

ON-LINE KNOWLEDGE MONITORING SYSTEM MENTOR

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ABSTRACT

Permanent timely monitoring of students' knowledge is very important for their study motivation, for high quality education. This paper presents an inexpensive, easy to use, Internet-based system called "Mentor". The system provides all necessary logistics for on-line monitoring of quality of studies by students in an educational establishment. The system has three independent subsystems with a common database. The student subsystem allows students to take tests with automatic assessment in different modes, to work with study materials for a subject, to audit grades etc. The tutor subsystem gives a teacher necessary tools for creating tests for subjects, for activating and disabling them, for safely keeping lists of classes and the grades etc. The administrator subsystem provides him with the necessary means for keeping the system and its database in working and safe condition.

KEYWORDS: computer learning,
database, tutors.

INTRODUCTION

At the present time there is no shortage for software systems for students' knowledge control on the market. There are world famous systems among them, such as Oracle iLearning, Lotus Learning Management System (LMS) or ReadyGo [1, 2, 3]. There are also systems that are popular only in some regions, such as WebTutor, Prometheus, Microtest [4, 5, 6]. These systems have a common feature: they take all-round care not only of the study process but also of other adjacent activities, such as registration of classes attendance, registration of payments for studies, development of teaching materials etc. As a result we get robust but expensive systems that scare off their potential users by their price and complexity. At the same time there are things of paramount importance for the success of teaching. Among them there are knowledge monitoring and registration of students' grades. It is no secret that not all

students have sufficient motivation to study. Many of them, especially first year students, think little about a remote, by their opinion, future when the acquired knowledge will be converted into a salary and a carrier. They care more about immediate events, such as quizzes, tests, exams. These are the things that urge them to study now. The more students are confident in the inevitability of objective knowledge monitoring, the better they study.

Unfortunately, not always members of the academic staff devote much time and effort to monitoring of the students' knowledge. Often they think that it is more important to improve the quality of teaching. This is understandable because a teacher is the first to suffer if he/she is not ready for a lecture. Some lecturers think that the better they present the study material the more knowledge is received by the students. To some degree it is true, but only to a degree. Without a proper motivation students do not apply much effort in their studies. But this is the only way to acquire profound knowledge.

Taking into account the above points it looked expedient to develop a simple and reliable software system which would allow a teacher to carry out a massive monitoring of students knowledge on a regular bases during the whole period of study of an academic discipline. Such a system (called "Mentor") has been developed in the Kharkov National University of Radio Electronics, Ukraine.

PURPOSES OF THE SYSTEM

Mentor system was designed for centralized registration and representation of the students' study level and also for preparing and performing tests in students study groups (classes). It aims to save time of a tutor and to make the assessment of knowledge of subjects more complete, objective, and transparent for students.

REQUIREMENTS TO THE SYSTEM

Before the start of the system design it was clear the system should satisfy the following requirements:

1. It must be a network system to make it possible for many students to be tested in parallel.
2. The system must store, on a permanent basis, lists of classes and grades received by students for tests and also other grades issued by a tutor.
3. A tutor should manage his/her tests personally: install tests into the system and delete them, have freedom to use them when appropriate.
4. The test preparation procedures must be as simple as possible and comprehensible for any tutor, including those who teach non-technical disciplines.
5. The system must be affordable in price and running expenses.

SYSTEM ORGANIZATION BASICS

- The system consists of separate subsystems with a common database. The subsystems are independent and are related only through the database.
- There are three types of registered users in the system: administrators, tutors (teachers of all ranks), students. The system does not allow unregistered users.
- The state of the system is reflected on web-pages. Each user has its own web-pages.
- A state of the system is changed by commands that are given by users. A command is entered as a web-query with parameters. A user sees the results of a command execution on the web-page.
- Execution of each command begins with verification of the user's authorization to issue such a command and of the correctness of the command's parameters.
- If a registered user enters the system successfully, a client's object is created and saved during a given session of system use. The object contains the information about the

user and serves for authorization of commands.

SYSTEM COMPONENTS

The system "Mentor" contains four major subsystems.

Student subsystem allows performing the following tasks:

- Taking a test as an exam;
- Taking a test as a self-control exercise;
- Working with study materials;
- Checking the grades (marks) that belong to a given student or to other students of the same class.

The functions of the tutor subsystem are as follows:

- Creation, update, deletion of monitoring points (called "checks" on the computer screen);
- Installation and removal of tests for monitoring points;
- Control of test parameters (modes, re-evaluation coefficients);
- Calculation of a student's rating;
- Generation of integrated reports about study results split by classes and disciplines;
- Copying grades given by a tutor;
- Automatic comparison of original grades and their copies;

The functions of the administrator subsystem are as follows:

- Entering a list of students;
- Entering a list of tutors;
- Entering a list of academic disciplines;
- Distribution of students among academic groups (=classes);
- Assignment of teachers and subjects to academic groups;
- Registration of new types of tests.

The automatic knowledge testing subsystem performs the following functions:

- Installation, update and deletion of tests copies;
- Tests approbation by tutors;
- Testing students;
- Accumulating and analyzing data on tests relevance.

STUDENT SUBSYSTEM

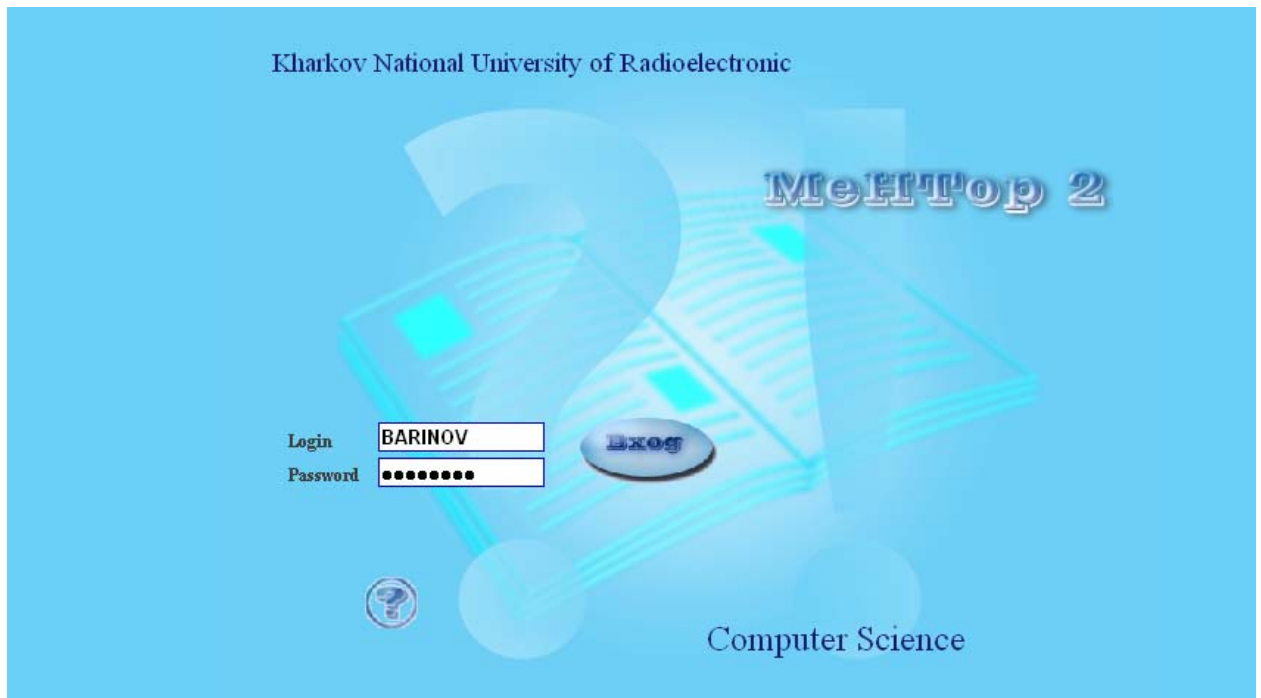
A student is the main user of the Mentor system. Every student can be a member of more than one study group. For example, he/she may be a full-time morning student and, in parallel, study another specialty or join some courses run by the university.

At any time a student can see his own grades or the grades of his classmates. He may undertake any of the opened tests (the tests are opened and closed by a tutor). Finally, he can move to the root resource of the discipline (if it is available) and to work with the study materials. Students, like tutors and administrators, are registered users. That is why they begin to log in to the system by entering the name and the password on the title page of the system as shown on Display 1.

contains the list of disciplines studied by the student and names of classes where the student studies each discipline. A click on the name of a discipline opens the root page of the discipline's resource. A click on the name of a group opens the file with grades (marks) of the group. If at the present time there are tests open for some discipline then the corresponding rows for such subjects display buttons named "test to pass".

MARKS FILE

This page presents the marks of a class for a given discipline as shown on Display 3. A row with marks of a user is presented in bold font. The marks may be issued in the 5-grades or percentage system. Typically the percentage system is used for presenting the results of tests. The relation between percentage and grades is defined by a tutor who may not break



MAIN PAGE

The student's main page (Display 2)

Display 1

Home Help Exit		
Discipline	Marks	Testing
Software Design	IBAC-03-1	
Software Evolution	IBAC-03-1	
Software Process	IBAC-03-1	
Software Quality	IBAC-03-1	
Software Verification and Validation	IBAC-03-1	
Change Password		

Display 2

the rule: "The higher a percentage the higher is the grade". If some tests are introduced for some monitoring points in the file then question marks are visible in corresponding cells. A click on a question mark starts a test.

are taught by the teacher. Information is gathered into a table of three columns: "Disciplines", "Marks", and "Checks" as shown on Display 4. In this table one row corresponds to one discipline taught in one

Home Help Exit							
Student Name	Lab1	Lab2	Lab3	Lab4	Test1	Test2	Rating
БАНТОВ	4	4	3	5	80		3.83
БАРИНОВ	5	5	5	5	94	TEST	4.5
БЕЗЗУБЕНКО	4	5		5	68		3.83
БИБИК	3	4	5	5	69		4
ВІТКОВСЬКИЙ	3	4	5	4	58		3.83
ГАВРИК	5	4	4	4	60		4
ГУБСЬКИЙ	5	5	4	4	70		4.17
ГУЗЕВАТА	4	4	4	3	56		3.67

TESTING

A tutor may install one or more tests in monitoring points (checks) in a class. In such a case a button named "TEST" is visible on the page "Marks file". If a tutor installed only one test then the test itself begins immediately after clicking the button "TEST". If there are more than one tests then after clicking the button the page "Grades file" is opened and a student himself can choose a test to be taken.

If a test is installed in the self-control mode then it can be taken any number of times. If a

Display 3

class. References in the table columns allow:

- To get to the web-resource, devoted to this discipline;
- To get to the page with marks in a given subject for a given class;
- To get to the page of planning of monitoring measures (checks) in a given discipline for a given class.

CHECKS (MONITORING POINTS)

Monitoring measures planned by a tutor are

Home Marks Checks Tests Help Exit		
Discipline	Marks	Checks
Object Oriented Programming	group1	
Software Design	ПЗАС-03-1	
Software Design	ПЗАС-03-2	
Software Design	ПЗАС-03-3	

[Change Password](#)

test is set in the exam mode then it can be taken only one time. A student can take such a test for the second time only after a teacher deletes his previous grade.

TUTOR SUBSYSTEM

Each tutor is assigned some disciplines and classes in which he teaches these disciplines. A tutor can plan monitoring procedures in the classes where he teaches his disciplines, issue the grades for his students, assign automatic testing, work with tests.

MAIN PAGE

The main page contains all the disciplines that

Display 4

as follows: tests, exams, intermediate grading, quizzes, laboratory assignments etc. They are represented by named columns in the marks file of a class (Display 5). Into the checks the marks are entered manually (by a tutor) or automatically in result of students testing. The automatically issued marks can be changed or deleted later as any other marks.

Any check has such attributes:

- Full name;
- Short name;
- Coefficients for converting percentage in a mark;
- Weight for calculating the overall rating;

IBAC-03-1

Full Name	Short	3	4	5	Weight	Exam	Vis	Update	Delete	Test
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	New		*
Lab1	Lab1	3	4	5	10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Edit	Del	Set
Lab2	Lab2	3	4	5	10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Edit	Del	Set
Lab3	Lab3	3	4	5	10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Edit	Del	Set
Lab4	Lab4	3	4	5	10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Edit	Del	Set
Test1	Test1	30	40	50	10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Edit	Del	Set
Test2	Test2	30	40	50	10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Edit	Del	Release

- Testing mode;
- Visibility region for marks of a given check;
- Flag informing that there is an automatic test in a given check.

A full name should reflect the essence of the monitoring activity. It appears as a pop-up prompt in the marks file. A short name is used as a name of a column in the marks file. The visibility region defines if a column with marks is visible for students and the tutor or it is visible only for the tutor. Marks with a limited visibility region allow a tutor to make some notes strictly for himself. All other attributes of checks are used only for automatic testing.

Coefficients for re-calculating of percentage into a mark allow equalizing the 100-grades (percentage) system to the 5-grades system. The coefficients are three numbers which specify three threshold values. For example, numbers 90, 70, 40 indicate that people who got 90% or more for a test receive the mark "5". People who got from 70% to 90% receive the mark "4". Those who got from 40% to 70% receive "3". The rest of the tested people receive "2".

The weight for overall rating calculation makes it possible to change the importance of a check. These coefficients vary from 0 to 100. By default all the checks have the same weight which is equal to 10. A testing mode specifies

Display 5

how a knowledge test is going to be performed: as an exam or as a training session. A student can take a test in training mode unlimited number of times. A new mark will replace the previous one.

A student can take a test only one time if it is installed in the exam mode. If a student wants to take such test for the second time then at first the tutor has to delete the previous mark.

TEST INSTALLATION/DELETION

It is possible to install a test in any of the available checks. It is done by clicking on the link "Install" in the row for a given check. A window appears with a list of tests in the memory for a given tutor. To complete installation it is necessary to click on the name of a chosen test. In order to delete a tests which was installed in some check, it is necessary to click on a reference "Delete" in the row of that check.

MARKS

A tutor can open a separate marks page for each pair discipline-class which was assigned to him. A marks page is a table (Display 6). Its columns correspond to checks which are planned for a given discipline. The rows correspond to the students of the class. A tutor can change a mark in any cell of the table. Legitimate values are integer numbers in the interval [0,100] and an empty cell.

In order to save changed values it is necessary to click the button "Edit marks". If illegitimate values are being saved then they are replaced by "-99" and a warning appears in the table.

Home	Marks	Checks	Tests	Help	Exit
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Student Name	Lab1	Lab2	Lab3	Lab4	Test1	Test2	Rating
БАНТОВ	4	4	3	5	80		3.83
БАРИНОВ	5	5	5	5	94		4.5
БЕЗЗУБЕНКО	4	5		5	68		3.83
БИБИК	3	4	5	5	69		4
ВИТКОВСЬКИЙ	3	4	5	4	58		3.83
ГАВРИК	5	4	4	4	60		4
ГУБСЬКИЙ	5	5	4	4	70		4.17
ГУЗЕВАТА	4	4	4	3	56		3.67

Tests

A tutor can enter into the system any number of tests. Only this tutor can use them for testing his students. At any time a tutor can delete any of his tests or edit it (Display 7).

In the upper part of the system page a table is given with tests entered by a given tutor. This table makes it possible to try a test, to edit it or to delete from the system.

In the lower part of the page a list of registered

Display 6

ADMINISTRATOR SUBSYSTEM

A general task of the administrator is to create and to keep a database of the system in a working state. The administrator performs his duties through web-interface of the system.

Home	Marks	Checks	Tests	Help	Exit
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Try Test	Update	Delete
sample	Edit	<input type="button" value="Del"/>

Load Test
Questions
Total test
Crossword

types of tests is presented. (It is a job of the administrator to register new test types in the system.) By clicking the name of a test type, a teacher can start a procedure of installation of a new test into the system.

Display 7

MAIN PAGE

The administrator main page presents a list of users who are in the system at a current moment (Display 8). Also a file of system events is visible. A list of clients in the system is composed using the file of events (users who logged into the system minus users who exited the system).

The following people are logged in:

```
id=1; Mentor2.Admin      enter: 18 Mar 11:47:47

id=11648; Mentor2.Student  enter: 18 Mar 11:53:11

id=8; Mentor2.Tutor      enter: 18 Mar 12:01:43
```

Event	Time	Details
CLIENT_LOGIN	18 Mar 12:01:43	id=8; Mentor2.Tutor
LOGIN_FAILED	18 Mar 12:01:38	tutor3/1
CLIENT_LOGIN	18 Mar 12:00:13	id=1; Mentor2.Admin
CLIENT_LOGOUT	18 Mar 12:00:09	id=8; Mentor2.Tutor

STUDENTS

All students registered in the system are entered into one common list ordered by family names. For a convenient work with a long list the page has a filter for the beginning of the family name and a limit on the length of a visible part of a list. For example, If a sequence of letters "pet" is entered into the filter, and the limit is 10 then not more than 10 family names will be displayed that begin with letters "pet".

DISCIPLINES

All disciplines that can be taught by a tutor are entered into one list ordered by discipline names (Display 9). The work with the list of disciplines is similar to that of students list.

Display 8

TUTOR'S LIST OF DISCIPLINES

It is the administrator's job to specify which disciplines are to be taught by a given tutor and in which classes. The administrator starts this assignment by clicking on the tutor's name on the page "Tutors" which opens the page of disciplines of the tutor (Display 11).

CLASSES

All classes are stored in one ordered list. The work with this list is the same as with the list of students. In addition it is possible to compose a list of students in a class.

Discipline Name	Update	Delete
	<input type="button" value="New"/>	
Development .NET applications	<input type="button" value="Edit"/>	<input type="button" value="Del"/>
Object Oriented Programming	<input type="button" value="Edit"/>	<input type="button" value="Del"/>
Software Design	<input type="button" value="Edit"/>	<input type="button" value="Del"/>
Software Evolution	<input type="button" value="Edit"/>	<input type="button" value="Del"/>
Software Process	<input type="button" value="Edit"/>	<input type="button" value="Del"/>
Software Quality	<input type="button" value="Edit"/>	<input type="button" value="Del"/>
Software Verification and Validation	<input type="button" value="Edit"/>	<input type="button" value="Del"/>

Display 9

TUTORS

All tutors registered in the system are entered into one list ordered by family names (Display 10). The work with the list of tutors is similar to the work with the list of students with the exception that it is possible to update the list of discipline taught by a given tutor.

CONCLUSION

Monitoring of students knowledge is of paramount importance for the success of education. In order to increase the study motivation of students, knowledge monitoring should be performed during the whole period

Name	Login	Password	Contacts	Update	Delete
				<input type="button" value="New"/>	
Bondarev Vladimir	bond	1	bond@kture.kharkov.ua	<input type="button" value="Edit"/>	<input type="button" value="Del"/>
Dudar Zoe	tutor3	*	zoja@kture.kharkov.ua	<input type="button" value="Edit"/>	<input type="button" value="Del"/>
Ivanov Ivan	ivanov	*	ivanov@kture.kharkov.ua	<input type="button" value="Edit"/>	<input type="button" value="Del"/>
Ossyka Alexandre	tutor4	*	alex@kture.kharkov.ua	<input type="button" value="Edit"/>	<input type="button" value="Del"/>
Shabanov Yuri	tutor2	*	yuri@kture.kharkov.ua	<input type="button" value="Edit"/>	<input type="button" value="Del"/>
Shkljarov Leonid	tutor1	*	leo@kture.kharkov.ua	<input type="button" value="Edit"/>	<input type="button" value="Del"/>

Display 10

Development .NET applications	<input type="button" value="Add"/>
Development .NET applications	group1
Discipline Name	Group Name
Object Oriented Programming	group 1 <input type="button" value="Delete"/>
Software Design	II3AC-03-1 <input type="button" value="Delete"/>
Software Design	II3AC-03-2 <input type="button" value="Delete"/>
Software Design	II3AC-03-3 <input type="button" value="Delete"/>

when a discipline is studied. Only Internet-based systems are capable to provide full and regular knowledge monitoring. Such systems can be used on a massive scale only if they are reliable, simple in use and affordable in price. Knowledge monitoring system "Mentor" satisfies these requirements to a full degree. It is going to be used for creation of a new education paradigm.

Display 11

REFERENCES

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2. <http://www.lotus.com/lotus/offering6.ns/wdocs/homepage>;
3. <http://www.readygo-br.com/demo3>;
4. <http://webtutor.thomsonlearning.com>;
5. <http://www.prometeus.ru>;
6. <http://www.thejournal.com/magazine/vault/a3590.cfm>;