DEVELOPMENT OF THE SERVER PART OF AN AUTOMATED INGREDIENTS TRACEABILITY SYSTEM IN A PACKING-HOUSE

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Abstract: The server part of an automated ingredients traceability system in a packing-house has been examined. The developed generalized scheme and operation algorithm of the application server have been presented as part of a three-tiered client-server system. A relational database scheme has been synthesized, for storing information about the ingredients, recipes, supplies, expenses and other events, related to the production process. A specialized software application has been developed, which implements graphical user interface for authorized personnel to create/edit recipes, ingredients, add supplies, generate and print reports, etc. The program also plays the role of a middleman between the client interface and the database server, by implementing the developed operation algorithm.

Keywords: automated system, ingredients traceability, database.

1. INTRODUCTION

The ingredients traceability in the packing industry has a major role in the process optimization. The ingredients traceability systems allow the reduction of the process expense by increasing the control over the ingredients usage. The modern systems store different type of information about the production process in a database (DB), allow to visualize and print this information, protect it from unauthorized access, etc. [1-4]. In order to achieve these requirements, the system should be divided into a client and a server, which is a necessary condition to ensure the basic data security, because the client and the server are physically at different locations. The goal of this study is to propose a specific implementation of the server part of an ingredients traceability system, including a generalized scheme of the system and the connections between its components, a scheme of the relational DB, operation algorithm of the application server and the primary functions of the developed software application.

2. GENERALIZED SCHEME OF THE AUTOMATED SYSTEM

The suggested automated system for ingredients traceability can be expressed as a three-tiered client-server system, which consists of a Client user interface, Application server and Database server (Figure 1) [5]. The application server is implemented over a personal computer (PC) with the use a specialized software application. It implements the possibility to add/edit recipes, add new ingredients, monitor their amounts, and others. It also

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is playing the role of a middleman between client interface and the DB server. The DB server can be implemented either on the same or on another PC and the connection with the server is based on the MSADO interface.

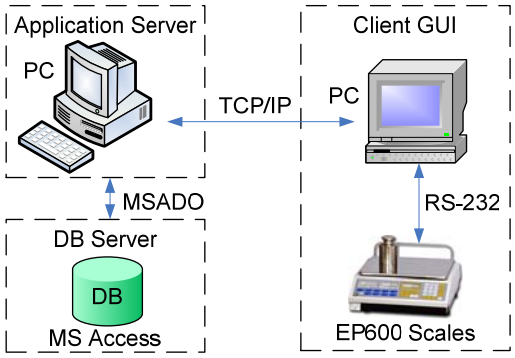

Fig. 1. Generalized scheme of the three-tiered client-server automated ingredients traceability system.

The client user interface is implemented with a PC, electronic scales and a specialized software application. The connection between PC and the electronic scales is established over a RS-232 interface. The specialized software application monitors the correct execution of the recipes in the boundaries of the required absolute error. It connects to the server through a local network and uses a socket based TCP/IP communication.

The Application server and the DB server are the main objects of this study.

3. OPERATION ALGORITHM OF THE APPLICATION SERVER

The operation algorithm of the application server is presented with the block-scheme in Figure 2.

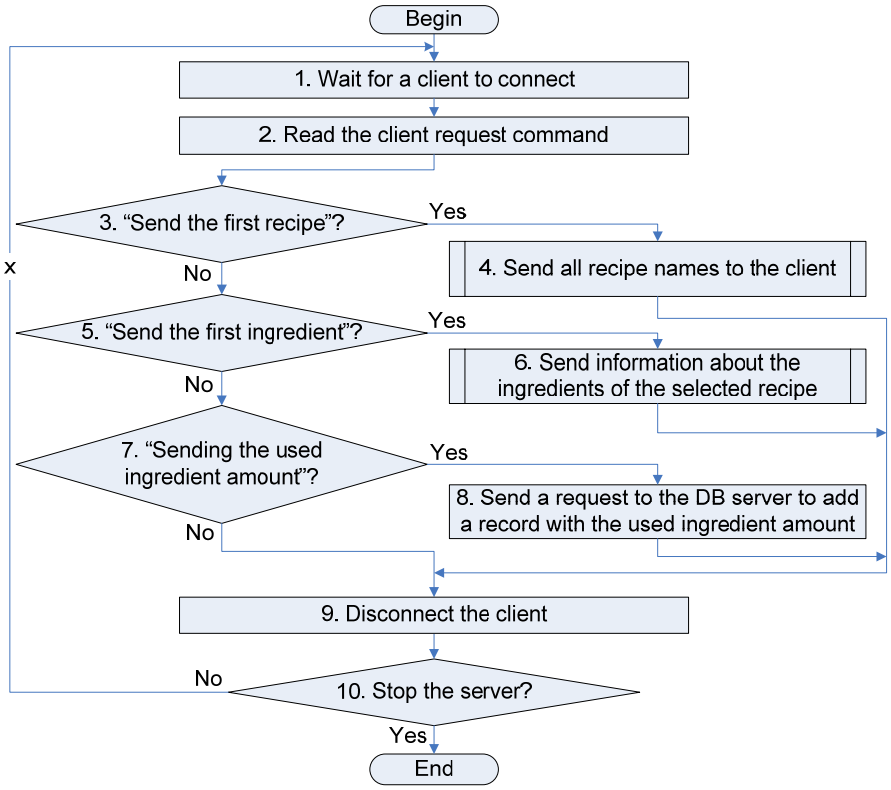

Fig. 2. Block-scheme of the operation algorithm of the application server.

Block 1 is the initial wait time for client connection. The incoming client command is read in block 2. In blocks 3, 5 and 7 is determined the command type: “Send the first recipe”, “Send the first ingredient” or “Sending the used ingredient amount”. Depending on the command, the server calls the function for sending the names of all the recipes (block 4), the function for sending the information related to a specific recipe (block 6) or the application server makes a request to the DB server, in order to add a record with the used ingredient amount (block 8).

When the command “Send the first recipe” is received, a request-responses sequence is initialized. For every “Send the next recipe” request, the server responds with “Sending the next recipe”. When all the recipe names have been sent the server responds with “No more recipes”.

The communication for the “Send the first ingredient” command is analogical, but the used commands are “Send the next ingredient” and “No more ingredients”. The transferred information contains the name, the amount and the maximum allowed absolute error for each ingredient. In both the cases before the actual request-response sequence begins, the application server makes a request to the DB server, in order to generate a list of recipes or ingredients.

4. DATABASE OF THE AUTOMATED SYSTEM

The used database is relational and is implemented with MS Access. The reason for choosing this database is that the system makes relatively low number of requests to the database and all of them are made by a single user – the application server [1]. The database contains 6 tables and their relations are shown in Figure 3. In the table Ingredients is contained information about all the ingredients and in the table Recipes are contained the names of all the recipes. The daily income/expense of the ingredients is stored in the History table.

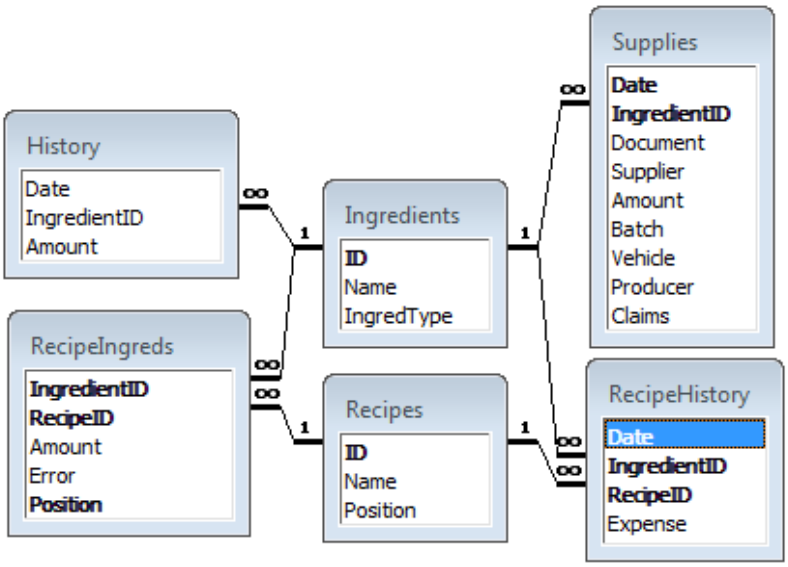

Fig. 3. Scheme of the relational database of the automated ingredients traceability system.

The information about the supplies of the ingredients, as well as supplier, country of production, amount, batch number and other documental data, is stored in the Supplies table. In the table RecipeIngreds are stored the recipes themselves. It contains the necessary amount and absolute error of each ingredient for each recipe as well as the order in which the components should be added. In the table RecipeHistory are stored all the records about the recipe executions, including the date/hour of the execution as well as their type (100%, 75%, 50% or 25%).

5. SPECIALIZED SOFTWARE APPLICATION

A specialized software application NadevdaMDozator Server v. 3.1 has been developed, with the use of the Developer Studio 2005 environment. The program implements the graphical user interface for adding/editing

recipes, ingredients, supplies deliveries, generation and printing of different reports, etc. (Figure 4). It also implements the algorithm from Figure 2 and plays the role of the middleman between the client and the DB server.

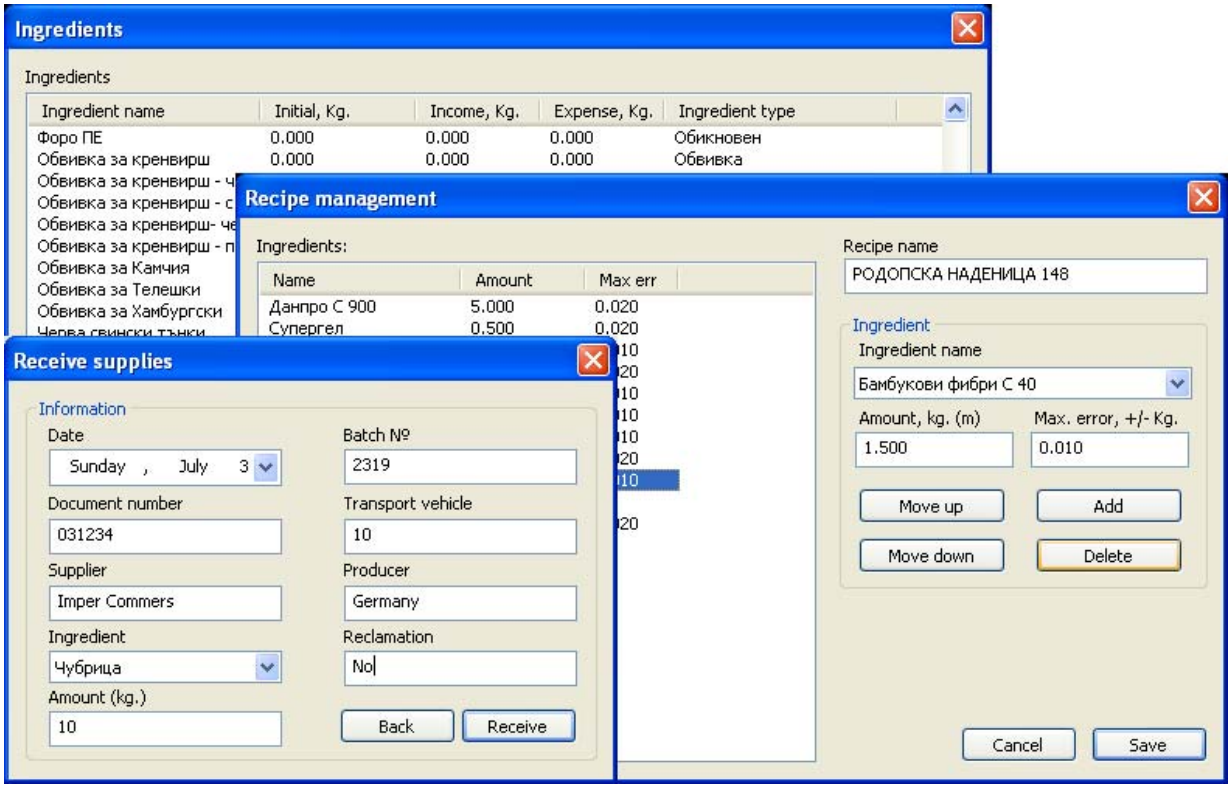

Fig. 4. Different windows from the NadevdaMDozator Server applications for visualization of ingredients, recipe management and receiving new supplies.

Structured in this way, the system guarantees that only personnel that have access to the room of the application server could make changes to the recipes, ingredients, amounts, etc. The security is additionally improved by the use of a custom communication protocol between the client and the application server.

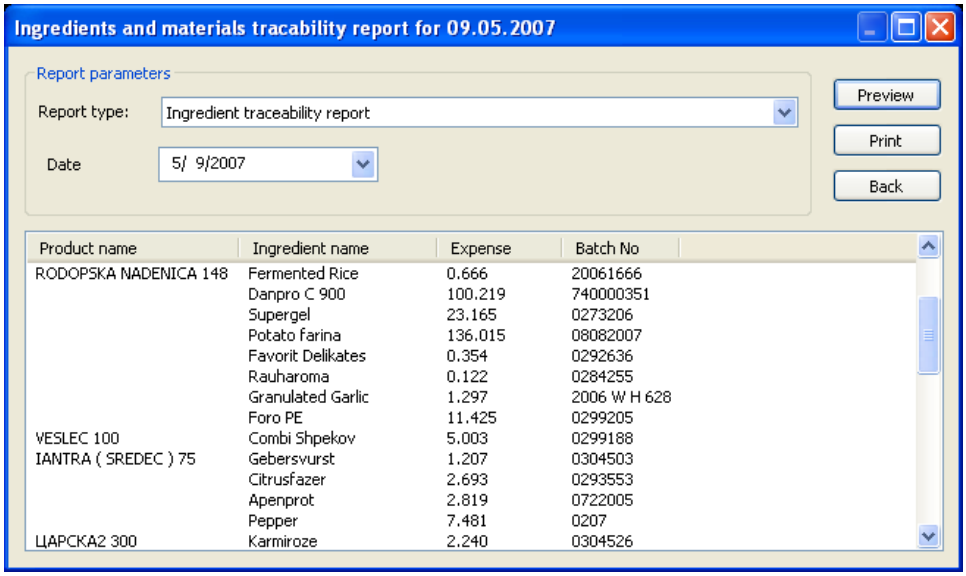

Fig. 5. Window from the NadevdaMDozator Server application for generation and printing of reports.

The program NadevdaMDozator Server also plays the role of a report system, which allows to generate and print a couple of report types (Figure 5): report for one ingredient, report for all ingredients, report for the used ingredients, report for the supplies and report for ingredients traceability (ingredients usage, sorted by recipes). This is one of the most important functions of the system, because it allows the monitoring of the current storehouse amounts for all the ingredients, their usage by days and by recipes. These functions make it possible to detect any discrepancy between the expected and the actual storehouse ingredient amounts and take the necessary timely measures.

6. CONCLUSIONS

A generalized scheme of the automated ingredients traceability system has been developed. An operation algorithm of the application server, structure of the relational database and a specialized software application implementing the algorithm have been created.

The DB holds information about the recipes, income and expense of the ingredients, supplies, etc. The developed program NadevdaMDozator Server plays the role of a middleman between the client user interface and the DB server. It also implements the GUI for making changes to the recipes, ingredients, and others by authorized personnel.

The software application can generate and print reports about the available amount of the ingredients, their usage by days and by recipes. This function makes it possible to detect any discrepancy between the expected and the actual storehouse amounts and take timely measures.

The system is implemented in the meat stocking-house “Nadejda M”, Biala, Ruse district, Bulgaria.

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