Development of Multi-platform System of Distant Learning at Technical University

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Modern university system of distant learning (SDL) must combine key features: learning, on-line interaction "student-teacher", knowledge evaluation, possibilities of external monitoring of students progress, formation of reports. All these features could be easily realised by the MS Learning Gateway (MLG) software. Teaching materials include texts, graphics, animation, video and could be really increase the effectiveness of studying while methodology of the development of these materials is rather easy and allows to create new courses and teaching modules very fast.

MLG is based on the platforms SharePoint Portal Server 2003 and Windows SharePoint Services and provides to students and teachers access to electronic teaching materials and services according their roles in the system. Embedded system Microsoft Class Server manage educational process and allows teachers to create plans of lessons, manage students groups, develop calendar of special educational events and evaluate students results. In MLG it's implemented the service of immediate messages exchange and detecting the places of users. Structure of MLG system is described at the fig.1.



Fig.1 Structure of MLG system

Embedded module of students' progress evaluation consists of different types of tests and special procedures of monitoring of current progress. There are 3 levels of access to the distant learning system:

- Teacher;
- Student;
- Parent.

Teacher can create educational materials, tests and can have full access to the results of students, create starting time and date of students' control, define duration of the exams, create different reports. One of the problems of modern Russian higher education is organization of students self-studies. For increasing effectiveness of it teacher can arrange special thematic on-line group discussions. Experience showed that they are very popular between students before exams. There are two ways of organization of such on-line discussions: by special embedded forum and by MS Live Communication Server software. The first one has limited abilities and allows to use text conferences only while the second one allows to transfer video as well as text. At the university we combine both strategies because students could use system of distant learning from computer labs as well as from home. Several computer labs do not have access to Internet because of

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information security reasons and students can interact with SDL by means of embedded forum while students working with SDL from home have access to it by means of MS Live Communication.

Student have access to educational materials, exams and on-line discussions. *Parent* has access to students' progress, to comments of teachers, to the calendar of educational events which have to be followed by students. Role of parent could be played not only by real parents but also by supervisers who control academic activities.

Implementation of SDL at the university demands changes in the structure of management of educational process, there should be create the technical support service and more rights is given to the teacher in development of the strategy of students studying, what is unusual for Russian universities. Traditionally educational trajectories are fixed in the course curricula and calendar of key studying events is fixed before starting of the semester. Using of SDL makes educational process more flexible for students, especially for part-time ones who spend more time for self-studies.

.Our experience showed that average time necessary for development of electronic textbook is 2-12 weeks depending on complexity of using materials (animation, video). For example, development of multi-media textbook on the module "Computer Animation" which needs specially created samples of flash and Toon Boom animation took 12 weeks, textbook on "Object-oriented Programming" which has modules for demonstration of the key features of object programming was developed for 10 weeks. At the same time textbook on "Basics on Development of Information Systems" consisting only texts and pictures was created in 2 weeks. Electronic teaching materials could use their own modules of students knowledge evaluation, in order to pass the results to the united data base of SDL it's necessary to develop Java-code. Students sudy these materials by means of web-interface.

At modern technical university there are many subjects in Engineering which demand complex calculations and high computational resources, such as tasks in robotics, data processing in modelling 3d-objects, parallel computations in solving of multi-dimension graph tasks, genetic algorithms. On-line education in these field of studies demands development of special electronic teaching materials which use on-line simulation, modelling of technical processes which need high computational resources. This problem could be used by grid-calculations and special software OurGrid supported Grid-node. Special modules written in Java are implemented in MS SharePoint Learning Kit 1.2 as parts of teaching materials.

OurGrid Technology contains three main components: MyGrid, Peer and UserAgent. MyGrid is a central component of the technology. The main aim of it is to coordinate, control and plan the execution of the task and to distribute necessary data between computers that are united into the grid-node. Peer component gives addresses computers with necessary configuration for fulfillment of the task. UserAgent is set on every computer of grid-node; it gives the necessary functionality to execute the task on computer on which it has been installed. So, SDL is a multi-platform system and it's structure is described at Fig.2.



Fig.2 Structure of system of distance learning

For solving of the second problem programming language Java is used. The Java code of the program isn't connected with any concrete operating system or processor's architecture. Java Virtual Machine (JVM) is must have been installed on every computer which could be used as a calculating element (GUM). JVM gives the opportunity to execute Java-program on the concrete computer and in the concrete operating system. Nevertheless this approach reduces the productivity and brings additional expenditure of operational memory but it is the only way to develop the only one program for a great number of variety of operating systems and processors.

System of distant learning developed at Saratov State Technical University (SSTU) uses Microsoft technologies for building educational environment and OurGrid for using grid-calculations for modelling of technological processes. Grid-node built at SSTU consists of 4 HP 4640 Itanium Servers.

The system was built with the technical support of HP. Using of the SDL allows to increase effectiveness of students training in Robotics, IT, Mechanical Engineering, Nanotechnologies as well as to solve research tasks of Ph.D students.

Let's describe key aspects of using SDL for the departments "Systems of Artificial Intelligence" and "Applied Information Technologies" of SSTU. Peculiarities of the special subjects taught at these departments are connected with using of complex calculations which demand high computational resources for solving of professional engineering tasks: for example, planning of movement of robot-manipulator or graph tasks. Such tasks are characterised by exponential complexity of calculations, from one side, and by possibility of using parallel calculations, from other side, and we can use OurGrid.

There were developed electronic courses in Robotics for course projects development in solving the task of direct and inverse kinematics for robot-manipulator [1]. Direct kinematic task could be easily solved by common PC while inverse task is a very complicated one which demands high computational resources which are taken from Grid-calculations and results are returned to the course module. Using of Grid-system allows students to fulfil course projects even at home through Internet access to SDL.

Another sample is developed electronic course in Technology of Programming where typical graph tasks are described. Common graph tasks studied by students are based on searching minimal paths in graph, typical graphs for studying consist of no more than 50 nodes and the minimal path could be found using of common PC only. At the same time research graph task (even very typical "traveller's task") based on real situation, for example, searching of minimal path on the Russian map which consists of hundred thousands of nodes has exponential complexity and that's why demands Grid-calculations [2].

Taking into consideration importance of studying grid-calculations themselves there was developed Master course "Grid-technologies" which includes modules on parallel and distributed calculations as well as hardware and software of modern Grid-calculations. For students of the last years of Engineer curricula in Information Systems & Technologies, Robotics there were developed special modules "Grid-calculations".

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