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Using Modern Tools for Efficient Library Services: A Perspective of Utilities and Concerns

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Abstract:

To examine the utilities and concerns of adopting modern tools into library services, this study has used a descriptive approach using content analysis of the literature review. The study's findings show that adopting some modern tools into libraries has many potential benefits, including increased throughput, 24/7 virtual assistance, improved client satisfaction, improved information accessibility, active collaboration, predictive analysis of collection management, data-driven decision making, knowledge sharing, chatbots, and more. Some of the difficulties with using contemporary tools in libraries are also identified by this study, including a shortage of skilled personnel, dependency on vendor solutions, high startup costs, fear of losing one's job, lack of maintenance culture, loss of human touch, insufficient network connectivity, etc. To successfully incorporate modern tools into library services, library professionals need to strengthen their competencies and administrative authorities must focus on effective and efficient policy framing as well as policy implementation to manage the user's keen interest regarding the practice of using modern tools for the services that the libraries offer in an efficient mode during this era of burgeoning technology.

Keywords: *Contemporary Tools, Digital Transformation, Knowledge Sharing, Virtual Assistance*

Abbreviation: ***AI****- Artificial Intelligence;* ***ES-*** *Expert System,* ***NLP****- Natural Language Processing;* ***NLG****- Natural; Language Generation;* ***ML****- Machine Learning;* ***ANN****- Artificial Neural Network*

1. Introduction:

Libraries lay out providing services to their users, and their roles have been metamorphosed by the advent of modern technology during this era of digital explosion. The burgeoning wants of the library users regarding modern technology & knowhow have necessitated library professionals to adapt sophisticated methods for delivering effective services. Time-consuming and repetitive tasks are used in library administration and operations. As a result, many libraries are shifting towards automation of their operations to boost efficacy and efficiency. Contemporary tools increase the automation of libraries' accuracy (Dwivedi et al., 2013)[1]. Adoption of AI tools hooked on the operation of libraries is playing the pivotal role to augment library services to its users. Through the amalgamated integration of contemporary tools in

[1]Dwivedi et al. (2013). RFID Systems in Libraries: An Empirical Examination of Factors Affecting System Use and User Satisfaction.

delivering varieties of services, today's libraries surpass their old-style frontiers, strengthening their proficiencies transversely, like, information repossession, cataloguing, reference systems, and active involvement of library users (Jha, 2023)[2]. Amongst lots of issues, classifying and acquiring the library items, as well as the arranging of books &other library materials in the shelves in a well-managed manner, are the matter of serious concerns that artificial intelligence has enabled the library professionals to address (Ajakaye, 2022)[3]. In order to increase the satisfaction level of the users, the services served by the libraries must be in more effective, quick and competent ways so that the library patrons can swiftly and efficiently obtain timely and accurate information.

2. Literature Review:

Branches of Modern Tools applicable in the Libraries:

Since the discovery of computers, their aptitude to accomplish numerous activities continued to grow exponentially. Human beings have come forth with the potentiality of computers in their diverse working domains. There exist several branches of contemporary tools, like, Expert System, Natural Language Processing, Robotics, Neural Network and Pattern Recognition which may be adopted in libraries (Mogali ,2015)[4].

2.1 Expert Systems:

Expert systems have been used to tackle problems in a variety of domains, such as computer science, engineering, and medicine. Another ideal setting for the use of intelligent and expert systems is the library. Additionally, Expert systems can assist with reference, management policy decision-making, cataloguing rule application, vendor assignment for library item acquisition, and more. Expert systems mimic human thought and reasoning to perform these sophisticated activities. They do this with the use of a knowledge base - a collection of guidelines derived from different human experts (Asemi & Asemi, 2018)[5]. An AI subset known as Expert System, is that branch of computer science which concentrates on generating smart computers behaving like human beings (Shrivastava, 2018)[6].

2.2 Natural Language Processing (NLP):

[2] Jha, (2023). Application of Artificial Intelligence in Libraries and Information Centers Services: Prospects and Challenges.
[3] Ajakaye. (2022). Applications of Artificial Intelligence (AI) in Libraries. Pp:73-90 Ajakaye. (2022). Applications of Artificial Intelligence (AI) in Libraries. Pp:73-90
[4] Mogali. (2015). Artificial Intelligence and its Applications in Libraries
[5] Asemi & Asemi, (2018). Artificial Intelligence (AI) Application in Library Systems in Iran: A Taxonomy Study.
[6] Shrivastava. (2018). Artificial Intelligence and Expert System: Intelligent Library.

NLP is an area of research & application which is engaged into exploring the phenomenon how the computers can be put into service to apprehend as well as to manipulate natural language text or speech to accomplish meaningful outcomes (Chowdhury, 2000)[7]. The Natural Language Generation -NLG rivets on exploring semantic analysis or figuring out the envisioned meaning of the text. NLG is the subfield of NLP which has undergone a radical change since the advancement of AI, moving from a system focus on rule to a more vibrant, dynamic and adaptive one. Prior to the advent of AI, rule-based algorithms were unable to grasp the subtleties and complexity of human language which puts forth the severe limited usage of NLP (Reshamwala, et al, 2013)[8].

Figure-1: Natural Language Processing (NLP)

Source: https://www.nextiva.com/blog/nlp-in-customer-service.html

2.3 Robotics:

Designing, building, and operating robots is the effort of the multidisciplinary field of robotics. Robots are programmable machines that may be controlled by computer systems, perform tasks fully or partially on their own, and interact with their surroundings using sensors and actuators. Despite having different objectives and applications, robotics is regarded as a subset of AI. AI techniques empower robots with the ability to process sensory data, gain knowledge from experience, identify the trends & patterns, communicate, and make decisions. This integration enhances the capabilities of robots and paves the path for the progress of autonomous systems (Rayhan, 2023)[9].

2.4 Artificial Neural Network:

Neutral networks are nothing but the Machine Learning (ML) models which intricate several functions of human brains. The processing units that comprise networks are considered as nodes. Like human neurons in a brain transmit electrical impulses to one another, these nodes transmit data to one another. An amalgamation of AI in the Neutral Network alias with Artificial Neural Network (ANN), a data processing paradigm that draws inspiration from the brain and

[7] Chowdhury, (2000). Digital Libraries: Philosophies, Technical Design Considerations and Example Scenarios
[8] Reshamwala, et al, (2013). Review on natural language processing
[9] Rayhan, (2023). Artificial Intelligence in Robotics: From Automation to Autonomous Systems

other organic nerve systems. A crucial component of this paradigm is the discrete structure of information processing system which is composed of a vast number of interconnected processing units, or neurons, that cooperate to resolve problems. ANNs learn by doing just like what human beings do. Through a learning process, an ANN is trained for a specific application such as data categorization or pattern recognition, (Maind & Wankar, 2014)[10].

2.5 Pattern Recognition:

The main objectives of the machine learning field of pattern recognition are to identify and categorize the forms and regularities in data (Rathod, 2018)[11]. The practice of utilizing computer algorithms to categories incoming data into objects, classes, or categories based on important qualities or regularities is acknowledged as pattern recognition. Computer vision, image segmentation, object identification, radar processing, speech recognition, and text classification are just a few of the fields that use pattern recognition. One of the most crucial instruments in process control for locating process issues is pattern recognition based on AI (Lakhsmi & Sharada, 2019)[12]. For computerized assistants of virtual reference, the advisory librarians for the library users, virtual narrators, and the guides of the library websites, pattern recognition of AI tools improves in-person human interaction (Das & Islam, 2021)[13].

The review suggests several practical solutions to overcome the challenges faced by developing countries in implementing modern tools in library services. These include partnerships between libraries and technology firms, investment in infrastructure and resources, training and capacity building for library staff and the development of regulatory frameworks to protect user data (Barsha and Munshi, 2023)[14].

3. Research Gaps:

Form the existing literatures, it was found that a significant research gap exists in understanding how library services using modern tools, including digital services and platforms, address the diverse and evolving needs of users. This gap stems from the rapid changes in technology, relationship between the modern tools & library services and the challenges libraries face in adopting the efficient library services to a digital environment.

[10] Maind, S.B., & Wankar, P. (2014). Research Paper on Basic of Artificial Neural Network. *International Journal on Recent and Innovation Trends in Computing and Communication*

[11] Rathod, (2018). Artificial Intelligence Based Pattern Recognition

[12] Lakhsmi & Sharada, (2019). Artificial Intelligence Based Pattern Recognition

[13] Das & Islam, (2021). Application of Artificial Intelligence and Machine Learning in Libraries: A Systematic Review

[14] Barsha, S., & Munshi, S. A. (2023). Implementing artificial intelligence in library services: A review of current prospects and challenges of developing countries

4. Objectives of the Study:

(i) To judge the nexus of relationships between modern tools and library services
(ii) To search for the utilities of incorporating modern tools for effective library services
(iii) To seek out the concerns of incorporating modern tools for competent library services
(iv) To suggest for policy prescriptions to incorporate modern tools for well-organized library services

5. Methodology of the Study:

This study investigates how modern tools can be incorporated into efficient library services using a descriptive research methodology. Understanding the benefits, challenges, and effects of adoption of modern tools on library operations and services is the main goal of this study. The basis for this study has been a review of the relevant existing literatures. This study, which is fully based on the results of the reviewed literatures, has been accomplished by using the secondary sources of data collected from previous works, including books, journals, magazines, newspapers, theses, and other thorough searches in web-databases such as Academia, ResearchGate, and Google Scholar, etc.

6. Data Collection of the Study:

A comprehensive literature search was carried out for this study restricted to peer-reviewed journals, books, conference papers, proceedings, handbooks, blogs.

6.1 Inclusion and Exclusion Criteria:

Inclusion criteria were: (1) articles must be written in English, (2) articles must be about any of modern tools like- ES, NLP, ANN, Pattern Recognition or Robotics (3) articles must belong to the sub-area of Library and Information Science (4) title, abstract and keywords of the articles must discuss libraries with the application of any of modern tools like- ES, NLP, ANN, Pattern Recognition or Robotics. The exclusion criteria were: (1) non-digital publications, (2) Publications not available for full review, (3) articles not in English language, (4) There is no application of any of modern tools like- ES, NLP, ANN, Pattern Recognition or Robotics.

6.2 Data Source & Modern Tools Applied in Library:

After careful consideration of inclusion & exclusion criteria, data was collected for this study which is shown in the following table.1

Table.1: Modern Tools Applied at the Domain at Library

Name of Modern Tools	Tasks in Library	Case Study	Data Sources
Expert System (ES)	Classification & Cataloguing, Reference Service, Information Service & Retrieval, Document and Delivery Service, Abstracting & Indexing	International civil aviation organization Library uses CUTT-X- an expert system for automatic assignment o cutter number was developed using Microsoft ACCESS relation database; Maccat, developed at the University of California used Apple HyperCard environment; Natural Agriculture Library (NAL) developed Cat-tutor, for training catalogues to provide descriptive cataloguing of computer files; RAS (Reference Advisory Systems)- is an expert system developed at San Diego State University to assist in providing reference services; In Johnson Library of Government Documents developed the Government Document Reference Aid (GDRA) using ES	Praveenraj, et al. (2025), Rudiansyah (2023), Rahi (2019), Amin and Razmi, (2009), De Silva (1997), Holthoff (1993), Chang (1990), Kemp (1988),
Natural Language Processing (NLP)	Information Retrieval, Automated Metadata Generation, Chatbots and Virtual Assistants, Multilingual Access, Digital Archiving & Preservation, Multilingual Access, Research Integrity	The New York Public Library has implemented an NLP-powered chatbot that assists users in finding resources using conversational language; RAS (Reference Advisory Systems) at Diego State University; National Library of Medicine's PubMed system uses for Information Retrieval; The University of Oklahoma Libraries;	Ashikuzzaman (2025), Praveenraj, et al. (2025), Wang (2022), Jeevitha & Kaviatha (2019), Reshamwala, et al, (2013),
Robotics	Automated Book Retrieval Systems, Inventory Management and Shelf-Reading, Controlling Circulation Workflow, transporting articles, acting as subject guides, attending reference queries, enhance information retrieval, customized user experiences,	New York Public Library-employs document delivery Robot that move on racks to bring resources to its users; Palo Alto city Library- have a humanoid NAO Robot for coding workshop and the robots shows to introduce Robotics to the public; Westport Library have two robots named Nancy & Vincent teaches the computer programming; Temple university's Charles library; Pennsylvania State University Library; Library of University of Technology, Sydney;	Gopi & Ramashanti (2024), Indrajit, et al (2024), De Sarkar (2023), Cordell (2020), Padilla (2019), Mahalingam et al. (2017),
Artificial Neural Network (ANN)	Cloud Library Construction, Search Accuracy, Borrowing and Returning Efficiency, Data Processing Capability, Online Number and Operation Efficiency, Handwritten Digit Recognition, Deep Learning	the Harvard Library improves search results over time using ANN; The Los Angeles Public Library; The University of Texas at Austin Libraries;	Praveenraj, et al. (2025), Lei, Yingxia, & Yuli. (2022), Sun, et al. (2022), Echedom & Okuonghae (2021), Padhi & Nahak (2019), LeCun, Bengio, & Hinton (2015)

Pattern Recognition	Speech Recognition, Character Recognition, Library security, User identification, RFID management	Karagandy University Library; The British Library;	Praveenraj, et al. (2025), Suryawanshi (2024), Adetayo (2023), Das & Islam (2021), Yang et al. (2017), Lei et al. (2018), Du et al. (2019), Minami (2008)

7. Analysis of Collected Data and Major Findings:

7.1 Nexus of Relationship between Modern Tools and Efficient Library Services:

Embarking in contemporary tools collaborators and library users is vital for recognizing their needs, beliefs, responses, and apprehensions. Furthermore, with the aim of recognizing the aptitude and relation of contemporary tools with effective library service, the library professionals will not only have to scrutinize them, but also to evaluate the impacts of incorporating modern tools for delivery of library services regarding their effectiveness and efficiency.

7.2 Expert Systems (ES) and Library Service:

From the Table:1, it is shown that ES applied at the different domain at library such as Classification & Cataloguing, Reference Service, Information Service & Retrieval, Document and Delivery Service, Abstracting & Indexing. Kemp (1988)[15] emphasized on the incorporation of expert system in the library operation for furnish the reference area to assist the users in finding out the replies to their concerns from the recommended origins in the precise manner. According to Rudiansyah, (2023)[16], this system can help the users in accomplishing lots of library tasks like cataloguing, referencing, archiving, literature selection, indexing, and cataloguing.

7.3 Natural Language Processing (NLP) and Library Service:

The library helps its users for effective service by applying the NLP at Information Retrieval, Automated Metadata Generation, Chatbots and Virtual Assistants, Multilingual Access, Digital Archiving & Preservation, Multilingual Access, Research Integrity (shown at Table.1)

Libraries can encourage and guarantee that an increasing number of users utilize their services by adapting the natural language interfaces in a similar way (Jeevitha & Kaviatha, 2019)[17]. By helping the library users through the creation of search queries and extraction of pertinent material from extensive academic databases and digital libraries, NLP supports research and

[15] Kemp, (1988). *Computer-based Knowledge Retrieval*
[16] Rudiansyah, R. (2023). Artificial Intelligence: Prospects and Challenges for Library Services
[17] Jeevitha, & Kaviatha, (2019). A Study on Adapting Natural Language Processing for Library Services Delivery

reference services. This feature improves the quality of the material retrieved and speeds up the research process (Ashikuzzaman, 2023)[18].

7.4 Robotics & Library Service:

A robotics system for the library can be efficient to distribute books to users. To deliver the books to the users, Mahalingam et al. (2017)[19] suggested a line follower robot that travels in a predefined path. Indrajit, et al (2024)[20] opined that there are a lot of chances for innovation and progress when robotics and AI are included into library services. These technologies, which streamline routine procedures, enhance information retrieval, and provide customized user experiences, have the potential to fundamentally alter how libraries operate in the digital age. In the Table.1 several case studies of robotics are given. One of the examples of application of Robotics is Palo Alto city Library- have a humanoid NAO Robot for coding workshop and the robots shows to introduce Robotics to the public.

Figure No. 2: Case Study of Robotics

Source- https://images.app.goo.gl/9YVKKEZLwtj1U5Pd7

7.5 Artificial Neural Network (ANN) and Library Service:

ANN algorithm's intelligent service base will handle resource allocation and task scheduling in the libraries utilizing the library resources acquired through the specific mechanism of acquisition. It also performs the responsibilities of in-charge of managing the users, digital resource security, and other allied tasks. Along with collecting, transmitting, and administering the data sources via the proper organization and management of equipment, the user service machine oversees the collection of data and its sources as well. Users receive the same through an integrated and unified ANN (Sun, et al, 2022)[21].

7.6 Pattern Recognition and Library Service:

[18] Ashikuzzaman, (2023). Application of AI in Libraries: A Comprehensive Study on the Integration and Impact of Artificial Intelligence in Library

[19] Mahalingam et al. (2017). Smart Robots in Library Management System

[20] Indrajit, et al (2024). Use of Robotics and Artificial Intelligence for Enhancing Library Services

[21] Sun, et al, (2022). Construction of Cloud Library Intelligent Service Platform Relying on Artificial Neural Network

To assure the security of libraries, the identity of the library users, recognition of the titles of library resources, management of RFID technology for libraries, and other interrelated administrative activities, some sophisticated AI and ML techniques, such as python libraries for pattern recognition are also being deployed. It has also been demonstrated that deep learning algorithm, ANN algorithms, and CNN algorithms in Machine Learning are effective AI tools for research, collection finding, search, and analysis. Additionally, a chatbot or conversational agent with artificial intelligence serves as a virtual reference librarian.

7.7 Impact of Modern Tools for Providing Efficient Library Services:

In this age of burgeoning technology, implication of contemporary tools in library services will aggravate users' accessibility to precise information and be treated a powerful tool for the usual penetrating the users into libraries. Its advantages for library service are incalculable.

- Automation of routine tasks
- Faster information processing
- 24/7 service availability
- Personalized recommendations
- Improved search functionality
- Adaptive learning support
- Reduction in manual labour costs
- Optimized resource allocation
- Energy efficiency
- Advanced data analytics
- Virtual and augmented reality experiences
- Predictive collection development
- Seamless integration of digital and physical resources

Chen et al. (2021)[22] opined that the incorporation of modern tools in human resource development has paved the way of generating smart libraries, resultantly the library services are gradually moving towards a pioneering one.

7.8 Major Concerns of Incorporating Modern Tools for Efficient Library Services:

Several challenges still stand in the way of the seamless adoption of modern tools for effective library services, like, lack of maintenance culture, insufficient network connectivity, technical constraint, fear of job-displacement, data privacy, bias in algorithms, ethical consideration, burgeoning cost, staff training & orientation. One of the biggest obstacles to the creation and

[22] Chen et al. (2021). Artificial Intelligence Methods in Natural Language Processing: A Comprehensive Review

transformation of smart library services through the adoption of contemporary tools is the inability to afford all the requisite equipment for deployment. Technical difficulties, such malfunctions caused by human error or technical flaws, are equally concerning (Padhi & Nahak, 2019)[23]. Poor networking, lack of well-trained librarians, erratic power supply, out-of-date tools &technologies, and high cost of implantation have to considered before incorporating modern tools in library systems (Echedom & Okuonghae, 2021)[24]. Financial constraints are a matter of serious concern to incorporate contemporary tools in library services. Most of the existing libraries may not have adequate physical infrastructure to care sophisticated tools in library services. Bulky data can be collected by using AI algorithms which raises concerns about data security and privacy. The requirement for specific abilities, such as knowledge of programming, machine learning, and data analysis, presents another difficulty.

8. Conclusion and Recommendation:

Libraries must rethink their operations and adopt their services if they want to prosper in the new information economy. Using artificial intelligence in libraries is a surefire way to do this. This study suggests the following recommendations for bringing forth effective library services using modern tools--

- To facilitate the adoption and deployment of modern tools, libraries should give top priority to investments in IT infrastructure. Sufficient financial budgets for embracing contemporary tools, the burgeoning technology, in library operations should be kept up with.
- To pipe up library professionals & library users with the new capabilities, library orientation/induction programmes must be organized at regular interval.
- Libraries should investigate the joint ventures and consortia agreements with other institutions/organizations to exchange resources, knowledge, and best practices for using contemporary tools so that the users can avail the efficient library services.
- To encourage library users' knowledge regarding ethical use of incorporating AI technologies in library services, libraries should place a high priority on user education and digital literacy programs.
- To guarantee the appropriate and open use of contemporary tools for providing library services, library administration should create the ambience of good governance as well as policy framework& implementation.
- To gauge the impact, efficacy, and user happiness of efficient services using modern tools, library administrative authorities should have to evaluate and appraise them continuously at regular interval.

[23] Padhi & Nahak, (2019). The Role of Smart Library and Smart Librarian for E- Library Services

[24] Echedom & Okuonghae, (2021). Transforming Academic Library Operations in Africa with Artificial Intelligence: Opportunities and Challenges

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