INFORMATION SYSTEM FOR MAINTENANCE OF PRINTING MACHINES

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Abstract: This paper describes the building structure of the ISO system. ISO is the information system for follow-up of the maintenance of printing machines at the printing company Vjesnik d.d. This programme deals with the storage of spare parts, machines, assemblies on printing machines, regular (planned) maintenance. The system informs the users of dates for carrying out regular maintenance procedures, missing spare parts in the storage, completion of particular maintenance phases, phases of purchasing spare parts etc. Particular phases in course of carrying out certain activities in the system are highlighted with responding colour.
Key words: maintenance planning, maintenance procedures, printing machines, information systems

1. INTRODUCTION

We are nowadays witnesses to the global digitalisation in all operational segments. Companies are forced to constantly modify its previously established machineries and procedures and improve them by introducing the computer automation.

Computer information system for follow-up of machine maintenance will be described in this article. This system was implemented in one printing company and is designed for registering and following-up of regular and urgent maintenance procedures for printing machines. The technical aspect and system specification is based on long-year experience of the employees responsible for machine maintenance.

The basic hierarchical overview of printing machines as units made of smaller assemblies, finishing with particular elementary parts was developed in the ISO system to achieve complete integration of storage modules, work orders, purchase orders and process of informing employees of time frames for regular maintenance procedures.

2. BASIC APPLICATION STRUCTURE

ISO information system is the smart client application implemented by means of Microsoft Click Once Technology (Liberty, 2005; Marshall, 2006). It is a Windows application, whose setup program is published on the Intranet and accessible for each computer within the company. ISO application is installed on the user's computer only once and afterwards the Click Once Technology enables the installation of new versions. Before each start-up of the application there is a check whether a new version of the setup program is published on the server and if so, this version is downloaded and automatically installed.

Basic application structure is showed on the Fig. 1. In the application background there is a MS SQL Server database (Johnson, 2005; Sceppa, 2006), in which all the data necessary for the functioning of the system are stored, as well as user data, all digital documents that are generated in various phases of machine maintenance follow-up, original producer's documentation and finally the instructions for the procedures of maintaining each particular assembly.

The power of client computers in the company, on which the Microsoft Office package has already been installed, is maximally used this way. On the one hand we have the application with enriched presentation layer in special user-friendly interface, which uses original applications of Microsoft Office (Word, Excel, Outlook) for additional reports, while on the other hand the data are stored on the central spot, i.e. in the server database.

3. DESCRIPTION OF THE INFORMATION SYSTEM

Information system ISO consists of 7 mutually connected parts (modules): *Users, Planned Maintenance, Machines, Storage, Purchase Orders, Work Orders* and *Statistics*, which is showed on the Fig. 2.
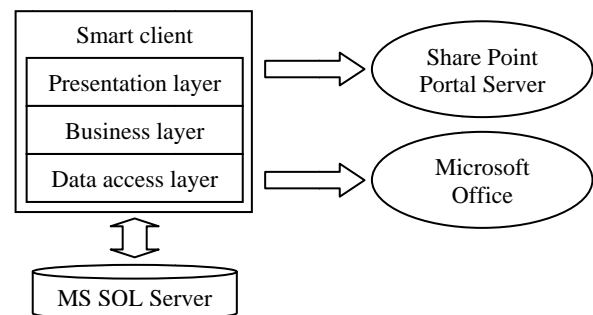

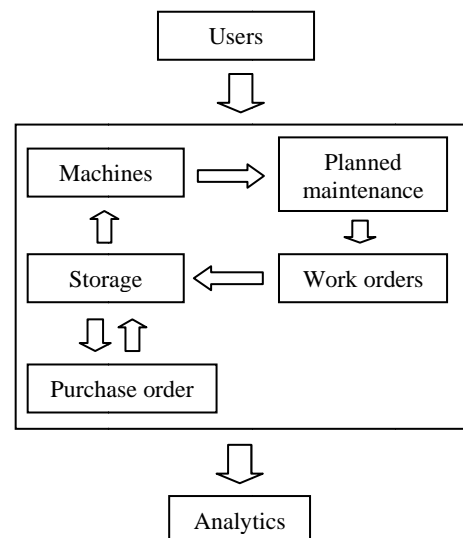Fig. 1. Basic structure of ISO system

Fig. 2. Modules of ISO system

First module *Users* controls the base of system users. The user must be introduced in the system and system administrator

needs to give him certain authorisations. There are five access levels, i.e. Reading, Writing, Filling out Work Order Forms, Deletion and Administration. Reading level allows the access to the system and detailed overview of all system parts, without any possibility to change the data. Writing level enables the user to enter and modify the data in the system, but not to delete them, for which possibility the user needs to have a special authorisation. Due to the fact that there is a responding hierarchy of employees within the company, it was agreed that a special authorisation is needed for filling out work order forms. To be more precise, the work order form can be opened only by the manager of certain department, while it can be closed by any employee who really carried out the last work assignment listed. For each record it can be seen who created it and who changed it last. Within the SQL Server database there is the follow-up of entire history of data changes in the system activated by the triggers (Brust & Forte, 2006). Apart from this, the system reduces the misuse of authorisations as much as possible, and therefore the changes and deletion of data are possible only a few days after closing the work order, i.e. purchase order, which can be modified only by the employee who closed it. Additionally, this authorisation has only the administrator.

Module *Machines* enables the entering and overview of the machines in the printing company. Each machine in the system is represented as node in the TreeView Control. Its child nodes are in the reality equal to physical assemblies the machine consists of. Bigger assemblies consist of smaller – its child nodes etc. So, each machine is represented as a tree. The leaves of this tree represent elementary machine parts.

For each particular assembly on each machine the producer prescribed the method and time frames for regular maintenance procedures. Maintenance procedures are carried out daily, weekly, monthly, quarterly, yearly etc. (parameter *Period*). They are controlled by the module *Planned maintenance*. Each planned maintenance procedure is represented in the system as record connected to the responding assembly and has its scheduled date and time. Planned maintenance procedures are presented in tables and sorted according to the scheduled date (on the top of the list are those who come first). The assignments of planned maintenance procedures that need to be carried out on the current date are highlighted with red colour in the background. The employee with writing authorities from this module can with only one mouse click create a new work order, which automatically overtakes specific regular assignments predefined in the record of selected planned maintenance procedure. Created work order is then visible as the record in the module *Work orders*. The date of original planned maintenance procedure is automatically changed according to the parameter *Period*.

If there is a need for unplanned maintenance procedure such as defect repair, urgent one-off work order can be created in the module *Work orders.* The employee who carries out responding work order is obliged to enter the performance status for particular work assignment immediately after its completion, so that the system can transparently in different colours show the levels of performance of different job assignments. In module *Storage* the quantity of used spare parts is automatically reduced.

Each spare part in the system is the record in module *Storage* that has its code, name, technical characteristics, quantity, price, minimum, maximum etc. When the quantity of certain spare part is below the prescribed minimum, this situation is marked in the system with red colour of the background. Then it is time to send the purchase order for acquisition of the missing spare part.

In module *Purchase order*s there are a few phases, which are again marked with different background colours. The phases in the procedures for each purchase order are the following: new purchase order (request sent), request approved, offer attached, offer approved, ordered spare parts received at the purchasing department, spare parts taken over (again available in the storage).

The last module *Analytics* gives the overview and analysis of the data entered in the system through other modules. Here it is possible to see the total stand-by time, as well as the total price of spare parts used for particular machine during particular time period.

4. INTEGRATION WITH OTHER SYSTEMS

One of primarily set goals achieved by the designer of this system is the connection between three departments within the printing company i.e. between maintenance, storage and purchasing department. The communication between these three departments with regards to purchasing spare parts is entirely digitalised thanks to the ISO system. Additionally, each digital record (work order, purchase order, instructions and offer) can be printed or sent by e-mail to any interested party, who is not in the system. The purchasing department can by one mouse click convert the purchase order from the ISO system into InfoPath template, whose archive is located on the SharePoint Portal Server within the local Intranet.

The next step, on which the designer is already working, is the integration with the production department and other departments within the company. Although it is even now possible to see the planned maintenance procedures, the final aim is the creation of digital planner, which would enable real-time production planning. Sales representatives will be able to give the answer to the potential client at any time about the possible time frames for the delivery of their printed product, depending on the current availability of the machines.

5. CONCLUSION

Through the implementation of the ISO system multiple benefits have been achieved. Definition and follow-up of the standardised procedures lead to higher maintenance efficiency. Higher maintenance efficiency results in higher machine efficiency. Improved document management and document archiving represent efficient mechanism for collecting facts, which are nowadays easily accessible to each system user.

In the future the next step will be to implement the modules of planning and production follow-up and finally to connect all of it with the system of customer inquiry papers, calculations and available printing services.

The ISO system has with the help of digital communication connected maintenance department, storage and purchasing department and can be easily integrated in the business system of the company.

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