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APPROACHES TO ENGINEERING DATABASES

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In the article problems arriving when developing and introducing engineering databases are outlined and the necessity of the research in the field of engineering databases is emphasized.

1. Introduction

When starting speculation over possible approaches to engineering databases development and implementation next two possible ways come instantly into the mind:

- The first one is connected with development of engineering database as a part of the creation of CAD/CAM system.
- The second one concerns engineering databases as a core element of Integrated Engineering Document Management System (IEDMS). [1]

After analyzing the ways small enterprises solve the problem of automation of their design and work we came to the next conclusion: from the tree methods of creation of the enterprise information systems they choose the first one:

- Application of standard software.
- Acquirement of separate components and their following integration.
- Independent development.

Independent development of CAD/CAM and document management systems by small enterprises is ineffective because of scantiness of staff. On the other hand, a high cost of corporative information systems positioned on market does not allow enterprise to use them. Specific characteristics of small enterprises do not find their embodiment in such systems. That is why the development of engineering document management system reflecting specific activity character of small enterprise is highly necessary.

Besides, the Integrated Engineering Document Management System is an intermediate point on the way of creation of the Engineering-Manufacturing Information Systems (EMIS) (to which Polish enterprises are much closer because of the high competitiveness with western manufacturers) which is one of the main tools for the small enterprises to increase the manufacturing efficiency in the near future [2].

This way doesn't mean the rejection of the engineering database technology, because while designing and implementing the IEDMS:

- the technology and techniques of the engineering database development still reserve;
- modern trends of the engineering database development remain at the tips of developer's fingers.

2. Documents are valuable – and expensive

Within any enterprise the number of documents is ever increasing. These documents contain irrecoverable work and knowledge. Many of these documents are under constant change, often involving teams of engineers, quality assurance, marketing, and production.

In this situation, mistakes can be very costly. The cost grows exponentially the longer it takes to detect and recover design errors. Document management often affects the entire enterprise, and costs increase rapidly with a growing number of files and users.

3. The solution is...?

In our opinion as well as that of distinguished researchers the solution for the document management problem is:

- An integrated system (not just a toolbox) that delivers highly sophisticated document management right out of the box. This minimizes the overall cost.
- The implementation of a document management system should not imply costly adaptation of existing applications. Instead, the solution should act as a transparent layer between the applications and the document.
- A well-integrated document management system offering a good and well-known user interface, which is easy to use and feels natural for the user. This reduces the required user training to minimum.[3]

4. Basis of the solution

Making research and implementing the above-mentioned approaches we should keep in mind a Concept of the Computer-Integrated Manufacturing which is vitally important for the small enterprises which are going to survive and prosper under modern market conditions with their mortal competitiveness.

The Concept presents the integration of CAD, Automated Management System (AMS), Administrative Management (AM) and Group Technology (GT) methods with the **Integrated Engineering Document Management System**, as illustrated in Figure 1.

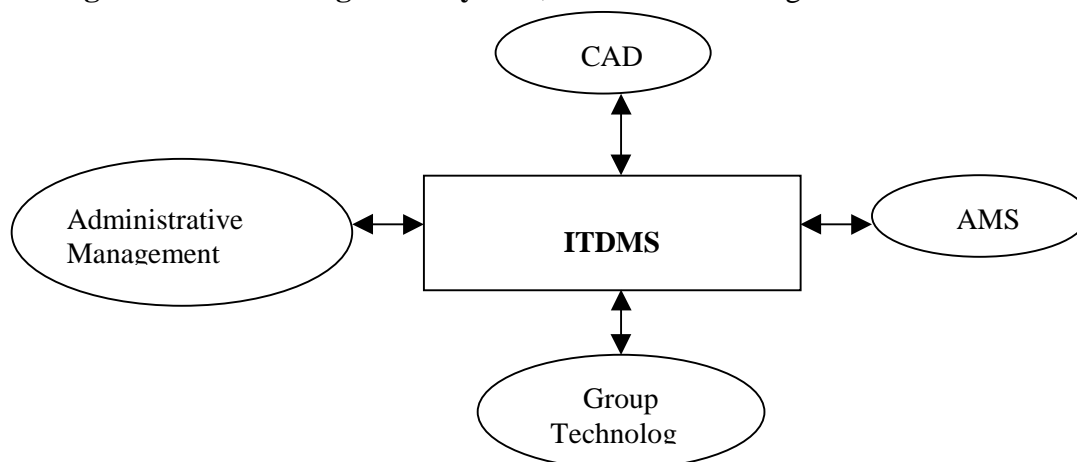


Fig. 1. Computer-Integrated Manufacturing Concept

Database technology plays in the CIM concept the main role, that of connecting and joint section.

Database of the CIM can be defined as an integration of CAD databases, AMS databases and AM databases, connected together in a computer network and operating in distributed environment.

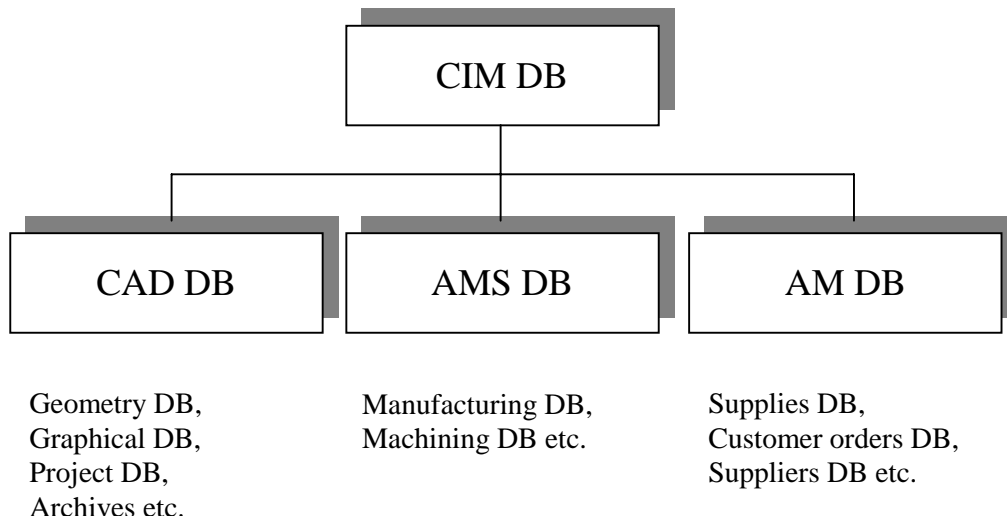


Fig. 2. CIM Database

As the Computer-Integrated Manufacturing fights for the complete integration of all types of activities during the item life cycle, from its emerging to the complete specification for the one hand, and from the order to its shipment – for the other, CIM Database consists of:

- Design Data (geometry, structural and analytical attributes etc.)
- Manufacturing Data (programs for numerically controlled machine tools, materials, process plans etc.)
- Manufacture Management Data (Machines, employees, prices, supply level etc.) [4].

5. Document management: giants vs. small enterprises

Information systems of the small and medium sized enterprises as well as their larger rivals must store, manipulate, process and maintain all kind of information necessary for the plant. Information is regarded as the main vital resource for the firm.

A great deal of leaders of small enterprises underestimate negative influence of bad documents management on productivity. According to the results of supervisions conducted by specialists such enterprises pay more for ineffective data management, than their bigger competitors:

- Small enterprises cannot afford the surplus expenses, which arise from the documents disparity.
- Small enterprises can draw less quantity of employees to overcome critical situations.
- Small enterprises have got much lesser financial reserves to eliminate their consequences.
- Small enterprises quicker lose its competitiveness because of low reliability and weak defense of system [5].

6. Results of the survey: there's no integrated solution for the small-sized enterprises

Most of document management systems nowadays are oriented only to work with office applications and documents, or exclusively with technical documentation (drafts). To manage all documentation associated with a certain project is certainly impossible. Violation of information integrity treatment takes place during this and, as a result, augmentation of cost and execution work terms, which is unacceptable for small-sized enterprises.

In addition to this attention of the majority of domestic and foreign researchers and developers at the given time is attracted to implementation of electronic dataflow systems for banks, industrial giants, corporations and offices. It reflects a real state on the market. The analysis of the needs and demands to system, which would brought into effect an automation of engineering dataflow for small-sized enterprises mostly haven't been fulfilled. Responding to the increasing needs of small enterprises in strategic choice of such system, we consider it is necessary to formulate the recommendations and demands to implementation and introduction of such systems [9].

7. Our colleagues on the way: example of the implementation

The Conisio document management solution is based on an entirely new and modern concept. The user interface is completely integrated into Microsoft Explorer®, which is a familiar environment to all. Therefore Conisio is easy to use and learn.

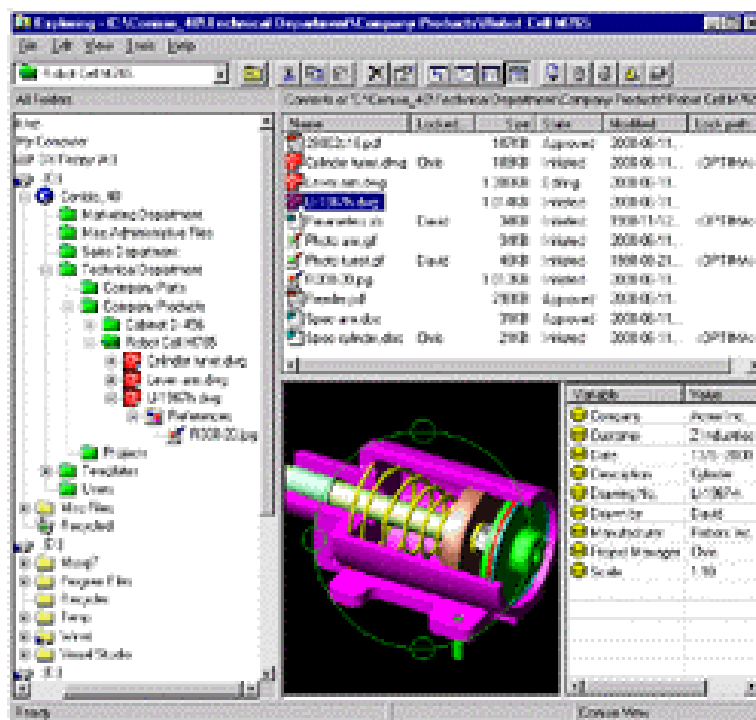
Conisio is the complete and easy-to-handle solution for anyone who, individually or in a project, wants to create and update documents, and to view, search, manage, and retrieve earlier versions of a document without constantly having to rename it.

If you are a CAD-user, Conisio offers you a large number of benefits. For example, the possibility to directly, from within Explorer, update drawing attributes without even starting the CAD program.

Familiar Interface

The Conisio user interface is integrated in Microsoft Explorer®. When you start Conisio, Explorer displays two additional windows, giving detailed information of the selected file. The left window offers a preview of the file and the right window displays its associated file data card.

The preview pane in Conisio can display over 280 file formats without having the actual program installed. Supported file types include Microsoft Office® documents, CAD-drawings, and images, among others.



Access Rights

Access to files and tools in Conisio is controlled by access rights on both an individual and a group level. These rights range from read access to delete rights, as well as the ability to rename a file or to modify the associated file data card or the workflow.

File Updates

All files are safely stored in a central file vault, and are only accessible to users with proper access rights.

Only one user at a time can lock and update a file. This prevents other users from overwriting any alterations made. However, users with sufficient access rights may view and copy the locked file.

History And Revision Management

Each time a file is unlocked and saved in Conisio's file vault, a new revision (version) is created. A file's history is reflected through its various revisions. The revision management tool in Conisio permits you to repetitively save a file under the same name without having the previous copy overwritten and destroyed.

Work Off-Line

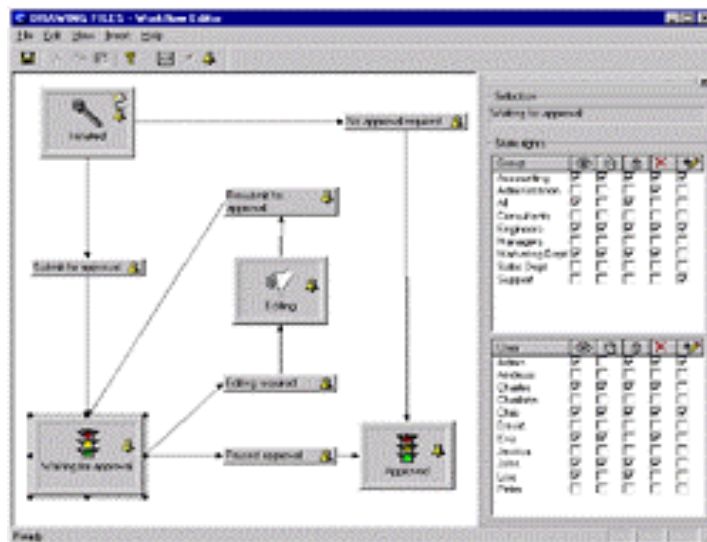
The off-line mode in Conisio gives you the means to still work with your files while disconnected from the LAN, e.g. at home. When reconnected to the LAN, Conisio synchronizes your files with the file vault.

File Data Card

The file data card contains information about the file content. If you are an AutoCAD user, you can, directly from Explorer, change the attributes in the drawing title-block without having AutoCAD installed.

Workflow

Managing and formalizing the work process is easily done with Conisio's graphical workflow editor.



External References (Xref)

Assemblies referring to detail drawings (Xrefs) are effectively managed by Conisio. Conisio always keeps track of which details belong to which assemblies.

Client Server Based Solution

Conisio is based on Microsoft SQL Server or MSDE, which are fully compatible with each other. The features of Microsoft SQL Server make Conisio scalable, i.e. Conisio can be used as a single-user system on a laptop, or as a multi-user system on a stationary computer, connected to a central server.

8. Requirements to the IEDMS

Integrated Engineering Documents Management System ought to accord with the following descriptions arising from peculiarities of small enterprises:

1. Orientation on the equal work with different CAD/CAM/AI systems.
2. Full openness of the system for adjusting, development and creation of applied modules by customer (a system administrator can create its own object types and attributes, tune system's business-logic, link to the existing database the external applied modules), presence of the open API (Application Program Interface) that gives user the possibility to write his own add-in applications.
3. Work with DBMS, which maintain ODBC, including Microsoft SQL Server, Oracle, DB2, Rdb, and also to perceive the data formats of Paradox, dBASE III, dBASE IV, Microsoft FoxPro.
4. Full adaptation to demands of the domestic standards and adjusting flexibility, which will permit to make easily the adjustment with the enterprise standards.[10]

That's why, based on the conducted analysis of needs and demands, the integrated technical documents management system is required, which will conduct:

- grouping of drafts and documents associated with them into thematic folders, which can be restructured without file physical movement;
- calculation of all drafts and documents associated with them being in current design of any member from work group;
- providing the easy search of drafts and associated information with parameters (criteria) with the possibility of further use;
- storage in archives any documents types – drafts, specifications, textual documents, etc. Maintenance of documents which consist of several files (for example, drafts on several leaves, hybrid TIFF+DWG drafts and other), documents which include references to other documents (for example, XREF into AutoCAD);
- supporting different access rights to documents – rights for revision, change, moving the documents away;
- storage of all drafts and documents associated with them in reliable and safe central repository;
- monitoring of authorization during the entrance into the system and access rights for guaranteed secrecy;
- automatic archivation of selected (or all) drafts and documents associated with them;
- routing procedure automation by thrashing of draft itinerary and associated documents;
- supporting open program interface;
- supporting parallel electronic documents storage;
- supporting work with national language (on-screen reports and prompting, data sorting and information search, including the same procedures in text of documents);
- interfaces to PDM (Product Data Management) systems and CAM systems [6].

9. Necessity of implementation of AI tools into IEDMS

Difficulty of Data processing in the modern enterprises increases due to the great variety of data types. Information can exist in the form of: data, text, graphics, drawings, drafts, rules, orders. That's why there is a necessity of implementation the techniques and tools of Artificial Intelligence into Integrated Engineering Document Management System. The researchers call such systems as Engineering Manufacturing Information Systems.

We can formulate the next requirements to such systems:

- Manipulation of the sophisticated object data types;
- Sophisticated Relationships;
- Long-term Transaction Processing;
- Version Creation;
- Joint use of the Object;
- Diverse Knowledge Presentation;
- Knowledge Separation;
- Processing of the Incomplete Information;
- Real-time Processing;
- Distributed Processing.[7]

Despite the fact that database techniques and techniques of expert systems have been developed separately, there are a great deal of causes for the creation of the advanced systems, incorporating the best characteristics from the both domain of engineering practice.

Let's take for instance the planning process. Creation of the machining plan for new item can start with the number of the Group Technology of the item. Using the code of the GT, the system can search for similar item in the machining plan database. Then the automatic editing module or expert system should modify extracted plan, using the coded knowledge of the expert of machining planning. To fulfill this task, the expert system will require the access to the CAD database, which store the item geometry description, and to the Machining database to determine the machining parameters according to the item material type.

10. Conclusions

There are few approaches to the integration of the database and expert system techniques. The researches still to be conducted which one to choose and in what way.

1. DBMS and ES Integration (existing systems are used, DBMS and ES can be used separately. Shortcomings: integration is too loose)
2. ES Shell Improvement by including DBMS functions.
3. DBMS Improvement by including ES functions.
4. Integration in the ITDMS. (the best features of the systems are implemented, new data and knowledge models are introduced) [8].

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