

# Enterprise Information Data Management System for Small Manufacturing Company

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**Abstract** – One of the key external factors that encourages businesses to innovate is scientific and technological development. An essential task is to develop new information and communication technologies and systems that give more opportunities to reduce costs when deployed to the enterprise. Up to 75 % of errors, which are closely related to the level of sophistication of the company information systems used, can be affected in pre-production stages. The article describes the design and development of an information data management system for the production engineering department to manage and archive data obtained from the pre-production stage, as well as machinery and tooling equipment extended with a number of additional information with a clear access to these data.

**Keywords** – Information system, PLM systems, Data management.

## 1. Introduction

Nowadays, the use of computer technology is a matter of course. To maximize the efficiency of computer technology, programs or systems are being introduced that increase efficiency and reduce time-consuming processes for processing and evaluating information, resp. data. Thus, the condition remains to look for a solution that enables sharing of information that comes from its source to final processing and use.

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As the demand for capturing new trends is growing with the dynamically developing market, the software of the organization is also changing. The company has to keep the trend in this area to be competitive. This presupposes the innovation of the software for the performance of the company's activities, but also the requirement to find an information system that would be effective for the operation of individual processes in the processing of individual information. [1]

In order for the product's "life cycle" to be as fast and top-quality as possible, it is important that the enterprise is equipped with a modern information system (IS). In most cases, companies choose a suitable IS as a complex system solution that includes all modular solutions. In selecting an information system, manufacturing companies place great emphasis on the system's production management and planning capabilities. It is already standard that production planning and management systems include a high-quality technical preparation of production (TPP) solution that is often underestimated. Underestimating the functionality of the TPP solution can result in errors in the production process, as the TPP is considered to be the basic pillar of production planning and management. Up to 75 % of errors can be affected at pre-production stages, resulting in a significant reduction in production costs. [2]

The goal of engineering production is not only to cast, forge, work or assemble. The goal is to stand in a globalized economy and to compete with competitive products. This can only be achieved by computerized information systems, by computer support for the creative activities of pre-production, production and post-production stages. On the market there are many IT suppliers who offer a variety of possible solutions. From small business solutions to several employees, to thousands of companies with offices around the world. [3], [4]

The paper describes the design and development of an information system that will allow managing pre-production data for easy search, filtering, adding, and other customization in a small manufacturing company. Java and SQL database were chosen to create the system. The use of SQL is needed to

effectively sort of information before further processing. The goal was to create a system that can communicate with a SQL server to which a directory structure has been associated with document files for items in the database. The basic task was to create an information system for the presentation of SQL table data synchronized with downloading relevant document files at the specified addresses.

## 2. PLM Systems

Deploying PLM system in the organization is organizational, time consuming and costly affair. The basic criterion for each business is the fastest possible return on costs. If the implementation of PLM solutions to organizations approaches only in terms of input costs, this step appears to be an expensive solution. But PLM is not just one closed file; it is tailor-made for each customer and provides a prerequisite for a rapid return on these input costs. PLM must be built gradually and not in the organization, only to best suit the processes and structures in the enterprise [5],[6].

The basic, first step to building PLM is the CAD system. They are an essential element of building a PLM solution that adapts to the nature of production and the products they produce. Otherwise, PLM looks for mass production and otherwise for small-scale production or piece production. It's different for a simple product and different for a more complicated product [7],[8].

### 2.1. Implementation of PLM System Into the Information System of an Organization

There are four basic stages in the life cycle of the information system [9]:

The first stage is the initial study. The main focus is on the functional, partial areas that use information systems. On this basis, intentions should be built based on the location and mission of the information systems they create, or their integrated links.

The second stage is the analysis and design of the system. It is a grouping of mutually overlapping projects and analytical activities that specify the preconditions and process of creating the information system. It is essential that, in cooperation with the intended users, interoperability is truly reciprocal, constructive and professional.

The third stage is implementation. The information system will be handed over to users for use only after the trial run phase. In practical implementation, there are usually minor but also larger shortcomings that need to be adjusted. The information system is tested and its modifications and improvements are implemented. User training plays a significant role in working with the new information system, its

structure and logic in order to fully benefit from its purpose.

The fourth stage is focused on maintenance and operation. This is a relatively stable period of use of the information system. At this stage, it will be practically proven to what extent and how economically the information system supports or ensures the information needs of its intended users. Proper collection and evaluation of information is very important for the proper operation of the company, but it is also important to sort the information according to the set criteria (use, function, properties). These collected data are important for subsequent evaluation and easier processing [10].

## 3. Design and Development of Enterprise Information System

When designing an enterprise information system whose main task is the ability to view and store information about manufactured components, used machines and tools in the manufacturing company, it is necessary to select the correct data storage (server) to be archived [11]. The use of server and database system is required for management, data administration, and the ability to use the enterprise information system on several remote devices [12].

### 3.1. Choice of Software Solution for Design and Development of Enterprise Information System

#### SQLite Manager

Since it was necessary to create and edit the SQL database, a free SQLite manager was used. This is a plugin for Firefox. With this program, 4 tables were created that store all text information and images in bit format, as it was assumed that the images would be small in size and thus not burden the database. The other files are stored outside the database and refer to them only via relative paths, since they are copied to the folder of relative addresses when they are saved to predetermined server folders.

#### Netbeans

For Java programming, Netbeans was chosen as the most appropriate program. It is primarily designed for development in the Java programming language, but thanks to its modular software architecture it also allows programming in other languages. The whole environment is programmed in Java, so it can be run on various operating systems (Microsoft Windows, Linux, Mac OS and Solaris).

#### 4. Description of Design and Development of the Created System

The created environment consists of six basic sheets: searching, inserting, sorting, machinery equipment, tooling equipment and users. The system is designed to insert, sort, index, and archive information about parts, tools, and machines in small manufacturing company. At the beginning of the work with the system the user needs to register.

The system creates a class to connect to the database and after saving the registration, two SQL sql1 and sql2 commands are sent, where the first is to determine whose name is no longer in use, and the second to go through the check of filling all fields. The developed application (system) has a simple user setup where the new user is assigned the lowest user rights by default. Higher rights may only be granted by an authorized person with higher rights (administrative rights).

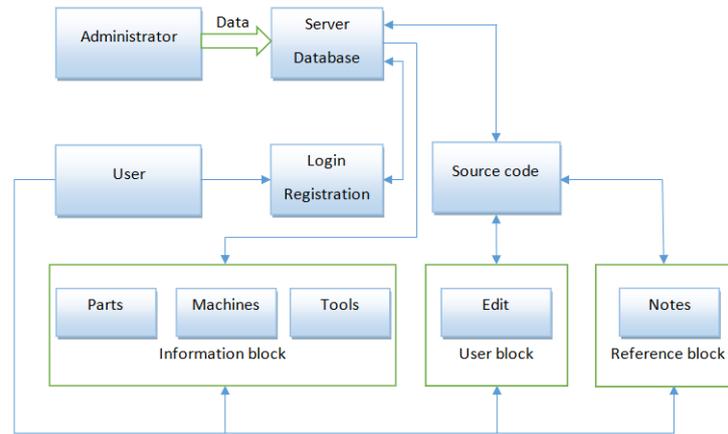


Figure 1. Simplified data flow scheme of the proposed system

After login into the application by typing a name and password, a connection is established that is created by the JavaConnet class. After pressing the login button, Java in the method associated with pressing the button that was previously generated, saves the sql1 command in the SQL form to String, which subtracts the values from the name, password fields, and sends the database if a match is found. Next, it checks whether the account has administrator rights through boolean. The main application window is loaded, if there is no match, only a pop-up window will appear indicating that the data is incorrect. In the application menu "File" you can

always unsubscribe or completely disable the application.

The main window is divided into several tabs for better clarity. First, the sheet "Search" was created, containing the jTable element, which is the dominant feature on all sheets, because it makes it easy to visualize data. The program has a special function called Update\_table, which is invoked every time the data is changed, and which updates all jTable in the program.

The sheet "Searching" (Fig. 2.) made available after successful sign-in, serves for quick access and component search, easy access to documentation, drawings and 3D models.

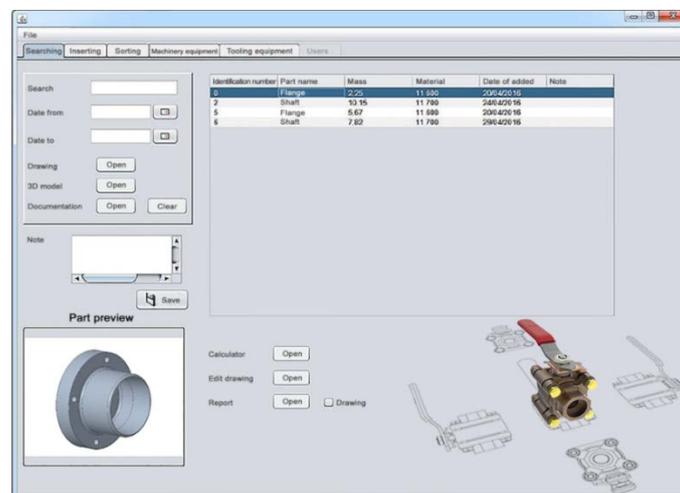


Figure 2. Sheet "Searching"

It also includes the ability to create a quick note for your needs. The sheet also includes an image preview of the added parts for better orientation. Additional application buttons are used for quick access to the calculator, which makes it easy to edit the drawing in

the sketchbook (the added PDF format is automatically converted to \*.png for editing). It also allows you to create a report with the option to add a drawing (Fig. 3.).

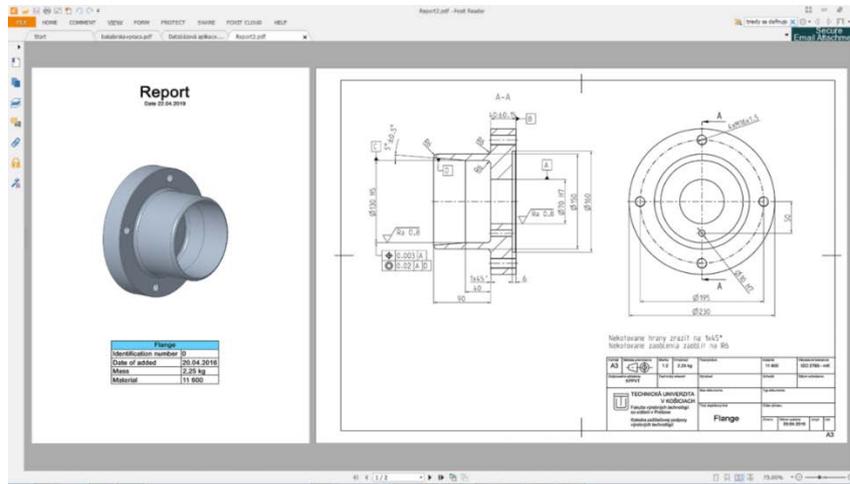


Figure 3. Generated report

The report button generates a report based on the marked, subsequently used data from the table as well as the image, and adds or does not add a drawing document based on the associated checkbox. The result is generating a pdf document (through the Itext library) and opening it.

The sheet "Inserting" (Fig. 4.) is used to insert, edit, and delete part data. At the bottom right of the application, there are buttons that can be used to insert, edit and delete all data in the database. The "Create Preview" button launches the Snapshot tool for previewing if necessary.

When you start typing the data, the only mandatory data is the part name, the remaining data can be entered based on the user`s own needs.

The application generates the ID and date separately. All buttons named "connect" open a file window that allows you to locate the file. To make the search easier, it is set to show only the files with the selected extension, while the drawings are the \*.pdf extension. After selecting Open, the file is copied to the created drawing folder (file/drawing) created in the folder where the application is located, and this indirect address is stored in String. All association buttons work on this principle; the only exception is the image assignment. The image is converted to a series of bits, which are then stored in the database. The database has a special BLOB type that is able to store the necessary string of numbers.

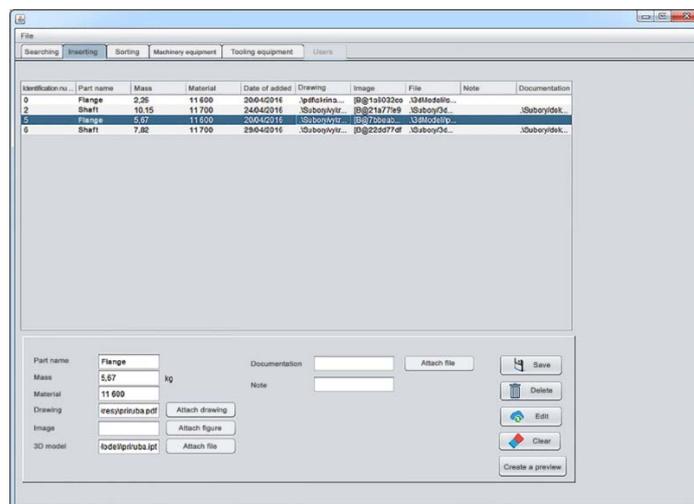


Figure 4. Sheet "Inserting"

In the sheet “Sorting” (Fig. 5.), the parts can be collected in more detail according to the specified criteria (name, material, mass ...). After pressing “Search”, it is found out which fields have been filled through the String method with the blank quotes

criterion. Depending on how many fields are filled in, the string is assigned to the sql SQL command. The sorting result will be reflected in the parts list and selected only by those that meet the specified conditions by pressing the “Search” button.

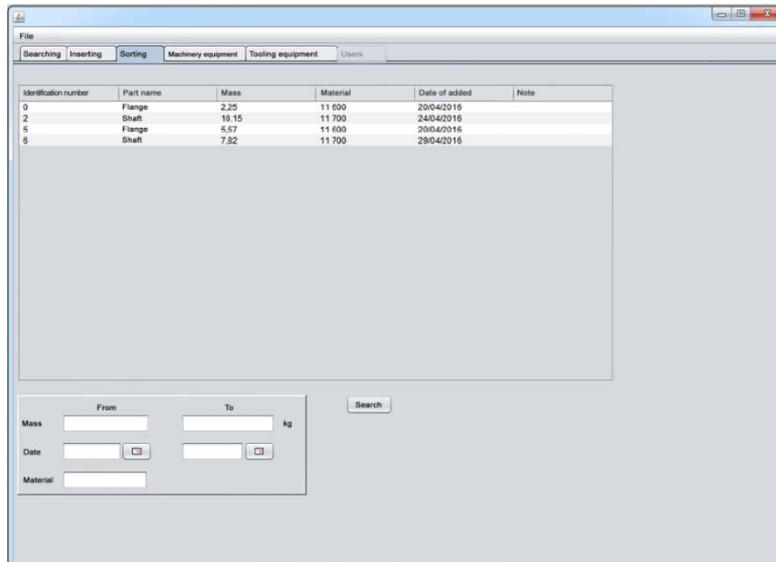


Figure 5. Sheet “Sorting”

The sheet "Machinery Equipment" (Fig. 6.) offers the possibility of adding data on machine equipment company. It contains image views of the associated machines and additional information regarding the purpose of using the selected machine.

The relevant data is easily inserted and edited through the created editing panel. For machine equipment, a new table containing machine information was created during programming.

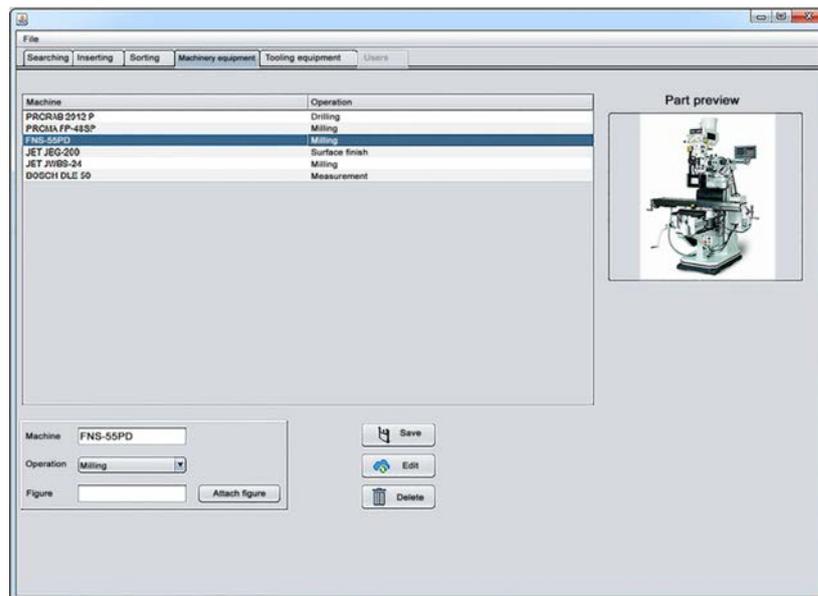


Figure 6. Sheet “Machinery equipment”

The sheet "Tooling equipment" (Fig. 7.) provides mechanical equipment like the same data editing capabilities, with differences in the determination of

input data entered. Sheet for tooling has also created custom database table to store information entered on instruments.

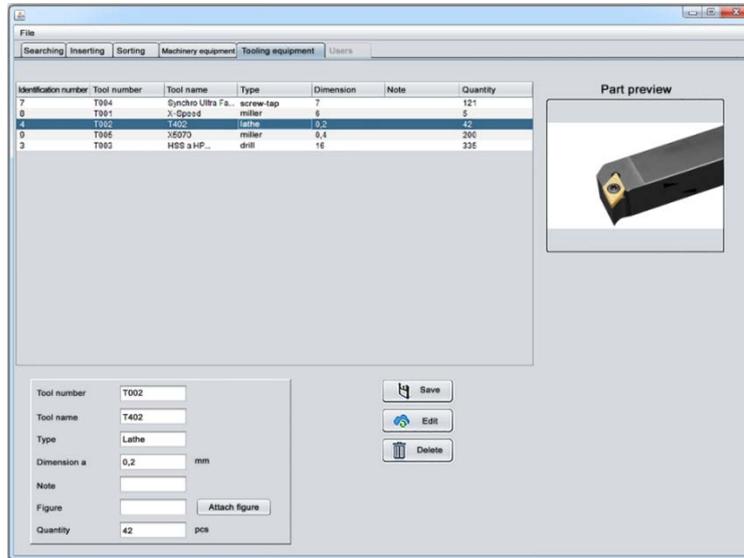


Figure 7. Sheet "Tooling equipment"

The last sheet "Users" (Fig. 8) is only available to users who are logged in with application

administrator rights. It contains a list of registered users, their passwords and rights (user role).

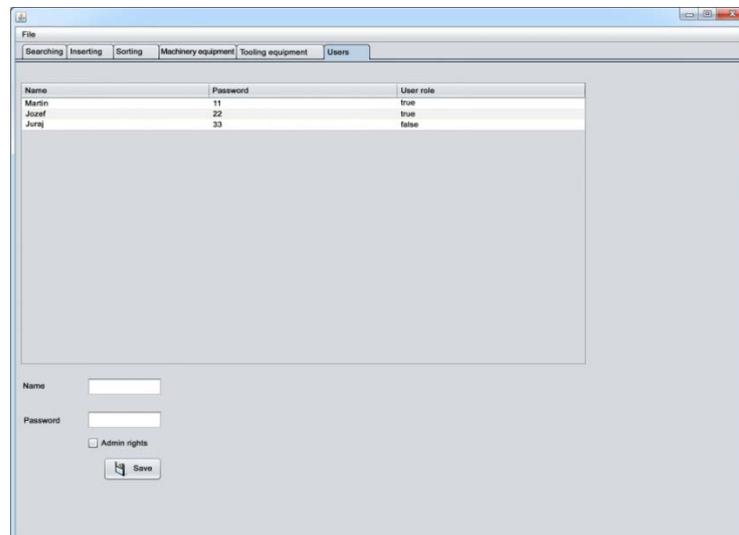


Figure 8. Sheet "Users"

## 5. Conclusion

The aim of this work was to create an information system that would interconnect and collect a lot of information about individual manufactured components and allow for transparent access to these data. The result of this work is a Java application that can be run on a computer with any operating system. After the application is launched, it is possible to use its functions according to the level of user rights associated with the login data. In the application it is possible to store unlimited parts with drawings, documentation, saved 3D parts created in CAD software as well as graphical views of parts. These data can be sorted and searched according to specified criteria. In addition, the application includes tools such as converting a drawing to an image and then opening it in an editing program where you can edit the drawing and also allow it to be printed. Another advantage is the participation in creating reports that contain data from a pre-created database. The result of the report creation is a generated pdf file with the details of the part drawing. The system also includes cards for creating machine or tool equipment. The designed information system has been programmed in the Netbeans and SQLite manager environments that work in Java and SQL programming languages. Subsequently, it was tested, customized and put into use in a small manufacturing company.

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