

## DEVELOPMENT OF A WEB SERVICE FOR MONITORING IN PHARMACIES

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Nowadays, information technology is widely implemented in various spheres of life, including health care. This paper presents a web-based pharmacy monitoring service that plays an important role in improving the accessibility and convenience of health care. The article covers the development of pharmacy business processes, highlighting key performance factors such as sales performance and service levels. The web service architecture provides secure storage of medication and pricing data. The service is designed with simplicity and intuitiveness in mind, making it easy to order medications for different user groups. The analytics and reporting components provide management with the tools to make informed decisions based on sales data. The security and confidentiality of medical data is an important consideration. Web service development and maintenance requires an integrated approach, providing a reliable, convenient and secure service for medication ordering and pharmacy monitoring.

**Keywords:** web service, monitoring, business processes, medication, databases, interface, architecture.

## РАЗРАБОТКА ВЕБ-СЕРВИСА ДЛЯ МОНИТОРИНГА В АПТЕКАХ

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В настоящее время информационные технологии широко внедряются в различные сферы жизни, включая здравоохранение. В данной статье представлен веб-сервис для мониторинга аптек, который играет важную роль в повышении доступности и удобства медицинского обслуживания. Статья охватывает разработку бизнес-процессов аптеки, выделяя ключевые факторы эффективности, такие как показатели торговых операций и уровень сервиса. Архитектура веб-сервиса обеспечивает надежное хранение данных о лекарствах и ценах. Сервис разработан с учетом простоты и интуитивности, что обеспечивает легкость заказа лекарств для различных пользовательских групп. Компоненты аналитики и отчетов предоставляют руководству инструменты для информированных решений на основе данных о продажах. Важное внимание уделяется безопасности и конфиденциальности медицинских данных. Разработка и обслуживание веб-сервиса требуют комплексного подхода, обеспечивая надежный, удобный и безопасный сервис для заказа лекарств и мониторинга состояния аптек.

**Ключевые слова:** веб-сервис, мониторинг, бизнес-процессы, лекарства, базы данных, интерфейс, архитектура.

## ДӘРІХАНАЛАРДА МОНИТОРИНГ ЖҮРГІЗУ ҮШІН ВЕБ-СЕРВИСТІ ӘЗІРЛЕУ

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Қазіргі уақытта ақпараттық технологиялар денсаулық сақтауды қоса алғанда өмірдің әртүрлі салаларына кеңінен енгізілуде. Бұл мақалада медициналық көмектің қолжетімділігі мен ыңғайлылығын арттыруда маңызды рөл атқаратын дәріханаларды бақылауға арналған веб-сервис ұсынылған. Мақала дәріхананың бизнес-процестерін дамытуды қамтиды, сауда операцияларының көрсеткіштері мен қызмет көрсету деңгейі сияқты негізгі тиімділік факторларын көрсетеді. Веб-сервис архитектурасы дәрі-дәрмек пен баға деректерінің сенімді сақталуын қамтамасыз етеді. Қызмет қарапайымдылық пен интуитивтілікті ескере отырып жасалған, бұл әртүрлі пайдаланушы топтары үшін дәрі-дәрмектерге тапсырыс беруді жеңілдетеді. Аналитика және есеп беру компоненттері нұсқаулыққа сату деректеріне негізделген ақпараттандырылған шешімдерге арналған құралдарды ұсынады. Медициналық деректердің қауіпсіздігі мен құпиялылығына баса назар аударылады. Веб-сервисті әзірлеу және қызмет көрсету дәрі-дәрмектерге тапсырыс беру және дәріханалардың жағдайын бақылау үшін сенімді, ыңғайлы және қауіпсіз қызмет көрсетуді қамтамасыз ететін кешенді тәсілді қажет етеді.

**Түйінді сөздер:** веб-сервис, мониторинг, бизнес-процестер, дәрі-дәрмектер, деректер базасы, интерфейс, архитектура.

**Introduction.** Modern technology has played an important role in making health care more convenient, accessible and safe. One way to utilize technology in this area is to develop a web-based service to monitor the status of pharmacies and the availability of pharmacy products, thereby improving the level of care for both patients and health care providers.

One of the important challenges in health care is to make medicines and medical products available to patients [1]. Pharmacy monitoring allows for more effective monitoring of drug availability and price, which contributes to more informed decisions in the best interest of patients. This article presents a number of benefits associated with the implementation of pharmacy monitoring:

- Ensuring accessibility. With these services, patients can quickly find the nearest pharmacies that offer the medical supplies they need, reducing the time spent searching.
- Time and cost savings. Price monitoring allows patients to choose the pharmacy with the most favorable offers, thus saving time and money.
- Awareness raising. Patients receive additional information about medical products, including instructions for use and possible side effects.
- Quality Improvement. Doctors and nurses can more accurately refer patients to pharmacies that have the items they need.

The development of web services for pharmacy

monitoring focuses on features such as medical product search, price comparison, map integration, and detailed product information.

**Materials and methods.** This study utilizes a website design based on the information system development method. The facilities utilized are drug buying and selling operations and storage of drug stock in the pharmacy. Thus, the result is a research process with the design of the system, database, interface.

Development includes the creation and maintenance of a database to store information about medical products, pharmacies, and prices. Reliability and efficiency of databases play an important role in service functionality [2]. The web services phase generates web services and API(Application Programming Interface) to interact with the database, providing access to information and security of user data [3]. The main goal is to ensure functionality and data protection in accordance with security standards.

**Results and discussion.** Created a business process model for the pharmacy using the ERWin Process Modeler tool. IDEF0 methodology, where business processes are described by blocks of work, was chosen to analyze the activities.

Figure 1 reflects a contextual diagram of the pharmacy's activities. Context diagram shows the flow of information about customers, suppliers, pharmaceutical market, orders and invoices. Results include requisitions, checks, and reports. The main participants are the director, economist, storekeeper,

warehouse manager, provisor, pharmacist. These the processes of managing the pharmacy network's key performers are involved in various ways in operations.

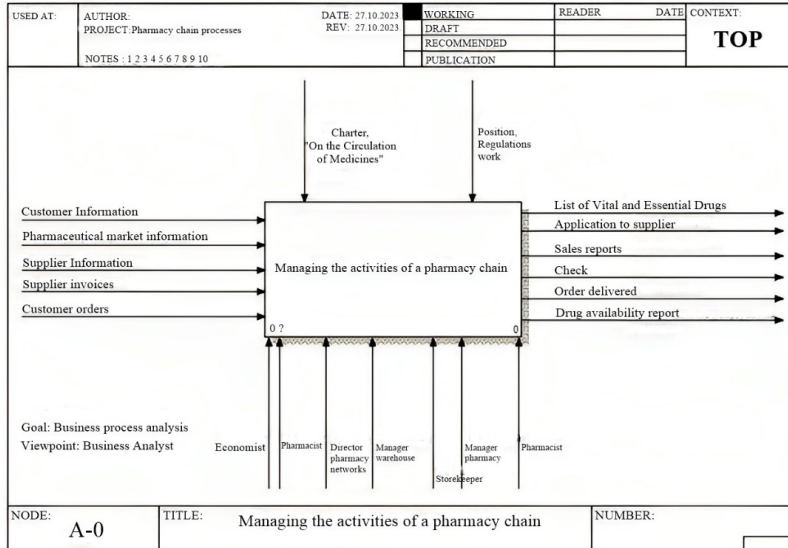


Fig. 1 - Context diagram of pharmacy activities

Figure 2 illustrates a diagram of the pharmacy's core management (including pricing, receiving, and labeling of goods), distribution of drugs to the pharmacy network, customer service and inventory control. There are several core business processes in a pharmacy, including drug assortment, procurement

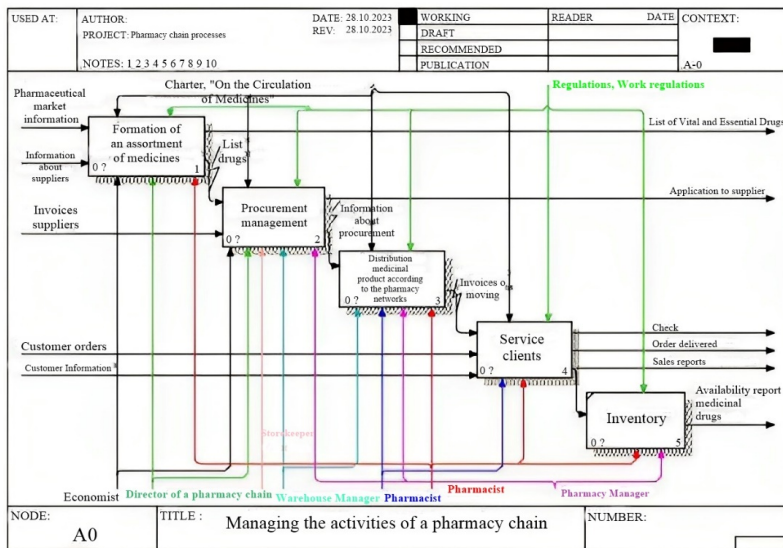


Fig. 2 - Basic business process of pharmacy operations

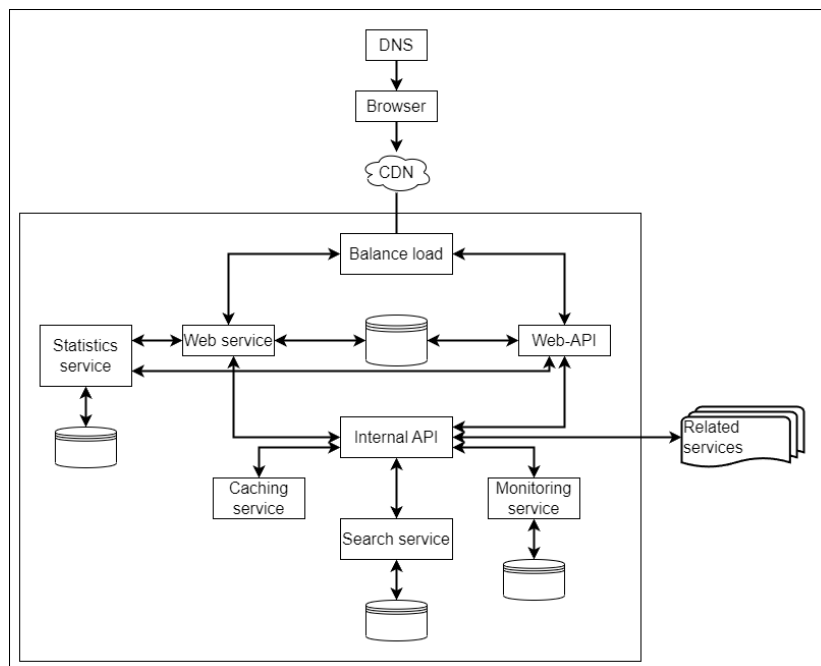


Fig. 3 - Web service architecture diagram

It can be concluded that the key factors affecting the performance of a pharmacy include sales productivity, service and customer satisfaction, investment turnover and logistics costs. The main business processes include drug assortment formation, procurement management, distribution of drugs to the network, customer service and inventory control.

Interface design is important for the usability of the web service, including the main menu, input, editing, and output. The system provides data entry of medication, inventory, and transaction statistics. API is used when developing an interface to access system functions. A payment gateway enables e-commerce and retail payments, consisting of a virtual terminal and a shopping cart website connected through an API [4]. A website requires a database that is logically linked to a structured representation of phenomena in specific domains to support applications in individual systems [5]. The database is also an important component of information systems because all information for decision making comes from the database.

Developing a web service for pharmacy monitoring is a complex and multifaceted task that requires careful design and careful implementation. The architecture of a web service for pharmacy monitoring is a complex system that includes several important components (Figure 3). The web-based pharmacy

monitoring service provides convenient access via DNS, CDN performance, reliable load balancing, sales tracking, and real-time statistics. Interaction with external and internal applications is realized through Web-API and internal API. Caching and full-text search optimize system performance, creating a single efficient architecture.

Effective web service development involves several key components. One is integration with external systems such as electronic health records (EHRs), drug databases, and payment systems. This allows to significantly expand the functionality of the service and provide users with a wider range of features [6]. It is possible to ensure stable operation of the service with increasing users and data through code optimization, application of cloud computing and use of scalable databases. Securing web service data requires careful adherence to standards such as HIPAA to ensure protection [7]. Безопасность, в соответствии со стандартами, важна из-за чувствительности медицинских данных.

In the entity-relationship model diagram (ER diagram) in PostgreSQL, you can see 13 objects that describe the database structure (Figure 4). The database structure in PostgreSQL, reflected in the ER diagram, simplifies CRUD operations using REST APIs and Spring JPA.

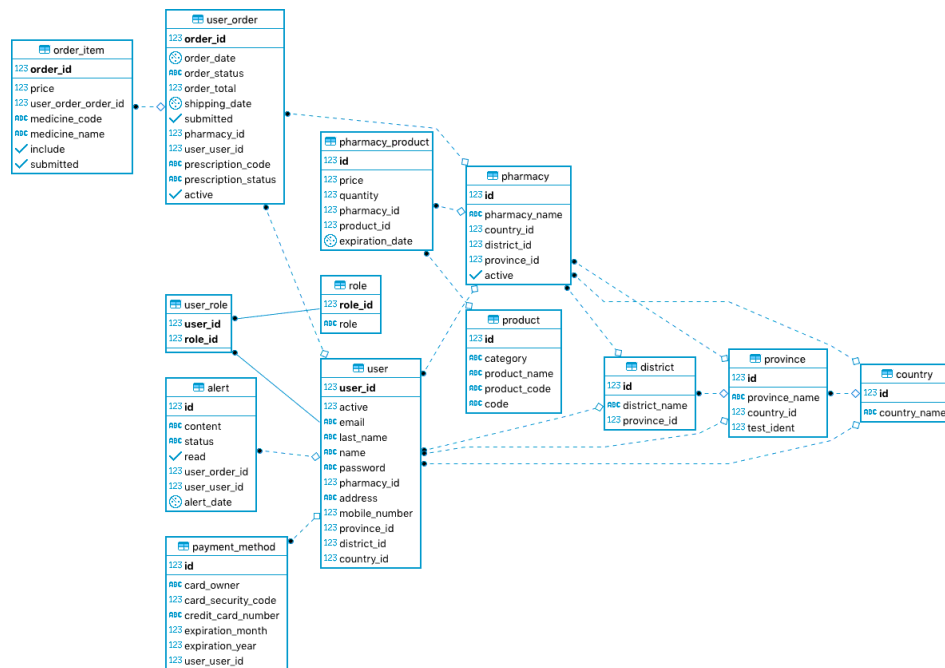


Fig. 4 - Database schema

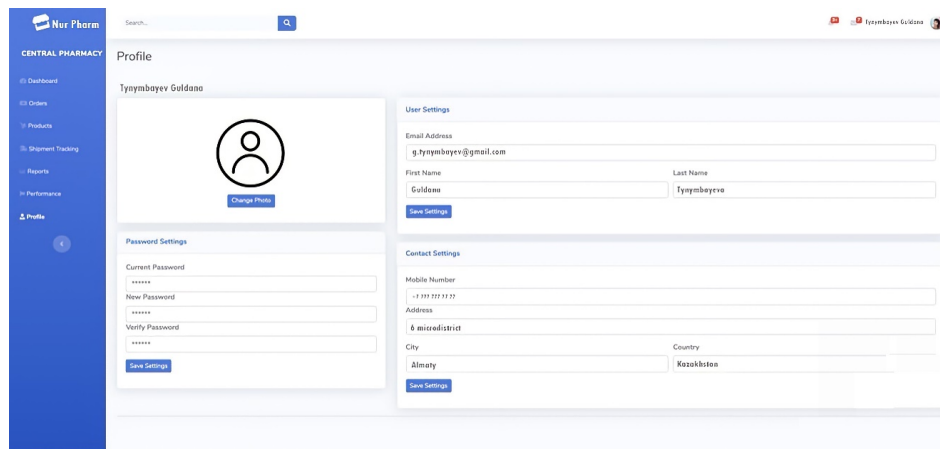


Fig. 5 - User profile interface

The database architecture in the web service for pharmacy monitoring includes tables "order", "product" and "pharmacies", creating relationships to track drug availability, prices and locations. Additionally, there are tables for user data including profiles, search, and purchase history, providing personalization and usability.

Web-based drug service provides detailed information about the drugs before purchase [8]. All information is stored in a PostgreSQL database.

Registration and email confirmation is required before purchases. Customers can opt for online payments via bank transfer. A customer profile includes name, address, phone number, and email (Figure 5).

The order page provides information about the items to be purchased, as well as prices. Before purchasing, customers are required to enter their details and addresses for delivery purposes, and customers can select a payment method. The order view page displays the list of transactions made by the customer, invoice

number, date, recipient's name, total payment amount, bank, virtual account number, receipt, payment status and printed invoice on the payment page, the name of the purchased item and the total cost payable to the customer. The "Create Order", "view orders", and "pay" pages can be seen in the bottom figure (Figure 6).

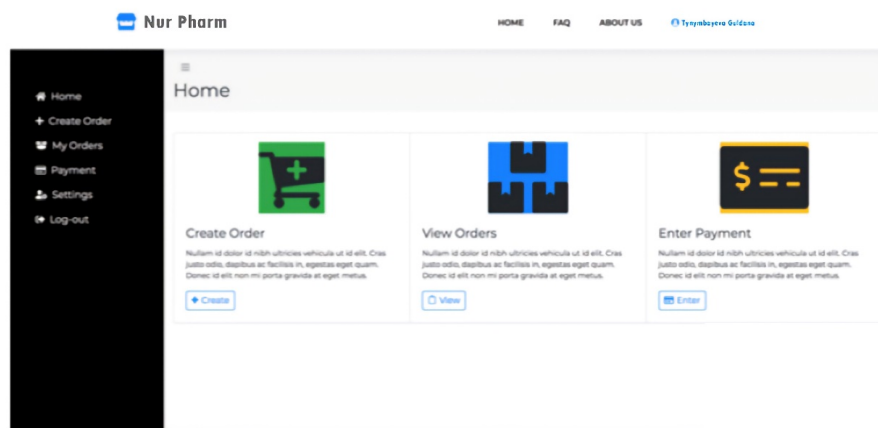


Fig. 6 - Web service user interface

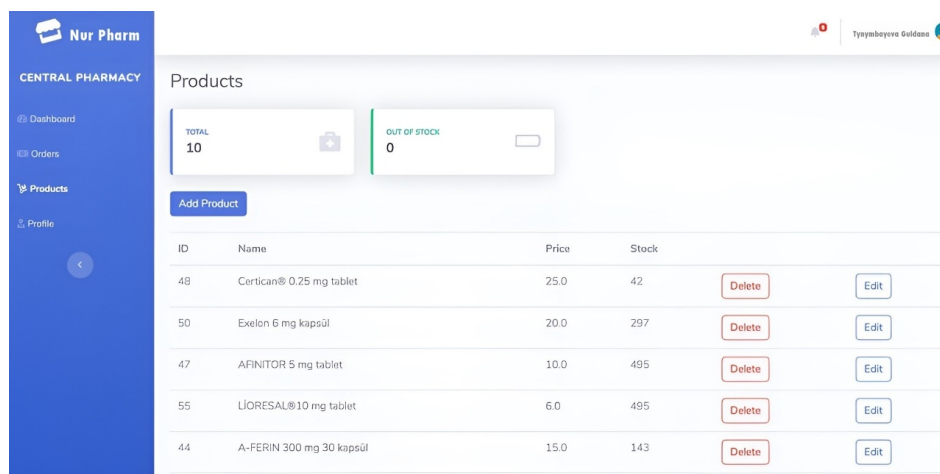


Fig. 7 - Sales analytics page

The tabular analytics component is designed to display rating and summary analytical tables and charts according to the needs of the company's management (Figure 7). The component provides convenient presentation of data in tabular form with the ability to select, filter, sort, combine and group data, as well as build simple charts in interactive mode. The report download component is designed to export data to CSV format.

Thus, the web service is designed to make it easy

for even elderly users to order medication without having to seek help. For this purpose, it is important to make the system structure as simple and intuitive as possible. Choosing a reliable database, such as PostgreSQL, ensures that information about medicines, pharmacies and prices is stored securely. This helps to ensure that data is always available and securely stored. Using cloud infrastructure allows the application to function in real time and provides high availability. The cloud also facilitates data management and backup,



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which is essential for system reliability. It is important to monitor the application and database through journaling. This allows for rapid identification and resolution of problems such as errors and failures, as well as problems with indexes and integration of external web services [9]. In summary, a simplified system structure, robust database, cloud infrastructure and monitoring and journaling systems provide a reliable and accessible medication ordering application.

**Conclusion.** In conclusion, a web-based pharmacy monitoring service is a powerful tool to improve accessibility and convenience in health care delivery. The development of modern technology plays a key role in ensuring effective monitoring of pharmacy status and availability of medical supplies. The paper created a business process model for a pharmacy using ERWin Process Modeler and IDEF0 methodology. And key performance factors such as trading performance, service level, investment turnover were highlighted. Web service architecture plays a crucial role in forming the foundation of a system by defining its structure,

capabilities and providing security. It includes linked tables and a PostgreSQL database, providing secure storage and management of drug, pharmacy, and pricing information. Important functional components of the web service are placing an order, selecting a payment method, viewing and managing orders. The user interface is designed to be simple and intuitive, allowing a diverse group of users to easily place orders without the need for additional assistance. The analytics and reporting components provide company management with the tools to make informed decisions based on sales data. Data security and privacy are of the highest priority, especially when dealing with medical information.

In summary, developing and maintaining a web service for pharmacy monitoring requires an integrated approach including architectural design, functionality, security, and usability. This service reduces the time it takes to search for and purchase medications, saves users' resources, and provides secure storage of medical data.

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