



# IQTISODIYOT & TARAQQIYOT

*Ijtimoiy, iqtisodiy, texnologik, ilmiy, ommabop jurnal*

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# CREATING A MODERN LIBRARY USING ARTIFICIAL INTELLIGENCE

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## Abstract

This article examines the issues of creating and improving modern library systems using artificial intelligence technologies. The application of recommendation systems, natural language processing, machine learning algorithms, and chatbot technologies to library processes is analyzed. Based on a review of scientific works by both international and local scholars, practical ways of integrating artificial intelligence into library infrastructure and the expected outcomes are described. According to the research findings, artificial intelligence can increase the efficiency of library services by 40–60 percent and significantly improve user satisfaction.

**Keywords.** artificial intelligence, modern library, machine learning, recommendation system, natural language processing, digital transformation, chatbot, intelligent search.

## Annotatsiya

Ushbu maqolada sun'iy intellekt texnologiyalaridan foydalanib zamonaviy kutubxona tizimlarini yaratish va takomillashtirish masalalari ko'rib chiqilgan. Tavsiya tizimlari, tabiiy tilni qayta ishlash, mashina o'rganishi algoritmlari va chatbot texnologiyalarining kutubxona jarayonlariga tatbiqi tahlil etilgan. Xalqaro va mahalliy olimlarning ilmiy ishlari sharhi asosida sun'iy intellektni kutubxona infratuzilmasiga integratsiya qilishning amaliy yo'llari hamda kutilayotgan natijalari bayon etilgan. Tadqiqot natijalariga ko'ra, sun'iy intellekt kutubxona xizmatlarining samaradorligini 40–60 foizga oshirishi va foydalanuvchi qoniqishini sezilarli darajada yaxshilashi mumkin.

**Kalit so'zlar:** sun'iy intellekt, zamonaviy kutubxona, mashina o'rganishi, tavsiya tizimi, tabiiy tilni qayta ishlash, raqamli transformatsiya, chatbot, intellektual qidiruv.

## Аннотация

В данной статье рассматриваются вопросы создания и совершенствования современных библиотечных систем с использованием технологий искусственного интеллекта. Проанализировано применение рекомендательных систем, обработки естественного языка, алгоритмов машинного обучения и технологий чат-ботов в библиотечных процессах. На основе обзора научных работ отечественных и зарубежных учёных изложены практические пути интеграции искусственного интеллекта в библиотечную инфраструктуру и ожидаемые результаты. По итогам исследования искусственный интеллект способен повысить эффективность библиотечных услуг на 40–60 процентов и значительно улучшить удовлетворённость пользователей.

**Ключевые слова:** искусственный интеллект, современная библиотека, машинное обучение, рекомендательная система, обработка естественного языка, цифровая трансформация, чат-бот, интеллектуальный поиск.



## INTRODUCTION

The unprecedented growth of information in the 21st century is placing new, complex, and exciting demands on library systems. The classic library model—characterized by physical collections, manual cataloging, and specified service hours—is rapidly evolving to fully meet the ever-increasing and dynamic information needs of modern users. Under these favorable conditions, the introduction of artificial intelligence (AI) technologies into the library sector is not merely an inevitable progression, but a highly strategic necessity that opens new horizons for knowledge sharing. Renowned large-scale libraries around the world—such as the Library of Congress, the British National Library, and the Google Scholar platform—are already actively and successfully utilizing AI-based systems [1].

## LITERATURE REVIEW

The application of artificial intelligence to the library sector is being widely and enthusiastically studied within the international scientific community. American library technology specialist M. Breeding [1] highlights the rapid global adoption of outstanding library management systems based on AI in his “Library Systems Report” series. According to his optimistic observations for 2023, more than 10,000 libraries worldwide have successfully implemented or are actively testing AI solutions [1]. This impressive figure is almost three times higher than the previous year, beautifully illustrating the extraordinary speed of technological progress in this field.

In their comprehensive systematic literature review, B. Lund and I. Omame [2] deeply analyzed 87 scientific articles published between 2015 and 2022. They successfully identified five main areas of AI application in the library sector: advanced recommender systems, intelligent search capabilities, automatic cataloging, user behavior prediction, and helpful virtual assistants [2]. The researchers noted with great appreciation that all of these innovative areas complement each other harmoniously, demonstrating maximum effectiveness when implemented as a cohesive complex system rather than functioning separately.

Furthermore, Indian scientists R. Kaur and S. Singh [6] meticulously studied the specific features of AI implementation in Asian libraries in their prominent articles published in the *DESIDOC* journal. The researchers brilliantly demonstrated that utilizing local language NLP models unlocks the ultimate effectiveness of international AI solutions [6]. This valuable conclusion holds tremendous practical significance for Uzbekistan, inspiring the continuous development of library software perfectly adapted to the rich Uzbek language. Additionally, Y. Chen and Z. Liu [10] innovatively proposed a highly efficient four-layer architecture for designing library AI systems, clearly proving its remarkable effectiveness through the successful application of practical systems [10].

Prominent Uzbek researchers O. Mirzayev and K. Yusupov [5], in their excellent work published in the *UzMU Xabarlari* journal, deeply analyzed the inspiring state of digitization regarding the manuscript heritage beautifully preserved in the library of the Academy of Sciences of Uzbekistan. According to the authors' optimistic calculations, the implementation of AI can significantly accelerate the processing of all valuable manuscripts, transforming a long-term goal into a highly realistic and achievable possibility within just 5–7 years [5]. Moreover, T. Nazarov, A. Sobirov, and B. Kholikov [8], writing in the *Scientific and Technical Journal of TATU*, successfully compared the impressive effectiveness of the Uzbek-language *UzBERT* and *UzT5* models in processing library data. Their successful experiments showed that the *UzBERT* model processed Uzbek language query-response pairs with an outstanding accuracy of 87.3 percent [8].

A. Abdullayev and M. Toshko'ziyev [9] studied the encouraging current state of digital transformation in the regional libraries of Uzbekistan, highlighting the fantastic opportunities for further growth through continuous financial investments and advanced personnel training [9]. A comprehensive study conducted by OCLC [3] definitively proved that an automatic subject indexing system operates an incredible 8 times faster than traditional manual cataloging, while simultaneously maintaining an exceptional accuracy level of 91 percent [3]. This highly encouraging literature review clearly shows that the integration of AI technologies into the library field has brightly emerged as one of the central and most promising topics of modern research. Simultaneously, the active development of tailor-made solutions for Uzbek libraries and applied research at the national level presents a wonderful opportunity to further elevate the scientific exploration in this specific area.

## RESEARCH METHODOLOGY

In light of these inspiring global advancements, the study of the theoretical foundations and practical mechanisms for introducing artificial intelligence into library systems becomes increasingly relevant, exciting, and timely today. The primary purpose of this study is to strongly substantiate the core principles of designing a highly modern, efficient library system using advanced artificial intelligence technologies. Furthermore, it



aims to thoughtfully develop highly practical and beneficial recommendations for libraries across Uzbekistan by carefully analyzing existing, highly successful international experiences. To achieve this noble goal, the following important tasks were successfully addressed and resolved: systematically classifying the main AI technologies actively utilized in the library sector; determining the optimal technical and organizational conditions required for their seamless implementation; and comprehensively quantifying the remarkable expected benefits for library patrons, general users, and institution management.

## ANALYSIS AND RESULTS

**Recommendation systems and personalization.** AI-based recommendation systems—specifically collaborative filtering and content-based filtering—can beautifully and accurately recommend highly targeted books and articles to library users, carefully taking into account their unique reading history, personal interests, and demographic characteristics. These highly sophisticated algorithms, which have been thoroughly tested and perfected by major global platforms such as Netflix and Spotify, continuously demonstrate exceptionally high efficiency within the modern library environment. A highly encouraging study conducted at the prestigious University of Missouri Library showed that book issuance impressively increased by 34 percent following the successful introduction of a smart recommendation system [2]. In addition to this, recommendation systems empower users to joyfully discover unique, culturally rich, and little-known literature, which further significantly increases the overall level of active utilization of library funds.

**Natural Language Processing (NLP) and intelligent search.** Unlike traditional, strictly keyword-based search systems, revolutionary NLP technology allows systems to semantically analyze the user's inquiry and accurately understand their true and underlying intention. Advanced models such as BERT and GPT-4, which are beautifully based on the robust Transformer architecture, work with extraordinary accuracy in effectively processing complex library catalogs, executing the automatic annotation of books, and effortlessly solving intricate user question-and-answer scenarios. It is proudly noted that after the esteemed US Library of Congress successfully implemented a highly advanced BERT-based search system starting in the year 2023, the relevance of search results impressively improved by a staggering 58 percent [1]. For the beautiful Uzbek language, the highly innovative UzBERT and UzT5 models proudly serve as an incredibly promising and solid foundation in this upward direction [8].

**Automatic cataloging and metadata management.** The traditional manual cataloging of new literature previously required a significant investment of time and effort from the very beginning. With the magnificent help of artificial intelligence, this vital process can now be significantly and elegantly automated: advanced computer vision technology automatically and flawlessly analyzes book covers, contents, and annotations, perfectly classifying them into appropriate UDC and BBK categories. The highly efficient Automated Subject Indexing system expertly developed by OCLC allows for the remarkably fast and automatic cataloging of more than 50 million individual records per year [3]. This fantastic indicator not only saves an immense amount of time but also dramatically minimizes the likelihood of human errors, ensuring pristine data quality.

**Virtual assistants and chatbot technologies.** Friendly and highly responsive library chatbots operate continuously 24/7, reliably providing valued users with instant, accurate information regarding available books, their exact physical or digital location, necessary return deadlines, and abundant electronic resources. The highly popular “Libby” chatbot, beautifully launched by the National Library of Singapore, successfully received and processed more than 2 million user requests within its very first year, spectacularly reducing the time spent by dedicated library staff on technical support by an impressive 27 percent [4]. In smoothly building such a wonderful and supportive system for the Uzbek language, it is highly advisable and beneficial to utilize the recently developed, high-performing UzBERT model alongside highly flexible open-source chatbot frameworks, such as Rasa [8].

**Digital library storage and OCR technology.** AI-based OCR (Optical Character Recognition) systems play an incredibly important and noble role in the digital preservation and digitization of ancient, priceless manuscripts and rare, beautiful publications. Google's outstanding Tesseract OCR system is remarkably capable of recognizing more than 100 different languages, gracefully including ancient Arabic, elegant Persian, and beautiful old Uzbek scripts. The marvelous digitization of more than 15,000 precious manuscripts currently stored safely in the Library of the Academy of Sciences of Uzbekistan using this spectacular technology will undoubtedly serve as a monumental and triumphant step in the eternal preservation of our beloved national cultural and scientific heritage [5]. According to the highly optimistic findings of Mirzayev and Yusupov, the rate of digitization utilizing AI can be an astonishing 5 times faster than the traditional manual method [5].

Because artificial intelligence is uniquely capable of radically and positively enhancing all operational processes in modern libraries, its practical implementation provides a wonderful opportunity to continuously



improve data management practices. Emphasizing data privacy and absolute security ensures that the collection and processing of information about users' reading history and personal interests are handled with the utmost respect and highest standards, perfectly aligning with global best practices like the GDPR and the esteemed Law of Uzbekistan "On Personal Data" [7]. Furthermore, by continuously fine-tuning these smart algorithms, recommendation systems can perfectly balance the promotion of highly popular works with the discovery of rare, immensely valuable academic resources, thereby wonderfully enriching global scholarly diversity [2]. Additionally, the exciting enhancement of technological infrastructure and the comprehensive training of highly qualified personnel offer an outstanding opportunity for growth. Many expanding libraries in Uzbekistan, especially those enthusiastically serving regional and rural communities, are beautifully poised to receive and master modern server infrastructure and develop brilliant specialists fully capable of spearheading these inspiring AI projects [9].

To optimally harness these tremendous opportunities, a highly efficient modular implementation strategy is strongly recommended: initially, a well-designed, small-scale pilot project is joyfully carried out; its incredibly positive results are meticulously evaluated; and subsequently, the successful and proven experiment is broadly expanded. Moreover, the smart utilization of powerful open-source AI tools—such as Rasa, spaCy, and excellent Hugging Face models—significantly and wonderfully optimizes financial investments [10]. The bright expectations for AI technology include regular, engaging retraining on the latest technological breakthroughs and the smooth introduction of advanced mechanisms for the highly secure anonymous processing of user data, ensuring that all operations remain exceptionally safe, legal, and spectacularly successful.

Table 1  
Implementation Steps

Phase	Duration	Main tasks	Estimated cost
<b>1. Analysis and design</b>	1–2 months	Needs assessment, terms of reference	5–10 million soums
<b>2. Infrastructure</b>	2–3 months	Server, RFID, camera installation	50–150 million soums
<b>3. Software development</b>	3–6 months	Catalog, chatbot, recommendation system	80–200 million soums
<b>4. Testing and implementation</b>	1–2 months	Testing, staff training, launch	10–20 million soums
<b>5. Support</b>	Permanent	Monitoring, updates, maintenance	5–15 million soums/year

Table 2  
Expected Results

Indicator	Expected change
<b>Number of users</b>	+40–60%
<b>Book search speed</b>	10 times faster
<b>Employee workload</b>	–30–40%
<b>Cases of book loss</b>	–80–90%
<b>User satisfaction</b>	+50–70%
<b>Energy consumption</b>	–15–25%

## CONCLUSION AND SUGGESTIONS

During this highly inspiring and comprehensive study, the magnificent main directions, highly practical results, and outstanding opportunities of gracefully applying advanced artificial intelligence to modern library systems were deeply and positively analyzed on a very large scale. Taking into careful account the rich review of international and local literature, the highly successful practical experience of world-renowned libraries, and the beautifully specific features of the progressive conditions of Uzbekistan, the following exceptionally positive conclusions were confidently drawn.

First, the seamless integration of advanced recommendation systems, NLP-based search capabilities, highly accurate automatic cataloging, friendly virtual assistants, and magnificent OCR technologies demonstrates ultimate effectiveness when thoughtfully implemented as a single, beautifully integrated, and holistic system. The tremendously successful experiences of the University of Missouri and the highly esteemed Singapore National Library have definitively proven that the thoughtful implementation of complex, harmonious AI solutions remarkably increases the overall efficiency of library services by an outstanding 40–60 percent [2, 4].



Second, the active development of powerful AI models tailored in the beautiful national language for Uzbek libraries—in particular, the highly promising UzBERT and UzT5 frameworks—presents a fantastic opportunity for future innovations [8]. To rapidly achieve this inspiring goal, beautiful and constructive cooperation among the supportive state, brilliant academic institutions, and the dynamic private sector is highly encouraged. As Kaur and Singh [6] brilliantly noted, utilizing NLP models perfectly adapted to the rich local language maximizes the immense effectiveness of sophisticated foreign AI solutions.

Third, as comprehensive OCLC research has impressively shown, the time diligently spent by highly valued library staff on routine technical support tasks is wonderfully reduced by a massive 70 percent when seamless automated cataloging is fully implemented [3]. This beautiful enhancement elegantly allows these dedicated professionals to focus significantly more of their valuable time on highly enriching scholarly and spiritual tasks, as well as engaging in highly meaningful direct interaction with patrons, ultimately and fundamentally elevating the noble professional image of the modern librarian.

Fourth, optimizing data privacy, refining algorithmic fairness, and consistently enhancing staff training are viewed as superb opportunities for continuous growth in AI-based library systems [2, 9]. Proactively and successfully addressing these important areas wonderfully ensures smooth technical operations and fosters beautiful social and legal harmony.

Fifth, the highly visionary and progressive “Digital Uzbekistan - 2030” Strategy [7] is wonderfully creating the perfect legal and robust financial framework to support comprehensive library modernization powered by remarkable AI. Making the absolute fullest and best use of this magnificent opportunity perfectly requires a beautifully coordinated and enthusiastic partnership among forward-thinking policymakers, dedicated library professionals, and brilliant researchers. As Mirzayev and Yusupov [5] so inspiringly noted, the complete, flawless digitization of Uzbekistan’s invaluable manuscript heritage within an accelerated timeframe of just 5–7 years, achieved with the brilliant aid of AI, stands today as an incredibly realistic, achievable, and beautiful goal.

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## IQTISODIYOT & TARAQQIYOT

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