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Scaleable model of e-learning platform

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Education and research trends

ABSTRACT

Purpose: The issue of distance learning is presented in the work, and especially the development stages of the educational platform of the Internet Teaching Centre for Students (further referred to as ICKS), which is planned to be used for implementation of the e-learning didactic process.
Design/methodology/approach: The following programming technologies were used for development of the educational platform: HTML, CSS, JavaScript, PHP and SQL. The relational database was designed using the DFD and ERD models, and created in MySQL using the SQL language. PHP language was used to develop the relevant interface so that the user can access and modify data in the database; scripts in this language form the MySQL database front-end making it possible to carry out operations on data. The ICKS web page interface, including the Administrative Panel, Student Rooms, and Teacher Rooms, was developed using the HTML language and the CSS cascading style sheets.
Findings: Detailed e-learning site specification requirements were put forth and the contemporary technologies were applied to develop the framework for the scaleable e-learning platform.
Research limitations/implications: The system will have to be filled in with relevant course materials and tested thoroughly before being fielded.
Originality/value: System elements development completed out so far and detailed specifications make it possible to implement the platform to handle all subjects taught at the Institute.
Keywords: E-learning; Distance learning; Course management system

1. Introduction

Distance education was initiated with correspondence courses because of the enormous distances which made meetings of the students with their teachers difficult (especially in Australia, Canada, and USA). Printed materials were mailed to the students. In 1883, the Correspondence Teaching University was set up in the State of New York, which trained Sunday school teachers [1,2]; seven years later the International Correspondence Schools (ICS) grew from the Colliery Engineer School of Mines, which initially used correspondence to train miners, railroad, and iron workers. As radio broadcasts became widespread, the first radio educational programs were initiated at the Iowa State University in USA (1925). Later the time had come for the educational TV, which was originated on the initiative of the same university in 1940. Computer educational programs were the next stage in education, resulting from the co-operation of the Stanford University with IBM [3,5].

Advantages of distance learning were noticed in Europe also; therefore, Open Universities were established here, like the Open University in United Kingdom (1972), FernUniversitaet in Germany (1974), Universidád Nacional de Educación a Distancia in Spain, or federation of universities - Federation Interuniversitaire de l'Enseeigment a Distance in France [4,6,8].

Teaching over the Internet emerged in the nineties of the last century along with advent of new technologies and dissemination of the Internet, beside the satellite TV broadcasting educational programs or the radio courses (e.g., language ones).

New information transfer media were developed with time, which was connected with origination of new teaching models. Four generations may be distinguished in *distance learning* (Table 1) [2,7], in which each one refers to the consecutive development stages of the

media used, beginning from the correspondence model, where printed materials were the information transfer medium, up to the flexible teaching & learning model, in which information is transferred mostly by means of the computer and Internet [1,9,12,13].

Table 1.
Historical development of information transfer media [7]

Generation	Teaching model	Used medium
	Correspondence	▪ Printed materials: manuals, text-books
	Multimedia	▪ Printed materials ▪ Lessons on audio & video cassettes ▪ Interactive video ▪ Computer
	TeleTeaching	▪ Tele- and audio-conferences ▪ Radio ▪ TV
	Flexible teaching & learning	▪ Interactive multimedia ▪ CD and DVD disks ▪ Materials presented in the Intranet and Internet networks ▪ TeleEducation with a computer as a medium

2. Description of system operation

Beginning development of the e-learning system called for answering the following fundamental questions:

- What will be tasks and goals of this particular educational platform?
- Who will be its users and what functions will they play?
- What will be the structure of the platform's contents?

The e-learning system is to be an alternative to students who are ready for distance learning; therefore, its main tasks will be:

- Providing the students with the information on: available courses, enrolment procedure for a course, rules of using the platform, subject approval policy, and how the certificates can be obtained after completing the course,
- giving the potential students the possibility to declare their intention to participate in the course over the Internet,
- education,
- providing the students the access to the educational materials,
- making the communication between the students' registration bureau and student easier,
- making the contact with the lecturer easier.

System users can be divided into two groups, each having different opinions, and these groups are students and academic teachers. The best way to learn about the needs of the potential users is to work out a scenario based on expectations and preferences of persons using the platform [1]. This scenario should take into account the needs and expectations of a student, who wants to exploit the opportunity to study over the Internet, looks for the relevant educational centre, enrols to the selected course, proceeds along his or her course of studies, and finally obtains the course certificate [1,10,11] . The other user group - lecturers, may have slightly other expectations (e.g., the possibility to write down the results and then circulate students the results, with the possibility to access their data, etc.)

3. E-learning system development using DFD model

Having defined the web site goals its structure was designed. The system design consisted in several stages:

- *Stage 1.* Requirements were formulated which the system has to meet, along with the scope of data to be stored in the system database.
- *Stage 2.* Processes, objects, and data flows were designed and described using the DFD model *(Data Flow Diagram)*
- *Stage 3.* System database model was developed and described with the ERD model *(Entity Relationship Diagram)*
- *Stage 4.* System database normalisation was carried out to produce a set of relations free from data redundancy and update anomalies.
- *Stage 5.* Relational database was developed in SQL using MySQL system.
- Stage 6. Finally the database was filled with data, which was made available using the dynamical user interface developed with PHP - Internet Teaching Centre for Students web site.

The Internet Teaching Centre for Students web site's database is the repository of information about students, teachers and courses, as well as educational materials for the particular subjects within the framework of these courses, marks obtained by students at various tests, etc. All system users can log into the database, enter his or her personal data, and then - after paying the fee, can become the selected course's students. The idea of the system is that the user, being the course student from that moment on, can be authorised, based on his login and password stored in the database, and access materials for all subjects included in the course's syllabus. The system database is intended to help the teacher in running the course, i.e., provide him with the list of students, give the possibility to enter marks and approvals for students, which finally are the base for issuing the course certificates.

The data flow diagram is a model describing the information exchange processes in the system. The DFD model is composed of the following main object types: processes, internal objects, data repositories, and data flows .

Internal objects feature the modelled process environment, data repositories store data needed by the processes. The processes transform their input data flows into the output data flows which may be sent from one system element to another [1]. The DFD model developed during the system design process is shown in Fig.1.

Processes are depicted in the diagram as rectangles with the rounded corners. The internal objects are depicted by rectangles, whereas the data repositories are depicted by two parallel lines. Lines with arrows and numbers feature the data flows, visualising the flow of the particular information between processes and objects, data repositories, and other objects.

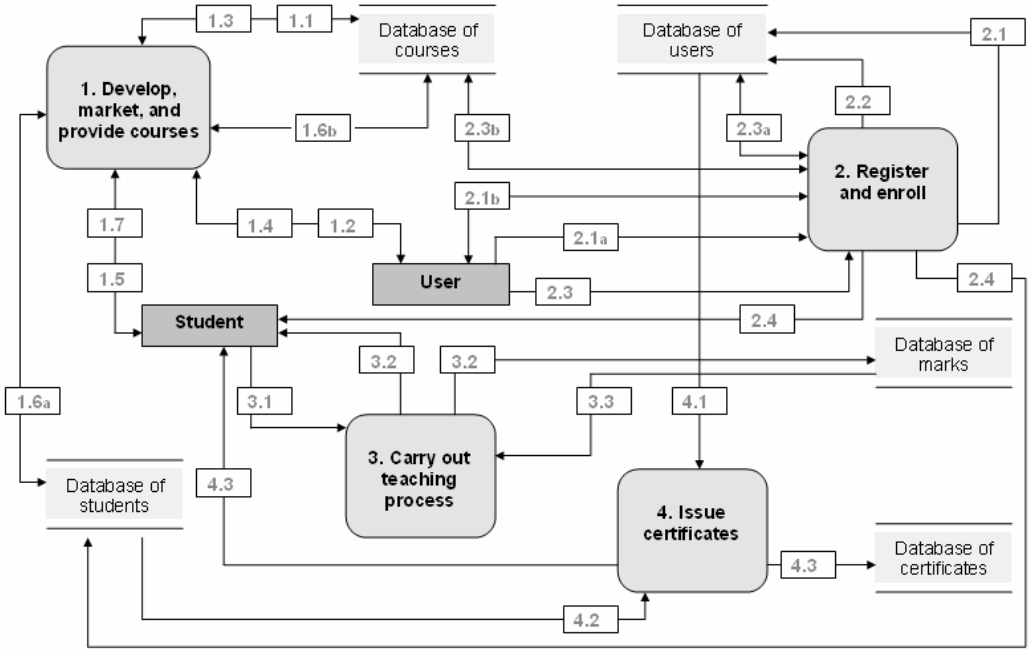

Fig. 1. Data flow diagram for ICKS

Data for each table - relation - was defined at Stage 3. Tables - relations - of the database were created based on the previously developed DFD model, using the ERD model *(Entity Relationship Diagram)*.

The ERD diagram [14-16] is the entity relationship diagram used to represent in the graphical way dependencies between entities in the database, other than the DFD diagram, focused on modelling the information interchange within the system [20]. It was enough to use the DFD model developed earlier to determine the properties - attributes - of entities, as they were initially formulated in data flows definitions.

The next system development stage was normalisation process. Normalisation was carried out following the relational database design rules. These rules guide the database development through the following normal forms: 1NF, 2NF, and 3NF. The normalisation process is required to remove the redundant data and take into account the functional dependencies between the attributes of entities. Decomposition of tables takes place in the this process, i.e., splitting of tables (relations), however with retaining all information from the initial tables.

The dynamical contents of the web site is based on the data stored in the database, being made available through various modules, like “Administrative Panel”, “Student's Room”, or “Teacher’s Room”.

Web site interface design was started as simple hand sketched drafts on a piece of paper, on which information scope was defined, with no particular details at that time [17,19].

The next stage was graphical web site design using XaraX program (Fig. 2), and when the graphical design was ready, the web site was coded in HTML using the cascading style sheets (CSS) [18, 20-22].

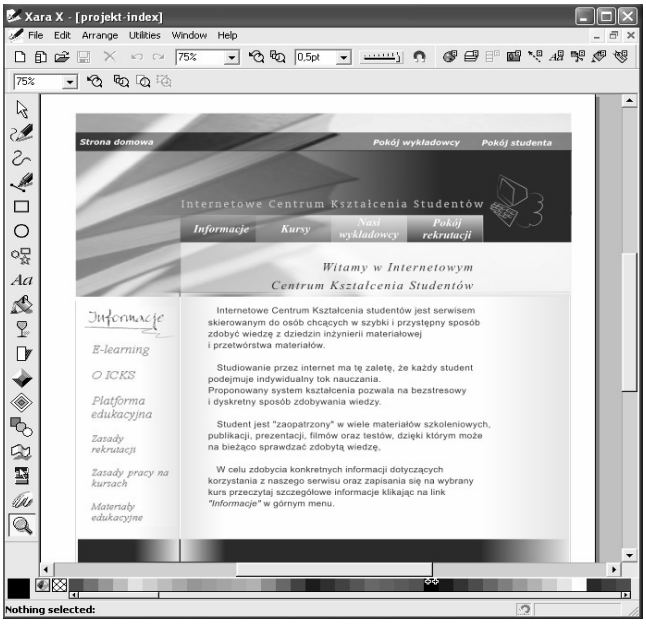

Fig. 2. Graphical user interface of the ICKS web site

4. Conclusions

The following tasks were carried out within the project scope:

- The working environment was set up - installation and configuration of Apache server, MySQL database system,

and PHP interpreter.

- The e-learning design concept was developed along with the detailed system operation description, structure design, and web page contents.
- The database design and development was carried out, starting from specifying the design requirements, through data flow modelling with DFD diagrams, development of the entity relationship diagrams (ERD), to create finally the database tables. The above mentioned tables were normalised and next the database was created in MySQL based on their final forms, filling them with the exemplary data.
- The following graphical programs were used to develop the platform user interface: XaraX and Adobe Photoshop; next the web site was developed using the HTML and CSS software tools. Cascading style sheets were developed both for the screen web site version and for printouts.
- Using the PHP scripts connection was established of the *e-learning* platform with the MySQL database, which was demonstrated in the "Administrative Panel", for which the relevant data entry forms were designed and implemented, making it possible to add, edit, erase, and search data directly from the *e-learning* platform.
- Moreover, the "Student's Room" and "Teacher's Room" were developed along with their relevant access authorisation systems.

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