Optimal Management of Commodity and Product Flows From the Supplier to the Consumer on a System Approach

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Abstract-- This paper shows results of development of one of the key modules, Requisition Log, which allows to automate receipt of the orders from clients and processing thereof. The follows tools have been used: Enterprise Architect Unified Modeling Language (eaUML) for logical development of logistical applications, toolboxes of MS SQL Server in design of the physical database, the Visual Studio environment to create the clients application.

Index Term— Database Management System, Logistical rules, Microsoft SQL Server, Unified Modeling Language.

I. INTRODUCTION

Logistics has been developed in modern times mostly due to the availability and development of the data transfer and processing means; today there is demand for logistics applications and hence topicality of the necessity to automate logistical operations is not questioned. The main goal of the creation of this project is to automate the courier service’s logistical operations handling as far as storage and processing of data related to the received orders are concerned. The creation of software aimed to solve logistical tasks allows to reduce labor costs abruptly, and the personnel can use the remaining time to accomplish a more effective work. The common object is automation of the traffic flow management. The direct object is automation of processing of the received orders.

The objective of logistics is to arrange placement of raw materials, unfinished goods, stocks of finished products so that costs related to the entire cycle of production and delivery of the finished product to the final consumer be minimized. Logistics is used in order to gain specific competitive advantages, primarily against high quality of services provided to the client. In particular, the logistics informware also means the continuous online follow-up of the process of client servicing in order to find out and remedy any defects before they become apparent in the course of client servicing.

Logistics is an optimal management of commodity and product flows from the supplier to the consumer, and related information, financial and service flows, based on a system approach aimed to reduce time and costs within the good delivery chain.

The process related to product flow management is based on processing of data circulating within the logistical systems. Therefore, the information flow appears to be one of the key terms of logistics. The number of telephone calls related to goods acceptance per day; the number of delivery notes received together with the goods on a weekly basis; the volume of information of the goods flowing through the storage area, which is transferred to the area computer per time unit are information flows. Effectiveness of the product flow management directly depends on the rational management there of [1].

This article describes results of development of the application to solve tasks of the transport logistics using Microsoft SQL Server [3,4] tools and Borland Delphi programming support environment. The developed Requisition Log module is designed to carry out logistical operations under the received orders within a courier service. The Requisition Log allows automating registration of all orders, their sorting out and data analysis.

Logistical rules

Activities related to logistics have the final goal called “six rules of logistics” [2]:
1) Cargo (required goods),
2) Quality (of the required quality),
3) Quantity (in the right quantities),
4) Time (to be delivered on time),
5) Location (to the required destination),
6) Costs (at minimum costs).

The goal of the logistical activities shall be deemed achieved when the above six conditions are met, i.e. the required goods of the adequate quality and in the right quantity have been delivered on agreed time to the agreed destination at minimum costs [3].

Encapsulated programming is generally typical for the logistical systems, subject to their functionality. Encapsulated programming is a method used to develop programs, which involves dividing programs into independent class modules.

A module is a separate all-in-one program unit executed in a standard manner with respect to compiler and other modules.

The major concepts of the encapsulated programming are as follows:
1) each module performs a sole independent function;
2) each module has the single input and output points;
3) if possible, the module size should be minimized;
4) each module may be developed and encoded by different members of the team of programmers and may be tested separately;
5) the entire system consists of modules;
6) each module is independent on a technique used to implement the other ones.

The Requisition Log module’s peculiarity is that it has been developed specially for logistics specialists, i.e. for executors empowered to execute all operations within the module. They know orders, sort them out to the route, transfer to the courier, follow up their statuses, may make a...
search, and view the data of the companies.

II. UNIFIED MODELING LANGUAGE (UML) MODELING
Using of CASE Technologies (Computer-Aided Software/System Engineering) and CASE Tools enabled to systemize and automate to the maximum all phases of software development. In this work, to ensure the logic programming of database, the CASE Tool Enterprise Architect Unified Modeling Language (eaUML) is used, and the “Essence – Communication” model is developed, e.g. see Figure 1. This diagram shows the intuitive review of the project and is especially useful for users to exchange their ideas.

The next step was the verification of any operational use of organization’s data related to the data processing, and the exclusion of all useless and repetitive data. In the process of database design, to solve tasks of data doubling minimization and facilitation of data processing and updating procedures, the relations were normalized. The tables of designed database are in 3rd normal form (3NF) accordingly to Dr. E. F. Codd [4].

For the system modeling, the Enterprise Architect Unified Modeling Language (eaUML), is used. UML enabled the software authors to agree upon on graphic codes to indicate general terms, such as class, component, generalization, aggregation and behavior, and rather to focus on design and architecture.

The function Order Generation and Management is most common, extended task with respect to the other ones. To perform all other operations at first it is necessary to generate an order and process it. A simple scheme of order addressing, subject to its successful close-out, is as follows:

By using the Order Management Chart, it is easy to follow up what new actions may be taken after each operation. For example, the following actions may be taken after the order is generated: sorting out for the route, shift by the date, making adjustments to details, order rejection. After each of these operations, the order status is changed, other operations or the same one corresponding to the status are possible.

Figure 1 shows the Sequence Diagram used for successful order addressing. However, it is a simplified scheme that is developed in order to understand the process of order addressing. In fact, a number of other operations with the order are to be carried out – the operations scheme is shown on the Order Management Chart (Figure 2).
III. PHYSICAL DESIGN OF THE DATABASE

The physical design phase consists of associating database logical structure and physical environment of storage with purpose to ensure the most efficient data allocation that is the mapping of the database logical structure in the storage structure. The following issues are in consideration: the stored data allocation in the memory space and the selection of efficient methods of access to different components of the “physical” database. Solutions made within this phase make critical impact on the system performance.

The physical design of the database was performed using the professional design package MS SQL Server 2005. The database is also intended to store information but, due to type of most files, makes not the information available directly to the user; the database launches the application which refers to the data stored in the database and makes it available in the format understandable for the user. MS SQL Server has a number of advantages over other DBMS (Database Management System) – easy installation, deployment and operation; scalability, creation of data warehouses and system integration with other server software. Another factor which influenced on the DBMS MS SQL Server selection for this work was the speed. As of the relational databases, the speed is the time needed to make query and to return to the user the results of the query processing.

The database has been designed for our system using the MS SQL Server 2005 tools, and is based on eight tables:

- Account contains data of the company by the business account,
- Courier contains information of the route,
- DT_Declaration – information of the orders,
- DT_DeclareEvents – event codes in the course of order processing, which may be as follows: order generation, sorting out for the route, transfer to the courier, order rejection, shift of the order by date, adjustments to details, closed-out, open, false call, prohibited order, changed route;
- DT_DeclareStatus contains information of possible statuses of the order. The order status may be as follows: new, sorted out, en route, shifted by date, adjusted, accepted, open, false call, rejected, prohibited.
- DT_DeclareEventScheme defines the flow chart related to order processing. There is the order status BeforeStatus, which was prior to an operation.
the operation with the order is accomplished (the operation is determined by the Event Code), the order status is changed to AfterStatus. DT_Associative contains data of the company by the relevant associative words. The associative words are used to automate data entry – the logistician enters an associative word and fills in all fields on a one-time basis, which contain data of the company (company name, business account, telephone, contact person, working time, lunch time, comments).

All information is stored in this table. When the associative word is entered next time, the system finds it in the table and automatically displays all data of the company.

The database table relation diagram [4] has been developed. The diagram is shown on Figure 3.

One of the most important elements of the database design is the development of the database protection. The protection has two aspects: protection against failures and protection against unauthorized access. The file back-up strategy is developed to ensure the failure protection. To ensure the protection against unauthorized access, each user will obtain the access only in compliance with his/her access rights.

In this work, the protection using SQL Server Tools was organized in standard conditions. The users’ accounts are used to control the access rights to specific server resources such as tables and stored procedures. The user account determines one or more roles of the user.

In the course of development of distributed information systems within the organization of user and server parts interaction the following tasks shall be solved: the database carriage to the server for its further sharing as corporate database; organization of queries of the front-end computer to the corporate database allocated on the server; development of client application for remote access of the front-end computer to the corporate database; server administration from the side of the client.

In this work, in the course of client-server application development, the technology ActiveX Data Objects (ADO) is used to enable the databases operation.

IV. DESCRIPTION OF WINDOWS

The Client Software for the database was realized in the visual object-oriented environment Visual Studio [6]. The database processing was organized as follows: data search with changing parameters, results of dynamic queries based on Transact Structured Query Language (TSQL): integrated, crosstab, associated etc.

User interface is a system(GUI) of rules and means regulating and ensuring interaction between the software and the user. The Requisition Log module contains one primary window and three auxiliary ones. Using the controls on the main Requisition Log form, it is possible to perform any necessary functions. The auxiliary forms will be called, when necessary.

At a time of the program start, the user authorization window will be displayed. Following successful authorization, the Requisition Log main menu is displayed, where you can perform all necessary operations with the
orders. Auxiliary windows are called out by pressing the Calendar and Search buttons on the control board, in order to view the orders as of the chosen date and to search for the orders by different criteria, respectively. When the Reference Books -> Organizations command is called, the Reference Book of Business Accounts is displayed. It contains companies' data.

The Requisition Log module is a program-complete unit. To simplify and demonstrate results, the executable file.exe has been created; it allows to check and test correctness of the module operation. It is noteworthy that this file is accessed in a different way within the system, i.e. from the Corporate Client application being a separate task. Figure 5 shows the Requisition Log primary window. The application enables searching by criteria, searching orders by calendar, where day, month, and year are specified and all orders valid as of the selected date will be displayed. Fragments of the program code are not shown here.

The work involves the analysis of the necessary requirements at the design phase, substantiation of the development tools, determines the task solution methodology; physical and logical design of the database, as well as design of the user interface; results of the application operation, testing obtained, and description of the Requisition Log operation is prepared; analysis and assessment of the application’s economic effect, calculation of costs related to development thereof.

Economic effect of the developed application:
1) Automated registration of all orders, simple and comfortable search for the required order using different criteria;
2) Possibility to follow up the order status and view the order history;
3) One-time entry of the company’s data; the data are stored in the database;
4) Possibility to view the Reference Book of Business Accounts and to use it as the companies’ database;
5) Possibility to analyze performance of the personnel, number of orders per day, etc.

V. CONCLUSION

The modern logistics development depends much on the efficient computerization and proper management of the information flows.

The model developed as a part of the project is of quite a high scientific and technical level; it is customized for the specifics of the logistical operations within the courier delivery service, has been introduced and used today. It is quite useful in automation of the personnel work and provisioning of higher quality services to the clients [9].

REFERENCES

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