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Development of a Publication Support R&D System

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Abstract. The University of Miskolc intends to strengthen its publication as well as R&D activities in line with European and domestic strategic goals. The University aims at developing partnerships at international level with its research fields, aiming at updating, renewing existing relationship capital and developing new industrial relations. The development of an overall information system for maintaining and strengthening the competitiveness of the R&D activities at the University of Miskolc should be prioritized to achieve the goals.

Keywords: research, development, publication support, information system, online web interface

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1. Introduction

One of the strategic objectives of the University of Miskolc is to play an internationally competitive role and to strengthen its competitive position by increasing its innovation performance.

The revenues of the University can be significantly increased through the introduction of industrial orders, co-operations, innovative solutions, research and development and knowledge transfer projects, supported by the development and results of the institution's education, training and service processes based on the operation of the centres of excellence.

At the University of Miskolc, there was a demand for electronic archiving of vocational training contracts in 2010, mainly to track income and expenses in one place. Given the specific nature and usability of these contracts, existing registration systems did not provide adequate flexibility to serve this purpose. For this reason, it was obvious to develop a completely new system with custom, specific functions for this purpose (see Figure 1), in which persons with appropriate rights at the level of a given organizational unit can access their contracts, data contained therein, make inquiries statements and annual reports. Given that these contracts contained confidential information, thus enhancing data security, it was advisable to build an online interface within the university intranet to reduce the vulnerability of the system.

Based on user feedbacks the system was well tested and fulfilled the intended goals, with which a large gap had been abolished by providing quick and efficient recording and archiving of vocational training contracts.

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Időpont	sorszám	szerződés	szerződés fenntartása	számok	számok fenntartása	módosítás	megállapodás száma	megállapodás dátuma	támogató cég neve	támogató címe	támogató adószáma	fejlesztési támogatás felhasználásának helyszíne	fejlesztési támogatás (akadémiához kapcsolódó) szak, felsőfokú szakképzés megnevezése	fejlesztési támogató hallgató létszám (fő)
	01.						123/2011	2011.12.01	MAVIR ZRt	1031 Budapest, Aiskó u. 4	12550753-2-44	számításelméleti laboratórium	jogi ismeretek	1
	02.						14/2011	2011.02.25	Marek Kft	1082 Budapest, Fűző u. 47-53	10887968-2-42	számításelméleti laboratórium	jogi ismeretek	
	03.						16/2011	2011.03.25	Vodafone Magyarország	1096 Bp. Lechner Eötvös köz	11895927-2-44	számításelméleti laboratórium	jogi ismeretek	

Figure 1. Registration System for Vocational Training Contracts at the University of Miskolc [1]

With the success of this system and with the aim of harmonizing the ever-increasing tendering activity, I thought it would be worthwhile to develop an internal, project-oriented research and development and innovation inventory system which aims to quickly and efficiently link the projects, the research topics and the researchers having relevant qualifications, professional experience and 'know-how'. An adequately thought-out and well-developed [2] information system can increase the efficiency of the institution and thus its business profitability [3], with benefits.

Benefits of a web-based R&D system:

- constantly improving transparent processes and organizational regulation,
- improving customer focus, customer orientation and customer satisfaction [4],
- meeting the needs for continuous development within the whole organization,
- improving external judgment and compliance,

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- compliance with the basic requirements of the higher education quality assurance framework,
- economic efficiency and effectiveness,
- employee satisfaction, improving internal and external communication.

The purpose of this paper is to present the comfort, user-friendly functionality of the system approaching from the IT and development side [5], and provide an insight into how well it can serve the purposes it has been aimed for, i.e, to make the project opportunities and related information more effective to provide for competent persons in time, thus helping to co-ordinate self-motivated colleagues on research topics.

2. Development Environment, System Development

With the implementation of the system, the primary goal was to be accessible online from anywhere, therefore web development was the most obvious solution that provides 24 hours of 'anywhere and anytime' access. As regards web development methodology, I preferred agile approach (*see Figure 2*) since it allows to make any change and to add features easier that will keep the system up to date with the latest developments and requirements at the institution.

The development of the system is based on PHP with MySQL support, which allows the data to be stored in the database at the University's central server (*the principle of operation is shown in Figure 3*). The infrastructure required for its operation is thus provided by the university server as follows:

- PHP module: to run server-side PHP-based code,
- MySQL module: centralized data storage, filtering and search functions.

PHP (Hypertext Preprocessor) is an open source computer scripting language that runs on any of the operating systems on a server side, working with most server programs. Its main field of use is the creation of dynamic web pages. [7]

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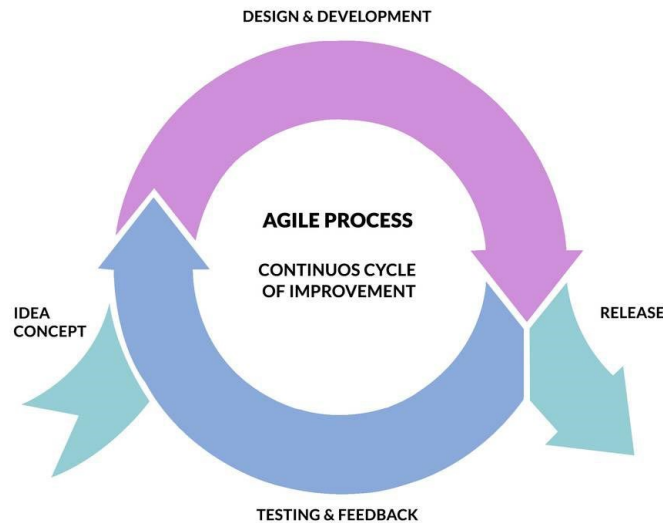


Figure 2. Concept of Agile Software Development [6]

MySQL is a very popular database management system that is famous for its simplicity and efficiency. Its simplicity is due, among other things, to the fact that it is based on SQL (Structured Query Language) commands, as its name suggests. Using a standardized language in SQL, you can handle different types of databases in the same way. [8]

Priority-treated aspects considered in the development of the system:

- modern, well-identifiable interface,
- web ergonomics (design, usability, simple navigation, standards, user experience, etc.)
- transparency, legibility,
- search box, breadcrumbs trail,
- style sheets, typographic specifications,
- platform independence,

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- predictable response time, dynamic operation,
- international appearance,
- accessibility principles, shortcut keys.

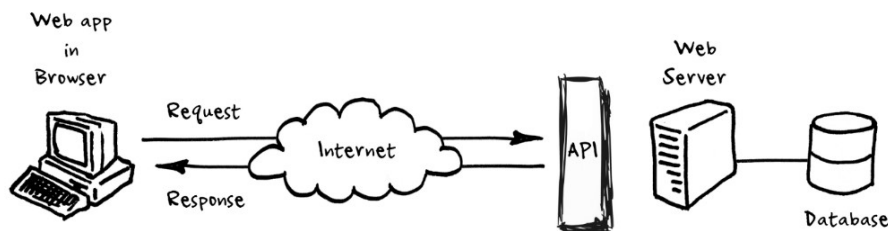


Figure 3. Client-server concept of the R&D system [9]

The main functions and features of the web-based information system:

- submission of proposals, online storage of R&D works in a central database,
- an authentication-enabled system with greater functionality for registered users,
- the registration of colleagues involved in the management and implementation of applications,
- storing academic and industrial relations capital of the University of Miskolc,
- data manipulation functions:
 - inserting, modifying and deleting data,
 - exporting data stored in tables (EXCEL, PDF, Clipboard),
 - filtering, searching and sorting data,
 - exporting filtered data (EXCEL, PDF, Clipboard),
 - aggregated data generation from basic data,
 - making statements,
- further functions:
 - management of users and their rights,
 - user profile settings,
 - logging user actions.

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Different functions are implemented through their own PHP functions. Users are managed entirely by the system administrator, who can (*see Figure 4*):

- create user accounts,
- disable users,
- remove user accounts,
- allocate users' rights,
- change users' rights.

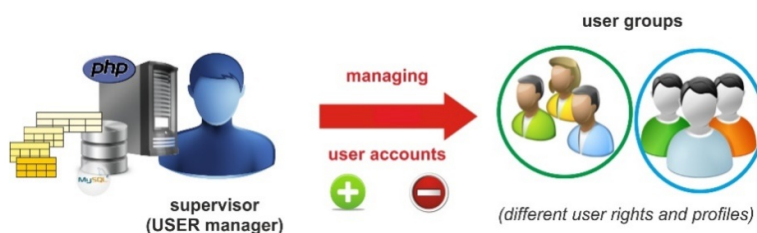


Figure 4. User management

The infrastructure required to operate the system (*see Figure 5*) is provided by the university server (PHP for running server-side PHP-based code, MySQL for centralized data storage, filtering and search functions).

To store data in the database, I had to clearly define what information should be stored to provide general search and more complex filtering features. The data is stored in properly formatted database tables. Here are some additional parameters for the data fields had to be given in the development stage:

- data field type: number, text, logic, date, etc.
- data field length: how many character lengths are needed for storage,
- integrity criterion related to the data field: internal rule system, correctness of the stored data (for example, whether the data field is left empty during recording, whether it is a primary key, etc.).

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Figure 5. Functions and features of the online system

The table structure and schema (*see Figure 6*) can then be described with the fields in the table. That is, if we specify the fields from which the table is constructed, then we will clearly state the structure of the table, so the structure of two tables differs from one another if there is a field in one and the other is not in the other.

Entering fields specifies the field name and the field data type. Since designing structures does not clearly identify a table, as there are several tables that can exist with the same structure, on the other hand, the description of the structure is very lengthy, so each table got a unique identifier name within the database. With this name, the tables in the operations can be clearly identified. The name of a table should therefore be unique within the database, and a field name must be unique within the table.

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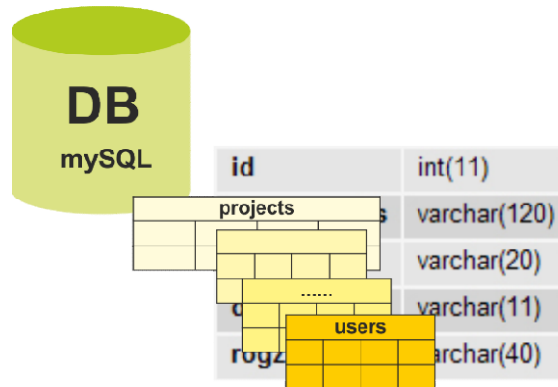


Figure 6. Database tables for storing data

3. Operation and Functions of the System

The importance of a user-friendly interface has been a top priority aspect during the development of the system. Connecting the design (see Figure 7) and the expectations of the users has resulted in a convenient, easy-to-use system, making it easier for users to work and reducing data entry and data handling errors.



Figure 7. User interface design [10]

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The R&D system consists of a public and a protected module [11]. Practically anyone can propose a topic, a project or an R&D opportunity on the public interface, which is registered into the system database classified by a selected specialization.

Recording of projects and other resource-generating activities can be done in batch mode by a user having administrator rights, so that multiple records can be imported into the system by using an Excel or CSV file with an appropriate data structure. It is practically possible for an external person, company, organization to offer research and development work to the university, or to provide a link to a call. All current projects can be quickly recorded into the system database in order to easily reach the competent people and research groups.

Offering themes within the university can be done manually by persons with administrative rights and by automatic forwarding to the colleagues being competent in the given research field.

In the login interface, user must enter a username and password for the user account, after which the data is loaded according to the user's rights.

Various functions are located under tabs, the colour of the currently selected tab of which differs from that of the other tabs. By clicking the tab the user wants, the features below the selected tab are available. After selecting the appropriate level of structure, it is possible to manage data according to the user's rights: recording, modifying, deleting.

The text entered in the input field next to the magnifying glass icon – at the beginning and at the end of the web page – search operation is performed in the currently selected data table, which results data rows matching the search criteria.

Entering a string into the input fields located under the header of the table searching in the given column can be performed. The system also provides multiple filtering by

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combining search keywords typed in multiple input field. Numeric data can also be used to specify a value range.

The entire data table or the filtered data can be exported in PDF or Excel format, or you can copy data to clipboard, which can then be inserted into a text editor.

In the headers of the data columns, the up and down arrow icons indicate the possibility to sort the data rows. By clicking on the header of a column, the data will be sorted based on the data in the column. After a single click, an ABC order will be done and then click again will result reverse ABC order of data rows. By pressing the CTRL key multiple sorts can be performed.

4. Conclusions

The Excellence Centre Project at the University of Miskolc generates organizational development and infrastructure transformation programs that make the laboratory and workshop infrastructure more useful in co-operation with the business sector.

Effective research increases technology transfer, dissemination and innovation potential. Compliance with standards and individual requirements as for all educational institutions is also essential at the University of Miskolc.

By promoting the R&D potential of the University of Miskolc, offering researchers' competences and capacities and tools, the University's revenue can be significantly increased. To do this, it was essential to create an online accessible interface, on the one hand, with due emphasis on the results of projects and co-operations on individual R&D activities of the departments, institutes and faculties at the University of Miskolc.

The aim of the development of the web-based R&D system is to facilitate contact between the University of Miskolc and its industrial partners, to keep up-to-date information on co-operations, resulting faster and more effective interactions during the implementation of

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R&D projects. Regulated and structured processes have a decisive influence on the quality of the services provided by an educational institution.

A well-thought-out and well-developed information system can increase efficiency and improve performance. The developed IT system is a constantly updated and up-to-date online information centre of knowledge for industrial players.

As regards further development goals, in the following I want to focus on user-specific modifications, additional convenience features and even faster and more efficient improvement of the system.

Acknowledgement

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