IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Innovation In Libraries And The Possible Use Of Artificial Intelligence (AI) In The Future

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Abstract: Innovation in libraries with the help of ICT (Information and Communication Technology) and the possible integration of AI technology into library systems in the near future is examined in this article with the goal of improving resource accessibility, streamlining operations, and improving user experience. It cover innovations in library using Radio Frequency Identification (RFID), Mobile OPAC, Chatbots, Robots and the possible use of AI applications such as expert systems, natural language processing (NLP) ChatGPT, Microsoft Bing for cataloguing. Additionally emphasized are the possible advantages of AI in collection development. Libraries may streamline operations, provide individualized services, and adjust to the changing demands of users in the digital era by implementing AI.

Index Terms -**:** Artificial Intelligence, Internet, Libraries, Chatbot, Robot, Mobile OPAC, Radio Frequency Identification, Natural language processing, Expert system, Chat GPT, Virtual Reality.

1. Introduction:

Today, the society is getting centered towards the use of technology for saving time and for easy access to the different needs of its users, for example: one need not go to market for shopping as the products are easily available on various shopping sites on the internet. People usually prefer it as it saves time which is a very precious thing in today's competitive world. This has all become possible with development in the field of Computer Science and has led to the innovation in libraries leading to its automation reducing time and labour. One area for research and development in the field of Computer Science today is "Artificial Intelligence" (Mehta et al., 2023). Nowadays, many rely on artificial intelligence (AI), but they are not quite sure if their assumptions are accurate. It has been observed that people usually visit libraries when they have certain doubts regarding information that they have gathered from online sources. If AI is integrated into libraries, libraries will remain the primary and most reliable source of information even in the digital age.

2. Artificial Intelligence (AI)

Artificial Intelligence (AI), as we know it today, is a relatively new field. Even though some groundwork had been laid earlier, AI began in earnest with the emergence of the modern computer during the 1940s and 1950s. It was the ability of these new electronic machines to store large amounts of information and process it at very high speeds that gave researchers the visions of building systems which could emulate some human abilities. During the past forty years, we have witnessed the realization of many of these early researchers' visions. We have seen computer systems shrink in size and cost by several orders of magnitude. We have seen memories increase in storage capacity to the point where they equal a significant fraction of the human brain's storage capacity. We have seen the speed and reliability of systems improved dramatically. And, we have seen the introduction of many impressive software tools.

AI is a branch of computer science concerned with the study and creation of computer systems that exhibit some form of intelligence: systems that learn new concepts and tasks, systems that can reason and draw useful conclusions about the world around us, and systems that can understand a natural language or perceive and comprehend a visual scene, and systems that perform other types of feats that required human types of intelligence. (W PATTERSON, 2007)

The intelligence shown by machines in contrast to natural intelligence shown by humans is generally referred to as "Artificial Intelligence" (AI). It enables a machine to perform a task such as understanding and interpreting messages or voice commands or moving an object. AI uses a combination of statistics, probability, mathematics and artificial neural networks. Today, AI is being used in almost every field to solve problems of varied kinds. The basic use of AI would be to identify a problem and finding a solution to it. "Python" is one such programming language that is used in artificial intelligence as it is easy to learn, use and has a rich library of packages like Numpy, python Notebook and matplotlib.AI's greatest potential is to create machines or robots that can think, act and even surpass human intelligence. This has a significant impact on librarianship. AI is being used more in libraries these days. Some among these are virtual reality for immersive learning, book reading and shelf reading robots and expert systems for reference services. While it may seem like integrating artificial intelligence into libraries will distance librarians from their patrons but in reality, it will enable them to serve its patron better rather than replacing them. The increasing need for information access has aided in the advancement of society in recent years, and libraries have long been the main source of that information. Libraries have changed to match the provision of information to a wider population due to the paradigm shift in the format and dynamics of knowledge and information brought about by the quick development of computer technology and software applications, particularly artificial intelligence. Libraries may become obsolete in this day and age if they don't start making use of new technology and methods to revolutionize the way they distribute information and services (Russell et al., 2010, Mehta et al., 2023).

Image 1: AI Image

3. Artificial Intelligence integrated Chabot and its application in Libraries

Chatbots have experienced significant growth over the past decade, with a proliferation of new applications across various domains. Previous studies also demonstrate the trend of new technologies, especially artificial intelligence, being adopted in libraries (Yan et al., 2023). Chatbot is a virtual assistance that can be created by using programming languages and allows a form of interaction between humans and machine. Numerous chatbots are integrated to websites, which can give replies to queries of users instantly. Creation of a virtual Chatbot and integrating it with the OPAC of library would help in searching the catalogue and also give other information to its users instantly (Russell et al., 2010, Mehta et al., 2023). Ask a Librarian is a Chabot that has been integrated to the Website of Sikkim University to help the patrons with their queries.

Image 2: Image of a Chabot

4. Robots and its application in libraries

The field of robotics is often described as a subfield of AI. A robot is a mechanical device that can be programmed using AI to perform specific tasks. The application of robots in library activities is one of the current trends of AI. Accessibility to the vast collection of information available on the web is a hallmark of the digital age. However, vast treasure of knowledge in the world is still in the pages of printed books. Tracing these books in libraries is laborious and often time consuming. Specially programmed robots can be used in libraries for accurate shelving of books in its specified location and retrieval of the same. As the acquisition of books in the library may increase with time, this may result in lack of availability of space. The process of lifting heavy books and to move them to unreachable spaces can be accomplished with the help of a robot. The Helsinki Central Library Oodi in Helsinki, Finland has used a robot. The robot has been useful from sorting, shelving of books and even for customer service. Due to this it has saved a lot of time of the librarians and they can get more involved in other professional activities.

Image 3: Image of a robot in Helsinki Central Library Oodi, Finland

5. Mobile- OPAC

The thing that people most frequently use these days is a mobile phone. It is easy to carry and it can give access to any information in the blink of an eye. A mobile OPAC is a software that is designed to work on a mobile phone or a tablet. It will help user to search for books by entering specific key-words like name of the book, author's name, publication etc. One can easily reserve book using it. University libraries can use it to upload and upgrade databases on its cloud. With this the University Librarians can also generate Management Information System Reports (MIS) in graphical formats during NAAC committee visits. LSearch is a Mobile-OPAC being used in Visva- Bharati University (A Central University) Shantiniketan, West Bengal. This app can be downloaded from Google Play Store. With the introduction of this app the search of the catalogue has also increased evidently.

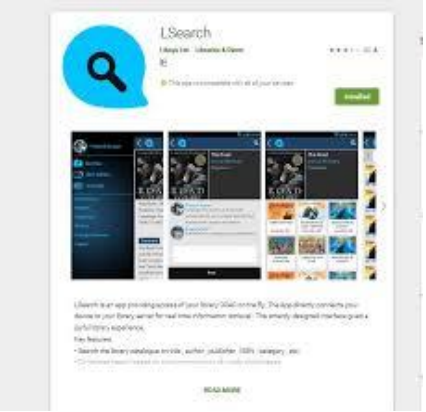

Image 4: Image of LSearch Mobile app

6. Radio Frequency Identification (RFID)

RFID uses automatic identification and data capture technology where the digital data encoded in the RFID tags or smart labels are captured with the help of radio waves, and then are directly entered into the computer systems. Smart cards consisting of both RFID and barcode technologies can be made for the patron of the library.

The users can have their library cards and ID encoded with tag or barcode integration. RFID tag data can be easily read outside the line of sight of the electronic reader whereas barcodes are required to be aligned with an optical scanner. Each barcode is linked to a specific book entry in a computer database that is automatically updated when books are scanned during issuing or returning.

The search function can help students to go to the library section on the university website and easily look for the book or topic. The students and library staff must be able to search books by using filter options, such as subjects, authors, or publishers. The search result will then inform the user whether the book is available and where it can be found, thus making the process hassle-free. This technology is used by universities libraries. All the collections in the library are RFID tagged that helps the user to issue and return books independently. Some of the institutions in the North East region that use this technology are as follows:

Table 1: Name of the Universities and their address

Sl. No.	Name of the institute	Address
1.	Sikkim University	Gangtok, Sikkim
2.	North Eastern Hill University (NEHU)	Shillong, Meghalaya
3.	Indian Institute of Management (IIM)	Shillong, Meghalaya
4.	National Institute of Technology (NIT)	Silchar, Assam
5.	Mizoram University	Aizwal, Mizoram

Image 5: Image of RFID technology being used in libraries

7. Use of Natural Language Processing (NLP)

Natural language processing, or NLP, combines computational linguistics, rule-based modelling of human language with statistical and machine learning models to enable computers and digital devices to recognize, understand and generate text and speech. NLP is a computerized approach to analyze text that is based on both set of theories and a set of technologies. NLP is a theoretically motivated range of computational techniques for analysing and representing naturally occurring texts at one or more levels of linguistic analysis for the purpose of achieving human-like language processing for a range of tasks or applications.

As we all know that library collections vary from place to place and are in different languages. We can use NLP in libraries as well to convert the books and magazines published in different languages into English and vice-versa. With the help of NLP we can convert the traditional books in different languages into English and preserve them for future use (Khurana et al., 2022), (N, 2021).

8. Expert system in Library

The library can create an expert system to offer reference services. Given that teams of the most knowledgeable specialists in the subject contribute to the creation and updating of the expert system's knowledge base, it can respond to the enquiries of its patron more thoroughly than a single librarian. Based on the keywords or phrases in the user's question, we can build an expert system to react to that query.

An expert system in the context of libraries is a knowledge-based computer system that emulates the decision-making processes of human experts. These systems are specifically designed to support various functions within libraries, including reference services, retrieval instructions, indexing, Selective Dissemination of Information (SDI), Current Awareness Service (CAS), online searching, and archiving. By utilizing predefined rules, facts, and heuristics, expert system assist librarians and users in making intelligent decisions related to information resources (Omame& Alex-Nmecha, 2020).

9. Use of ChatGPT and Microsoft Bing for Cataloguing/MARC record

Cataloguing is a fundamental function of libraries, facilitating the organization and retrieval of information resources for users. Traditionally, cataloguing has been a manual and labour intensive process, requiring librarians to input bibliographic data for each item into library management systems. However, with the proliferation of digital content and the increasing diversity of materials, traditional cataloguing methods are becoming inadequate. In response to these challenges, libraries are exploring innovative technologies such as AI and web search engines to modernize their cataloguing processes.

ChatGPT and Microsoft Bing, developed by OpenAI, is an advanced AI model capable of understanding and generating human-like text based on given prompts. The ability to accurately create descriptive records using ChatGPT could significantly reduce the time and resources required for copy cataloguing which could free up library workers to focus on other important tasks, such as collection development, user services, and metadata management. Moreover, ChatGPT could improve the accuracy and consistency of records in library catalogues. As ChatGPT follows established cataloguing rules, records created by the model are less likely to contain errors or inconsistencies; this could lead to improved search and discovery experiences for library users, as well as better interoperability between library catalogues and other systems (Applications of Artificial Intelligence 2024),(N, 2021). Microsoft Bing, on the other hand, is a widely used web search engine known for its comprehensive index of web pages and multimedia content. By combining these technologies, libraries can automate and enhance various stages of the cataloguing workflow.

10. Use of AI in collection Development

Artificial Intelligence system could also be developed to handle resource development or collection development of the library. Collection development deals with the resources selection, acquisition development in the library or simply the process of meeting the user's requirement in a timely and economical manner through acquisition. University library generally select books from different publishers and suppliers with the help of faculty members and after final approval send the list to suppliers/publishers for the price (in respect to quality and quantity). Nowadays every publishers/suppliers is available through mail and website. Here library can take help from AI to get the feedback from others about their experiences of purchasing a book from particular

supplier/publishers. It can also recommend new books and periodicals for the library (Mehta et al., 2023).

11. Virtual Reality (VR) in Libraries

Virtual Reality (VR) is the use of computer technology to create a simulated environment. It is a computer technology that uses multi-projected environments, sometimes in combination with physical spaces, to generate realistic images, sounds and other sensations that simulate a user's physical presence in a virtual or imaginary environment Virtual reality headsets are built with artificial intelligence features such as computer vision, image processing and speech recognition, to create an artificial 3D world that immerses users in a 360-degree digital world. Until now, libraries have not fully explored the potential of virtual reality (VR), augmented reality (AR), and mixed reality (MR). Augmented reality enhances users vision/sight by overlaying 3D objects over real word, while mixed reality allows digital created objects to interact with the real word. The combination of virtual reality, augmented reality and mixed reality can be used in libraries to enhance user experience and give opportunities for disabled or remote users to visit the library virtually. Like the traditional library environment, a patron using virtual reality headset is able to move around the artificial library environment and by simulating as many senses as possible (vision, hearing, touch, smell), interact with virtual library resources. Furthermore, virtual reality gives the patron a virtual presence (tele-presence) in the library by immersing him/her inside the virtual library environment rather than viewing it from a computer screen. Since creating a virtual reality of all the information material in the library might seem to be difficult or time consuming, the combination of mixed reality and virtual reality can be used to link the enhanced robotic system for browsing/reading materials, so that when patrons from the virtual reality environment initiate an action to read a particular book, the book-reading robot is signalled/triggered to locate the physical book in the library in order to enable the virtual patron to browse through it via a live-feed of the pages of the book captured from the book-reading robot and transmitted to the virtual reality headset of the patron. It should be added that, the virtual reality headsets are a product of artificial intelligence systems that have gained applications in various field of science and engineering, medicine, aviation, military etc. It is mostly used in these fields for live training of students especially when it involves hazardous or sensitive activities in real life situations.

12. Conclusion

The advancement of technology with the help of ICT has eased the work of librarians and has attracted patrons in the library. RFID technology has been used in a number of libraries in the world and also in institutional libraries in the North East region. Mobile-OPAC have been developed for institutes with the help of IT (Information Technology) firms. The third law of library which states Every Book its Reader has been made much possible through Mobile- OPAC wherein individuals can search the catalogue through their mobile phones. Robots that have been used in Helinski Cental Library Oodi, Finland has eased the work of the librarian thereby giving them time for other professional activities. The advancement of technology in the domain of artificial intelligence can offer libraries unparalleled prospects to foster innovation and enhance their community's services. Libraries can improve user engagement, change conventional procedures and increase access to information resources by utilizing AI tools and approaches. The potential use of AI in libraries are numerous and exciting, ranging from robotic shelving systems and virtual assistants to AI-powered cataloguing and collection building. Libraries can remain efficient, responsive, and relevant in the contemporary times by embracing AI. While the prospect of AI is immense, libraries must navigate ethical considerations. Privacy protection, fairness, and transparency are critical and libraries should safeguard user privacy when collecting and analysing data. Additionally, AI algorithms must be designed to avoid perpetuating biases present in training data. Striking a balance between automation and human expertise ensures responsible AI adoption. By embracing AI thoughtfully and ethically, libraries can continue their vital role as community hubs, empowering users and transforming services.

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