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WEB-BASED SYSTEM FOR A HOSPITAL PHARMACY AND INVENTORY MANAGEMENT

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Abstract: *The effective functioning of medical centers is related to the management of hospital pharmacies responsible for storing medications and medical consumables released by the National Health Insurance Fund for the needs of patients in a medical environment, and to the inventory management for controlling and monitoring the medical items stored in the pharmacy premises. This paper describes a web-based system designed for a hospital pharmacy and its inventory management. It allows customers to make online orders for medicines and other medical items from the hospital pharmacy, and on the other hand – the pharmacy staff can process the orders, control and manage the product stock.*

Keywords: *hospital pharmacy, inventory management, software, medicine procurement, reporting, medication control, references.*

INTRODUCTION

Medications and medical consumables are the basic means applied in the treatment of patients and one of the biggest sources of hospital expenditures. The effective functioning of medical centers suggests the availability of an integrated hospital pharmacy for storing and dispensing the medications and medical consumables released by the National Health Insurance Fund for hospitalized patients. So, it is necessary to provide efficient instruments for carrying out a continual control over the procurement, storage, preservation and consumption of the medications and medical consumables. A hospital pharmacy is a medical organization for medication storage, preparation, packing, monitoring and consulting [5].

For daily handling of medications it is necessary to obtain, on the one side, information from the patient concerning their health status including symptoms, medical history, period of illness state, intake of other medicines and allergic reactions, and on the other side, information regarding a number of factors related to the medicine itself, i.e. its specific nature, expiry date, possible medication alternatives in case of replacement, and storage conditions [2], [4].

Yet, since the mid-1990 various software products have been implemented as well as modules for automation and control of the reporting how the movement of medical items in hospital pharmacies is being realized. Over the recent years a good amount of funds have been invested in developing the information technological infrastructure and the implementation of suitable software systems in both the state and private sectors. According to the assessments of the European commission approximately 5% of the national budgets for health care in the countries on the Old Continent have to be invested in systems and services for e-health development [1], [5].

The inventory management supports the daily operation of stores providing distribution of orders and control over storing operation performance. Designing a web-based system for inventory management ensures accurate information about the available stock in real time mode. Via the inventory management relevant orders

can be issued concerning store operations, no matter if they refer to the shipment of medication items, or requests for materials release or transfer to another store, as well as service of orders regarding receipt of purchased goods, record of items and receipt of goods from another store.

NECESSITY OF WEB-BASED SYSTEM FOR A HOSPITAL PHARMACY AND INVENTORY MANAGEMENT

Long lists of medical software products have been compiled but most of them are in service only to general practitioners, specialist physicians or laboratories and do not provide the possibility to manage the information related to a hospital pharmacy and inventory [2].

The main causes for using a web-based system for a hospital pharmacy and inventory management originate from the following demands:

- Automating the entire information process and minimizing the probable risk of errors;
- Improving and speeding up the decision-making process related to the management of suppliers of medicines and medical items;
- Facilitating the pharmacy staff in their daily activities regarding procurement, management and sale of medicines and medications;
- Classification of the data related to the pharmacy and inventory management according to a specific feature;
- Easy data retrieval;
- Creating databases for the various system objects: stores, patients, suppliers, departments, medical items and medicines, etc.;
- Automating the queries for medicines and medications;
- Automating hospital documentary lists – preparing printed and blank forms, pieces of information as tests, nomograms, etc;
- Reporting the income, expenses and the items in stock;
- Ordering and releasing materials without a paper carrier (online);
- E-signing of documents (authorization);
- Dispensing material and medication expenses to a specific patient;
- Management of medication items, negotiated prices and quantities;
- Document templates of content types;

SYSTEM DESCRIPTION

The web-based system has been designed using Laravel 5.2 and Bootstrap 3.3.7 frameworks in PHP 5.6, MySQL, HTML 5, CSS 3 programming languages and jQuery 1.11.1 library in JavaScript.

The main functions of the system can be grouped in three logical levels, also known as logical layers, i.e. presenting, logical and data layers. The presenting layer is responsible for supplying and processing the data intended for the system users. It is also named *front-end* or *user interface (UI)*. It transforms users' tasks into commands, which can be interpreted by the rest of the system layers. The logical (business) layer acts like go-between for the other layers. Its task is to interpret commands, make logical conclusions and relevant calculations. After receiving the commands from the user, the logical layer sends queries to the data layer (the back-end). Here the information is stored and released from the database. The necessary

data is forwarded to the logical layer to be processed and after that it is submitted to the user 0.

The system architecture described above is named a three-layer-architecture model.

The database contains 14 tables (see Fig.1).

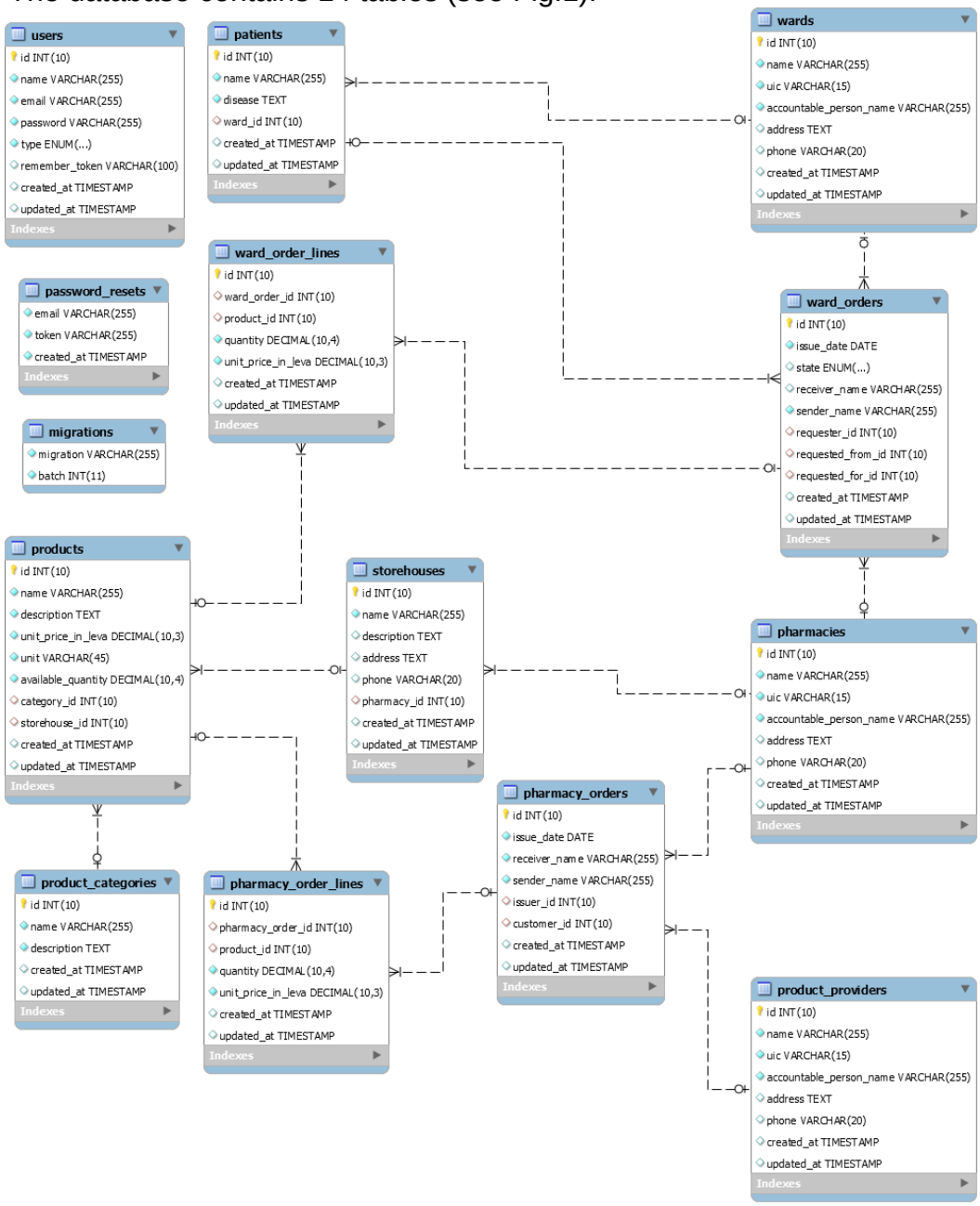

Fig.1. Relationship in data base

The system is composed of three modules:- for unregistered users, for clients (registered users) and administrator module.

The Unregistered user module has access only to the public part of the system including the following functions: registration of a new user; language change of user interface; authentication (sign in the system); recover access to the system in case of a forgotten password or user name.

Besides having access to the public part, the Client module provides the following options to the users: view all the available or not available products, filter products by various criteria, view products in details, add products in the basket, manage products in the basket; make queries and log out the system.

The Administrator module has access to both the public and client's part of the application and it allows to enter the system and operate it: confirm or reject queries; manage new queries; manage the data for users, patients, pharmacies, hospital wards, medicines and medication items, suppliers; add, change, delete records in the database tables; manage stores and categories; prepare and manage different documents; prepare reports and exit from the system.

Fig.2 shows the functionalities of the three types of users.

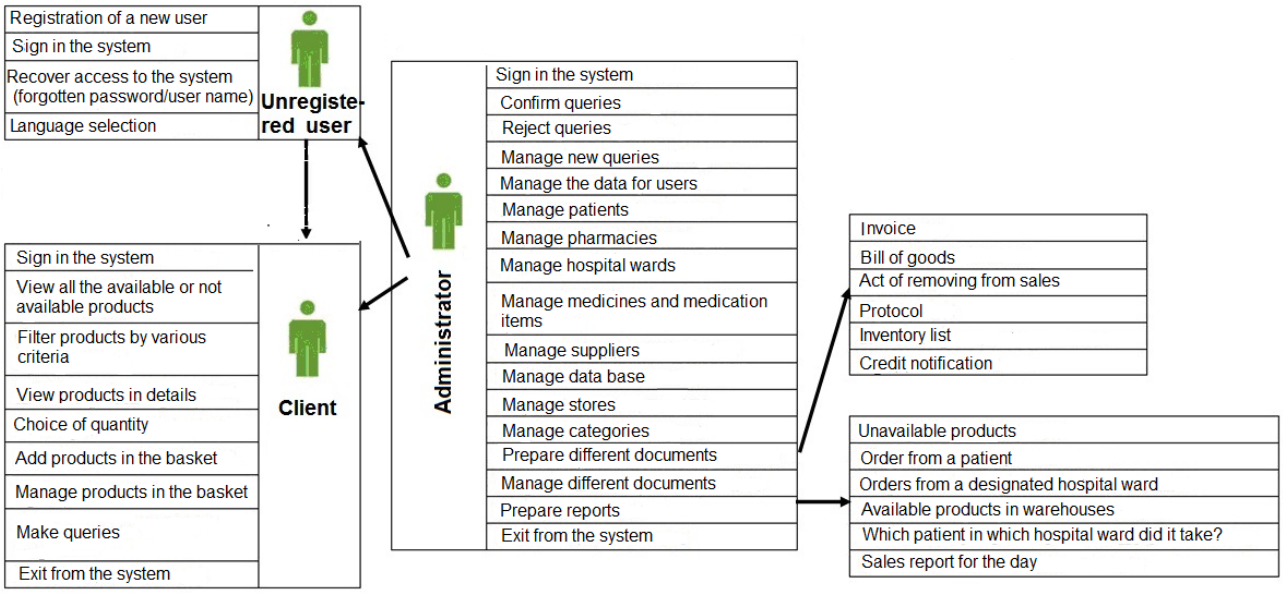

Fig. 2. Functionality of the system

For access to the system from each module it is required to make a successful authentication by user name and password. In case of unregistered user, there is an option for registration. The user enters his/her e-mail address. If a user has forgotten his/her password, the system sends a link to his/her e-mail to set up a new password. On choosing the "Products" button on the navigation bar, the user has the possibility to view the available medicines and medication items and he/she can pick up the desired products by pressing "Add in the basket". All products chosen go to the user's basket. If the user wants to buy, he/she chooses the "Basket" button. From the dialogue window the user/patient can manage the products:- delete a product, add a product, or change the quantity of products. After pressing "Continue the query", the user follows the dialogue windows to finalize the order. In response the user receives a notification in his/her e-mail for a successfully completed order.

Fig.3 represents the basic window of the system related to the Client module. The hospital pharmacy is named "X", as the system can serve the needs of any medical center.

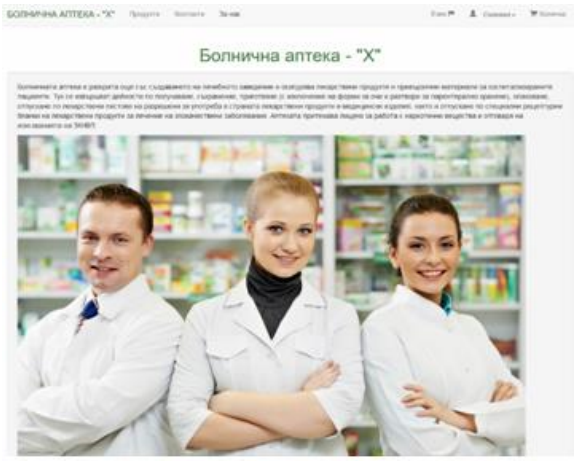

Fig.3. Client module

On entering the system, the Administrator can see on his/her window all new orders (pending for execution); he/she can view them, execute and manage them after pressing the “New queries” button. If choosing “References” the administrator can see, manage and create new references (Fig.4).

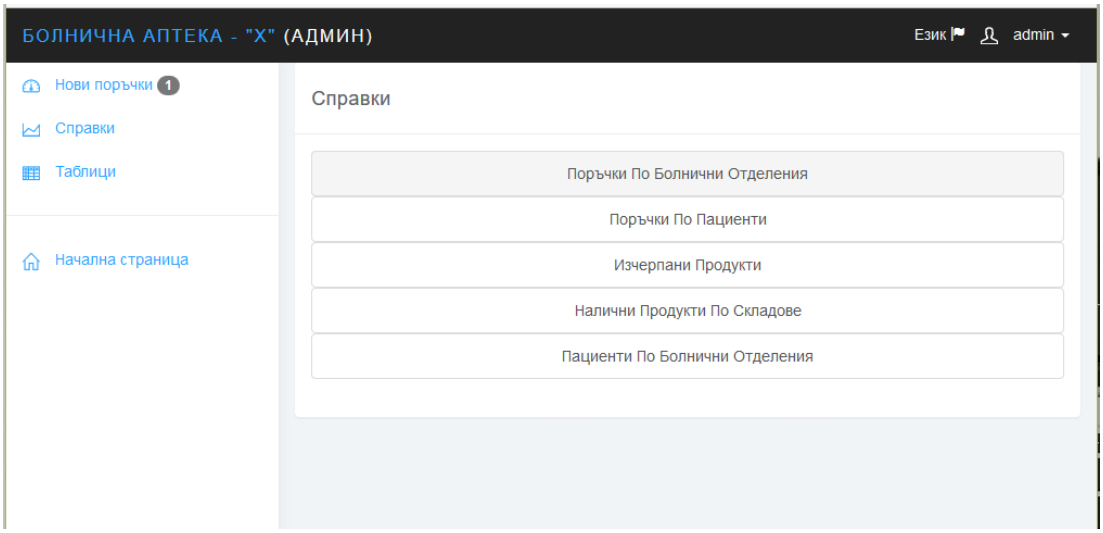

Fig.4. Administrator module - Reporting

If choosing the “Tables” button the administrator can manage all objects in the medical center: users, pharmacies, products, hospital wards, patients, categories, stores or suppliers (Fig.5).

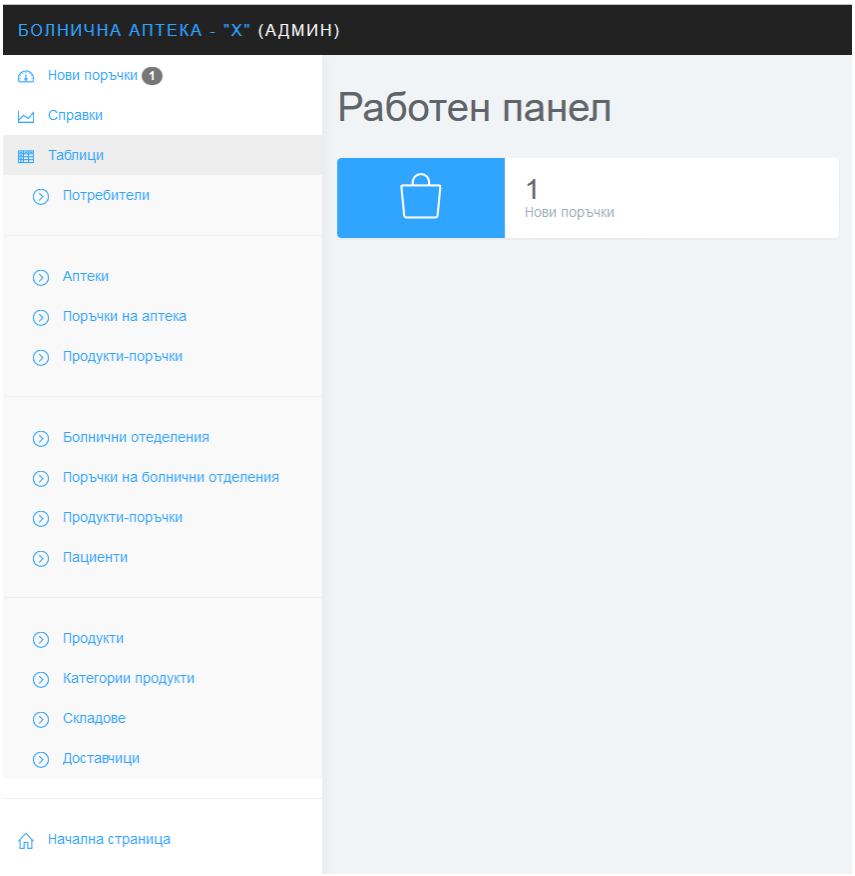

Fig.5. Administrator Module - Managing Tables

CONCLUSION

The web-based system designed for a hospital pharmacy and inventory management is provided with all the necessary functionalities in service to any medical center – ordering, procurement and management of medicines and medication items; management of suppliers, stores, patients and queries; preparation of various types of documents related to the movement of medications as well as different types of reports in association with the medical center. The user interface of the system is simplified and intuitive covering a wide range of functions.

Further directions for developing the system:

- Users can monitor the status of their orders;
- Displaying images of the products;
- Security of user accounts.

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WEB БАЗИРАНА СИСТЕМА ЗА БОЛНИЧНА АПТЕКА И СКЛАДОВО СТОПАНСТВО

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Резюме: *За ефективното функциониране на лечебните заведения е необходимо наличието на болнична аптека, която да се грижи за поддържането на лекарствени средства и консумативи, предписани по здравна каса, за нуждите на постъпилите в болницата пациенти, както е на складово стопанство за контролиране и управление на тези лекарствени средства. Проектирана е Web-базирана система за болнична аптека и складово стопанство. Тя позволява на потребителите да правят онлайн заявки за лекарства и други продукти от болнична аптека, а от своя страна служителите в болничната аптека могат да управляват тези заявки, да следят и управляват продуктите в складовете.*

Ключови думи: *болнична аптека, складово стопанство, софтуер, доставка на лекарства, отчетност, управление на медикаменти, справки.*

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