' KNOWLEDGE

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Abstract. This paper describes original technology for problems solving and basic principles of design of automated learning and knowledge control system. This system is created as open adaptive hyper media system with personalized access to educational repositories, navigation, learning strategy and control. Such system is a necessary fool for users, because it provides special educational tools for distance learning. It includes: definitions of learning aims; definitions of beginning user's knowledge; choice of learning strategy; dynamic course materials and personal tests generation; projects development; consultations with teacher; common projects discussion; projects evaluation by teacher. System will make it possible to implement open mobile personalized learning with access to information resources.

Keywords. Open learning education, personalization of learning, personal distributive access, adaptive control/learning systems, individual users testing process, technology for complex problem solving, three-component-structure.

Introduction

Rapid development of WWW and Internet/Intranet technologies opens new was for implementation of an open learning for distance users. Allows us to create distributed information resources and provides a personal access to this resources. There are different educational tools: hyperbooks, adaptive hypermedia, control/learning systems, etc. Design of these tools is based on principles of personalisation, individualisation and open learning [3]. On the one hand the critical parts of these systems are the definitions of beginning user's knowledge, development of personal learning strategy, training of practical skills, personal learning strategy update depending on current user's knowledge, on the other hand – integration of local tools and learning repositories into Web Global Learning Network. Now we are working on a design of automated learning and knowledge control system, which will solve some problems mentioned above. The main idea of our system is an activeness of learning process and orientation on real project. It is achieved by special basic technology, which is based on a problem decomposition, solution of subproblems, current testing and control of knowledge.

Basic technology

Presented system is invariant to application domain and permits receiving practical skills for solution of problem in different fields. This property is possible due to original technology for problem solving. According to this technology the process of problem solution contains two phases: design of project and project implementation. The most labour-intensive and long phase for student and teacher is the first one, because all main elements of a problem are defined in this phase. Opportune detection and correction of errors in the first phase are intended to realize project fast and on high professional level. Therefore the focus of our technology is the design of project.

This technology is based on a system approach to complex system design and contains following steps: general aim definition; input and output data definitions; design of function table by three-component-structure [4] (FF=(D, G, H), where FF – function, D – action, G – subject, H – condition); definition of function type (general, basic, service); functions grouping; task function tree by three-component-structure description; module structure design; development of algorithms and tests modules; implementation and testing.

This technology has great advantages for object-, structure-oriented and mixed design. It was created at CAD Department of Volgograd State Technical University as a manual technology. It is successfully used for engineers in system design learning and for many practical problems solving for many years [5]. That is why the development of automated learning system, which is based on this technology, is urgent and now we are working on automation of this technology for the learning of high level languages (C/C++) and technology of programming.

Automated basic technology

The process of personal learning, testing, design and implementation of project according to the above contains following general sequence of steps:

Step 1 Learning aims definition (for example, to take examination, to make practical task, user's certification);

Step 2. Current user knowledge definition (the level of necessary knowledge depends on learning aims);

Step 3. Learning strategy definition (sequence of steps for reaching learning aims);

Step 4. Individual course materials and tests generation (course materials are generated as hyper media pages with tests, tests are generated in passive and active forms, for example, "question-answer", "fill in template", "to find the accordance ", graphical tests, etc);

Step 5. Personal project design (there is a special editor for project's design, where input and output data are defined, test examples are designed and algorithm is generated);

Step 6. Project evaluation (teacher evaluates project by special criterions and educational tests for personalization of learning).

If steps 4, 5, 6 are not successful, aims and strategies are updated and new course materials and tests are generated. During these steps user can discuss current problems with teacher and other users on-line. All successful projects are stored in the project library and opened for use in new projects.

Architecture and functions of automated learning and knowledge control system

To implement this approach we have designed following system architecture and its functional description. Our learning and control system contains three main modules: "Shell infrastructure and smart service", "Client – Server tools", "Shared and individualized access to learning repositories".

The module "Shell infrastructure and smart service" includes basic tools for system infrastructure creation, navigation model, personalized queries to information resources, views of learning materials.

This module contains submodules:

"Learning aims module" is a module for project aims and evaluation criterions definition, general, basic and service aims definition and aims like tree design.

"Control and test module" is a module for beginning and current user's knowledge definition.

"Define learning strategies module" is a module for development of personal learning strategy.

"Dynamic generation of course materials and personal tests module" is a module for dynamic generation of course materials and tests according to personal learning strategy and control of user knowledge quality.

"Projects module" contains special editor for projects solving and description. **"Projects evaluation module"** is a module for automated testing and evaluation by teacher of projects.

"Forum" is a module for current consultation with teacher and common discussions with other users.

The module **"Client – Server tools"** is a module for storage and processing of information resources, includes modules and data bases: **"Protocol storage module"** for storage of personal user queries; **"Learning repository"** includes full course materials and tests; **"Project Library"** includes successful projects; **"User personal results storage module"** for user personal grades storing.

"Infrastructure and intelligent service module" is a module for adaptation and integration of new course materials into learning repositories.

The module **"Shared and individualized access to learning repositories"** includes tools for shared and personalized access to archives, interfaces, guidance as well as Web-oriented courseware.

The main advantage of this architecture is a special project editor, which allows us to generate algorithm of problem solution by use of special templates according to design technology (object-, structure-oriented and mixed design). This editor contains the original recursive algorithm for problem decomposition.

Conclusion and current work

In this paper we discussed the design principles, function, architecture and modules of automated learning and control system and methodology of learning in this system. The result of our first year work is a prototype of system and now we are working on system development. As a perspective we consider possibilities to integrate our learning system as Edutella-peer application in Web Global Learning Network [1].

References

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