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ARTIFICIAL INTELLIGENCE DRIVEN TRANSFORMATION IN HIGHER EDUCATIONAL INSTITUTES: WEBSITE BASED STUDY WITH SPECIAL REFERENCE TO HEI LIBRARIES

Mrs. Poonam. M. Harode
Research Scholar
Visvesvaraya National Institute Technology ,Nagpur
Email Id - poonam.312h@gmail.com
Mob.No-9404080223

Dr. (Mrs.) Manju N. Dubey
Librarian, R.S Mundle Dharampeth Arts & Commerce College, Nagpur
Email Id - libraryrsmdacc@gmail.com
Mob.No. - 9960551181

Abstract:

Artificial Intelligence (AI) which is predicted to be generating human intelligence in machines is now familiar to almost all the professions to some extent. It is mainly related to the field of Computer Science but its use, scope and coverage is not limited to it. Use of AI tools and technologies has opened new doors in services provided across different professions whether it may be markets, institutions, libraries, health etc.

This paper seeks to investigate about the expected and possible use of generative Artificial Intelligence (AI) tools in enhancing the efficiency of library services. The study undertaken reveals the extent to which artificial intelligence tools and technologies are applied in top 10 globally ranked Universities and their Libraries, through the study of their websites. The research methodology involves study of websites of 18 Universities and their Libraries ranked highly in some of the world ranking system. Scholarly literatures on the related topics were also explored & reviewed from Google Scholar, Research Gate and Academia.edu. The finding of the study gives an overview on application of AI tools in Libraries.

Key words: Artificial Intelligence (AI), Emerging technologies, Future Libraries, World Ranking Universities, Generative AI, Chatbots, Higher Educational Institute (HEI)

Introduction:

Technologies are transforming and its effect is seen in every field to some or the other extent. Advanced or updated version has become a word of routine discussion in every sector, may it be of education, health or finance. Emerging technologies are reshaping libraries and library services in HEIs. The journey of transformation of libraries from book warehouse to techno savvy hubs started from manual to automated services moving towards integration of ICT, inclusion of digital technology and finally embedding artificial intelligence tools for smarter services. The purpose of libraries is to provide best possible services to the users in best possible way which co relates with the purpose of using AI Tool and technologies in their services. Hence AI tools can be assumed to work as an expert assisting tool for librarians rather than being a threat to their profession. This study also purposed to identify the extent of AI applications in HEIs and their libraries.

AI is used in aviation, finance, hospitals and medicine, heavy industry, customer service, and on the Web. AI has been assumed to be the computer design that can work as humans do. Rather it is expected to give more better, instant, sophisticated and critical service

in a very simple, easy and user friendly manner. Hence it is also assumed that AI innovations may affect the position of human beings in service giving organization but that may not be that fact only if one take it in positive way and use the technology for improving the standard of service . AI tools may emerge as a boon for the fast changing, smart and busy world. It would be interesting to study how AI tools are integrated in library systems of HEIs. Any technology whether it may be ICT, Digital or AI can be used in either ways ie. constructive or destructive. It is solely the responsibility of human being and depends on their perception, thoughts and desire to achievements, in what way it is used. Libraries have always been a pathfinder in success of its nation and integration of AI in libraries will surely add up to its efficiency in services.

Review of literature:

Many articles were explored to study the prevalence of Artificial Intelligence in the field of library services to know the extent to which AI is assisting and helping Librarians in providing effective services to library users and satisfying their information needs. Review study reveals that AI can assist library service providers via expert system, NLP, speech recognition, robotics etc. This machines i.e. AI can help in various task like classification, cataloguing, indexing, reference service performed in libraries and reduce the work load and time required to be done by the humans. They also tried to identify and address the merits, demerits and challenges in implementation of AI in libraries. In fact most of the papers reviewed here speaks about the chatbots that were built, utilized and known in different fields since 1966. Chatbots due to their interactive features were found to be mostly implemented in libraries and other fields as compared to other AI tools. They give real humanlike experience to their customers. Chatbots like ELIZA, PARRY, Jabberwaky, UltraHal, Suzette/Rosette, Cypher etc. are found to be popular in providing services in different fields. Similarly Lillian, Emma, Pixel, Darcy, Stella, askademicus, Kornelia are few of the examples identified providing reference service in libraries. The chatbots were also found to won the Loebner prize one or more times and proved their efficiency to be real humanlike interactive machines. Loebner competition was started by an inventor and a businessman Hugh Loebner in 1990. In this competition Chatbots were judged and ranked on basis of their humanlike behavior. (McNeal & Newyear, 2013) Germany, USA and China are among the initiator countries that are using chatbots and making it favorite among the users. Assistance provide by these chatbots were helpful for the service providers and interesting for the users of those services and they were well appreciated by them. McNeal & Newyear discussed about chatbots and highlights about different notable chatbots that were programmed for different purposes since 1966 .The author also stated few typical conversations of these chatbots with the users. Author have also discussed about the chatbots that were used in several German and US Libraries working as virtual assistant and embedded in libraries websites answering to user's queries. Tubachi also discussed about history of development, usability applications, advantages, disadvantages and limitation of chatbot and shared examples of different chatbots practically applied in different libraries for reference service. (Tubachi & Tubachi, 2017) Majideh S, Behzadi H. and Gomroki G. discuss about various artificial intelligent tools that can be used as smart applications in various library functions and services. Author has reviewed and referred various research paper published about the features, usability and applications of chatbots in library services .The paper also discuss about the chatbots that are used in libraries for providing user service in different Libraries of Germany (Majideh, Behzadi, & Gisu, 2022). Julie Behan & Derek T. O'Keeffe describes about the making of a robot named LUCAS. LUCAS (Limerick University Computerized Assistive System) is a robot that was devised for guiding the users for locating

textbooks in the bookshelf. This robot was capable of interacting meaningfully with the user to know their book requirement and help them to locate the book in the bookshelf. This robot was found useful in providing assistive services to the elder people and can be used in any service giving location. While developing this robot the researcher has taken utmost care to develop natural human interaction quality in the device so that it would give human like experience and be easily acceptable by the users . The robot successfully offered its services to the patrons with disability or cognitive impairments in Library of Limerick University, Ireland. (Behan & Keeffe, 2008). Mohammed Ali, Salihin explained how Chatbot was developed based on messaging platform Telegram and Google Dialog flow for providing library services in Singapore Management University. They further prepared a campus wide chatbot AskSmooSmoo for answering administrative queries. It also tells about Pepper, a semi-humanoid robot, who was programmed to conduct introductory workshops and library tours. (Mohammed Ali, 2019) Isaiah and Juliet discuss about the artificial intelligence technology and justify its application in Library in a book chapter. Further they describe the concept of artificial intelligence explored through various research papers. It also briefly discuss about various trends seen in the field of Artificial Intelligence and various field wherein artificial intelligence is used to provide services. It also touched upon robot applications in Connecticut's Westport Library, Aberystwyth University and British Library's National Newspaper Building and different museums and archival centres. It also speaks about use of virtual reality technology for providing experience of physical presence in libraries and museums to users from remote location. Further it discuss about how this technology benefits by assisting in classification, cataloguing, indexing and retrieval of information sources. It also asserted some challenges and demerits of using AI for providing library services. (Omame & Alex-Nmecha, 2020). Simon Prananta Barus, Evalien Surijati explained about chatbot that was built using dialog flow platform and implemented in Mantana University Library during Corona Pandemic for answering user queries (Simon & Evalien, 2021). John Dowd describes about the creation, implementation and trial of a chatbot LISA (Learning and Information Service Assistant) in library website and OPAC system of University of Wolverhampton (Dowd, 2011). Joseph Vincze explained about chatbots. He presented a case study of chatbot EMMA implemented in Mentor Public Library of Ohio and tells about A.L.I.C.E. Artificial Linguistic Internet Computer Entity) which works as Virtual Reference Librarian and has won the Loebner competition thrice in 2000,2001,2004 and considered to be most humanlike by the judges (Joseph, 2017).

Aims and Objectives:

- The aim of this study is to gauge the use of AI applications in HEIs.
- To find out the extent to which the libraries have embedded AI tools in their services and its presence in Libraries.
- To study the existence of AI in highly ranked universities and their libraries.

Scope & Limitations:

The study was narrowed down to the universities ranked among top 10 based on QS World University Ranking, Times Higher Education World University Ranking and Shanghai Jiao Tong World Ranking. Top five Universities from QS World University Ranking by Subject were also included. The study was carried out for the university ranked in 2023.The study was limited to the data collected from websites of the universities and their Libraries.

Methodology:

QS World Ranking By Subject Category (consolidated list of top five universities from different subject category)	Times Higher Education World Ranking 2023 Overall	QS World Ranking 2023 Overall	Shanghai Jiao Tong Ranking 2023
Harvard University	University of Oxford	Massachusetts Institute of Technology	Harvard University
University of Cambridge	Harvard University	University of Cambridge	Stanford University
Stanford University	University of Cambridge	Stanford University	Massachusetts Institute of Technology
University of Oxford	Stanford University	University of Oxford	University of Cambridge UK
University of California, Berkeley	Massachusetts Institute of Technology	Harvard University	University of California, Berkeley
Johns Hopkins University	Harvard University	Imperial College London UK	Princeton University
INSEAD : The Business School For the World	Princeton University	California Institute of Technology	University of Oxford UK
London Business school	University of California, Berkeley	University College London (UCL)	Columbia University USA
Carnegie Melon University	Yale University	Swiss Federal Institute of Technology Zurich, ETH Zurich SWITZERLAND	California Institute of Technology
Massachusetts Institute of Technology (MIT)	Imperial College London	University of Chicago	University of Chicago USA
Columbia University			
Swiss Federal Institute of Technology Zurich, ETHZ			
California Institute of Technology			

Reference of AI in different context was explored through the websites of eighteen universities and their libraries to study the extent to which AI is being embedded in their academics, research and mission. Various articles were explored and reviewed to study about the possible applications of artificial intelligence tools in HEIs and their libraries. The sample selection was based on various Global University Rankings i.e. **Q**uacquarelli **S**ymonds (QS) World Ranking, Times Higher Education (THE) World Ranking and Shanghai Jiao Tong ranking of universities for the year 2023. Top 10 Universities from overall category for all three rankings and top five universities from QS world ranking by subject (i. e. Arts &

Humanities, Natural Sciences, Life Sciences & Medicines and Engineering technology) for the year 2023 were selected. The data was collected in Dec 2023. Various search terms like artificial intelligence, neural networks, deep learning, curriculum, generative AI tools were used to explore the websites. Search terms were explored in different context like strategic planning, guidelines and policy statements, vision and mission, course list, research, news and events to study about application of artificial intelligence technology in the university and their libraries.

Table No. 1 : List of Top 10 HEIsas per World Ranking.

Source: (University Ranking CH, 2009)

Findings:

The website of 18 eighteen HEIs and their libraries were explored to study the application of AI under different context like guidelines formulated for using AI Tools, research publications of the universities, Innovations in field of AI, curriculum based on artificial intelligence technology, various conferences, seminars, workshops , webinars held on, reflecting the innovations and discussions on AI technology, presence of AI perspective in Mission, Vision and Strategies of University . Out of these 18 sampled Universities three universities i.e. INSEED, Colombia University and University of Cambridge didn't showed any presence of artificial intelligence in their websites in any of the context mentioned above. The findings therein are as follows:

Guidelines framed using Artificial Intelligence:

Most of the universities have offered courses to study about artificial intelligence and undergoing research on this concept. They have been using various tools of artificial intelligence. Nine out of eighteen universities i.e. 50% have provided certain guidelines while procuring and usage of artificial intelligence tool which aimed to have an appropriate privacy and security protections. Guidelines were also prescribed for staff with respect to use of AI tools in teaching and learning process and those for students regarding engaging AI tools in their assessments efficiently and ethically. Proper care was taken to avoid feeding their confidential data in publicly available generative AI tools. Data was classified to different level of confidentiality and AI tools were categorized and permitted for different level of confidentiality. Different level of confidentiality was defined for different category of tools used.

Research Publications, Innovation and Curriculum on AI:

Almost 83.33% of the sample universities offered courses on artificial intelligence by Computer Science department. Some of them organized online courses for artificial intelligence. The courses offered were either one year course or short term courses on Artificial Intelligence, Machine Learning Natural Language Processing .

UCL offered one year courses in Artificial Intelligence for MSC level whereas four year courses for Graduate level as well as few short term courses were also mentioned. Almost 83.33 % of Sample University had research publications on various topics of Artificial Intelligence like machine learning, neural networks, robotics etc. and they had added in new researches based on Artificial Intelligence technology. University of California, Berkeley has developed an industry affiliated program namely BAIR Open Research Commons wherein 100

students and seven industrial partners were engaged in 70 projects on different topics related to AI. Many of them combine artificial intelligence within their research projects. Robotic Lab for research on small Unmanned Aerial Vehicles (UAVs) is developed by ETH Zurich in collaboration with their industrial and academic partners. Researchers of ETH Zurich has innovated a tool for measuring the depth of snow more accurately than ever with the help of Artificial Intelligence technology.

Some of the Universities for example ETH Zurich and UCL (University College London) had a distinct centre for Artificial Intelligence fostering research excellence, industry innovation, and AI entrepreneurship to promote trustworthy, accessible, and inclusive AI systems. Computer Science and artificial Intelligence laboratory is developed by MIT University. Five startups from John Hopkins University involving Data Science and AI to address social problems was awarded by Microsoft with Inaugural Microsoft Innovation Acceleration award. "A novel artificial intelligence blood testing technology was developed and used by Johns Hopkins Kimmel Cancer Center to successfully detect lung cancer in a 2021 study has now detected more than 80% of liver cancers in a new study of 724 people" (Amy & Valerie, 2022).

AI related Conferences, Seminars, Workshops and Webinars:

Researchers are always interested to discuss and share their research and innovations through conferences and seminars. About 72.22 % of the sampled universities were seen involved in organizing robotic seminars, series of workshops on AI, conferences, symposiums or webinars on AI related topic.

AI reflected in Mission, Vision and Strategies of University:

Though most of the sampled universities are doing research and innovations in field of Artificial Intelligence only Stanford University and ETH Zurich has mentioned it in their mission and vision. MIT Libraries have mentioned about their future strategy related to artificial Intelligence in their strategic planning. Most of the universities have mentioned about accelerating research, education, innovations and enhancing collaboration for the benefit of society in their mission and vision.

AI in Libraries:

Though Libraries selected for study showed very few existence of AI tools but some of the libraries (Ex. Harvard, MIT and Carnegie Melon University) had future planning and were committed for assisting their universities in exploring this challenges and opportunities in the field of Artificial Intelligence. Carnegie Mellon University Libraries planned for documenting archives and collection on AI and making it accessible to its research community. They have developed 'Keenious' a powerful recommender tool which uses search algorithm and AI for text analysis and helps in searching research articles relevant to the topic of research. They have also provided a chatbot named Andy in their library website under ASKUS tab for answering user queries. "Engineering Librarian Haoyong Lan from Carnegie Mellon University received the opportunity to work with International Federation of Library Associations and Institutions Artificial Intelligence Special Interest Group for working on IFLA Statement on Libraries and AI, and help to build an international platform to increase AI awareness and literacy for library professionals" (Bender, 2023).Scholarly literature

reviewed for the study reveals about the presence of Artificial Intelligence tools used for providing reference services and helping users to locate books in the bookshelf. Various libraries in Germany UK, USA and China used chatbots for answering the reference queries. Few of such examples are Beacon, a chatbot provided through library website of Staffordshire University, UK which is a digital coach app for mobile phones.

Table No. 2. Context wise percentage of application of AI tools.

Sr No.	Context	Percentage of Application
1	Curriculum taught	83.33
2	Research Publications	83.33
3	Guidelines/ policy	50
4	Library applications	16.66
5	Conference /Seminars/ Virtual classes /webinars/ Symposiums	72.22
6	Mission	11.11

Chart No. 1 Context wise percentage of application of AI tools.

Sample Universities	Curriculum taught	Research / innovation	Guidelines/ policy	Library applications	Conference /Seminars/ Virtual classes /webinars/Symposium	Mission
Havard University	Yes	Yes	Yes	No	Yes	No
University of Cambridge	No	No	No	No	No	No
Stanford University	Yes	Yes	Yes	Yes	Yes	Yes
University of Oxford	Yes	Yes	No	No	Yes	No
University of California, Berkeley	Yes	Yes	No	No	Yes	No
John Hopkins University	Yes	Yes	No	No	No	No
INSEAD: The Business School for the World	No	No	No	No	No	No
London Business School	Yes	Yes	No	No	No	No
Carnegie Melon University	Yes	Yes	Yes	Yes	Yes	No
Massachusetts Institute of Technology	Yes	Yes	Yes	Yes	Yes	No
Columbia University	No	No	No	No	No	No
Swiss Federal Institute of Technology Zurich, ETH Zurich	Yes	Yes	No	No	Yes	Yes
California Institute of Technology	Yes	Yes	Yes	No	Yes	No
Princeton University	Yes	Yes	No	No	Yes	No
Yale University	Yes	Yes	Yes	No	Yes	No
Imperial College London	Yes	Yes	Yes	No	Yes	No
University of Chicago	Yes	Yes	Yes	No	Yes	No
University College London (UCL)	Yes	Yes	Yes	No	Yes	No

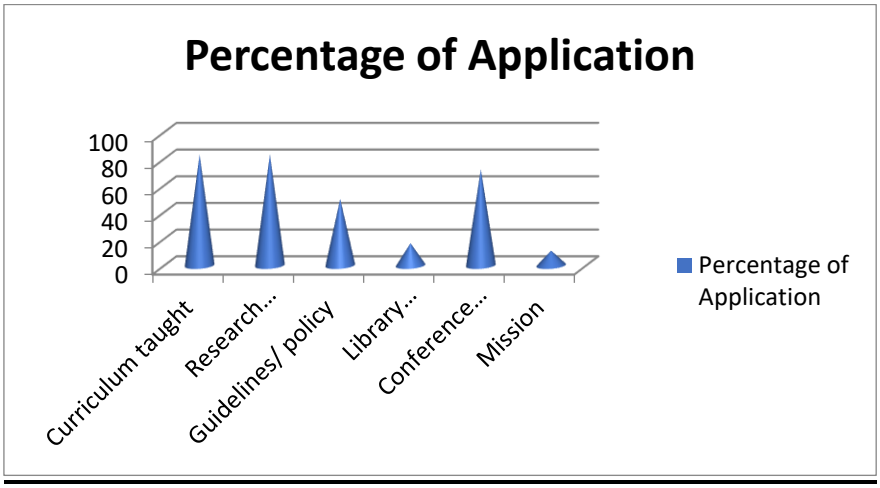

Table No.3: Status of AI Application in related context in top 10 highly ranked HEIs and their Libraries.

Conclusion:

The emergence and integration of chatbots and other AI tools have been observed across various fields since 1966, with their application in Higher Education Institutions (HEIs) and libraries becoming prominent only after 2000. However, despite this evolution, the adoption rate of these technologies remains comparatively lower in the top 10 highly ranked HEI Libraries. Notably, certain libraries in China, Germany, the UK, and the USA have incorporated chatbots, conversational agents, chatting robots, and virtual agents, as well as locomotor robots, for providing assistance and engaging in face-to-face interactions.

The primary utility of these AI tools lies in their ability to efficiently perform repetitive tasks that may be deemed redundant for humans. Innovative practices in select universities, exemplified by institutions such as ETHZ, demonstrate the utilization of AI tools to tackle tasks that surpass human analysis, capacity, or limitations—particularly those perceived as risky or challenging. The strategic use of technology for assistance, workload reduction, and the execution of complex tasks is fostering innovation with the overarching goal of supporting humans rather than replacing them. (Home)

It is important to note that this study relies exclusively on data gathered from the websites of sampled universities. Considering the global reputation of these highly ranked institutions, there is a possibility that they have implemented AI tools to enhance library services, even if such applications are not explicitly detailed on their websites. Therefore, a comprehensive investigation into these institutions is warranted to shed more light on the extensive applications of AI in their libraries, thus contributing to a deeper understanding of the role of AI in highly ranked institutions and their libraries.

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