Application of Business Subsystem for Production Monitoring

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Abstract: - The large companies business processes, especially in production, depend on IT (Information Technology) infrastructure, including one or more of various computing environments as NW (Network), DB (Database) and SW (software) modules needed for the implementation, management and monitoring of the business activities. The worldwide implementation of ERP (Enterprise Resource Planning) systems shows the lack of the parameters needed for the sufficient monitoring of the production processes. This paper, based on analysis of the requirements in various industries, recommends software subsystem useful for the production monitoring tasks.

Key-Words: - production process, production monitoring, business process, software application, ERP

1 Introduction

Production represents rational activity aimed at getting things for use or sale and the appropriation of natural resources for human needs, therefore is equally inherent to all forms of human societies. Production system can be also defined as a combination of humans, machinery, and equipment that are bound by a common material and information flow [1]. A production process consists of a sequence of steps, traditionally assigned to separate departments, that take various inputs (such as parts, components, and subassemblies) and convert them into desired outputs [2].

Almost all objects that we encounter during the day participate in the production process. Efficient production, and efficient production means lower expenses, that is, cheaper products, must be monitored and supervised. Manual track of documents and production processes requires a lot of effort, spent working hours, calculating and eliminating mistakes occurred in calculations. After a certain period of time, companies are faced with the problem of storage and lack of proper document management.

A strong trend today is toward the fullest feasible integration of all elements of manufacturing. This trend toward total integration is called concurrent engineering [3]. In order to ensure good performance and integration the production process must consider the requirements of many disciplines, such as:

- marketing and sales
- customer relations
- product definition and specifications
- product design
- process planning and routing
- production management
- economics
- purchasing
- inventory management and control
- costing and bookkeeping
- storage, packing and shipping
- material handling
- human resource planning[4].

Due to above mentioned reasons, efficient organization is impracticable without IT infrastructure. By implementation of the system for production monitoring, production costs should be reduced to a minimum and the entire production could be detailed planned far in advance.

The development of standalone application for the purpose of production is not advised because the majority of manufacturing companies have human resources departments, sale departments, finances and others. Also, in some companies, production is only a part of their activities. Therefore it has been decided to create a subsystem for the production monitoring which will be placed in the ERP system as its module.

2 Production process

Documents, marked by italic font, are particularly important for the production because they give us information about the reason for production, record flow of goods, waste or extortionate waste which occurs during production.

2.1 Implemented production model

In a production system all begins and ends with consumers. They buy products and reduce storage reserves. When the number of items on sale storage reaches critical level sale administration sends *production request* to the manager of production. He then, by examining all requests, makes *general plan of production* that relates to a longer period of time. For the following month he copies items from the *general plan of production* into *operational plan of production* which contains the dates when should production of specific items start.

When production starts, with help of *product constituent* (normative for making one product), *work request* (request for manufacturing products) is sent off and additionally another document called *work request constituent* predicting total amount of spent resources is added. Than a production manager sends off *warehouse request,* based on *work request constituent,* requesting raw materials. Warehouse delivers those materials to the production unit with all deliver information supplied in *deliver of raw materials* paper. Raw materials are received in the production unit and production of items starts. During the production two documents are made: *raw materials consumption* containing information about spent materials and *product acceptance* containing information about amount of produced products. At the end of the production, all materials derived from production are sent into warehouse. Those materials are unspent raw materials (*return of raw materials*), products (*product delivery*) and waste (*waste*).

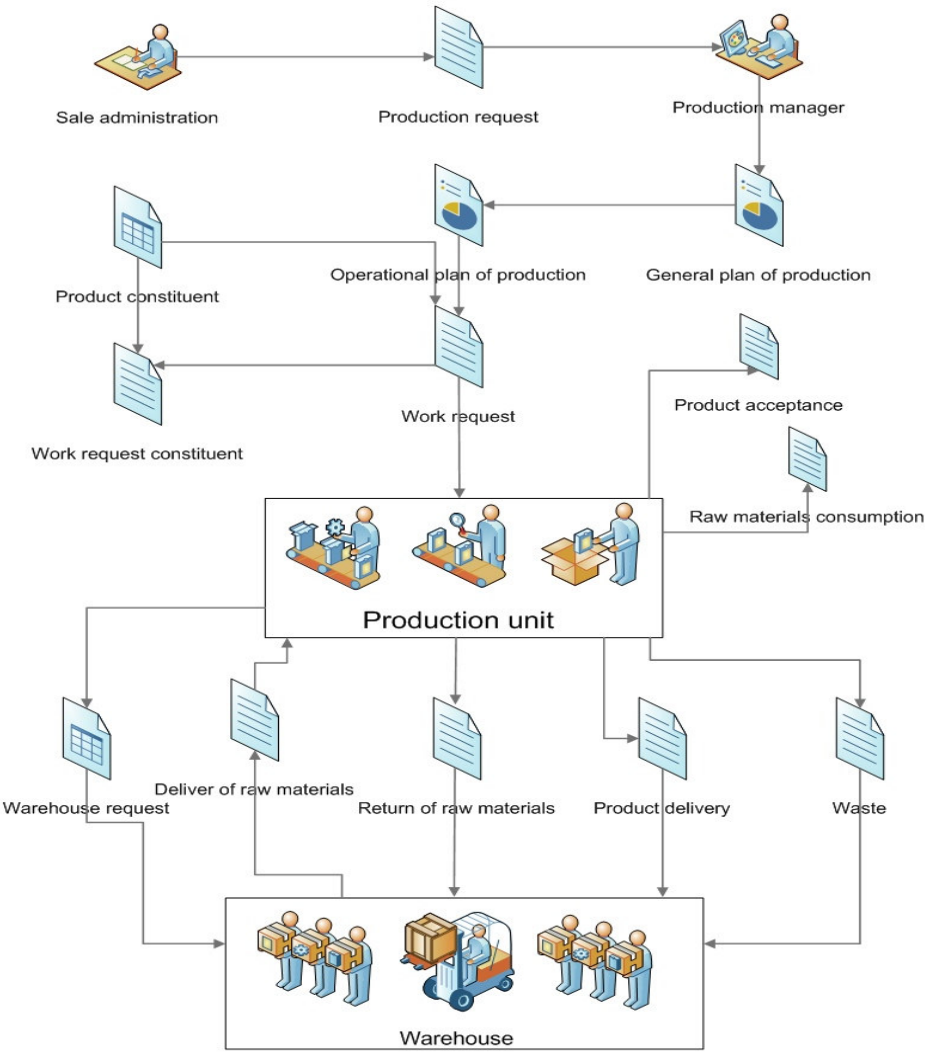

Fig. 1. Production model

In this subsystem all of above mentioned documents are included. Automatically calculation of values that occur is provided as well as copying of entries, creating one document based on other and linking documents.

3 Subsystem implementation

Subsystem application architecture is divided into several layers:

- Database
- Business logic
- Presentation layer
- Report layer

Depending on the configuration file, during the implementation of system in user's company, number of application layers can be set regarding user's demands.

Subsystem is placed into DArt ERP system, developed by Faculty of Electrical Engineering and Computing [5] and ProLogis Technology Ltd [6]. Some technologies with which the subsystem was developed are made by mentioned institutions [7], and certain objects are inherited from DArt system.

3.1 Database

Database is made of views created over the existing meta-modeled database [6] containing more than 240 tables. For each document in production model two views are made, one for document's header and second one for its entries.

Each view has seven procedures with characteristic suffix which defines its function:

- _C - enters a new record in view
- _U - changes the existing record
- _D - deletes record
- _R - reads record from the database
- _X - gets primary keys of documents list
- _Q - reads record from the database, but with defined condition
- _N – gets default values for new record

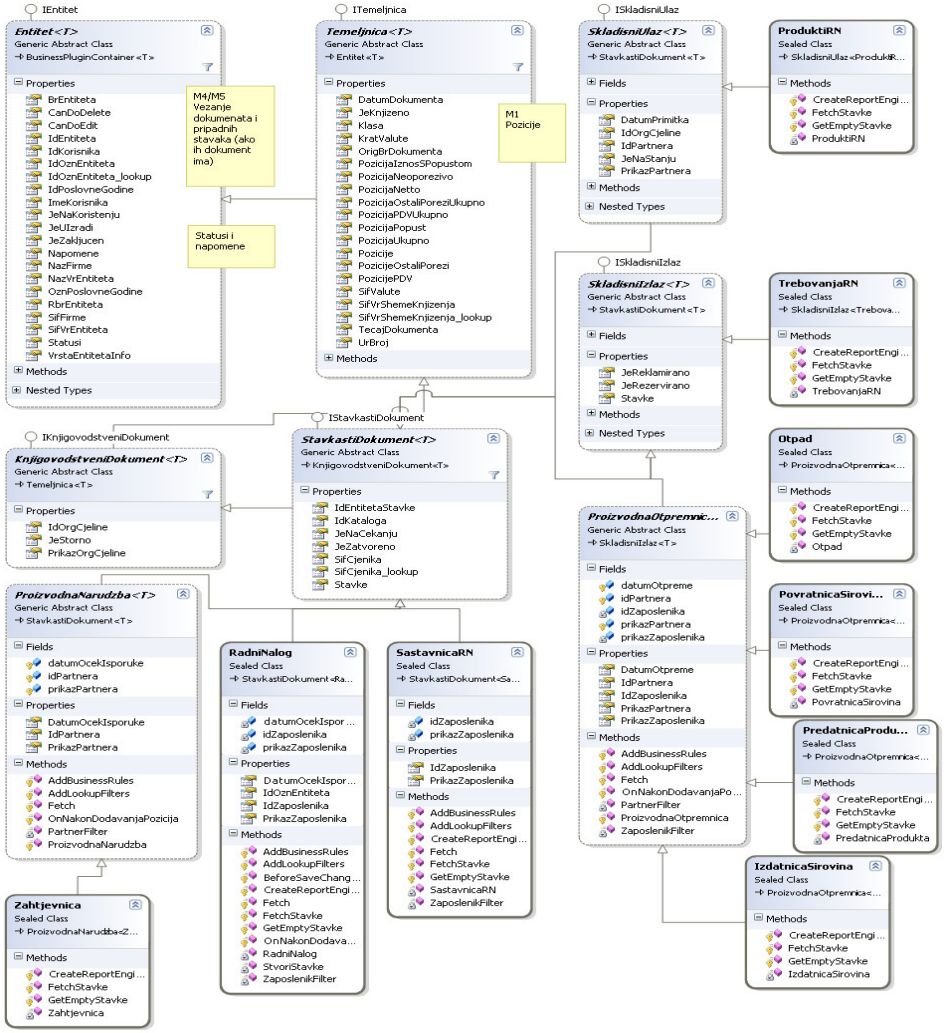

Fig. 2. The object model of documents' header data class

3.2 Business logic layer

This layer contains classes of all objects. Here are all business rules implemented, document's header associated with its entries and methods for database manipulation supported. In this layer are also located mechanisms responsible for merging modules. Some of classes are generated by CSLA .NET [8] code generator, while others are manually written and incorporated in the object model.

3.2.1 Object model

As views in the database have a lot of common attributes, so does have classes in business logic layer. Bearing that in mind, making of object model, which enables inheritance of attributes and mechanisms that unify and pervade all modules of DArt system started. Some mechanisms inherited from DArt are:

- M1 – finances
- M2 – warehouse input
- M3 – warehouse output
- M4/M5 – association of document's header with its entries
- Statuses and notes
- Linked documents

One part of the production documents does not have many similarities with existing object model, so their classes are generated by CSLA .NET code generator. These documents are: "Production request", "General plan of production", "Operational plan of production" and "Product constituent". All other documents lean on the object model.

In the business logic layer there are two object models: the model of documents' header classes (fig. 2) and model of its entries. Classes, on figure 2, that do not have pointed out methods are made by FER [5] and the ProLogis Technology Ltd [6].

3.3 Presentation layer

In this layer, during development process, simplicity and ergonomics were emphasized on the benefit of end user. It filters information which are presented to user in the way that only relevant and document related are presented. Functions are dynamically displayed to user in toolbar allowing very simple handling and reducing number of clicks.

Forms integrated in presentation layer are directly with DataBinding control linked to related classes in business logic layer. Those classes contain lots of attributes that are not displayed in window by initial settings. Because of DataBinding control, user is able, with a little help, to change shown attributes. Custom definition of business rules is also supported.

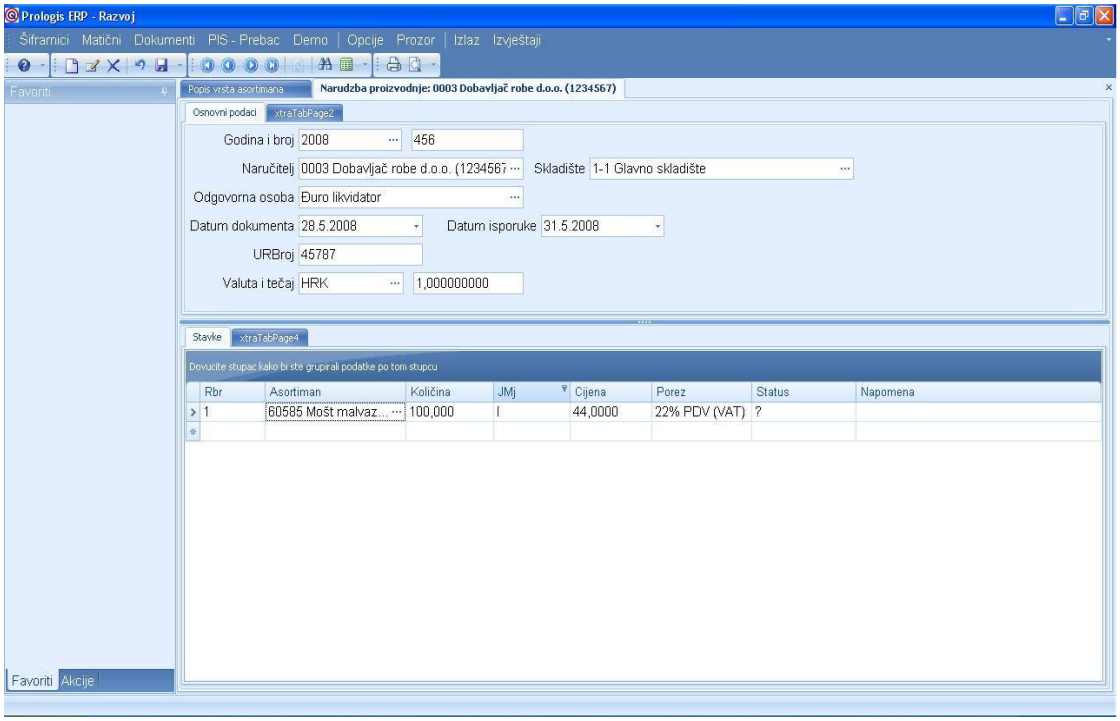

Fig. 3. User interface

3.4 The specifics of the subsystem application

All documents have these special functionalities:

- **Linked documents**
  During the process of making products, required by "Work request", it is important to collect all documents of the process in one place. Therefore each document is able to contain links to other documents. This makes monitoring procedure simplified from the very start of production process.
- **Finances**
  Each document which refers to the material means must contain production finances. They consist of different financial data and its description, account, analytics, date, amount and payment status.
- **Notes**
  Users are able, for each document, to define and edit their notes.
- **Statuses**
  It is also possible to define custom statuses for all type of documents. System is set to track all status changes

4 Conclusion

The application module, that is developed and implemented, provides successful monitoring and management of the production process. Development efforts to modify existing and to produce new documents resulted in a subsystem that makes data entering process easier and suitable for the end user daily tasks. Design of data screens follows ergonomic guidelines, in order to present data in a fast and efficient way. As presented in this paper, the production manager's as well as employees' activities become more efficient, the number of faults is significantly reduced, and finally, this leads to the lower production cost.

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