Realization of Production Process Information System on RDBS Oracle Base

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***Abstract* — This paper is dealing with realization of information system (IS) in automated assembly line (flexible production system). This assembly line model is modeling a real production process in company and it is located in Department of Cybernetics and Artificial Intelligence. Methodics for design and creation of real information system is providing the designer with the theoretical base for realization of information system. Important part of this system is the Oracle database, which is used as storage unit in created IS. Main part of this paper is showing various diagrams used in design phase, followed by experimental usage of created IS in production process.**

***Keywords* — Information system, Oracle, flexible production system, C#**

I. INTRODUCTION

An information system is a complex system, which consists of these parts: program resources (software), hardware resources (computers, servers, databases, etc.), database-stored data, users and a control interface.

Information systems play an important role in various business platforms. Thanks to information systems, businesses can:

- achieve higher productivity and efficiency,
- create new products and services,
- build closer relationships with customers,
- improve decision processes,
- gain an advantage over the competition.

Information systems implemented in production lines generally have many advantages, f.e.: higher production efficiency, lower error rate due to human mistakes, decreased administrative workload, analytical and statistical output, etc.

Our motivation for creating this information system was absence of information system for particular assembly line model, which would have proper functionality. Assembly line model is described in details in following chapter.

Knowledge of methodics for creating information system can be really helpful in designing a properly functioning information system. There is also need to become familiar with specific processes and functions for particular company, because information system has always some specifications, according to company purpose, company type etc. In production companies, IS can be helpful in monitoring warehouses or monitoring and controlling production process itself.

Methodical process of designing and building IS consists of following steps:

1. analysis of current company state:
    a. analysis of hierarchical company structure,
    b. analysis and description of company material flow.
2. designing the draft of IS, which is being developed:
    a. design of functional model,
    b. design of process model,
    c. design of data model.
3. designing the Graphic User Interface:
    a. designing navigation diagram,
    b. description of Graphic User Interface.
4. creation of System Guide,
5. creation of User Guide.[2] [5]

II. FLEXIBLE PRODUCTION SYSTEM

This system is a fully automatic model of a real manufacturing process. Its task is to build a product -- a grid of 5x5 cubes (individual cube dimensions are 2x2cm) on a pallet. This model is located in Laboratory of Production Lines and Image Recognition in Department of Cybernetics and Artificial Intelligence.

The cubes are initially located in a vibration stack, from which they are transferred by a conveyor to a color sensor. They are then divided into four stacks according to their color: green, blue, white and black. In case the color-specific stack is already full, the cube is moved back to the vibration stack by the conveyor. This process is filling the stack and making the cubes ready for assembly of the actual product.

After the pallet is transferred from the storage to the proper position, a 3-axis manipulator lays the cubes on a pallet according to a defined pattern. When the requested pattern is assembled, the pallet is moved to a camera by a conveyor. The camera determines whether the product was built as specified. If so, the pallet is moved to storage, if not, the pallet is moved to the end of the conveyor and emptied.

This cycle repeats until all the orders are finished. The whole flexible production system is shown on Fig. 1.[3]

Fig. 1 Flexible production system

III. USED PROGRAM RESOURCES

A developer environment was necessary for the realization of the information system. In this case, the IDE product used was Visual Studio by Microsoft. Another used program was the database system Oracle.

A. Oracle database and the SQL language

The Oracle database is the database with record-oriented data model. Its main feature is record management, which determines Oracle is a relational database. In present, it's the most widespread commercial database platform and has the biggest database market share.

To enable operations with data in a database, a computer language has to be used for the definition and manipulation with data. The SQL language serves this purpose and is the most widely used language to work with relational databases. [1]

B. MS Visual Studio and C#

A tool capable of creating a GUI (graphic user interface) application was needed and the Microsoft's Visual Studio product, the Professional 2013 version exactly, was chosen. The programming language C# was used. This language is object- oriented, therefore it works with objects and classes. It was designed and implemented by Microsoft. The entire information system was created using this language.[4]

IV. THE INFORMATION SYSTEM DESIGN FOR THE FLEXIBLE PRODUCTION SYSTEM

This chapter describes the design of created information system, closely describing the data model, navigation diagram and a functionality model.

A. Data model

All the data needed for the proper IS functionality are saved in the database in the form of tables. There were 5 tables used for this information system:

1. USERS
2. CUSTOMERS
3. ORDERS
4. ORDER_DETAIL
5. MATERIAL_PRIZES

For the data model of the information system created, see Fig. 2. Each table is defined by its name, attributes and their data types, primary and foreign keys. The letter P in front of an attribute signifies a primary key, the letter F a foreign key. An asterisk denotes that the attribute value has to be filled.[2]

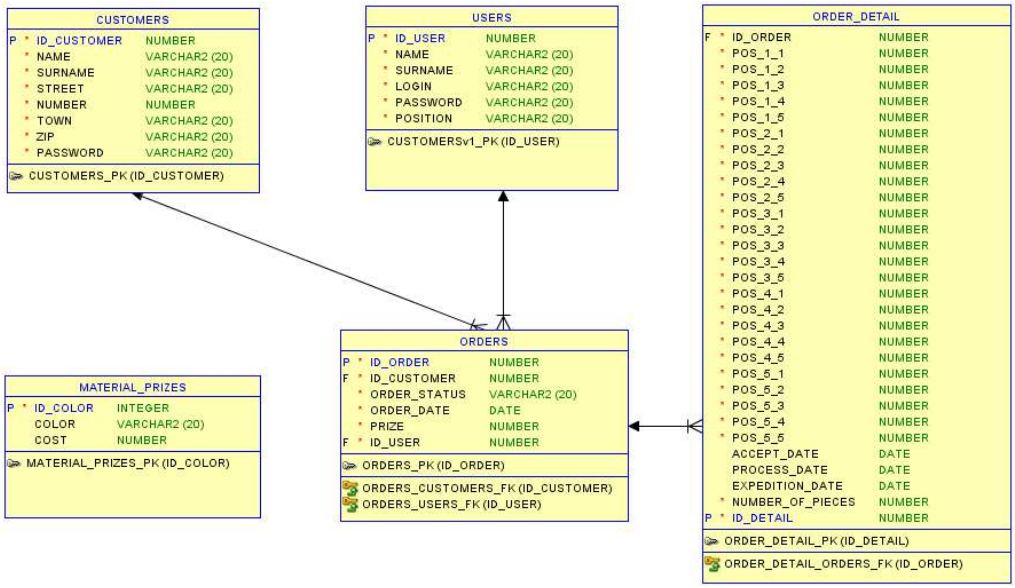

Fig. 2 Data model

B. Navigation diagram

A navigation diagram shows all the windows of a given information system. The left side contains the parent windows, from which the used can be navigated into child windows, which are on the right. There are 16 windows overall. The entire structure of navigation diagram is shown in Fig. 3.[2]

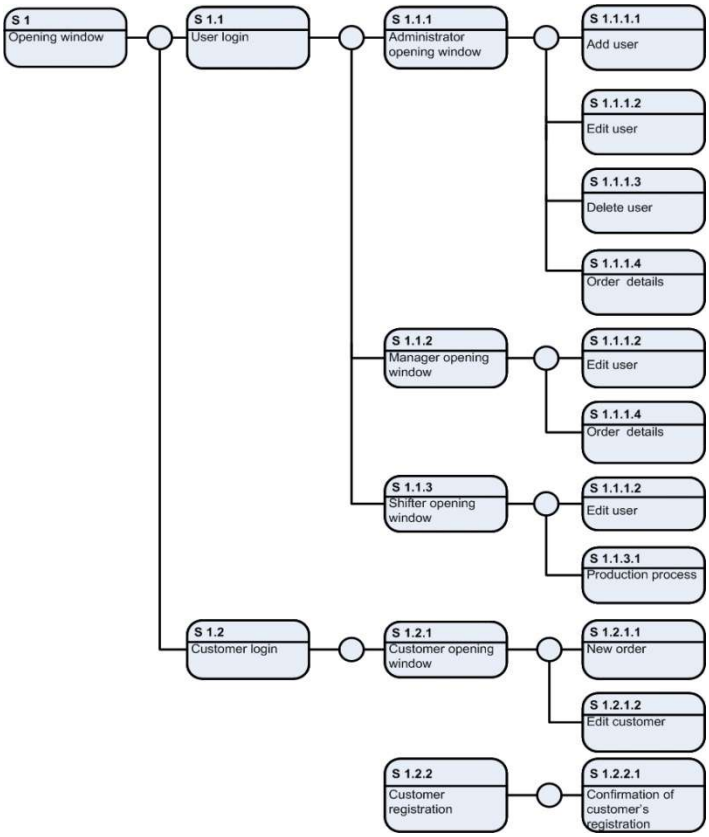

Fig. 3 Navigation diagram

C. *Functionality model*

The information system contains four basic modes: administration, manager, shifter and customer mode. Every user can perform a number of operations, depending on his/her classification. For better illustration of the functionalities and user competences, a Use Case diagram was created, shown in Fig. 4.

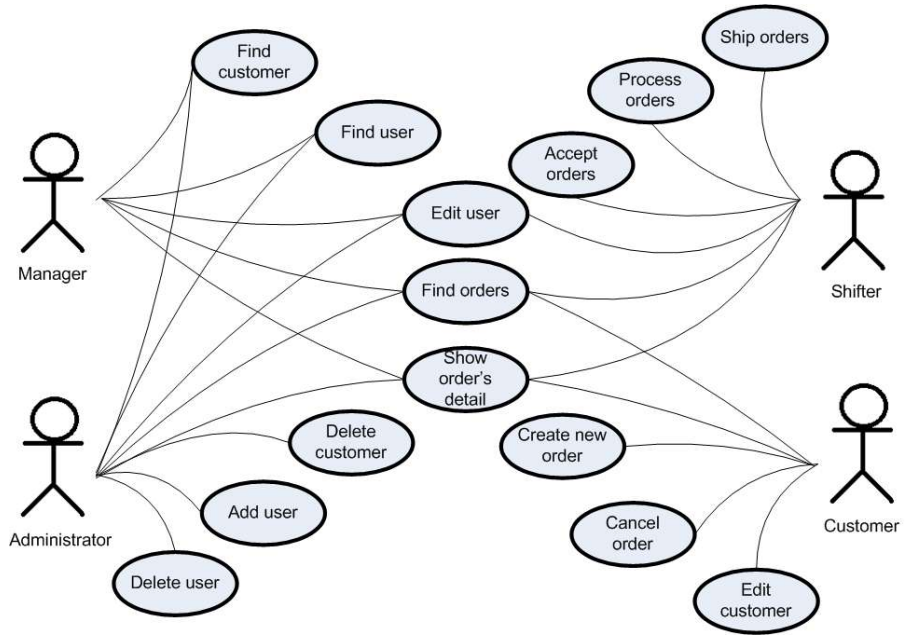

Fig. 4 Use Case Diagram

An administrator has the largest competences and is able to:

- add new users to the system,
- search, edit and remove users,
- search and remove customers,

- search orders and show their details.

The competences of a manager are smaller than those of an administrator, namely manager is able to:

- search users,
- search customers,
- search orders and show their details,
- edit his/her own personal information.

Among the competences of an employee can be included:

- search orders and show their details,
- accept, process and send out orders,
- edit his/her own personal information.

Customers, using their mode, are able to:

- create a new order,
- cancel an already sent order,
- search orders,
- edit her own personal information.

V. EXPERIMENTAL TRIAL

After logging into the IS, the first window is shown according to the role of logged user. First window for administrator mode is shown in Fig. 5.

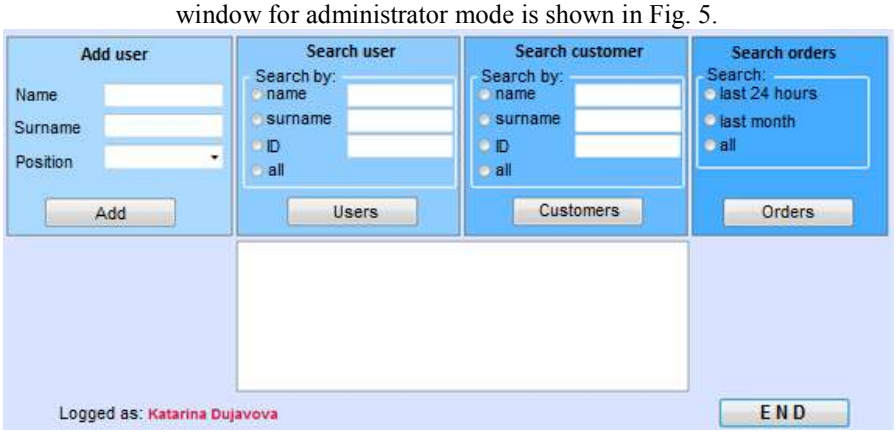

Fig. 5 First window in administrator mode

Production process is launched from shifter mode, so first step to start the production is to log into the IS as shifter. After the production is launched, the order information is sent using a server to the production line. Fig. 6 shows shifter window before launching the production process of particular order.

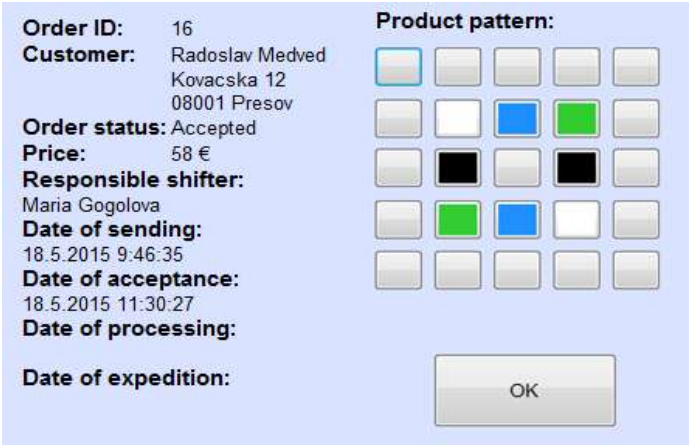

Fig. 6 Shifter window before lauching production process

An employee chooses a specific order to be processed in the order processing window. By pressing the “Add order” button, the shifter adds the order to the queue. In the next step, the shifter presses the “Start production” button and the production line starts working thereafter.

An empty pallet is laid on the conveyor, by which it is transferred to the 3-axis manipulator, which assembles the ordered product. When the assembly is finished, the product is moved by the conveyor under a camera, which captures the finished product and compares it to the ordered pattern. Fig. 7 shows the picture from camera.

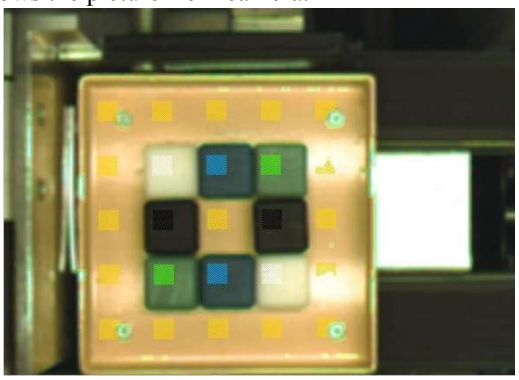

Fig. 7 The picture from camera

Fig. 8 shows the finished product stacked in position in storage unit. In case the product was assembled incorrectly, the pallet is moved to the end of the conveyor, where it is emptied. If the product matches the ordered pattern, the pallet is moved to storage.

The position in the storage is the same one, from which the empty pallet was taken at the beginning of the production process.

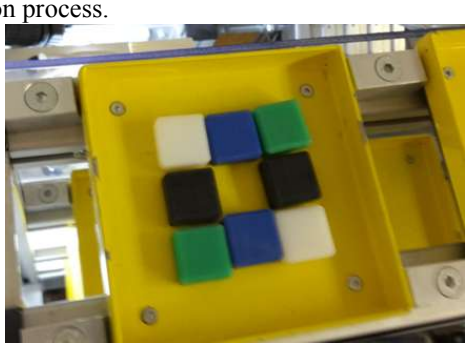

Fig. 8 The finished product

APPENDIX

In this paper were described processes of design, creation, implementation and experimental trial of information system created for laboratory assembly line model (flexible production system). Created information system can be used by 4 types of users. Each of them has its own level of privileges. Information system is storing data in the database, and it is also connected with real model (shifter can start production process via IS). Although created information system seems to be complex, the number of functionalities can be increased in the future, for example to include statistical output for the manager or add some new user functionalities.

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