The Selection of Best Open Source Integrated Library Management Software: A Review

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Abstract

Since the first established library in the 7th century B.C., libraries have played a main role in civilization development due to their ability to help humans reach the required information easily. However, in the last decades, after the huge propagation of information from various sources, including the addition of books, other data types such as audio, video, and images have emerged. Therefore, finding an integrated system to manage this huge amount of library data became necessary. As a result, the integrated library system (ILS) improved its efficiency and ability to manage various and enormous amounts of data in addition to following the lending processes and inventory management. There are many commercial and open-source integrated systems used in libraries; selecting the best open-source integrated library system to achieve the library requirements is still challenging due to the variety of available libraries. Although these libraries are open source and freely available, the installation process requires a long time and expert effort, making selecting the best library system a sensitive and important mission. This survey demonstrates the most famous open-source integrated library systems and the essential technologies used to build them, along with the system specifications, to help librarians and educational and academic institutions select the best one for their requirements. Through reviewing the previous academic research, it was noticed that many of them had the task of selecting the right ILS, but most of them did not handle the programming principles based on it, which is the milestone in its building, so we recommended using an automated technique to evaluate ILS and select the best one.

Keywords: Integrated library system, open source, software, library, ILS selection.

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اختيار أفضل برمجيات المكتبات الالكترونية: مراجعة

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الخلاصة

منذ إنشاء أول مكتبة في القرن السابع قبل الميلاد، لعبت المكتبات دورًا رئيسيًا في تطوير الحضارة نظرًا لقدرتها على مساعدة البشر في الوصول إلى المعلومات المطلوبة بسهولة. في العقود الماضية، وبعد الانتشار الهائل للمعلومات من مصادر مختلفة إضافة إلى الكتب ظهرت انواع مختلفة من البيانات مثل الصوت والفيديو والصور . لذلك، أصبح من الضروري إيجاد نظام متكامل لإدارة هذا الكم الهائل من البيانات. ونتيجة لذلك، ظهر نظام المكتبات المتكامل (ILS) الذي بدوره قام بتحسين كفاءة وقدرة المكتبات على إدارة البيانات المتنوعة والهائلة

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بالإضافة إلى متابعة عمليات الإقراض وإدارة المخزون. وعلى الرغم من ان هناك العديد من الأنظمة المتكاملة التجارية والمفتوحة المصدر المستخدمة في المكتبات، فإن اختيار أفضل نظام مكتبة متكامل مفتوح المصدر لتحقيق متطلبات المستخدم لا يزال يمثل تحديًا كبيرا بسبب تنوع المكتبات المتوفرة، وعلى الرغم من أن هذه المكتبات مفتوحة المصدر ومتاحة مجانًا، إلا أن عملية التثبيت تتطلب وقتًا طويلاً وجهدًا من الخبراء، مما يجعل اختيار أفضل نظام مكتبة مهمة حساسة وهامة. يوضح هذا الاستطلاع أشهر أنظمة المكتبات المتكاملة مفتوحة المصدر والتقنيات الأساسية المستخدمة في بنائها وفقًا لمواصفات كل نظام لمساعدة أمناء المكتبات والمؤسسات التعليمية والأكاديمية على اختيار أفضل نظام يناسب متطلباتهم. من خلال مراجعة البحوث السابقة لاحظنا أن العديد منهم قد أوكلوا مهمة اختيار افضل نظام ILS بالاعتماد على طرق إحصائية وان معظمهم لم يتعامل مع مبادئ البرمجة والتقنيات الحديثة، وهو حجر الأساس في بناء ILS ، لذلك نوصي باستخدام تقنيات آلية لتقييم المعايير واختيار أفضل أنظمة المكتبات المفتوحة المصدر.

1. Introduction

Libraries are important to society because they give people access to information and culture [1]. The tools and services they offer make learning easier, encourage literacy and education, and help people come up with new ideas and points of view, which are important for a creative and inventive society [2]. Also, they help keep an accurate record of the information that previous generations learned and knew. Without libraries, it would not be easy to improve human understanding and research and preserve the global body of information and cultural heritage for upcoming generations [3]–[5]. Nevertheless, on the other hand, the exploration of the data in the last decades after the world wide web and various open data sources made the automated library systems (ALSs) [6]–[8], which have been used in traditional library management systems since the 1970s, incapable of meeting the libraries' increased requirements. In ALS, a database is used to gather the library's data in a basic way, with the ability to call this data [7]–[9]. To manage the enormous amount of data, it is necessary to find an integrated system called an integrated library system (ILS) that can save and split each library operation [10]–[12]. Through the ILS, a software interface is used to search the library catalog and automate other tasks, such as following the lending books and the due date of their return, among other tasks [13]–[15]. Most ILSs share the same main components for tracking and scheduling. A typical ILS consists of a relational database for saving library data, software for interacting with this database, and two graphical user interfaces, one used by the staff and another for the patron's use. The software is built using many modules, each with a specific role [13, 14], and [16].

It can be concluded that to build an integrated library system, cooperation between librarians and program developers is required [17]–[20], and through this cooperation, many open-source ILSs have been established. In open-source system (OSS) applications, the source code is kept available and editable, allowing other developers to create developed copies or editions compatible with their special requirements [21]–[24]. This feature enabled the creation of many systems. Thus, the librarian should choose a suitable system in terms of performance, efficiency, and flexibility to make changes according to future needs and the continuous expansion of the data [25]. Through reviewing the previous academic research, it is noticed that many of them handed over the task of selecting the right ILS, but most of them did not handle the programming principles based on it, which is the male stone in its building. This paper will take some previous work that talks about the methods that were used to select the best ILS, then talk about the programming principles behind the ILS, explaining the basics of open-source software and the most commonly used ILS and their specifications like Koha, Evergreen, NewGenlib, etc., and also discussing the criteria that were used to evaluate the ILS in the hope of helping the librarians and people involved in library management select the right ILS for

their current needs while considering the evolution of the data and the requirements of supporting the new technologies. In this paper, the methods that were used to select the best ILS are reviewed, followed by a discussion of some of the most common open-source ILS and the criteria that were used to evaluate them.

2. ILS Selection Methods

Many previous works dealt with the use of open-source integrated systems in libraries. This section highlights some of them. The authors of [6] listed factors like being compatible with different platforms, having low or no license fees, being able to change to meet the library's needs, and having experience keeping all data safe, while [10] conducted a survey comparing the ILS with web-scale discovery services at academic libraries in the top-ranking higher educational institutions in India. Fifty-two libraries (26% of the total number of libraries in the study) use Koha as their primary ILS, according to the authors, who also observed that LibSys is a close second with 18 institutions (9%). Also, [12] studied the benefits of adopting Koha ILS at the University of Southern Nigeria.

The study surveyed online Google forms to collect information from the Koha ILS libraries. According to the survey, Koha proved its efficiency in cataloging, acquiring, and circulating, while it was not preferred in payment processes for subscriptions and book purchases. Furthermore, the libraries require regular training on Koha use to optimize Koha performance, and [26] evaluated the ILS using four quality factors (usage, service, system, and internet) and the relationship among them affecting job satisfaction. One hundred ten librarians using ILS at academic libraries in Selangor, Melaka, Johor, Negeri Sembilan, and Pahang were questioned, and the results were analyzed using IBM SPSS. According to descriptive data, there are intermediate impressions in four main areas (mean values range from 3.18 to 3.45). At the same time, there is a bad perception in one category (Internet quality), with mean values ranging from 2.69 to 3.02. In addition, the results reveal a modest relationship between service quality and Internet quality and a strong and statistically significant relationship between work satisfaction and usage quality.

Nonetheless, the association between system quality and job satisfaction is weak, whereas [27] introduced findings that can help the library realize how much their job satisfaction will depend on the performance of their ILS. The library information system must be improved to provide superior library services as well as [28] conducted a study using Koha in two Arab schools in Kuala Lumpur, Malaysia. Their qualitative study concluded the efficiency of Koha in building the catalog system and the ability to provide a customizable interface to be used according to the requirements of the library's usage. The research was launched by comparing the two schools based on gender, library positions/ranks, and IT devices. However, they suggested that for software upgrades, a group of experts be required to discuss the system improvements frequently. Moreover, [29] presented a descriptive qualitative study about INLIS Lite (another ILS). The data was collected by a team of librarians and a head of information technology using their observations, documentation stages, and interviews. The study's findings show that the library management function of INLIS Lite has been well employed.

Furthermore, the issues being resolved involve the administration of library resources, lending and returning, subscription, the Online Public Access Catalog, the creation of reports, and visitor books. Furthermore, [30] used the matrix of cross-impact multiplications applied to the classification method to perform a study for identifying the key factors of designing an ILS. They concluded that intuitive design, flexibility, interconnection, and portability are the key factors for designing ILSs in universities. Additionally, [31] examined the factors affecting

Koha utilization in Nigerian libraries. Their method is based on adopting a descriptive survey of over 45 libraries. The research found that a lack of institutional support, insufficient knowledge, and unfavorable librarian attitudes were among the obstacles facing Koha in Nigeria. In light of the findings, libraries should install Koha and join the Koha software users' community to comprehend and utilize all modules.

Regarding the properties of ILSs, several researchers disagree on the most important features they must include. According to [32], there are many important factors to consider when choosing an ILS, including the availability of permanent library data, the ability for users to conduct sophisticated searches, a suggestion box for users, recurring reports, and the capacity to track missing volumes. [33] examined the capacity to perform various operations and processes, library retrieval, web-based data access, comfort of use, and perception of usefulness as the main predictors of system utilization and essential characteristics to consider.

However, [34] considered the following elements: flexibility (the capacity to add new functionality as needed by the institution), buying cost, reasonable maintenance costs, and ease of use. The [35] considered critical elements such as design and architecture, no restrictions on use with different types of electronic devices, the ability for users to set their objectives, constant connectivity to the entire library, interoperability, and the ability to operate on local networks without internet access. Finally, [36] said that the most important things about ILSs are continued access to the online catalog, local data storage, the ability to modify the program's source code, and ease of use. Before ending this section, it is important to show that adopting ILSs is a good idea. Libraries can help with learning, research, and knowledge management because ILSs are used [37].
Nevertheless, ILSs are not as popular as they used to be, and in the past few years, new technologies have been developed that may help libraries manage their resources better and give them access to a wider range of resources. Table 1 summarizes the previous works on ILS, explaining each work's limitations.

Table 1: Summarization of the previous works on ILS

Study	Year	Description	Limitations
[6]	2020	Include compatibility with several systems, minimal or no license fees, adaptability to match the library's demands, and experience keeping all data secure as criteria for factors affecting choosing the best ILS.	No technical explanation for building the system is provided.
[10]	2021	A study was undertaken to compare the ILS to web-scale discovery services at the academic libraries of India's leading higher education institutions.	The survey study did not discuss the technical aspects of building ILSs.
[12]	2022	The benefits of implementing Koha ILS at the University of Southern Nigeria were investigated.	The study was limited to Koha and did not discuss other ILS.
[27]	2021	Analyzed the association between the ILS's four quality criteria (use, service, system, and internet) and work satisfaction.	The study discussed the quality factor and its effects on choosing the right ILS from a statistical perspective, but no technical

			explanation for building the system is provided.
[28]	2021	Two Arab schools in Kuala Lumpur, Malaysia, participated in a Koha-based study. Their qualitative investigation confirmed Koha's catalog system's effectiveness and capacity to provide a configurable interface.	The study is limited to using Koha.
[29]	2021	Descriptive qualitative research on INLIS Lite. A team of librarians and the head of information technology acquired the data through observations, documentation stages, and interviews.	The study is limited to using INLIS Lite.
[30]	2021	Utilized the cross-impact multiplication matrix applied to the classification approach in order to conduct research identifying the essential design features of an ILS.	No technical explanation for building the system is provided.
[31]	2021	Using a methodology based on a descriptive survey of over 45 libraries, the variables influencing Koha usage in Nigerian libraries are analyzed.	The study is limited to using Koha.
[32]	2020	The important factors to take into account when choosing an ILS were studied.	No technical explanation for building the system is provided.
[33]	2018	The main predictors of system utilization characteristics to consider in selecting the best ILS are discussed.	No technical explanation for building the system is provided.
[34]	2018	Considered flexibility, purchase price, affordable maintenance expenses, and usability while determining the optimal ILS.	No technical explanation for building the system is provided.
[35]	2018	Considered important characteristics such as design and architecture, interoperability, and the capacity to function on local networks without an internet connection.	No technical explanation for building the system is provided.
[36]	2017	According to the research, the most significant aspects of ILSs are continuing access to the online catalog, local data storage, the ability to modify the program's source code, and user friendliness.	No technical explanation for building the system is provided.

3. Most Common Open-Source ILS

This part discusses the most common open-source ILS, presenting its most important features.

3.1 Koha

Koha can be considered one of the first ILSs [38]. Since it started in 2000, it has been the most successful web-based open-source ILS, according to many researchers [39]. With MySQL [40] as a database working in the background, a configurable user interface, easy adaptability, and support for about 50 languages made it highly popular, especially in the academic field [41]. The most common Koha features are ease of use, flexibility, clarity, and simplicity of the interfaces (for both users and library staff), advanced search options, and supporting web 2.0 features [42] (such as RSS feeds and tagging, which enabled the users to give feedback according to their experiments and allowed the librarians to develop the library based on the reviews and suggestions) [43]. More features include reading and printing barcodes easily, a supporting serial system, and a reading list. Additionally, many updates are added continuously to support new technologies with the ability to make them fit the library requirements [44].

Since Koha ILS is built on open-source software licensing, there is no need to buy any license even for building the database, which, as mentioned earlier, is based on an open-source MySQL database [45]. Furthermore, while Koha is web-based, it does not require installing any software on the workstation except the main software installed on the main server, and any internet browser on any device (PC, tablet, or smartphone) can access the system and use its resources [46]. Figure 1 shows the Koha user interface.
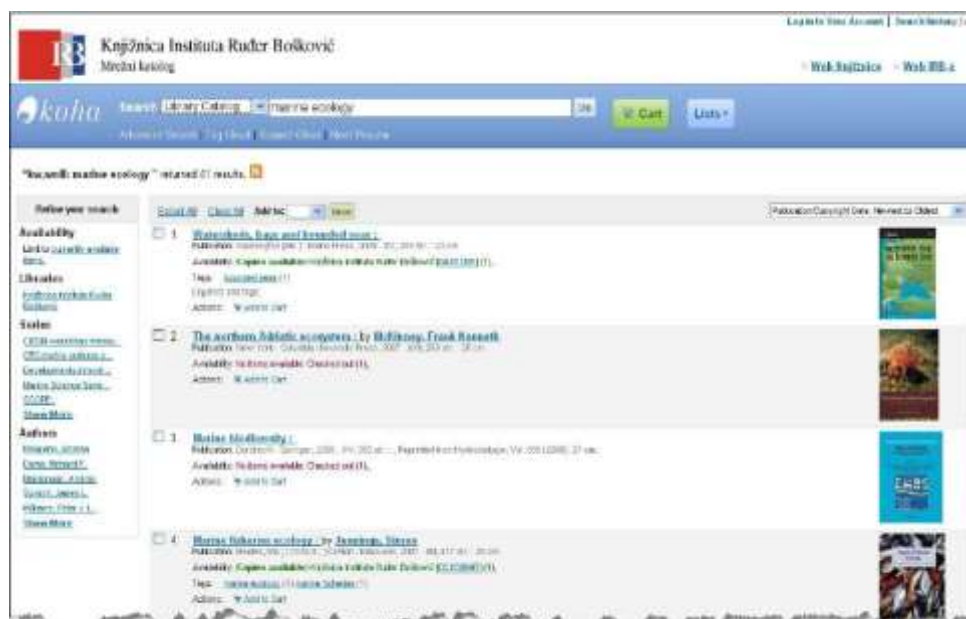

Figure 1: Koha user interface.

3.2 Evergreen

The library was developed by the Georgia Public Library Service and used by about 2000 libraries globally as an open-source, free ILS. The Evergreen developers emphasized making it stable, flexible, and easy to use [47]–[52]. Most features include:

•Object-oriented programming-based: using this programming principle to build the library makes it more reusable according to a library's requirements.

•Flexible indexing system: Evergreen used a flexible and configurable catalog according to Congress library standards to fit libraries' requirements.

•Using book bags: this feature is used to save the books' data to help patrons request or search the books using an online public access catalog.

•Keep track ability to make the library track the purchases and orders using orders and invoices.

•Automated tasks: the library comes with the ability to activate some tasks automatically, such as registration and checkouts, Statistical reports: the ability to retrieve reports based on the statistical database analysis. Figure 2 shows a sample of the Evergreen interface [47].
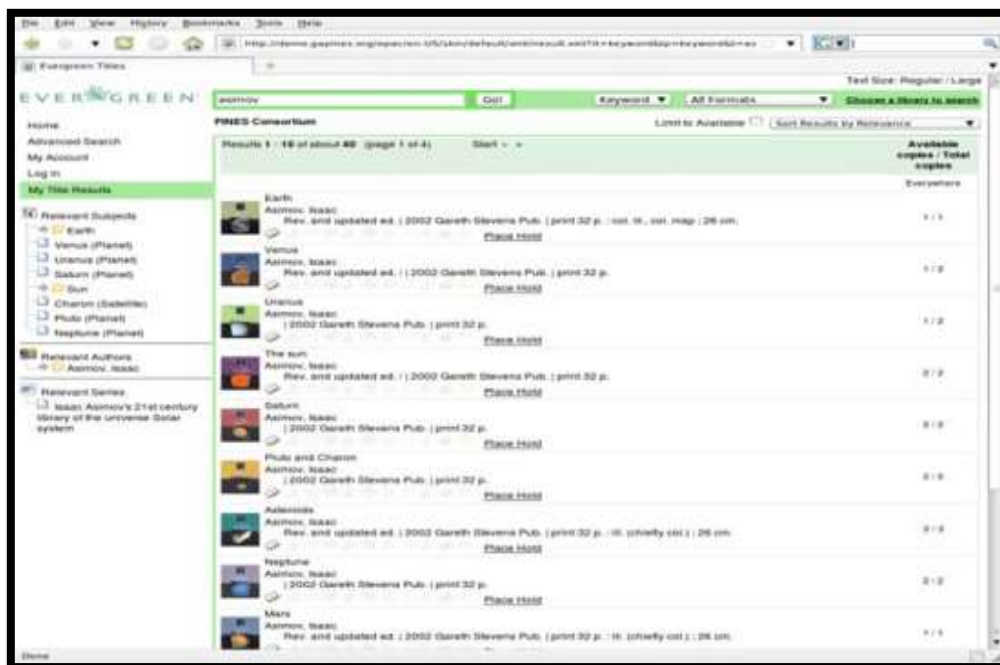

Figure 2: Evergreen interface.

3.3 NewGenlib

After three years of development as a closed-source software library in 2005, NewGenlib was announced as an open-source ILS [53]. The database search features are combined with the other ILS capabilities and make them compatible with most libraries' international standards, such as Unicode, Dublin Core, and International Standards Bibliographic Description (ISBD) [54]–[58]. Its features include:

• Using Java as a design programming language, PostgreSQL [59] as a database system, and web-based technology.

• The library source code can be downloaded under a general public license with the availability of setup instructions for Windows and Linux operating systems to enable the libraries to configure and enhance the software to fit their requirements without limitations. However, trained staff and technicians are required. Figure 3 shows the NewGenlib cataloging interface [54].
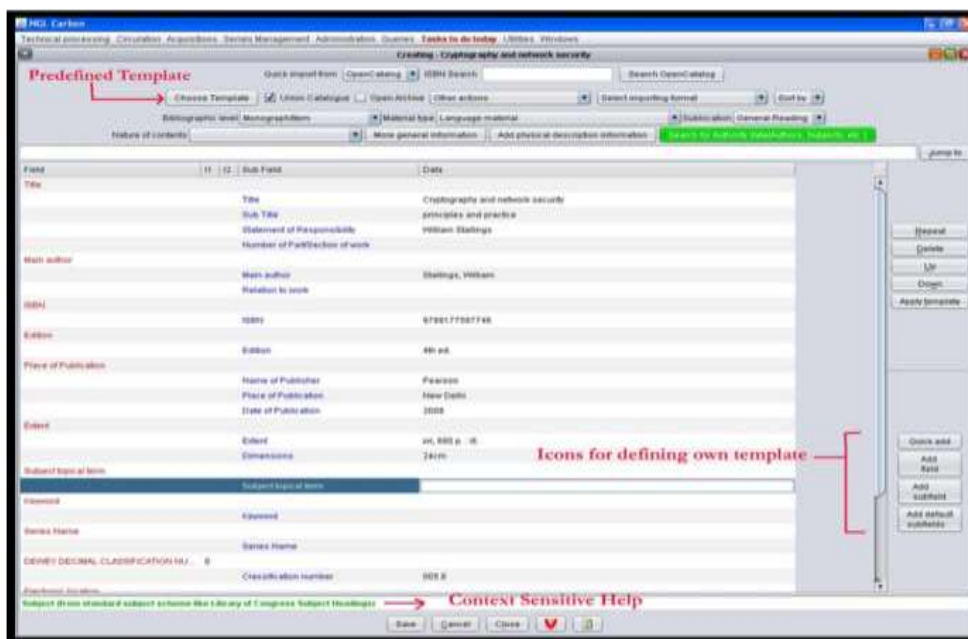
Figure 3: NewGenlib cataloging interface.

3.4 OpenBiblio

Due to its simplicity, well-documented nature, and easy installation, OpenBiblio became widely used in small libraries worldwide. Additionally, no prior knowledge of the PHP programming language is required to build the reports since OpenBiblio uses the RPT reporting language. These mentioned features made OpenBiblio suitable for small and medium libraries but not for large ones because of the lack of advanced features such as the staff's ability to keep track of purchased materials (this feature is available in other ILSs like Koha) [60]–[63]. Figure 4 shows the OpenBiblio interface.

Figure 4: The OpenBiblio interface.

3.5 PhpMyBiblio (PMB)

A web-based open-source ILS with support for installing nine language interfaces, most popular in Europe (maybe because of high installation availability in French) [64], [65]. Its features include:

• It is designed according to object-oriented programming principles, making reusability and programming it according to library requirements easier.
• Supporting many Web 2.0 features.
• User-friendly user interface.
• Easily data backup and restore.
• As a limitation, it depends on PHP/MySQL as a base for its database, so SQL query language knowledge is required to build the reports. The PMB interface is shown in Figure 5 [64].

Figure 5: PMB interface.

3.6 Emilda

It started in 2000 and is based on the Perl language. Then, in 2003, an open-source version with a general public license was released using PHP as a programming language and MySQL as a database. Emilda contained many administration functions, but the software is not under development anymore [66]. The Emilda interface is shown in Figure 6 [66].
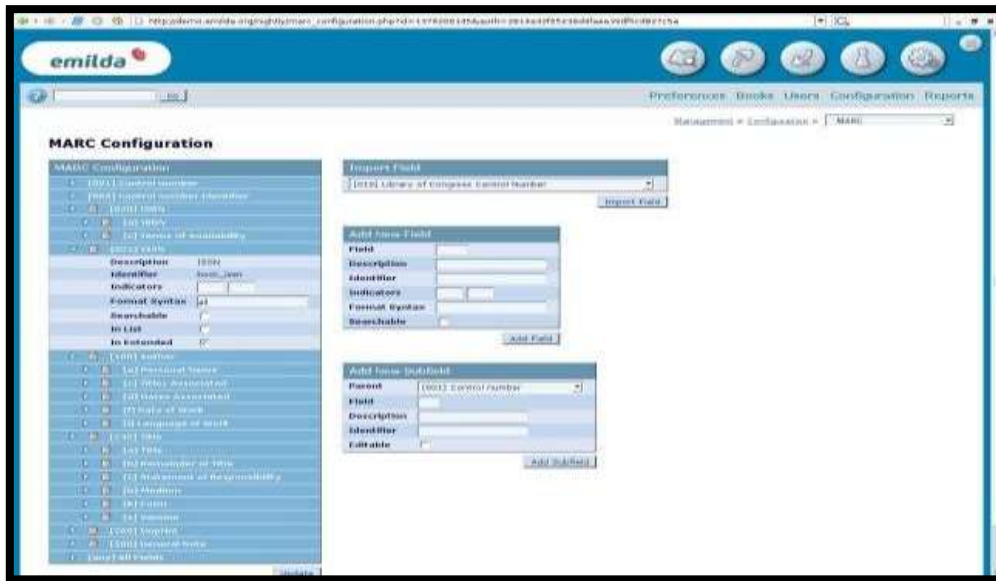
Figure 6: Emilda interface.

4. ILS Evaluation Criteria

To select the best ILS, the researchers divided some categories into criteria and tested the match of the ILS with these criteria [15], [57], and [60]. [65] tested nine libraries by making a wishlist for features required in ILSs. The shortlist was used to make a short list of the best libraries, and the libraries that did not match the wishlist were excluded. The steps in the wishlist included maturity, language, operating system, assistance availability, and interface. As a result, the only two libraries that met all the requirements in the wishlist are Koha and PMB. As well, [66], in its survey about open-source ISLs, compared the benefits and costs between closed-source and open-source ILSs.

In this study, Koha and Evergreen were chosen as open-source ILSs. A questionnaire was conducted to measure the rate of satisfaction with the benefits. Furthermore, questions about the reasons for choosing a specific library, the library's customization ability, demographics, and the issues faced in the deployment process are added. The study concluded that, despite some difficulties with deployment and a lack of documentation issues, open-source ILSs are more affordable and cost-effective than closed-source libraries. Then [67] identified three stages to filter and select the optimum SIL. In each stage, a matching process is done to exclude the ILS that does not match the criteria. For example, in the first stage, the open-source behavior and whether the ILS is free are tested with software licensing testing. In stage two, the ISL community is evaluated to determine whether or not it is active. Choosing an ISL with an active community is vital since an active community supports the library and participates in finding solutions for many problems.

Finally, in the third stage, the libraries that passed the previous stages are submitted to functionality tests by analyzing their matching to 800 features and functions that obey the libraries' requirements. After testing 20 ILSs with the previous method, only three libraries passed all the stages (Koha, PMB, and Evergreen). So, [68] conducted a study at the University of Delhi and Delhi Central Library to review the staff's knowledge of Koha and NewGenlib. The review is based on comparing the two libraries using a checklist. The checklist included primary features such as cost, transparency, community activity, ease of use, development ability, and flexibility, in addition to technical features such as the architect, web 2.0 support, and search system used. Each feature is ranked with five points (higher is better), and then statistical analysis is conducted on the final result. This study concluded that both libraries have many required features, but Koha surpasses NewGenlib in some features, such as ease of

installation and advanced database features, while NewGenlib has higher functionality and more user support. And then, [69] conducted a comparison study between Koha and Evergreen. The comparison is based on software documents, manuals, user reviews, and bugs reported.

In addition, performing some operations on both libraries and instantly highlighting the differences. The operations included maintenance, updating patron records, PIN reset, check-in/out, renewing items, and handling payments, bills, and fines. The study concluded that Koha is more user-friendly, requires less maintenance, and has more tagging, reviewing, and commenting features. On the other hand, Evergreen is more flexible and has more consortium features (such as group setting, floating collection management, and granular user permissions). Additionally, [70] conducted an analytical study about the features required to select the best ILS. As a result, the opinions of 50 engineering college librarians were taken about some important features of the ILS, such as library requirement satisfaction, quality of the software, functionality, number of features, support and training requirements, usability, installation requirements, customization ability, flexibility, and security, among other features. Table 2 summarizes the research related to ILS selection.

Table 2: ILS selection works summarization.

Research	Year	Method Summary	Criterion	Outcome
[65]	2006	Nine ILSs were tested using a Wishlist.	Utility, Documentation, Security, Interface, Assistance, Flexibility, Norms, Generic, Integration, Easiness of deployment, Easiness of administration and supervision, Code liability, and robustness.	Only Koha and PMB met all Wishlist requirements.
[66]	2008	Compared close source and open-source ILSs.	The reasons for choosing it, satisfaction, problems, and cost	Open-source ILSs are more inexpensive and cost-effective than closed-source libraries, notwithstanding implementation and documentation challenges.
[67]	2011	Three-stage filtering process according to features criteria in each stage.	Licensing, community, functionalities	Only Koha, PMB, and Evergreen passed all filtering stages.
[68]	2012	Review comparing Koha and NewGenlib using a checklist.	Software, System Administration, Functional modules, functionality, Circulation, Acquisition, Serials management, and online public access catalog	Koha is easier to install and has a more sophisticated database than NewGenlib. However, NewGenlib is more functional and user-friendly.
[69]	2011	Comparison study between Koha and Evergreen	Patron Maintenance, Check-in/out, Renewing Items, bills, fines, payments, holds, Changing Status of Items, and changing load periods	Koha provides additional tagging, reviewing, and commenting functions and is easier to use. Evergreen is more adaptable and user-friendly.
[70]	2013	An analysis of ILS characteristics.	The study used an analytical method to find out the specifications of each library separately without using a unified criterion	The ILS features required include software quality, functionality, the number of features, support and training needs, usability, installation, customization, adaptability, and security.

5. Conclusions and Future Works

ILS played the main role in developing the library system, and the open-source ILS is more stable and configurable to suit the library's requirements. However, selecting the best ILS is vital due to the time and effort required to install and test an ILS. Many previous works are based on building a checklist of many steps, each with many feature criteria. The feature criteria mostly test cost, fully or not fully open source-based software, reusability, a user-friendly interface, the number of features, community activity, support, flexibility, and security, among other features. After filtration, statistical analysis, like a checklist to make a comparative analysis between different types of ILS, was conducted to analyze the results. Koha and Evergreen are the libraries that fit the checklist filtration process, with Koha being superior to the other libraries. However, since the Mueller study in 2011, which was the most detailed study, many changes and new ILS versions have been released, and no modern deep study has been conducted. Furthermore, no automated technique has been used yet, and all previous works have been based on hand-crafted evaluation methods to select the best ILS. For feature work, using an automated technique to evaluate ILS and select the best one is suggested. As another future direction, making a survey on the front-end and back-end programs with a technical overview about building ILS is also suggested.

References

[1] D. Kouis and G. Agiorgitis, "Library Service Platforms (LSPs) Characteristics Classification and Importance Ranking through DELPHI Method Application," International Information and Library Review, vol. 53, no. 4, pp. 136-144, 2022.

[2] J. Garner, "Experiencing time in prison: the influence of books, libraries and reading," Journal of Documentation, vol. 76, no. 5, pp. 1033-1050, 2020.

[3] O. Bakhareva and D. Kordonchik, "Investments in preservation and development of regional cultural heritage: A library of bim elements representing national architectural and urban-planning landmarks," Architecture and Engineering, vol. 4, no. 3, pp. 39- 48, 2019.

[4] N. E. V. Anna, "The role of libraries in building and promoting the cultural heritage collection," International Journal of Information Studies & Libraries, vol. 2, no. 2, pp. 19-23, 2017.

[5] E. Villanueva and A. Shiri, "Methodological diversity in the evaluation of cultural heritage digital libraries and archives: An analysis of frameworks and methods," Canadian Journal of Information and Library Science, vol. 43, no. 3, pp. 316-342, 2021.

[6] H. A. Moruf, S. Sani, and Z. I. Abu, "Open Source Automation Software: Stirring Automated to Integrated Library System," Journal of Applied Sciences and Environmental Management, vol. 24, no. 7, pp. 1273-1278, 2020.

[7] M. Shahbazi, A. Farajpahlou, F. Osareh, and A. Rahimi, "Development of a scale for data quality assessment in automated library systems," Libr Inf Sci Res, vol. 41, no. 1, pp. 78-84, 2019.

[8] K. Puritat and K. Intawong, "Development of an Open Source Automated Library System with Book Recommendation System for Small Libraries," in 2020 Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering, ECTI DAMT and NCON 2020, 2020.

[9] V. V. Samarin, O. S. Gordienko, and V. A. Kopnin, "The Use of the Automated Integrated Library System for Cosmo-naut Training Process," MANNED SPACEFLIGHT, no. 4(37), pp. 109-114, 2020.

[10] B. P. Balaji, M. S. Vinay, K. v. Anitha, M. R. Khan, E. Edwin, and B. G. Shalini, "A review of integrated library systems and web-scale discovery services in India," Library Hi Tech News, vol. 38, no. 7, pp. 14-18, 2021.

[11] J. Pruett and N. Choi, "A comparison between select open source and proprietary integrated library systems," Library Hi Tech, vol. 31, no. 3, pp. 435-454, 2013.

[12] E. Jamogha, J. Owoeye, and L. S. Godwin, "Perceived usefulness and adoption of Koha integrated library systems by librarians in universities in Southern Nigeria," Digit Libr Perspect, vol. 38, no. 1, pp. 55-68, 2022.

[13] P. Yuniar and T. Mathar, "Analysis of the Implementation INLISlite (Integrated Library System)," Literatify: Trends in Library Developments, vol. 1, no. 2, pp. 52-60, 2020.

[14] Y. Wang and T. A. Dawes, "The next generation integrated library system: A promise fulfilled," Information Technology and Libraries, vol. 31, no. 3, pp. 76-84, 2012.

[15] V. Singh, "Experiences of migrating to an open-Source integrated library system," Information Technology and Libraries, vol. 32, no. 1, pp.36-53, 2013.

[16] N. Maharazu and S. H. Malumfashi, "Adoption of Koha Integrated Library System (ILS) for the Automation of Umaru Musa Yar'adua University Library, Katsina, Nigeria: Problems and Prospects," Asian Journal of Information Science and Technology, vol. 11, no. 1, pp. 9-14, 2021.

[17] A. S. Ngozi, "Library Automation in University: A Literature Review," Predestinasi, vol. 13, no. 2, pp. 115-134, 2020.

[18] A. Nurfajiah, T. Hartati, and D. Rizki Amalia, "Integrated Library System untuk Meningkatkan Efektivitas Layanan Perpustakaan Dengan Menggunakan Metode Algoritma Apriori," Journal of Information Technology, vol. 3, no. 1, pp. 39-44, 2021.

[19] O. Arriola, G. Tecuatl, and G. González, "Software propietario vs software libre: una evaluación de sistemas integrales para la automatización de bibliotecas," Investigación Bibliotecológica. Archivonomía, Bibliotecología e Información, vol. 25, no. 54, pp. 37-70, 2017.

[20] A. K. Das and S. Mandal, "Standards requirement for integrated library system," Asian Journal of Multidisciplinary Studies, vol. 1, no. 5, pp. 61-70, 2013.

[21] G. Kapllani, I. Khomyakov, R. Mirgalimova, and A. Sillitti, "An Empirical Analysis of the Maintainability Evolution of Open Source Systems," in IFIP Advances in Information and Communication Technology, vol. 582 IFIP, pp. 78-86, 2020.

[22] A. TELLA, I. Edward, H. B. Akanbi-Ademolake, and S. A. Akande, "Perception, use and effectiveness of open source library systems by academic librarians in selected tertiary institutions in Kwara State, Nigeria," Journal of Academic Librarianship, vol. 47, no. 2, 2021.

[23] Z. Ajab Mohideen, A. Sheikh, and K. Kaur, "Developing an open source mobile app in library services: the case of a national university in Malaysia," Digit Libr Perspect,vol.38,no. 3, pp. 283-300, 2021.

[24] Z. A. Mohideen, A. Sheikh, K. Kaur, and M. Tahira, "Acceptance of Koha Open Source System among Librarians in the Malaysian Academic Libraries: An Exploratory Qualitative Study," Serials Review, vol. 45, no. 4, pp. 201-210, 2019.

[25] D. Rousidis and G. Christodoulou, "A Guide for the Optimum Selection of a Free Open Source Integrated Library System," Qualitative and Quantitative Methods in Libraries, vol. 7, no. 1, pp. 39-49, 2018.

[26] E. Board, "IBM SPSS," Global Journal of Enterprise Information System, vol. 9, no. 1, pp. 134-146, 2017.

[27] M. N. Abdullah, "Success Factors of Web Integrated Library System and Job Satisfaction in Academic Libraries," Journal of Academic Library Management (AcLiM), vol. 1, no. 1, pp.31-42, 2021.

[28] S. Y. M. A. Et.al, "KohaILS:AnEfficientOpenSourceApplicationof Integrated Library System," Turkish Journal of Computer and Mathematics Education (TURCOMAT), vol. 12, no. 3, pp. 1437-1445, 2021.

[29] E. F. Anindya and Moch. F. Wicaksono, "ANALISIS PEMANFAATAN INLISLite (Integrated Library System) DI DINAS KEARSIPAN DAN PERPUSTAKAAN KABUPATEN TRENGGALEK," Shaut Al-Maktabah : Jurnal Perpustakaan, Arsip dan Dokumentasi, vol. 13, no. 1, pp.67-84, 2021.

[30] E. P. Cisneros-Corrales and Y. L. Acosta-Lozano, "Key factors for the design of integrated library systems in universities," AtoZ: novas práticas em informação e conhecimento, vol. 10, no. 2, pp. 49-57, 2021.

[31] L. F. Kolawole and T. A. Oladokun, "Utilization of Open Source Software in Nigeria Academic Libraries: Matters Arising," Cat Classif Q, vol. 59, no. 4, pp. 399-407, 2021.

[32] Dr. G. Marcel, "DEVELOPMENT OF AN ONLINE INTEGRATED STUDENT MANAGEMENT INFORMATION SYSTEM: CASE STUDY "UNIVERSITY OF GITWE," International Journal of Advanced Research in Computer Science, vol. 10, no. 5, pp. 59–67, Oct. 2019.

[33] W. Hardyanto, A. Purwinarko, and M. A. Adhi, "End-user satisfaction analysis on library management system unnes using technology acceptance model towards national standard of integrated library," in Journal of Physics: Conference Series, vol. 983, no. 1, pp. 1-5, 2018.

[34] S. R. Ponelis and P. Adoma, "Diffusion of open source integrated library systems in academic libraries in Africa: The case of Uganda," Library Management, vol. 39, no. 6–7, pp. 430-448, 2018.

[35] B. Farouq, O. Olatunji, and M. Idris, "Adoption of Integrated Library Management Software (Newgeblib): The Experience of Kano University of Science and Technology Library, wudil, kano State," Library Philosophy and Practice, 2018.

[36] V. Mammadova, "INTEGRATED LIBRARY SYSTEMS: SELECTION AND IMPLEMENTATION ISSUES," Library Science and Bibliography, vol. 2, no. 41, pp. 80–92, 2017.

[37] E. Paredes Esponda and R. Pérez Matar, "La calidad de la biblioteca universitaria y sus ventajas para la formación en educación superior," Educación Médica Superior, vol. 32, no. 1, pp. 219-228, 2018.

[38] T. Bwalya and A. Akakandelwa, "Challenges of using koha as a library management system among libraries in higher education institutions in zambia," DESIDOC Journal of Library and Information Technology, vol. 41, no. 2, pp. 82-88, 2021.

[39] I. E. ANYIRA, "NEED FOR ADOPTION OF KOHA INTEGRATED LIBRARY MANAGEMENT SOFTWARE IN NIGERIAN ACADEMIC LIBRARIES," Library Philosophy and Practice, vol. 2020, 2020.

[40] J. W. Krogh, "MySQL Workbench," in MySQL 8 Query Performance Tuning, 2020.

[41] K. Niranjana, T. Desta, and V. K. Vijaya Kumar, "Implementation of KOHA Integrated Library Management System in Wollega University Main Library, Nekemte, Ethiopia," Information Impact: Journal of Information and Knowledge Management, vol. 11, no. 4, pp. 69-80, 2021.

[42] N. S. Harinarayana and N. V. Raju, "Web 2.0 features in university library web sites," Electronic Library, vol. 28, no. 1, pp. 69-88, 2010.

[43] R. Bhawan and K. L. Mahawar, "Adoption And Functionality Of Koha Integrated Library Management System In Indian Institute Of Technology: A Comparative Study Between Bombay And Bhubaneswar," Library Philosophy and Practice, vol. 2021, 2021.

[44] D. P. Tripathi and S. R. Pandey, "Technological competencies of professionals and challenges in using and implementing koha in Indian libraries," Annals of Library and Information Studies, vol. 66, no. 2, pp. 76-79, 2019.

[45] B. Macan, G. V. Fernández, and J. Stojanovski, "Open source solutions for libraries: ABCD vs Koha," Program, vol. 47, no. 2, pp. 136-154, 2013.

[46] M. Asim and M. I. Mairaj, "Librarians' perceptions about adoption and uses of the Koha integrated library software in Punjab, Pakistan," Electronic Library, vol. 37, no. 4, pp. 624-635, 2019.

[47] Q. Zou and G. Liu, "Chinese localisation of Evergreen: An open source integrated library system," Program, vol. 43, no. 1, pp. 49-61, 2009.

[48] R. K. Kampa and P. Kaushik, "Economics of open source library software: Evidences from Indian libraries," Global Knowledge, Memory and Communication, vol. 68, no. 4–5, pp. 337-355, 2019.

[49] J. Weber, "Evergreen: Your homegrown ILS," Library Journal, vol. 131, no. 20, pp. 38-41, 2006.

[50] J. L. Balas, "online treasures. How They Did It: ILS Migration Case Studies," Computers in Libraries, vol. 31, no. 8, 2011.

[51] M. D. House, "Implementing the open-source Koha-ILS at the Deutsche Schule Charlotte," Digit Libr Perspect, vol. 32, no. 4, pp. 253-269, 2016.

[52] S. Q. Yang and M. A. Hofmann, "The next generation library catalog: A comparative study of the OPACs of Koha, Evergreen, and Voyager," Information Technology and Libraries, vol. 29, no. 3, pp. 141-150, 2010.

[53] R. Giri, "NewGenLib 3: An integrated open source library management system that makes your library visible in web," Library Hi Tech News, vol. 29, no. 10, 2012.

[54] G. Biswas and D. Paul, "NewGenLib, The First Indian Open Source Software: a Study of Its Features And Comparison With Other Software," Conference Proceeding, 23rd National Seminar of IASLIC held at Bose Institute on Library Profession in Search of a New Paradigm, Kolkata, Special Publication No.48, PP 333-340 in 2008,2008.

[55]   K. Singh, "NewGenLib: open source software in Indian libraries," International Journal of Advanced Research in Management and Social Sciences, vol. 1, no. 6, pp. 173-181, 2013.

[56]   S. Setiawan, "Analisis Komparatif Sumber Tebuka (Open Source) Sistem Manajemen Perpustakaan Terpadu Antara Koha dan Newgenlib," Pustakaloka, vol. 9, no. 2, pp. 313-322, 2017.

[57]   C. S. V. REDDY, "Comparative study of free/open source integrated library management systems (FOSILMS) with reference to Koha, Newgenlib and E-granthalaya," e-Library Science Research Journal, vol. 1, no. 12, pp. 1-10, 2013.

[58]   M. Madhusudhan and V. Singh, "Integrated library management systems: Comparative analysis of Koha, Libsys, NewGenLib, and Virtua," Electronic Library, vol. 34, no. 2, pp. 223-249, 2016.

[59]   The PostgreSQL Global Development Group, "What Is PostgreSQL?," Postgresql.Org, 2021.

[60]   M. K. Khan, "Library Automation and Digitations Through Open Source Software," IOSR Journal of Humanities and Social Science (IOSR-JHSS), vol. 22, no. 11, pp. 49-54, 2017.

[61]   V. T. Kamble, H. Raj, and Sangeeta, "Open source library management and digital library software," DESIDOC Journal of Library and Information Technology, vol. 32, no. 5, pp. 388-392, 2012.

[62]   S . Khan and M. A. Alshara "Adopting Open Source Software for Integrated Library System and Digital Library Automation," International Journal of Computer Science and Network Security IJCSNS, vol. 20, no. 9, pp. 158-165, 2020.

[63]   T. Bwalya, "OpenBiblio: a free and open source integrated library management system that answers small libraries' automation needs," Journal of Balkan Libraries Union, vol. 5, no. 1, pp. 35-42, 2017.

[64]   N. Othman, F. Othman, F. Alzaghoul, and A. Alzaghoul, "Usability degree for Arabized open source software: PHP my bibli integrated library system as a case study," in Proceedings - EMS 2015: UKSim-AMSS 9th IEEE European Modelling Symposium on Computer Modelling and Simulation, 2016.

[65]   P. X. Chalon, L. Alexandre-joaquim, C. Naget, and C. Becquart, "Open your mind ! Selecting and implementing an integrated library system: the open-source opportunity Selecting the software," in 10th European Conference of Medical and Health Libraries, 2006.

[66]   L. M. Riewe, "Survey of open source integrated library systems," Nebraska Library Association Quarterly, vol. 39, no. 4, 2008.

[67]   T. Müller, "How to choose a free and open source integrated library system," OCLC Systems and Services, vol. 27, no. 1, pp. 57-78, 2011.

[68]   M. Singh and G. Sanaman, "Open source integrated library management systems: Comparative analysis of Koha and NewGenLib," Electronic Library, vol. 30, no. 6, pp. 809-832, 2012.

[69]   A. and N. C. Jones, "Comparing open source integrated library systems: The circulation module of Evergreen \& Koha," LIBR 551: Library Automation \& Systems, 2011.

[70]   K. Kumar and T. R. Reddy, "Analytical study on knowledge about open source software in technological institutional LIS professionals," International Journal of Library and Information Science, vol. 5, no. 11, pp. 439-446, 2013.