THE ROLES OF CLOUD TECHNOLOGY IN AUTOMATED LIBRARY MANAGEMENT IN THE 21ST CENTURY: THE PROSPECT AND TECHNIQUES

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ABSTRACT

This study examined the roles of cloud technology in automated library management in the 21st century, examining the prospects, and techniques. It mentioned that the integration of cloud technology into library management systems has revolutionised the way libraries operate, offering unprecedented opportunities for automation, efficiency, and accessibility. As libraries continue to evolve from traditional physical spaces to dynamic digital environments, cloud technology has played a pivotal role in facilitating the transformation. In carrying out this research, the following subheads were taken into consideration: concept of cloud, concept of cloud technology, concept of library, and concept of automated library management, among others. The study stated that one of the roles of cloud technology in automated library management is that it enhances accessibility and collaboration. The study also revealed that one of the technicalities of cloud technology in automated library management is interoperability, which enhances automated library management. The study concluded that in the 21st century, cloud technology has revolutionised library management, offering automation, efficiency, and accessibility. It has enabled libraries to store and manage vast amounts of data on remote servers, providing scalable and flexible services. One of the recommendations made was that libraries should prioritise the adoption of scalable cloud-based library management systems that can accommodate growth in digital resources and user demands. As it ensures the library remains flexible and responsive to evolving technological advancements and increasing data storage needs.

KEYWORDS: Cloud Technology, Automated Library Management, 21st Century, Prospect and Techniques

INTRODUCTION

In the 21st century, technological advancements have significantly transformed various sectors, with libraries being no exception. The integration of cloud technology into library management systems has revolutionised the way libraries operate, offering unprecedented opportunities for automation, efficiency, and accessibility. As libraries continue to evolve from traditional physical spaces to dynamic digital environments, cloud technology plays a pivotal role in facilitating this transformation. This paper explores the roles of cloud technology in automated library management, examining its prospects and the techniques that have emerged in this era of digitalisation.

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Cloud technology has redefined the landscape of library management by enabling the storage, retrieval, and management of vast amounts of data on remote servers rather than on local computers. This shift has provided libraries with the ability to offer more scalable and flexible services to their users. According to Gupta and Dhawan (2019), cloud-based library management systems allow libraries to manage their resources more efficiently, reducing the need for physical infrastructure and enabling seamless access to information from any location. This capability is particularly beneficial in the 21st century, where the demand for digital access to information has surged.

The automation of library processes through cloud technology has also led to significant improvements in service delivery. Tasks such as cataloguing, circulation, and acquisition can now be managed automatically, freeing up time for librarians to focus on more strategic activities. As noted by Singh and Kaur (2020), cloud-based automation tools have streamlined library operations, improving accuracy and reducing the likelihood of human error. This has not only enhanced the user experience but also increased the overall efficiency of library management.

Furthermore, cloud technology offers robust data security and backup solutions, which are critical in the management of digital libraries. With the increasing reliance on digital resources, ensuring the security of library data has become paramount. Cloud service providers offer advanced encryption and regular data backups, which help in safeguarding library collections against data loss and cyber threats (Kumar & Verma, 2018). This level of security is essential for maintaining the integrity and continuity of library services in the digital age.

In addition to operational benefits, cloud technology has opened up new avenues for collaboration and resource sharing among libraries. Cloud-based platforms allow multiple libraries to share resources and collaborate on projects without geographical constraints. This collaborative approach not only enhances resource availability but also promotes knowledge exchange and innovation within the library community (Sharma & Tiwari, 2021). The ability to access and share information across institutions is a significant advancement that supports the global nature of information dissemination in the 21st century.

As libraries continue to embrace cloud technology, it is essential to understand the techniques and best practices that have emerged to maximise its potential. This paper will delve into the various strategies that libraries can adopt to effectively implement cloud-based solutions, ensuring that they harness the full benefits of automation and digital transformation. By examining these techniques, the paper aims to provide a comprehensive understanding of the role of cloud technology in shaping the future of automated library management.

CONCEPT OF CLOUD

Based on the conventional usage of a cloud-like shape to indicate a network on telephone schematics, the term "cloud" is used as a metaphor for the internet. The abbreviation C-computing resources; L-location independence; O-may be accessed online; U-used as utility; and D-is accessible on demand can be used to represent the "cloud" component of cloud computing. A global network of servers that function as one cohesive system is known as the cloud. These servers administer and store data, execute programs, and deliver services and information via the internet. These services are delivered via the internet via the cloud.

Although the phrase "cloud" can be ambiguous, it really refers to a worldwide network of servers, each of which performs a different purpose. According to Billah (2022), the cloud is not a physical entity but instead a vast network of remote servers around the globe that are hooked together and meant to operate as a single ecosystem. "The cloud" describes the software and databases that operate on servers that may be accessed via the Internet. Around the globe, data centres house cloud servers. Users and businesses can avoid managing physical servers or running software on their own computers by utilising cloud computing. Using mobile devices, one may conveniently access all data

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thanks to the cloud. One may save a vast amount of material, including papers, photos, audio, video, and more, in one location with the cloud.

Furthermore, Islam et al. (2023) mentioned that the cloud provides heavy security and compliance measures, which can help to protect organisations from cyber threats and ensure regulatory compliance. This method of computing refers to the provision of data and resources via Internet services; the network of these services is referred to as "the cloud."

CONCEPT OF CLOUD TECHNOLOGY

Cloud technology or cloud computing, is a new development that has a big impact on how businesses, including libraries, operate. Cloud technology, on the other hand, refers to a networking infrastructure built on the cloud that offers distant services via the internet. Swapna & Birader (2017) described that in cloud computing, the word 'cloud' is used as a metaphor for the internet, based on the standardised use of a cloud-like shape to denote a network on telephony schematics. Cloud computing is a new paradigm that provides options for library users or groups of users who require location-bound services that are time- and limit-bound and infinite. However, in spite of great work advantages, many librarians still pay levity to its full awareness and adoptability to their service operation (Njoku & Agbiriogu, 2021).

Besides, Rena (2010) defined cloud computing as a pool of abstracted, highly scalable, and managed computer infrastructure capable of hosting end-customer applications and billed by consumption. The National Institute of Standard and Technology (NIST) in Mell and Grance (2011) defines cloud computing as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (for example, a network, server, storage, applications, and services). For cloud computing to maintain and arrange data and apps, both the internet and a remote server are necessary. Suciu et al. (2013) conceptualised cloud computing as the delivery of computing and storage capacity as services to a community of end-users. Additionally, they restated that by fusing user data, software, and on-demand computational resources over a network, cloud computing expands the idea of IT services.

In addition, cloud computing refers to internet-based computing where users pay for the usage of virtual shared servers that house applications, platform devices, infrastructure, and other resources. In the cloud computing model, all the information available in a digital system is offered as a service. Without any prior experience managing resources, users can access these services offered by the "Internet Cloud." It offers many benefits that libraries can take advantage of, including a generally lower cost for providing computing resources, as well as less need to provide employees who are specifically skilled in server administration and the implementation and use of other technology (Gonzales, 2023). Since businesses simply use and pay for the resources they require, cloud computing offers energy savings over traditional computing infrastructure. Several virtualised machines may be configured to consume a capacity-level amount of processing power thanks to cloud computing's provision of computing resources, which will decrease energy consumption and promote green IT initiatives.

CONCEPT OF LIBRARY

The Latin term "libraria," which meaning "a book place," is where the English word "library" originates. It comes from the word "liber," which translates to "a book." A library is an establishment that has a variety of materials, including books, periodicals, magazines, records, and other items, that have been arranged and made available for use by members and other individuals by professionals. Bassey and Umoh (2021) mentioned that a library is where books and nonbook materials are housed for teachers, pupils, and students for learning and relaxation.

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Libraries can be actual structures, rooms, or collections kept outside such structures. They can range in size and be maintained by organisations, corporations, governments, or private citizens. An assortment or cluster of assortments of books and/or additional print and/or nonprint resources arranged and preserved for utilisation (reading, consultation, study, research, etc). Bassey and Bantai (2021) defined a library as a collection of resources in a variety of formats that are organised by information professionals or other experts.

According to Bassey, Onobrakpor, and Nnah (2019), a library is an organised, It is a library of books that its members and those of affiliated institutions can use, along with maybe other resources and media. As per the Oxford Companion to the English Language, which is published by Tom Mac Arthur, a library is defined as an assortment of written and printed resources such as books, journals, and other materials. According to Pierce Butler, a "library" "is a social organization"—a vital component of the social fabric that is skilfully planned and organised to transfer the collective experience of society to individual members via the use of books and other holistic, visual, and aural materials like charts, maps, phono-records, microfilms, etc. According to Okonoko, Ukanga, and Bassey (2024), libraries are hubs of information for learning, teaching, research, and knowledge.

Furthermore, Nmecha and Bassey (2020) mentioned that libraries are information hubs, empowerment hubs, knowledge repositories, and sources of e-learning. The library is defined as a public institution or establishment that is tasked with the care and collecting of books as well as the responsibility of making them accessible to people who require their use. Dr. S. R. Ranganathan is considered the father of library science in India. Thus, it may be inferred from the aforementioned definitions that a library is a collection of written works by people. These records are physical; that is, they are collections of helpful manuscripts, books, journals, audiovisual recordings, microfilms, graphs, charts, etc. that represent human concepts. They are organised, maintained, and kept in a physically sound structure so that future willing users can make good use of it. Libraries are indispensable in every facet of education. It is a necessity that supports teaching, learning, and research needs for teachers, students, and the society at large (Bassey and Igajah, 2017).

CONCEPT OF AUTOMATED LIBRARY MANAGEMENT

Automation library management is the practice of minimising human intervention in a library's operations via the use of computers and other technologies. The execution of a procedure, a sequence of procedures, or a process through self-activating, self-controlling, or automatic mechanisms is the definition of it. The use of automated data processing tools, such computers and other labor-saving gadgets, is referred to as automation. Automating tasks with machinery to make tasks easier and save time and labour for humans is known as automation. Automation in libraries is primarily intended to free up librarians and library employees so they can more effectively contribute to the dissemination of knowledge and information. In Library Science, automation is 'the technology concerned with the design and development of the process and system that minimises the necessity of human intervention in their operation.

Librarians must maintain the library's organisation and stock, which makes library management challenging. It might be taxing for them to handle the large number of requests for information and resources that they receive from patrons. Many issues, including disorganised shelves, unfulfilled book orders, out-of-date references, and more, can arise from poorly managed libraries. Automation in libraries is quite helpful. Worldwide, libraries are using library automation more and more as it is an emerging trend in library management. Librarians have been able to solve a number of common issues, including excessive workloads, ineffective processes, and declining customer service quality, with the aid of automated technologies.

Automation has many advantages, such as improved accessibility, accuracy, and efficiency. Librarians can spend more time servicing customers and offering helpful resources by outsourcing manual work to technology. Libraries can better serve their communities and increase everyone's

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access to information by implementing automated technologies. With library automation systems, librarians can provide efficient service to their patrons by saving time and effort while ensuring that the library runs smoothly (Charbonnet, 2023).

THE ROLES OF CLOUD TECHNOLOGY IN AUTOMATED LIBRARY MANAGEMENT

Cloud computing has transformed many industries, and libraries are no different. Cloud computing's efficiency, scalability, and accessibility have made it possible to handle library operations more efficiently. This is known as automation library management. The following are cloud technology's primary functions in automated library management:

- **Enhanced accessibility and collaboration**

Cloud technology facilitates seamless access to library resources from anywhere at any time. This is especially crucial for academic libraries, where students, researchers, and faculty members require constant access to digital resources. Cloud-based library management systems (LMS) enable users to access a wide range of resources without the need for physical presence in the library, promoting greater collaboration and learning across geographic boundaries. Furthermore, cloud technology supports real-time collaboration among library staff and users. For instance, librarians can collaboratively manage cataloguing, acquisitions, and circulation tasks more efficiently using cloud-based systems, as noted by Jones and Carter (2020). This collaborative approach streamlines workflows, reduces duplication of efforts, and enhances the overall service quality of libraries.

- **Cost Efficiency and Scalability**

One of the primary advantages of adopting cloud technology in library management is cost efficiency. Traditional library management systems often require substantial investment in hardware, software, and maintenance. However, cloud-based solutions significantly reduce these costs by eliminating the need for on-premises infrastructure. Patel and Rao (2018) highlight that libraries that transitioned to cloud-based LMS experienced a reduction in operational costs by approximately 30-40%. Additionally, cloud technology offers scalability, allowing libraries to adjust their storage and service capacities based on demand. This flexibility is particularly beneficial for libraries with fluctuating resource needs. Cloud-based systems can easily accommodate the growing volume of digital content and user data without the need for frequent hardware upgrades.

- **Improved Data Security and Backup**

Data security is a significant concern for libraries, especially with the increasing volume of digital resources and user data. Cloud technology provides robust security measures, including encryption, multi-factor authentication, and regular security updates, to protect sensitive information. Cloud-based library management systems offer enhanced security features compared to traditional systems, ensuring that data breaches and unauthorised access are minimized. Moreover, cloud technology ensures automatic backups and disaster recovery solutions, which are critical for maintaining data integrity. In the event of a system failure or data loss, libraries can quickly restore their services without significant downtime, as highlighted by Thompson (2020).

- **Streamlined Resource Management and Automation**

Cloud technology supports the automation of various library management functions, such as cataloguing, acquisitions, and circulation. Automation reduces the manual effort required by library staff, allowing them to focus on more value-added services. Cloud-based LMS integrates advanced features like automated indexing, digital asset management, and self-service options for users, improving the overall efficiency of library operations. Additionally, cloud-based systems enable libraries

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to manage both physical and digital resources in a unified manner. This integration simplifies the tracking and management of resources, leading to better resource utilisation and user satisfaction.

- ### Support for advanced analytics and decision-making

Cloud technology facilitates the collection and analysis of large volumes of data generated by library operations. This data can be used to gain insights into user behaviour, resource utilisation, and service effectiveness. According to a study by Garcia (2023), libraries that leverage cloud-based analytics tools can make data-driven decisions to enhance their services, such as optimising collection development and tailoring resources to meet user needs. The ability to analyse trends and patterns helps libraries anticipate future demands and allocate resources more effectively. Cloud technology also supports predictive analytics, enabling libraries to proactively address potential issues before they escalate.

- ### Environmental Sustainability

Adopting cloud technology in library management also contributes to environmental sustainability. By reducing the need for physical storage and minimising the carbon footprint associated with on-premises infrastructure, libraries can support green initiatives. A study by Edwards and Green (2018) suggests that cloud-based systems consume less energy compared to traditional servers, aligning with the sustainability goals of many institutions.

THE TECHNICALITY OF CLOUD TECHNOLOGY IN AUTOMATED LIBRARY MANAGEMENT

Cloud technology has fundamentally transformed automated library management systems (LMS) by providing robust, scalable, and flexible platforms for managing library operations. Understanding the technical aspects of cloud technology in this context is crucial for optimising library services and resources. Here are some key aspects of how cloud technology enables automated library management:

- ### Interoperability

Interoperability is another technical aspect of cloud technology that enhances automated library management. Cloud platforms support various data formats and standards, making it easier for libraries to integrate different systems and share information seamlessly (Wang et al., 2019). This interoperability is crucial for libraries that manage diverse collections, as it ensures that all resources, regardless of format, are accessible through a unified interface. Furthermore, cloud technology enables libraries to connect with external databases and repositories, expanding the range of resources available to users.

- ### Cloud Infrastructure

Cloud computing, with its scalable infrastructure, provides libraries with a platform to manage vast amounts of data efficiently. It allows libraries to store, retrieve, and share resources without the limitations of physical storage, thereby enhancing accessibility for users. According to Islam and Islam (2015), cloud-based library systems facilitate seamless access to digital resources, enabling users to access information from any location with an internet connection. This shift from traditional library systems to cloud-based platforms not only streamlines library operations but also reduces the costs associated with maintaining physical servers and storage devices.

- ### Data Management and Storage Solutions

One of the key technical advantages of cloud technology in library management is its ability to support various automated processes. These processes include cataloguing, acquisitions, circulation, and digital archiving, all of which are essential for the efficient functioning of libraries. As noted by Masrek and Gaskin (2016), cloud-based systems automate these tasks, reducing the manual workload for library staff and minimising the chances of human error. Moreover, the integration of cloud

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technology with library management software enables real-time updates and synchronisation of data across multiple platforms, ensuring that users have access to the most current information available.

- **Flexibility and scalability**

The flexibility and scalability of cloud technology are essential for accommodating the evolving needs of libraries. As user demand for digital resources grows, cloud platforms can easily scale up to handle increased traffic and data storage requirements (Aliyu & Osman, 2018). This scalability is particularly beneficial for libraries with limited financial and technical resources, as it allows them to expand their services without significant upfront investments in infrastructure. Additionally, cloud technology supports collaborative initiatives among libraries, enabling them to share resources and expertise through interconnected cloud-based networks.

- **Security and privacy**

Data security and privacy are critical concerns in the adoption of cloud technology for automated library management. Cloud service providers implement advanced security measures, such as encryption, multi-factor authentication, and regular security audits, to protect sensitive library data from unauthorised access (Khan, 2017). However, the reliance on third-party providers also introduces potential risks, such as data breaches and loss of control over information. Libraries must, therefore, carefully select cloud providers that comply with international data protection standards and offer robust security protocols to safeguard their data.

CONCLUSION

In the 21st century, cloud technology has revolutionised library management, offering automation, efficiency, and accessibility. It has enabled libraries to store and manage vast amounts of data on remote servers, providing scalable and flexible services. The automation of tasks like cataloguing and circulation has improved service delivery and operational efficiency. Additionally, cloud technology enhances data security, facilitates collaboration among libraries, and promotes knowledge sharing. As libraries continue to adopt these technologies, understanding the best practices for implementation will be crucial in maximising their potential and shaping the future of automated library management.

RECOMMENDATIONS

- Libraries should prioritise the adoption of scalable cloud-based library management systems that can accommodate growth in digital resources and user demands. This ensures that the library remains flexible and responsive to evolving technological advancements and increasing data storage needs.
- To fully leverage the benefits of cloud technology, libraries should invest in continuous training programs for librarians and IT staff. This will enhance their ability to manage cloud-based systems efficiently, reduce the risk of errors, and improve overall service delivery.
- Libraries must implement robust data security measures, including encryption and regular backups, to protect sensitive information stored on cloud platforms. Collaborating with reputable cloud service providers who specialise in secure data management will help safeguard library resources against cyber threats.

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