

Teaching Information Systems for Mechanical Engineers

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Abstract: For many years the Department of Control Systems and Instrumentation of VSB - Technical University of Ostrava is dealing with teaching subjects in the area of Computer Science. One of the important areas are information systems. Our experience says that the graduates of Mechanical faculty are quite often involved with information systems as **users**, **supervisors** of systems developed by external suppliers, **managers** requiring system design or **designers** of the systems in small companies. We rely on required information from our former graduates and from our contacts with different companies in our region. In teaching we are focused especially in the area of database information system design, which we can divide into three parts (a) **data analysis**; it results in the optimal data model design, (b) **function analysis**; it results in required changes of data structure for speeding up the activity (data aggregation), dividing the system into completed parts, form design and output sets, (c) **analysis of system's security**; it results in the definition of user groups, their access rights and perhaps data structure changes, further then implementation of data backup copies, database replicas etc. The students verify their theoretical knowledge during working on concrete problems from practice. They also often co-operate during special database application configuration for co-operating companies (in the past, these tasks were solved: databases of operation measurements, database support of design, economic and accounting systems of small firms, registering publication activities, CD-ROM library etc.). Mastering the application design in concrete database system environment is, however, students' independent work in a significant level. In order to support the self-study the Department of Control Systems and Instrumentation published whole range of study materials including solved examples. At the present time are these textbooks digitised and made available through the faculty's web site.

Keywords: database, information, system, education, Internet

1. The present state

We utilize former experience how graduates of our faculty are able to get jobs during syllabus creation for teaching students. Actually, all graduates are users of one or even more information systems services. However, only our graduates of the field of *Applied Informatics and Control* (Bachelor study) and *Engineering Informatics and Control* (Master study), are dealing with creation of information systems, whose teaching is ensured by our Department. That is why the teaching of information systems was divided into two parts.

First part is running for the first year students of the entire faculty and it's task is to introduce students to using information systems, namely, for their own study. Especially, various librarian information systems, which range from the classical to electronic, retrieval systems, etc, belong there. The emphasis is also on use of Internet information systems and the necessity of verification of obtained information, of the sources credibility, of the information from more independent sources, connected to the systems. There are still problems found in this area. The students have tendencies to trust to all obtained messages without regards to a source, which they were obtained. This approach, however, can be observed in the entire society, as the success of advertising, rumor spread, and ever-survival of unverified or directly false information are witnessing.

The second part is determined for students with the Computer Science specialization and for students of other fields it is an optional subject. Its goal is to introduce students with an analysis and synthesis of information systems, in order to participate in process of the data, functional and security analysis. The extent of these requirements is so large, that it requires the division into several independent subjects, as further described.

2. Specialized information system education

The education of students in *Applied Informatics and Control* and *Engineering informatics and Control* fields is directed towards creation of information systems, as well. The direction is, at the same time, influenced by common graduate's employability at small and medium enterprises, therefore the education is directed on creation of information systems of smaller extent, using also especially office software (Microsoft Access). Later, the students are introduced to large information systems in economic and management areas, but only from the user's point of view, and perhaps from the point of view of their administration. The entire problem is, at the same time, divided into several connected subjects:

- **Basic Informatics** - contains an introduction with security methods and data acquisition, transfer and data processing implementation. Especially data formats, principles, coding, programming and transfer. Important parts are also the principles of secure communication, authenticity and electronic signature of messages.
- **Database Systems** - creation of information systems in the environment of office software, directed to Client-Server systems, implementation of data analysis, function analysis including security analysis. The emphasis is on SQL language applications, even though the graphical interface QBE is mostly used for query creating.
- **Economic Software** - introduction to larger information systems in the area of economics and management of enterprises from the users and administrators point of view.

The most important part of the teaching is, however, focused on Database Systems subject. The main task is to engrave students the basic knowledge from process of creation of information system, especially in connection with individual phases of the process of the information system creation, as shown in fig.1.

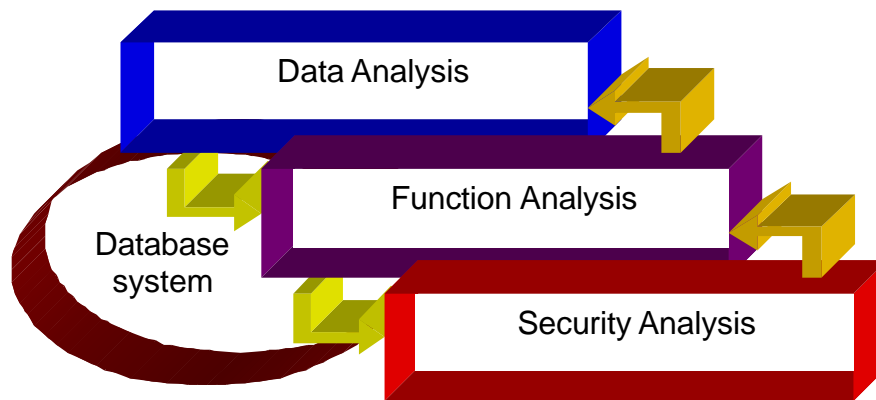


Fig. 1. Concurrence of the main phases in information system creation

The teaching itself is divided into 14 weeks, as it is common at our University for one-semester subjects. The lectures are directed to theoretical bases, methods and processes, the tutorials then conclude the practical creation of information system in the chosen environment. At the present time, the Microsoft Access is used, which corresponds to earlier mentioned direction on small and medium enterprises and their information systems. The entire structure of teaching is shown in Table 1.

Table 1. The curriculum of Database systems for bachelor study

No.	Lecture Tutorial	Curriculum
1	Lecture	Introduction to content of the subject, requirements of a credit system. Tuning the subject curriculum.
	Tutorial	Installation of Microsoft Access.
2	Lecture	Basic types of databases (relation, hierarchical, net), architectures of database systems (central, file-server, client-server).
	Tutorial	Operation of individual systems.
3	Lecture	Object oriented databases. Object types in databases and their application, data types.

	Tutorial	Basic operation with object databases, applications, menu, help.
4	Lecture	Data analysis and table design, their items and connections.
	Tutorial	Table creation in Microsoft Access Semestral project tasks.
5	Lecture	Query, virtual items design. SQL (query language) applications. Test No. 1. : Data analysis.
	Tutorial	in Microsoft Access in Query by Example system.
6	Lecture	SQL according to ANSI.
	Tutorial	Query in Microsoft Access by SQL.
7	Lecture	Form creation for input data. Connecting tables for input.
	Tutorial	Form creation by Microsoft Wizards Test No. 2. : Query creation.
8	Lecture	Forms creation with sub-forms, manipulation with objects of forms.
	Tutorial	Forms creation and their arrangements.
9	Lecture	Output sets creation.
	Tutorial	Output set creation by Microsoft Wizards
10	Lecture	Macro and module in object database, their significance and application.
	Tutorial	Makros application and user functions for forms and sets.
11	Lecture	Definition of constants and variables, object data types, operations with objects in a program.
	Tutorial	Structuring of a problem, design, division of functions and procedures. Test No. 3. : Forms and sets creation.
12	Lecture	Command for control, IF, DO WHILE, SELECT CASE. Communication with user, MsgBox, InputBox.
	Tutorial	Creating simple user functions.
13	Lecture	Operation with data types, data conversion, operators for data processing.
	Tutorial	Creating menu of a user program, AUTOEXEC, AUTOKEYS.
14	Lecture	Typical proceedings during data and objects manipulation, their solutions.
	Tutorial	Design and its systematic approach and a concrete database application.

3. Tutorials implementation

During the tutorials, it has been verified for a longer period of time, that it is a good practice not to pay attention only to a creating always special examples which would document and solve the taught topics, but continuously solve one simple problem from the very beginning till its end. It is obvious that it is very difficult to choose enough simple problems to be solved, which would be at the same time able to document necessary possibilities of database systems. As an example, an information system of observing working out extended problems is shown here. E-R model of the resulting database is in Figure 2. This system is not too complicated, however, it enables showing a whole range of technical elements of the Microsoft Access database including cross references (Crosstab Query), and the creation of aggregated computing for the output sets.

The example described here was used during the last year as a basis of a textbook for MS-Access, published at the VSB-Ostrava namely for students of a combined study and for supporting the self-learning. The textbook gradually works out this task as well, and shows the creation of:

- tables,
- queries,
- forms,
- sets
- macro commands,
- simple users functions (and thus programming modules),
- security of a database

- output data into other applications (MS-Office) and output to web.

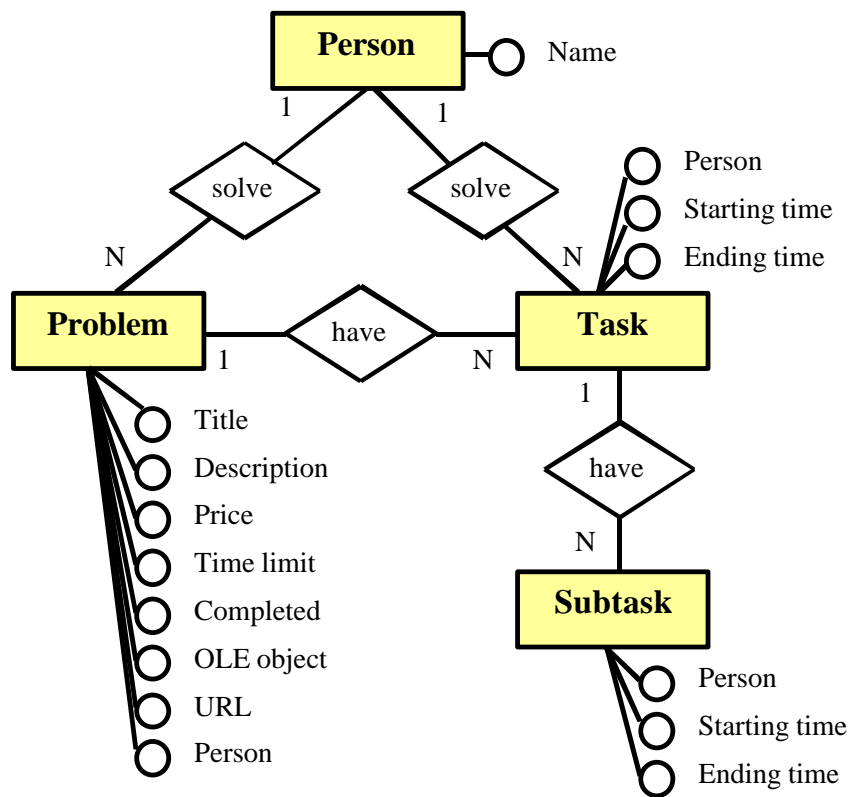


Fig. 2. E-R model of problems

4. Students work

The implementation of an individual database project is a part of the subject of Database Systems. The students are during working out the project limited only by a minimum required extent. They determine the topic of its focus and required outputs after consulting them with a teacher, who approves them. In this way the students verify their knowledge and skills in information systems design.

The extent and the depth of working out the task is the best documented by following concrete results of students. The Figure 3 shows a structure of a system for keeping recording of business trips by business cars, which represents a concept well done, however, of a small problem by its extent.

On the other hand, the task of keeping recording of invoices (Figures 4 and 5) was worked out much more thoroughly, which is witnessed by a fact, that a student chose a problem, which he was personally interested in. In such case, and it is quite often, the task must be very useful for the student. This approach is obviously supported, because it is mutually advantageous. The student designs a database, which is needed and, at the same time, is willing to invest into its working out a significant amount of energy and proceed it into a considerable depth.

The most frequent problems, which are solved, are naturally tasks, which reflect personal interests of students:

- keeping records of personal collection of music (tapes, CDs, videotapes, ...),
- keeping records of videotape renting (CDs, video-games, ...),
- keeping records of invoices, accounting,
- keeping records of www pages, web sites and others.

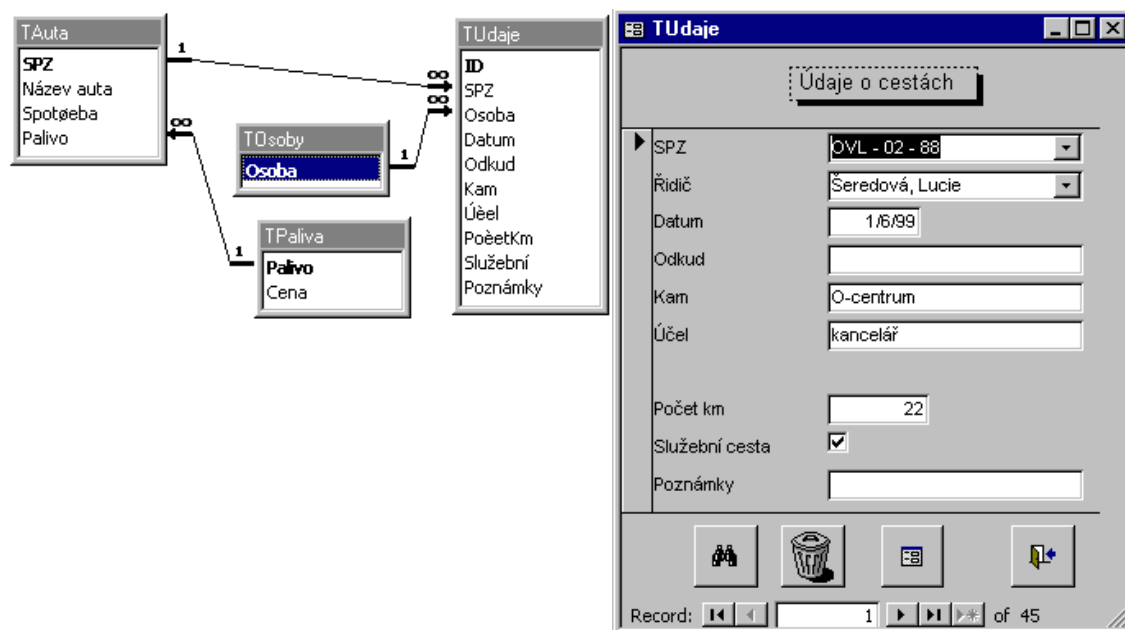


Fig. 3. Business trips records

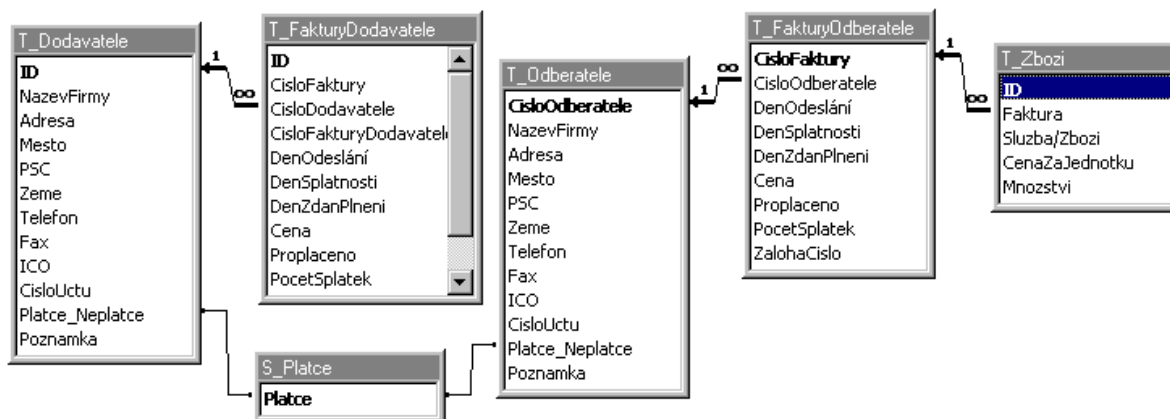


Fig. 4. Structure of an invoice records system



Fig. 5. Operating the invoice records system

5. Results

At the present time, the attention is growing towards the areas of web-based information systems. It corresponds to gradual move into direction of projects in these areas. The problem is, that the extent of this work grows, because besides present database program, which must be divided into data and operator parts (basically corresponding to a system with the architecture of client-server), it is necessary to debug also an Internet access to data.

In the framework of the given time, it usually means decreasing severity and extent of solved problem. As an example, the issue of Internet textbook of block oriented simulation program SIPRO[®] is given. The teaching text is saved in a database, which enables its easier arrangement and especially easy listing throughout chapters according to key words, or individual type blocks, as it is shown in Figure 6.

In this area, the technologies of IDC/HTX files (Internet Database Connector) and ASP (Active Server Pages) are in a broad use, supported by products of Microsoft firm. Even though the Access database contains tools for publishing the database on Internet, it shows that their only application is not sufficient. It is always necessary to treat the obtained files further and that is why the students must be introduced to their design. By this, the extent of taught material is getting larger. Since the time for teaching is constant, it necessarily leads to suppression of other parts of teaching.

Lately the Internet application pressure is so big, that its separation from the subject into independent Web-based Information Systems is considered. At the same time, the transfer to design of fully applicable client-server systems including extensive software means applications for database administration as well as the design of client applications is considered. The PowerBuilder system has been tested already, which is able to support design of not only client applications, but also application servers for publishing data on Internet. Its implementation into teaching was meanwhile kept back for its considerable extent and great demand on user. It would also contradict already given orientation on needs of small and medium firms. PowerBuilder belongs, on no count, into a category of office software, either by possibilities or price.

6. Conclusions

From the present experience, the orientation towards the present trends of teaching information systems was verified at the Department of Control Systems and Instrumentation, VSB-TU Ostrava, as correct. It shows, however, that in the area of common knowledge and skills of students for the information system application is a space, especially then in the area obtained data verification, the techniques of data security and common security of information systems, which, according to our opinion, belong to the area of common computer literacy of a present engineer.

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7. References

- [1] Radim Farana. "Databazove systémy. Microsoft Access 2.0." 1. ed. Ostrava, VSB-TU Ostrava, 1995, 130 p. ISBN 80-7078-288-9.
 - [2] Radim Farana. "Tvorbá relacních databazových systémů." 1. ed. Ostrava, VSB-TU Ostrava, 1999, 100 s. ISBN 80-7078-706-6.
 - [3] Radim Farana. "Using Internet Information Technologies for the Support of Education." International Conference on Engineering Education ICEE'99 [CD-ROM]. Ostrava, VSB-TU Ostrava, 1999, Paper 145, 2,82 MB. ISSN 1562-3580.
 - [4] Radim Farana., Dalibor Kacmar, Lubomir Smutny, et al. "Podpora nových vzdělávacích forem prostřednictvím informačních technologií na bázi Internet a Intranet." Ostrava, VSB-TUO, 1997, 193 p. Technical report of grant project FR MSMT CR F1/0733.
 - [5] Pavel Olszowski and Radim Farana. "Dotazovací jazyk SQL. Internal textbook." 1. ed. Ostrava, kat. ATR VSB-TU Ostrava, 1996, 28 p.
 - [6] Pavel Olszowski and Radim Farana. "Tvorbá aplikací v prostředí PowerBuilder. Internal textbook." 1. ed. Ostrava, kat. ATR VSB-TU Ostrava, 1996, 40 p.
 - [7] Václav Roubíček, Tomáš Čermák, Jaromír Polák, Andrea Krizáková and Radim Farana. "Report Report on the development and realisation of the International Conference on Engineering Education, ICEE'99, 10. 8. - 14. 8. 1999, Ostrava and Prague, Czech Republic." Ostrava, VSB-TU Ostrava, 1999, 7 p. (37 p. with supplements).
- Supplements:
 Radim Farana and Andrea Krizáková. "Communication System for ICEE'99." Ostrava, VSB-TU Ostrava, 1999, 21 p.
 Radim Farana. "Database system KONFER." Ostrava : VSB-TU Ostrava, 1999, 9 p.

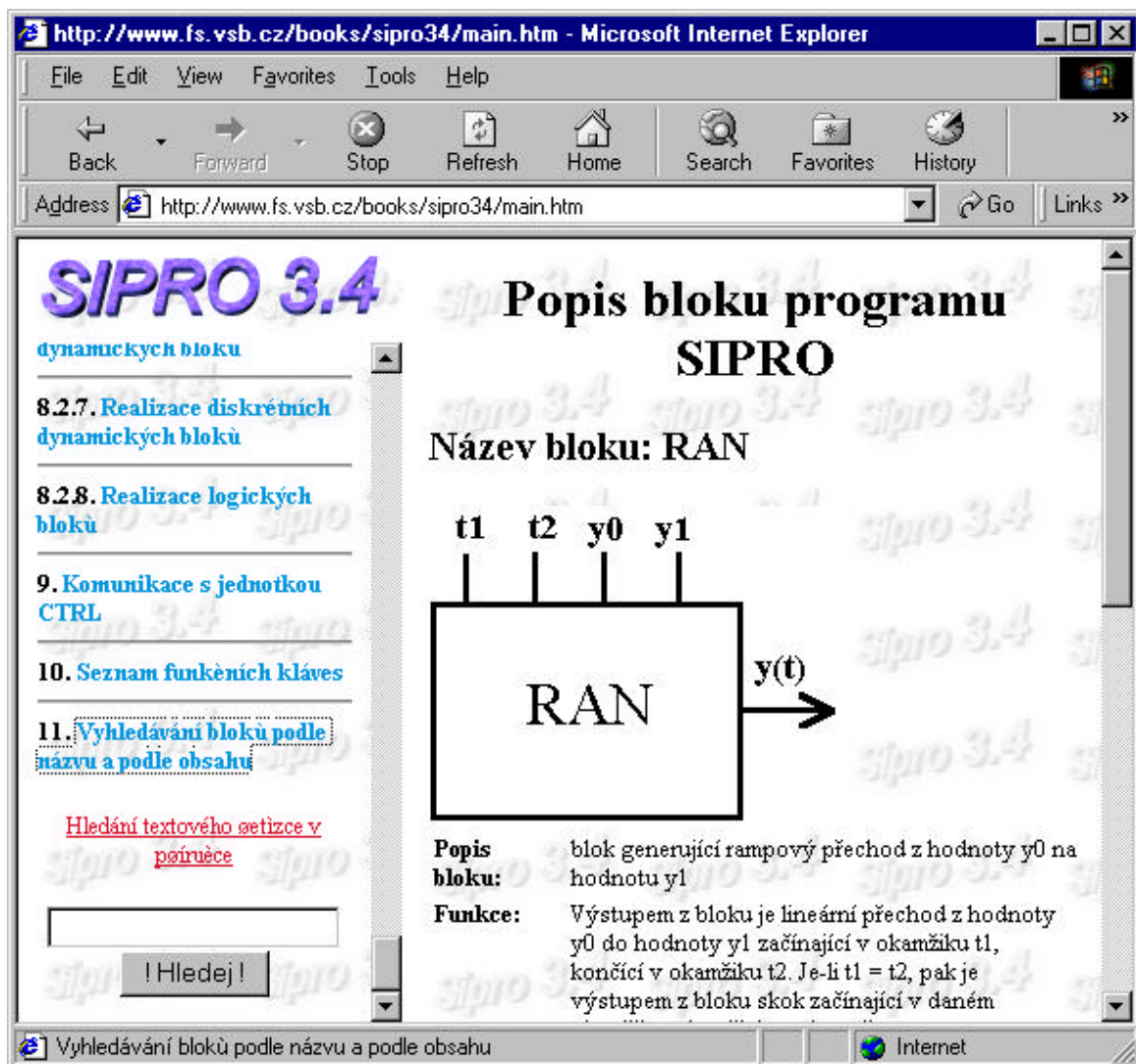


Fig. 6. Operating the invoice records system