International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 21s, 2025
https://theaspd.com/index.php

Automation And Intelligence In Libraries: A Holistic Review

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Abstract: *In an effort to offer a more comprehensive explanation of the progression of library amenities, this paper offers an overview of clever library automation. Clever automation of library is the process of combining cutting-edge technology with conventional library services. It offers a complete solution that is available in the digital age to satisfy customers' evolving needs. The foundations of smart library automation are thoroughly examined in this paper. By methodically analyzing the function design aspects and implementation strategies, it establishes the groundwork for future research and practical application to develop smart library systems. This introduction provides a conceptual framework and looks at new trends to provide the groundwork for the later design and implementation of intelligent library automation systems. Through the analysis of emerging trends and the development of a conceptual framework, this introduction establishes the foundation for the future design and implementation of smart library automation solutions. The investigation's primary objective is to examine papers about the use of developing technology. Examining how university librarians' roles are changing and doing a comprehensive literature review of the newest technologies being used in university libraries today were the objectives.*

The current library staff is also taken into account in the study. The study examines four topics: "Barriers to the implementation of emerging technologies," "Attitudes of librarians towards emerging technologies," "Technology compatibility among library professionals" along with "Status of emerging technologies in university libraries." Nonetheless, a lot of research has been done on changing technology in academic libraries. This study's main objective is to assist libraries and information science fields in understanding how these technologies are still developing.

Keywords: *-library, virtual, smart library, technology in libraries, university libraries, modern and emerging technologies, library professionals, university librarians,*

INTRODUCTION

Conventional Library Systems: Their Drawbacks

Internet-based websites that provide integrated access to many databases are known as virtualized automated intelligent library services. Library portals are the primary source of web-based library services, as they provide a unique entry point to online library resources, as per Gavitt (2019). It offers unified access to metadata across all of the library's databases. "Digital library services," "web-based library services," and "electronic library services" are some names for virtual library services. The concept of virtual library systems signifies a significant shift in the way individuals get information and services. Digital- library systems were developed as a result of technology's realization of the challenges faced by physical libraries.

These programs seek to improve client happiness, cross regional borders, and provide unparalleled access to a range of services. Learning and education have always benefited from physical libraries. They do, however, have some inherent disadvantages, such as restricted operating hours, a lack of physical space, and the need that users be physically present. Widespread access to resources has been hampered by these restrictions, particularly for distant or remote educators. According to Araya and Mengteb (2020), inadequate library administration has frequently resulted in several difficulties for physical libraries. Human mistake accounts for the majority of record-keeping failures, such as handwritten records being misplaced or destroyed by inexperienced users, despite the fact that this chaos and furthermore, the Internet's and digital information's explosive rise highlighted how important technology is to libraries' continued relevance and efficacy in the digital age.

These days, technology plays a significant role in all aspects of life. Globally, its pervasive influence has transformed people, institutions, governments, and more. Libraries have also evolved over time to offer their patrons the greatest services and goods. Academic libraries have been significantly impacted by technological breakthroughs. New technology and web-based services have drawn a lot of people. Technology is frequently

linked to overcoming obstacles, producing tangible outcomes, and carrying out activities with incredible potential (Lane and Young, 1996). Academic librarians must, however, be aware of and knowledgeable about these technologies in order to modify their libraries to meet user needs and acquire the requisite technological know-how.

Despite the fact that technological trends are evolving quickly, librarians are clearly unable to implement every trend in their library. They should select technologies that will benefit their users in the long run while taking into account their information needs. Nonetheless, academic libraries should be the primary location for the documentation or actual use of these technologies if higher education institutions are to stay on the cutting edge of technology. Studying the many advanced library technologies that are advantageous and practical for university libraries is necessary.

Need for digitization and modernization

According to Dande et al. (2023), libraries have long been considered a reliable source of knowledge, proving the quote's continued validity. However, manual procedures like book tracking, inventory management, and shelf alignment frequently impede smooth operations, making them less efficient. To address these issues, we have created a complete library management system (LMS) that optimizes all procedures. From issuing and collecting books to cataloging new entries, the LMS smoothly makes use of the RFID tags that come with every book, in conjunction with an RFID reader that the librarian operates. User convenience is increased by the software interface's intuitive design, which streamlines the hardware functions needed to guarantee seamless operation across multiple platforms. Prioritizing cost-effectiveness is our main objective, and it is strongly backed by improved operational efficiency. The results include: facilitating more modernization in different library settings; streamlining the laborious borrowing and returning process; and improving its overall usefulness value from a modern standpoint. FID technology has emerged as a viable approach to enhance the precision and efficacy of library management systems. This article summarizes the advantages and technical developments of RFID-based smart library management systems from a wide range of scholarly sources.

REVIEW OF THE LITERATURE

Analysis of the Automated Virtual and Advanced Digital Library Systems

Thanks to technological advancements, the virtual library system has emerged as a solution to these problems. These systems provide users with access to vast collections of resources without requiring a physical location by use of digital platforms. The virtual libraries are accessible from any location with a web connection and include e-books, academic papers, interactive materials, and more. A virtual library is an e-library system that utilizes ITC to store materials and provide services electronically, according to Magetto (2021).

This platform makes it feasible to utilize digital technology for online distribution, storage, preservation, and retrieval. Because booking and payment processing are handled through secure channels, the method is both economical and dependable enough to ensure good library service delivery. The term "virtual library services" describes particular websites that are accessible online and offer integrated access to many databases. A unique doorway to web-based library materials, library portals are the primary source of web-based library services, according to Gitt (2019). It compiles metadata from a number of library databases. Among the types of virtual library services are electronic, digital, and web-based services.

The detrimental impacts of Nigerian university libraries' lack of funding on research, education, and development are highlighted in the paper by Gabje (2007). Through national virtual library programs and regulations that support access to up-to-date knowledge for teaching and learning, the government has taken steps to improve its response to this issue. Institutions of the Higher education can benefit greatly from the deployment of virtual libraries, which also allow students access to a wealth of online resources. He asserts that electronic collections are an essential part of virtual libraries and that they are more than just a collection of digital materials or an individual locator (URL) for easily accessible online content.. Beyond the capacity of a typical library, creating a digital collection requires understanding of online technology and information. To establish a virtual library, follow these steps:

DIGITIZATION

Digitalization is the process of converting non-digitally produced content into a digital format. For librarians, one of the initial digitalization challenges was the development of computer-readable catalogues from printed

library cards. Choosing the necessary material from the collection, scanning, annotating, and transcribing it while creating an index, creating metadata, having subject matter experts confirm its accuracy, and processing the images before putting them into the digital asset management software (DAM) are the steps involved in digitization. Numerous programs, such as D-Space E-Prints Fedora Greenstone, manage digital assets, build metadata records that offer cross-platform search possibilities, and organize indexes that give access through locally or remotely accessible databases.

Development and acquisition of collections

Acquisition is the process of acquiring and assuming ownership of digital content, including journals, databases, and e-books. The subscribed electronic resources are hosted on the vendor's remote server and made accessible to the target community following authorization and authentication. Physical libraries frequently suffer from poor management techniques, according to Araya and Mengteb (2020). There are numerous instances of human error in record keeping, including the misplacing or destruction of handwritten records due to inadequate management techniques. Confusion and time wasted looking for books can result from such flaws, which may not have been adequately handled in manual systems. Furthermore, libraries must adopt new technologies if they want to continue to be useful in this day and age, as the Internet is producing a vast amount of digital material.

Comparison between Virtual Libraries and Physical Libraries

- Physical libraries are based in real places, but virtual libraries are made in virtual spaces (such servers, datacenters, and clouds).
- compared to traditional libraries, virtual automated libraries include racks and electronic material (such as e-books, e-journals, online publications, and reports).
- Since traditional libraries mostly hold Conventional books and printed publications like journals or monographs, they are isolated from this digital world of information carriers.
- While traditional libraries are challenging to scale up, virtual libraries struggle with space constraints dictated by the scalability of their IT infrastructure.
- A physical library's issue and reserve system allows for the access of an item, whereas a virtual library's access is unlimited.
- Interface-based indexing and searching are offered by virtual libraries.
- While the primary problem with physical libraries is the ongoing loss, distortion, and deterioration of material, virtual libraries provide long-term digital preservation and storage.

Smart Library Automation technologies

- Etola et. al. (2003) conducted a ground-breaking study that inspired libraries to integrate several IoT- and AI-driven tactics into other facets of the industry. Specifically, IoT technologies have a significant impact on day-to-day library management and operations; in this discussion, we will primarily concentrate on elucidating their fundamental ideas and making them more understandable.
- RFID: Having been around for more than 70 years, RFID has grown in popularity as an Internet of Things technology. With advancements in integrated circuit manufacturing, RFID applications have become more affordable (Khadka et al., 2022). Intelligent shelving, self-borrowing/return bins, and access control are helpful examples of how libraries have implemented this smart technology (Ali .et: al., 2022).
- BLE: According to Jeon .et:.al. (2018), BLE is a the new Bluetooth wireless technology that provides a broad range and efficient energy utilization. Important applications of BLE in intelligent libraries that emphasize student social interaction and navigation capacity are highlighted by G et al. (2022).

Library Management Systems

One excellent illustration of technical innovation that has greatly influenced the evolution of library management systems is the KOHA system. The word "KOHA" in Māori means "gift" or "generosity." Koha (2023) claims that the system's deployment marks a dramatic departure from traditional library management strategies and a move towards innovative, tech-driven strategies that transform how libraries operate and serve their users.

The Koha System is a complete library solution for libraries of all sizes. In 1999, Katipo Telecommunications developed this open-source project to benefit the Horowhenua Library-Trust in New Zealand. Promoting open information access and increasing the transparency of library services are the primary objectives of

KOHA. Its adaptable and community-driven development strategy has led to its global adoption (Koha, 2023). When KOHA's remarkable Zebera indexing engine was introduced in 2005, it became a viable option for libraries of all kinds.

This article, which was written by Niranjana and colleagues in 2020 and titled "Implementation of KOHA Integrated Library Management Systems at Wollega the University Main Library, Nekemte, Ethiopia," investigates the technical setup, Koha library software installation, customisation, and data transfer procedures that are carried out at the Wollega University Library. In May of 2017, the library successfully implemented all of Koha's components, which included cataloguing, online public access catalogue, and serial control. Educational system was modified to add the new feature "Email notification to users" when KOHA version 17.05 was upgraded to KOHA 19.05. This modification took place in September of 2019. Decision tree algorithms are used in a wide variety of industries, and data categorization approaches are often utilised in data mining in order to split data into distinct categories. Machine learning is an approach that aims to eliminate the need for explicit programming by teaching computers to learn from a variety of training and test datasets. This approach gives computers the ability to independently pick their own outcomes in every given circumstance. A decision tree is an example of a machine application. The employment of these algorithms is possible in a variety of contexts, including search engines, statistical approaches, text extraction, and medical-certified industries. The ideals of accuracy and cost-effectiveness are the foundation upon which many decision tree algorithms are constructed. The decision tree algorithms ID3, C4.5, and CART have been analyzed and evaluated in the study that was written by Patel and Prajapati (2018). What we mean when we talk about classification is the act of putting things into categories that may be used for a broad variety of purposes. They assert that the execution time for the CART method is 0.5 seconds, while the ID3 algorithm takes 0.02 seconds, and the C4.5 algorithm takes 0.06 seconds. CART is the slowest, whereas ID3 is the fastest of the three. Although CART takes a much longer amount of time than the other algorithms since it is the slowest, it has the greatest accuracy and gives results that are more accurate than those produced by ID3 and C4.5. When compared to the other two algorithms, CART is the most effective one. Priyam et al. (2013) use three decision tree algorithms (ID3, C4.5, and CART) to educational data in order to make predictions about test performance. On the basis of the data collected from the students' internal assessments, each algorithm is used to make a prediction about how well the students would do on the final examination. It is feasible to evaluate the relative efficacy of a number of different decision tree algorithms by analyzing the correctness of the tree and the amount of time that is required to produce it.

Teachers may use the system's predictions to assist weak pupils perform better. The primary disadvantage of the serial decision tree method (ID3) is its poor classification accuracy, which worsens as training data accumulates (C4.5 and CART). However, all of these datasets are tiny, and some or all of them need to be stored in memory forever. Thus, its application in large-scale database mining is restricted.

Research gaps

library resources in intelligent automation systems for libraries. Traditional library operations have been revolutionized by intelligent automation and monitoring technologies, which have improved user experience, accessibility, and efficiency. According to other evaluated studies, the main emphasis of current research is on the features and application of current systems. New technologies and innovative concepts must be included to enhance the performance and efficacy of smart library automation systems, however there is a significant research gap in this field. Although wise library systems prioritize user-centered design, sophisticated personalization strategies, as well as cataloging techniques, can be difficult to understand and implement. These strategies are based on user preferences, behavior, and context. This project's objective is to enhance user engagement and satisfaction by employing classification trees for cataloging, adaptive user interfaces, and personalized content recommendations.

CONCLUSION

The research successfully developed and put into use a "Smart Library Automation and Monitoring System" that highlights the advantages of virtual libraries that are accessible over the internet. This strategy will solve the drawbacks of conventional libraries, such as their small physical footprint, exorbitant costs, and

accessibility problems. The research enhances the availability of information for both educators and learners by using digital technologies and creating an easy-to-use user interface.

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