

COMPLEX ADAPTIVE ON-LINE LEARNING SYSTEM "THEORY OF AUTOMATIC CONTROL"

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Abstract. The controlled from distance teaching (DT) in the system of technical education has a row of features: complication of informative content, necessity of development of simulation models and trainers for conducting of practical and laboratory employments, conducting of knowledge diagnostics on the basis of mathematical-based algorithms, organization of execution collective projects of the applied setting. For development of the process of teaching bases of fundamental discipline control system Theory of automatic control (TAC) the combined approach of optimum combination of existent programmatic instruments of support was chosen DT and own developments. The system DT TAC included: controlled from distance course (DC) of TAC, site of virtual laboratory practical works in LAB.TAC and students knowledge remote diagnostic system d-tester.

Keywords: system, theory, management, content, algorithm, testing, diagnosing, laboratory stand, animation, device, knowledge control.

ACM Classification Keywords: H.1.1 Systems and Information Theory: Value of information.

Introduction

In the present time in Ukraine large attention is spared the problems of introduction of modern of informatively-communications technologies (ICT) in higher education. In formation of humanitarian direction the proof tendencies of growth of rates of passing were set to modern computers technologies and use of methods DT.

DT in technical education, because of the special methodological and algorithmic approaches, integrated considerably slower.

Development of the systems of diagnosing of knowledge's of bases of technical disciplines is related to realization of difficult algorithms of testing, such as organization of answers in a free form by built-in formula editors, testing is based on the methods of matrix calculation, multilevel questions which are not included in the standard set of the developed systems DT [1].

It is necessary also to take into account that planning of the effective system DT must be based on a careful analysis and search of modern pedagogical approaches during its organization.

At development of the system DT discipline of TAC bases of social structural pedagogics, which are foundation of Learning Management Systems (LMS) Moodle, were incorporated, to modern textual criticism and two-parameters theory of interpretation Rasch testing results.

Informative maintenance of DK TAC has the developed multimedia support as 3D and Flash-animations, laboratory practical work is built on the basis of the use of virtual mathematical models and recordings devices.

System structure

The system is built on principle of adaptive control. On a fig. 1 the flow diagram of the system is represented. In obedience to the modern theory of management connections are synthesized between the participants of educational process. Adaptation of students in the process of mastering of course TAC is provided testing of initial level of knowledge's, intermediate diagnosing and feedbacks between a teacher, students, informative content and system of d-tester.

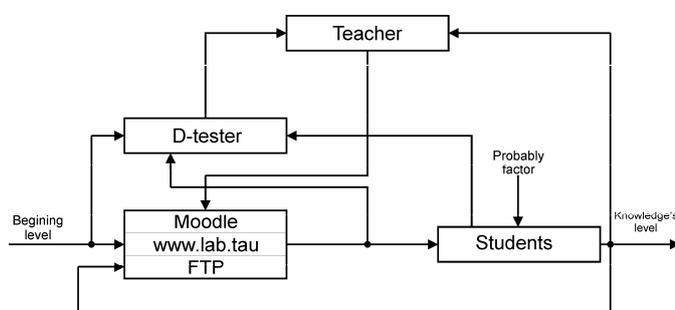


Fig. 1. The flow diagram of the system

Results of students teachings are latently structural parameters and depend on complication of information and set the problems, and also from the level of course participant knowledge's.

The distance course of tac in LMS MOODLE

A course is built on the basis of social structural pedagogics which is basis of LMS Moodle and the most strong side of project i. Doudzhyamosa.

The method of creation of DK of TAC is presented on fig. 2. A teacher is the moderator of course and executes a role function in a student collective.

Basic functions of teacher: development of card of conceptions (plan) of course, organization of independent work of students, their discussions, and joint projects. A teacher carries responsibility for creation of effective scale of evaluation of results of activity of teaching subjects, support of operative feedback with a student audience and transforming of maintenance of DT, in accordance with the current results of teaching process.

Students must in time execute all tasks of teacher. Teaching results are in direct dependence on their executiveness, efficiency of work and creative initiative.

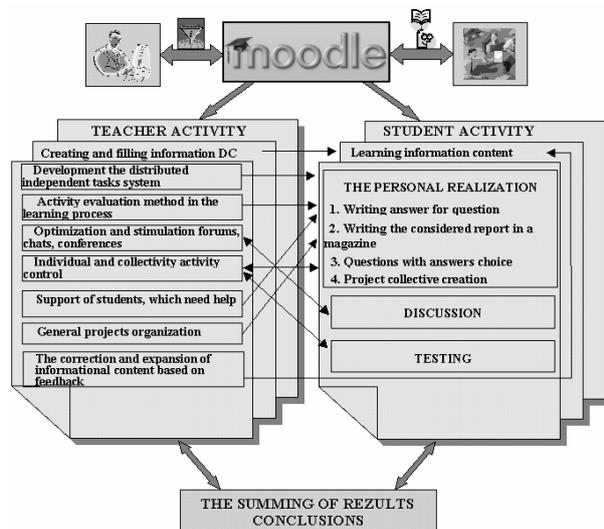


Fig. 2. The method of creation of DK of TAC



Fig. 3. The educational page of DT TAC in a SCORM-format

On fig. 3 the educational page of DT TAC is presented in a SCORM-format. On a page a multimedia resource, which illustrates work of steam Watt engine, is placed.

Conclusions: The presented adaptive control teaching system is in the process of forward dynamic development. On the real stage its filling goes informative materials; the library of models of simulations of technological objects and systems broadens on the basis of adequate mathematical models.

In the stage of development and realization there is the module of the adaptive diagnosing of level of knowledges of students on the basis of statistical treatment of results

of testing of latently structural analysis and parametrics theory of Rasch methods.

The informational technologies using during the laboratory employments concluding of «Theory of automatic control on discipline»

Presently there are plenty of modern programmatic facilities of animation presentations during conducting of laboratory employments on technical disciplines. At the design of the difficult systems motion of objects is examined not on a plane, but in space. That is why among basic and the most popular programs for creation of three-dimensional objects it is possible to select the system of 3D Studio MAX.

By this program videos-rollers, which allow students it is better to understand principle of work of the classic automatic control systems, in an evident form present (to represent) motion of executive mechanisms



Fig. 4 The three-dimensional model of engine of direct current

(engines, reducing gears), regulators and other components of the system, are created. On a fig. 4 the three-dimensional model of engine of direct current is shown. Video-roller is also created, which shows work of engine in a cut air-cooled.

Another popular graphic program is Macromedia Flash. The program Flash in essence is multitask: it and illustration program, editor for graphic arts and sound, mean for animation and machine for writing scripts which are incorporated in one program [2]. Its advantage is in that she allows creating interactive laboratory trainers, games.

By Macromedia Flash the row of rollers of animations was created for the study of others that the disciplines «Theory of automatic control». Process of they is creation very much stand: at first it is necessary to create the row of static pictures, put in order them and create an animation file.

On a fig. 5 the last shot of animation roller that demonstrates the order of creation of model for the construction of phase plane of the automatic control system is resulted.

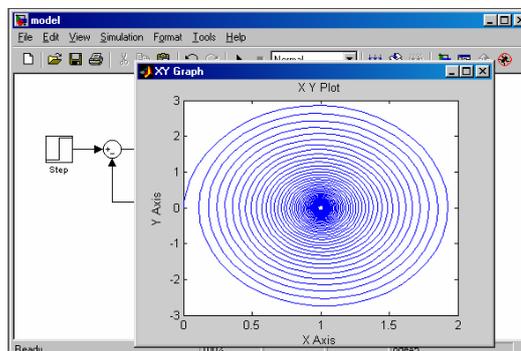


Fig. 5 Construction of phase plane of the automatic control system

Next to Macromedia Flash there is plenty of the small programs for creation and editing of animations (Timer Lock, Advanced Gif Animator). Their advantages are simplicity, high speed and small volume of initial files.

Virtual laboratories as inalienable part of the controlled from distance studies

Virtual laboratories are important part of educational process. A virtual laboratory can be created for the study of certain discipline or section of discipline. She must consist of virtual laboratory stands, each of which must provide a study and practical mastering of lecture material. A purpose of creation of virtual laboratory stands is conducting of research of the phenomena and processes in a situation, near to reality.

Experiments on virtual laboratory stands in essence are researches of theoretical models. Such stands allow in an evident and usual for an experimenter form to represent the results of theoretical calculations.

A laboratory stand is named virtual because from one side a researcher sees him, can by a mouse manage conducting of experiment, to get the results of measuring with some degree of convention. From other side, this stand does not exist physically in nature, his image is created by a computer on the screen and elements execute the functions because in accordance with the program a computer is changed by an image on the screen, creating at a researcher the illusion of participating in the real experiment [3].

The analysis of results of experiments is conducted with the purpose of exposure of dependences between different factors and sizes, which characterize the explored process, object or phenomenon, establishing reasonable following connections between them.

Basic advantages of creation of virtual laboratories:

cheapness - a dear equipment is replaced the computer program;

a compactness is scaling of equipment of largeness, placing on one computer of plenty of "virtual" equipment;

speed is a change duration both too slow and too rapid processes;

safety - at a design potentially of dangerous equipment, for example, nuclear a reactor.

Among the products of software of the virtual measuring devices and systems intended for creation it is needed to select the applied package of the graphic programming of LabVIEW 8.0.

LabVIEW, like programming in PASCAL or BASIC, is a programmatic package for development of the application programs. However, unlike the programming languages indicated higher, LabVIEW uses a graphic programming of G (Graphics), intended for creation of the programs in the form of diagrams of flows language. LabVIEW contains the vast libraries of functions and tools, intended for creation of the systems of capture of data and automated control systems. LabVIEW also includes the standard tools of development of the programs, allows to set the points of controls, use computer animation for implementation of the program, to see that information pass through the program, to carry out incremental implementation of the program, for facilitation of development and program debug [3]. A presence in the system of LabVIEW special Simulation Module does her maximally suitable for a design and research of the difficult dynamic systems.

The programs in LabVIEW are named virtual instruments (VI), as the real measuring devices imitate their kind and functioning.

In the environment of LabVIEW 8.0 a stand is created for the calculation of parameters and research of descriptions of sentinels of executive DPS. The frontal panel of stand has three insets (fig. 6).

On an inset "Choice of type of engine" in a block "Weekend an user can set information" value of parameters of management (PM) (static moment of loading of PM, moment of inertia of PM, high angular speed and maximal angular acceleration of PM and speed of change of static moment of loading of PM) object in obedience to a requirement specification. In a block the "Technical parameters of DPS" it is possible by a switch "Choice of engine" to carry out the choice of certain engine, thus the values of technical parameters (nominal power, nominal tension, nominal speed of rotation of billow of engine, nominal current of anchor of engine, moment of inertia of anchor, resistance of puttee of anchor, CUA of engine) in the proper fields change automatically. In a block the parameters of "Calculations of DPS" enter parameters: nominal angular speed of engine, nominal moment of engine, optimum gear-ratio of reducing gear, total moment of inertia, inductance of engine, parameters of calculations. Parameters over of transmission function of DPS are brought in a fourth block: amplification of engine factor, amplification of engine factor in relation to loading, electro-mechanics and electromagnetic permanent time of DPS.

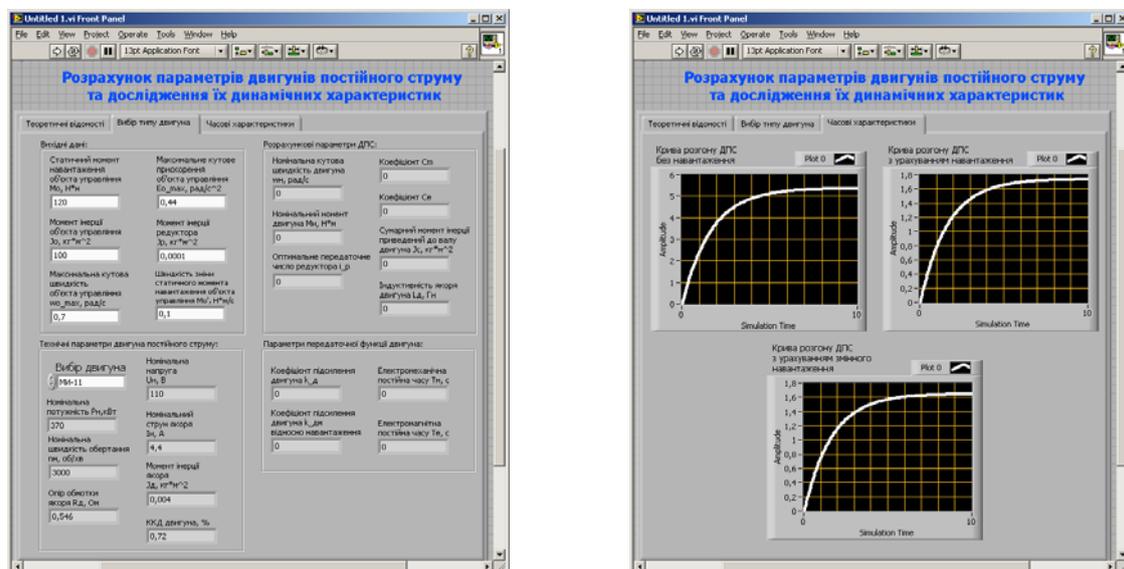


Fig. 6 The frontal panel of stand has three insets

On the third inset descriptions" of "Sentinels are resulted curves of acceleration of engine of direct current without loading, with a quiescent and variable load. Comparing the graphs, draw conclusion, that at the variable loading frequency of rotation of billow of engine is the least, and in default of loading - most frequency is set accordingly.

Consequently, the programmatic package of LABVIEW allows easily creating virtual devices for research of dynamics of the control and their separate elements systems.

Students knowledge remote diagnostic system d-tester

D-tester 1.1 is the most powerful system, designed for providing testing in different high schools; it has the all necessary abilities and functionalities for making testing process simpler and faster. This testing system is developed for using in different operation systems and it is based only on the most popular free web-technologies such as Apache web server with PHP + MySQL. D-tester 1.1 has the rich couple of different statistics that make analyzing results faster and easier.

The system consists of two subsystems: administrative subsystem and testing subsystem. The scheme of the system, external links and scheme of administrative subsystem is showed on a fig. 7.

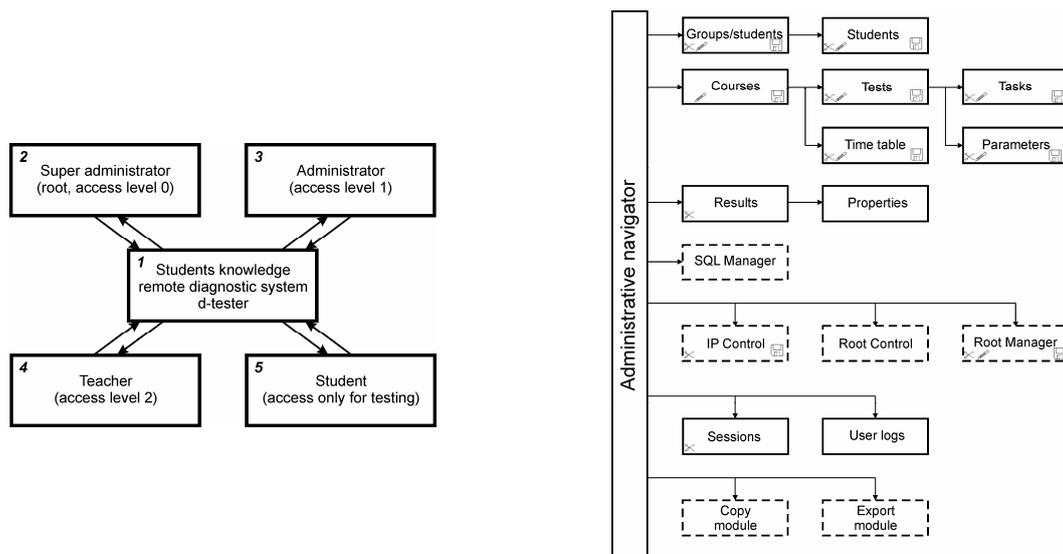


Fig. 7 The scheme of the system and external links and scheme of administrative subsystem

The administrative subsystem owns next possibilities:

- creating tests blocks;
- registration new students and groups of students;
- analyzing results of testing;
- active sessions control.

Three levels of administrator's privileges are foreseen in the system:

- Zero level – foresees possibility of complete access to all modules, and also direct access to the system database with using the SQL manager module;
- First level – foresees possibility of complete access to all modules, except for SQL Manager, IP Control, Root Control, Root Manager, Copy module, Export module;
- Second level – foresees access only to that part of the system, which is certain by a quota. Information about proper quota is kept in a database. A quota consists of identifier of course – unique number of course in a database, and also privileges of access:
 - SB_READ is revision of information about courses;
 - SB_WRITE is adding/modification of information about objects;
 - SB_DELETE is deleting information about courses;
 - RES_READ is revision of results of passing of test control;
 - RES_DELETE is deleting of information about the results of passing of testing.

It should be noted that in this case under a course not only a course but also all is understood subcategories are tests, tasks are related to him.

Description of modules:

- groups/students – management students and group of students information;
- courses – management courses and subcategories tests and tasks;
- results – generating reports about results of testing;
- SQL manager – direct access to system database using SQL queries;
- sessions – active session control functions;
- IP control – functions of LAN computers control;
- user logs – user logging information functions;
- root control – admin logging information functions;
- root manager – management system administrators functions;
- copy module – copy tasks functions;
- export module – export tasks functions.

The system supports the task in the IMS QTI 2.0 standard. Next types of test tasks now supported:

- simple choice (simple choice text & images);

- multi choice (multi choice text & images);
- short answer;
- numerical;
- alternative (partial of the simple choice question) [4].

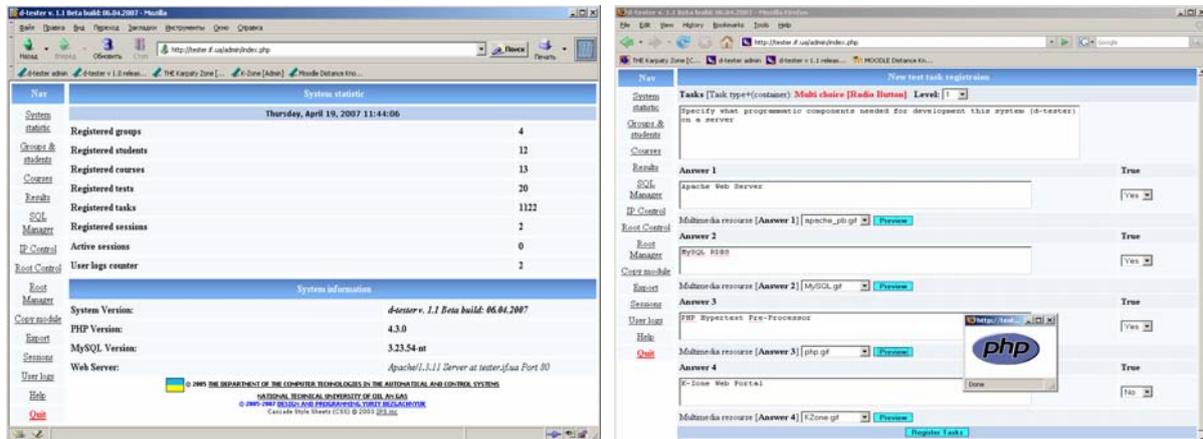


Fig. 8 Start page of administrative subsystem and task editor

The system has a simple and intuitively clear interface projected so, that you can conduct its localization for any language package. Some web pages of administrative subsystem are shown in fig. 8 - start page of administrative subsystem and task editor. For registration task you can use some tags of the HTML language. In a next version of the system the TINY_MCE editor, which considerably will simplify the process of registration of test task, will be used in the task editor.

One of important functions of the system is possibility of conducting of analysis testing results.

You can also generating some histograms about the testing results.

The testing subsystem is intended for providing student's test control. It owns next possibilities:

- show testing questions;
- time control;
- checking user answers;
- generate and show result of testing.

User can simply distinguish the type of task, which is offered him. For example: simple choice type of task is shown using radio buttons, multi choice type – check boxes.

A page with report and a page with question (multi choice [images]) is shown on fig. 9.

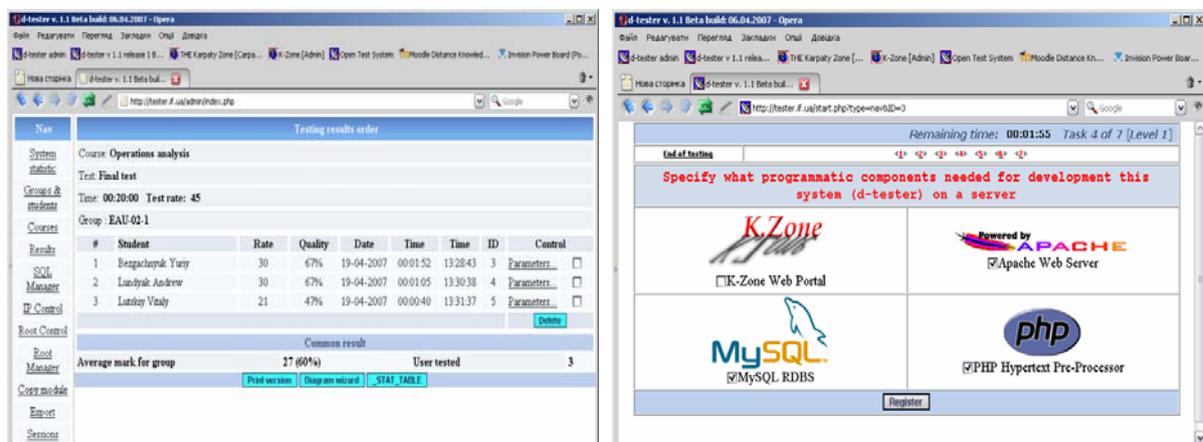


Fig. 9 A page with report and a page with question

Conclusion

Informative content for organization of Web-teaching technical specialties requires a considerable reinforcement mathematical conclusions, multimedia materials, models of simulations, interactive trainers, virtual laboratory stands. Software for development of similar educational materials often is inaccessible educational establishments in a price relation.

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