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**ПРОГРАМНЕ ЗАБЕЗПЕЧЕННЯ ДЛЯ ІНТЕРАКТИВНОЇ**  
**ВЗАЄМОДІЇ З БІБЛІОТЕКОЮ**

**Анотація.** Стрімкий розвиток інформаційно-комунікаційних технологій змінив вимоги до організації діяльності бібліотек, особливо в учбових закладах. Зміни, в першу чергу, відбувалися в інформаційних функціях, розробки баз даних, надання доступу до мереж, як вітчизняних так і міжнародних. Сучасна бібліотека – це не лише сховище для книг, а й своєрідний електронний архів, місце, де можна отримати доступ до інформації як на традиційних носіях, так і в електронному вигляді.

В роботі представлено розробку програмного забезпечення для віддаленої взаємодії з бібліотекою, яке дає змогу ознайомитись з наявними літературними джерелами та можливостями, які надає бібліотека, підвищує швидкість опрацювання матеріалу, та робить систему крос-платформною.

Основним об'єктом дослідження є система особистого кабінету для зручного перегляду, замовлення, бронювання та сортування книг, наявних в бібліотеці. Одним з основних елементів розробки проекту є графічний інтерфейс. Він був реалізований за допомогою інтегрованого середовища розробки програмного забезпечення IntelliJ Idea та фреймворку java Spring Boot.

Створений сервіс у вигляді web-додатку, дозволить перебудувати застарілу систему роботи бібліотеки завдяки інтерфейсам бібліотекар-комп'ютер та відвідувач-комп'ютер, привабить більшу кількість відвідувачів та заохотить студентів проводити більше часу за книгами.

Використання сучасних технологій та фреймворків оновить існуючий проект бібліотек та поліпшить масштабованість, дизайн, інтерактивність, як можливість взаємодіяти з іншими студентами та викладачами онлайн та швидкість.

**Ключові слова:** бібліотека; MS SQL; інтегроване середовище intellij idea; Framework java Spring Boot; HTML; CSS; Repository.

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**SOFTWARE FOR INTERACTIVE INTERACTION WITH THE LIBRARY**

**Abstract.** The rapid development of information and communication technologies has changed the requirements for the organization of library activities, especially in educational institutions. Changes primarily occurred in information functions, development of databases, providing access to networks, both domestic and international. A modern library is not only a repository for books, but also a kind of electronic archive, a place where you can access information both on traditional media and in electronic form.

The work presents the development of software for remote interaction with the library, which allows you to familiarize yourself with the available literary sources and the opportunities provided by the library, increases the speed of material processing, and makes the system cross-platform.

The main object of the research is a system of a personal cabinet for convenient viewing, ordering, booking and sorting of books available in the library. One of the main elements of project development is the graphical interface. It was implemented using the IntelliJ Idea integrated software development environment and the Spring Boot java framework.

*The created service in the form of a web application will allow to completely rebuild the outdated work system thanks to librarian-computer and visitor-computer interfaces, will attract more visitors and encourage students to spend more time with books.*

*The use of modern technologies and frameworks will update the existing library project and improve scalability, design, interactivity, as well as the ability to interact with other students and teachers online and speed.*

**Keywords:** *library; MS SQL; integrated environment; intellij idea; Framework java Spring Boot; HTML; CSS; Repository.*

**Introduction.** A modern library is not only a repository for books, but also a kind of electronic archive, a place where you can access information both on traditional media and in electronic form.

The rapid development of information and communication technologies has changed the requirements for the organization of library activities, especially in educational institutions. Changes primarily occurred in information functions, development of databases, providing access to networks, both domestic and international.

Electronic libraries can be called libraries of the 21st century, representing a certain network that connects them with the outside world through the latest electronic technologies. This is a social institution whose activity is aimed at ensuring equal access to information, under the conditions of the development of the processes of humanization of education, its informatization, openness and the formation of educational information needs, which is capable of providing high-quality technological, social, and educational access to information

Electronic libraries differ from traditional ones in that they use the electronic format of publications and provide access to a remote resource using telecommunication technologies. These are repositories of electronic documents, equipped with the necessary mechanisms for accessing and working with them. It is not enough for a modern library worker to know where and on which shelf this or that book or magazine is located in its storage, it is also necessary to know on which virtual shelf this book is placed in the global distributed space.

The library should play a key role in providing users of the institution with scientific information, regardless of the sources from which this information comes. A reader who applies to the library should be able to obtain both external and internal information (from the local repository), both in electronic form and in print. That is why the library should support the electronic repository, it should contain all the tools and tools for finding information from various sources.

**Problem announcement.** Every library in an educational institution offers literature for every taste, both in the learning process and outside of it. Every day, no wonder, pupils and students use the services of the library and go through a difficult bureaucratic process. Dozens of shelves, hundreds of readers, thousands of books, a pile of unnecessary pieces of paper, each book must be recorded on the reader's personal form. Confusion caused by complex document management, constant problems with debtors, withdrawals and registration in the library. All this is very stressful for the reader and the library worker, and can even negatively affect the educational process. The development will help protect the strength and nerves of both readers and library staff. Our product eliminates paper documentation, which will make the procedure for obtaining books easy and transparent.

To develop software for remote interaction with the library, which allows you to familiarize yourself with the available literary sources and the opportunities provided by the library, increase the speed of material processing, and make the system cross-platform was the task of the work.

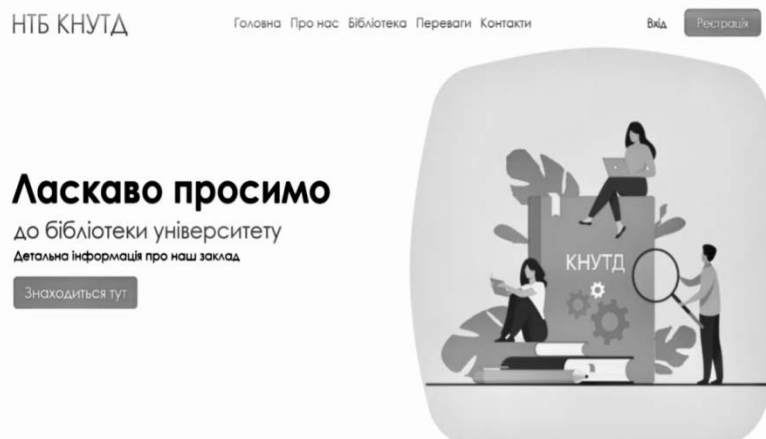


Figure 1. Start page

In order to achieve the main goal, a number of tasks were solved:

- the full cycle of interaction between readers and library employees was monitored and analyzed;
- methods and means of achieving the main goal were selected, which will correspond to the material level of educational institutions;
- usability testing of the developed information system was conducted.

The goal from the technical side is: the use of modern technologies and frameworks (an infrastructure of software solutions that facilitates the development of complex systems, in other words, a kind of complex library), scalability (the ability to change individual components of the application for the programmer with minimal expenditure of time, money and effort), design, interactivity (the ability to interact with other students and teachers online), speed.

**Results of the research.** The development of software for remote interaction with the library is a finished development. The use of this system will reduce the time spent by the user and reduce the burden on the librarian, eliminate paper documentation and make the procedure for obtaining books easy and transparent.

Algorithm of the online library:

1. After registration, the user gets access to the complete list of books available in the library on the All books page (Fig. 2).

Figure 2. Login to the system

Each user after registration receives his unique security token which is stored in the database and attached to the user. Also, to ensure good security, you need to encrypt the password in the database so that even when accessing the database, no one but the user can know the password.

2. If the user is unable to register, the librarian will be able to create a user profile.

3. The user chooses a book, which is automatically added to the number of the user's favorite books. By contacting the library of the educational institution and showing the QR code of the book, he can get it (Fig. 3).



Figure 3. QR code of the book

The QRCodeGenerator class was used to create QR codes. For the correct operation of this class, it was necessary to add dependencies for the QR code to the pom.xml file.

4. The librarian, scanning the code, finds the book in the catalog and assigns the selected book to the student using the administrative panel.

5. The librarian has full access to the book catalog, he can add, edit and delete books from the catalog.

All user personal data will be stored encrypted in the project database tables in MS SQL. The functionality that will be available to users is as follows: viewing all available books in the library and access to e-books, the ability to select books by various filters, mark "favorites" and reserve desired ones.

One of the main elements of project development is the graphical interface. It was implemented using the integrated software development environment IntelliJ IDEA Ultimate and the Java Spring Boot framework.

The system is implemented using a system for building templates and pages in the HTML markup language and is styled using the Bootstrap and CSS framework (Fig. 1). CSS (Cascading Style Sheets) and the Bootstrap and JS (JavaScript) Angular framework are used to create a good-looking site page (Fig. 2) for the site's interactive behavior.

Angular is an open source web application based on TypeScript, led by the Angular Team at Google. It is a platform for building single-page client applications using HTML and TypeScript. Angular is written in TypeScript. It implements basic and additional functionality as a set of TypeScript libraries that you import into your applications.

Bootstrap is a client-side framework, i.e. a user interface. It is a free, open-source toolkit for creating websites and web applications that includes CSS and HTML templates for typography, forms, buttons, navigation, and other interface components, as well as additional JavaScript extensions. It simplifies the development of dynamic websites and web applications.

In addition, there is a prospect of creating a mobile application for more convenient interaction

In the future, the program will definitely be improved and ported to other platforms, a smart decision would be to port it using Xamarin technology, because it allows you to simultaneously develop a software product on several systems: Windows, iOS and Android.

Another improvement will be the transfer of the database to cloud mode, or to some kind of hosting.

There are also plans for a huge amount of additional functionality that will be implemented in the future.

**Conclusions.** The modern educational process in educational institutions and the fields related to it increasingly require the use of digital technologies. The fact that the educational process will continue to move to the online format is inevitable.

The library, as a part of the educational institution, also needs innovation and renewal of the old system. The book issue and return system, which is currently not adapted to librarians and readers, needs special updating.

The created service will allow to completely rebuild the outdated system of library work thanks to librarian-computer and visitor-computer interfaces, attract more visitors and encourage students to spend more time with books. The service will make it easier for students to cooperate with each other and with teachers during distance learning.

The developed software product allows you to create an interactive application for interaction with the university library according to all modern standards. Planned microservices within the project will allow creating diverse and comfortable software for students and teachers, which will allow them to study more productively and comfortably.

The software product can be used to automate the work of the library of any educational institution or other organization. The use of this system will reduce the time spent by the user and reduce the burden on the librarian, eliminate paper documentation and make the procedure for obtaining books easy and transparent.

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