



Cover Page



ROLE OF WEB 3.0 TOOLS AND TECHNOLOGIES IN LIBRARY SERVICES

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Abstract

With the advancement of Web tools and technologies, library system shifts from digital to virtual. Web 3.0 tools and technologies have changed the dimension of libraries and information services. To carry on with modern technologies, libraries use new technologies. This paper discusses on the tools and technologies of web especially on web 3. 0. Sometimes, Web 3.0 is called as 'intelligent web' that can use micro formats, natural language search, semantic web, data- mining, recommendation agents, machine learning and artificial intelligence technologies. Here is also a discussion among various generation of web. Finally, the application of web 3.0 in library and information services is also explained here.

Keywords: Blockchain, Cloud Computing ,Geo Tagging, Library 3.0, Ontology, Semantic web, Web 3.0, Web OPAC.

Introduction:

Information technology (IT) and Information communication technology (ICT) play a vital role in library and information services. It happens mainly for the evolution of World Wide Web (WWW). Web tool and technologies develop day by day. Web 3.0 refers to the third generation of internet- based services that collectively comprise semantic web, micro formats, natural language search, data- mining, machine learning, recommendation agents and artificial intelligence technologies. It has opened an unimaginable opportunities and challenges in library system and services. At first web 1.0 was about the basic publishing and transaction medium; web 2.0 is about the social and co-created web contents and web 3.0 is about the semantic and intelligent web. With the advancement of Web, library also transforms from traditional to virtual that is library 1.0 to library 3.0. This present paper discusses on the tools and technologies of web especially on web 3. 0. A comparative study among various generation of web is also explained here. The application of web 3.0 in library and information services is also presented here.

Growth of Library 3.0:

At the first time, people avoid internet as it was expensive, scarcity of devices and slow surfing rate. That age is called as Read-Only era. Google was not that time. People used Alta Vista and Yahoo search engine. To share files, Napster and Bit Torrent were used frequently. The web was neither so social nor semantic. Hyperlinks and bookmark feature in earlier were static. There was no provision of communication and interaction between a user and the servers. To cope up with this situation, web 2.0 tools and technology arrives. Web 2.0 deals with the social and co-created web. It has the ability of reading and writing. It is dynamic in nature. Instant messaging, Wikipedia, blog, twitter etc are used for sharing and communication purpose. It is called 'Social web' or 'co-created web'. But, today a man cannot stay alone without a mobile. In this situation, Library embraces Web3.0 tools and goes beyond. The role of the librarian has been weakened in the Library2.0 environment, so they must be aware of the use of artificial intelligence management tools and semantic web in Library (Ahmed, 2015)¹. Library 3.0 is a model for library automation using modern technology. It provides library services using technologies such as the semantic web, cloud computing and mobile devices. It is the borderless library. User can access their library collection without going to library physical location (Wankhede et al, 2019) ². Figure 1 shows that the library services cohesively interact and develop together. With the advancement of technologies, library services become very much rich and comfortable.



Cover Page

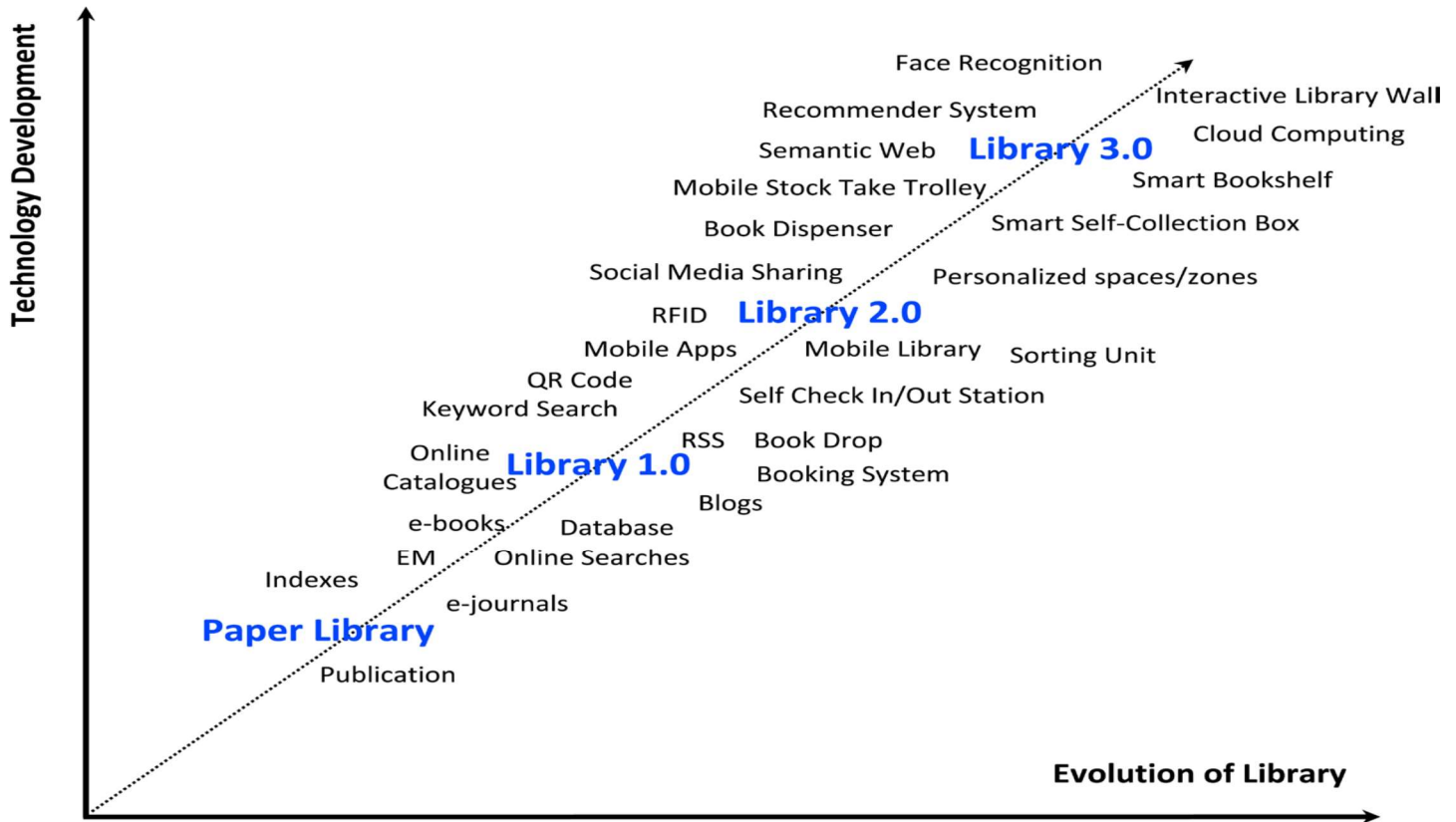
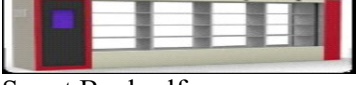
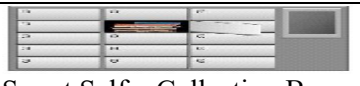


Figure 1. Evolution of Library Technology (Adopted from Noh, 2012³)

According to Chan a full featured library 3.0 is still far from reality (Chan, 2015)⁴. Table 1 explains the various products and services of library 3.0 which are plotted in Fig 1. It is elaborated with the available technology in market.

Table 1 Product and Services of Library 3.0

Products	Purpose
 Library Automation	Detects the temperature; saves energy; integrated with room reservation and door access system; intercom system for communication with librarian.
 RFID Applications	Security checks and counts the number of visitors.
 Smart Bookshelf	Detects on Shelf books; update system records; searching books.
 Smart Self – Collection Box	Distributes reserve books; provide alarm for misplaced book; use for monitoring and tracking.
	Detecting books for uploading to shelves.



Cover Page



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Stock Take Trolley	
	Sorts books according to categories; improves accuracy in book location.
Book Drop and Sorting Unit	
	Provides integrated access to the authenticated users.
On line Booking System	
	Encourages self services; analyze user behavior.
Self Check In or Out Station	
	Detection of books on shelf; generates readers card; check in or out; reserve book and recommended book.
Book Dispenser	
	Monitor abnormal user behavior.
Intelligent Monitoring System	
	Provides location base promotion and services; helps in social interaction.
Real Time Location System	
	Identifies users and their preference.
Recommender System	
	Authenticates users
Face Recognition System	
	Use for searching on the Web and for interaction and meetings.
Interactive Library Wall	

Characteristics of Web 3.0: The characteristics of Web 3.0 are in the following -

- **Ubiquitous that is universal in presence of content at same time.**
- Open in technology that is open APIs and Protocols, open data formats, Open Source Platforms, Open data etc.
- Open in identity that is open reputation and portable identity
- Distributed database
- Saas Business Model
- Unique in search that is unique searching for data from database.
- 3 D simulations and augmented reality
- Supports pervasive broad-band, wireless and sensors etc.

Differences of Web 1.0, Web 2.0 and Web 3.0: While Web 1.0 is read-only web targeted on content creativity of producer, Web 2.0 targets on content creativity of users and producers and Web 3.0 targets on linked data sets. A comparative difference among various generation of Web is given below:



Cover Page



Table 2 Difference among various features of Web 1.0, Web 2.0 and Web 3.0.

Criteria	Web 1.0	Web 2.0	Web 3.0
Users	Millions of users	Billion of Users	Trillion of Users
Focus on	Organization/Companies	Communities	Interactive/Personal
Interaction	Static or read only	Dynamic or read and write	Portable or Personal
Content	Ownership	Sharing	Dynamic
Query Language	SQL	SQL or Xpath	SPARQL
Metadata	Relational Schema	XSD/DTD	Ontology
Classification system in Web	Taxonomy	Tagging	Menomy
Data presentation Language	HTML/FTP	Flash/Java/XML/RSS	RDF/RDFS/OWL
Data Model	Relational	Relational and Hierarchical	Graphical
Search Term	Directories	Keywords	Content /Relevance
Research in progress	Britannica online	Wikipedia	Semantic web
Value	Page Views	Cost per click	User engagement
Approach	Finding data	Sharing data	Searching, Integrating and controlling data
Application Area	Searching, advertising and marketing	Social networking	Intelligent Search and Semantic social networking
Examples	Netscape	Google	igoogle, Net Vibes

From Table 2, it is clear that there is a steady development in web generation. The human comfortable level gradually uplifts with the advancement new tools and technologies of web.

Web 3.0 technologies: **Several technologies provide a new maturity level to the third generation of Web or Web 3.0. These are discussed below:**

1. Web OPAC: OPAC is the modern version of traditional catalogue card. It helps the users to find, locate the available resources within the library or remotely. Library uses two types of OPAC. One is OPAC and other is Web-OPAC. OPAC is used in the library or within the campus or LAN of an organization. Web-OPAC can be accessed remotely from anywhere at any time. It helps library users to search required document from library collection by author, title, subject, call no., keywords (Singh, 2018) ⁵.

2. Blockchain Stack: A block chain is a data structure. It can be increased its size and shared by various clients in Peer-to-Peer (P2P) architecture. Each block consists a set of transactions that occur during a specific time period. Here is an example of a simple Blockchain. User A wants to make a transaction to User B using Blockchain. For each transaction, it verifies each and every nodes of transaction. Finally, User B receives the last transaction. Fig 2 is the explanation of the whole transaction between User A and User B.

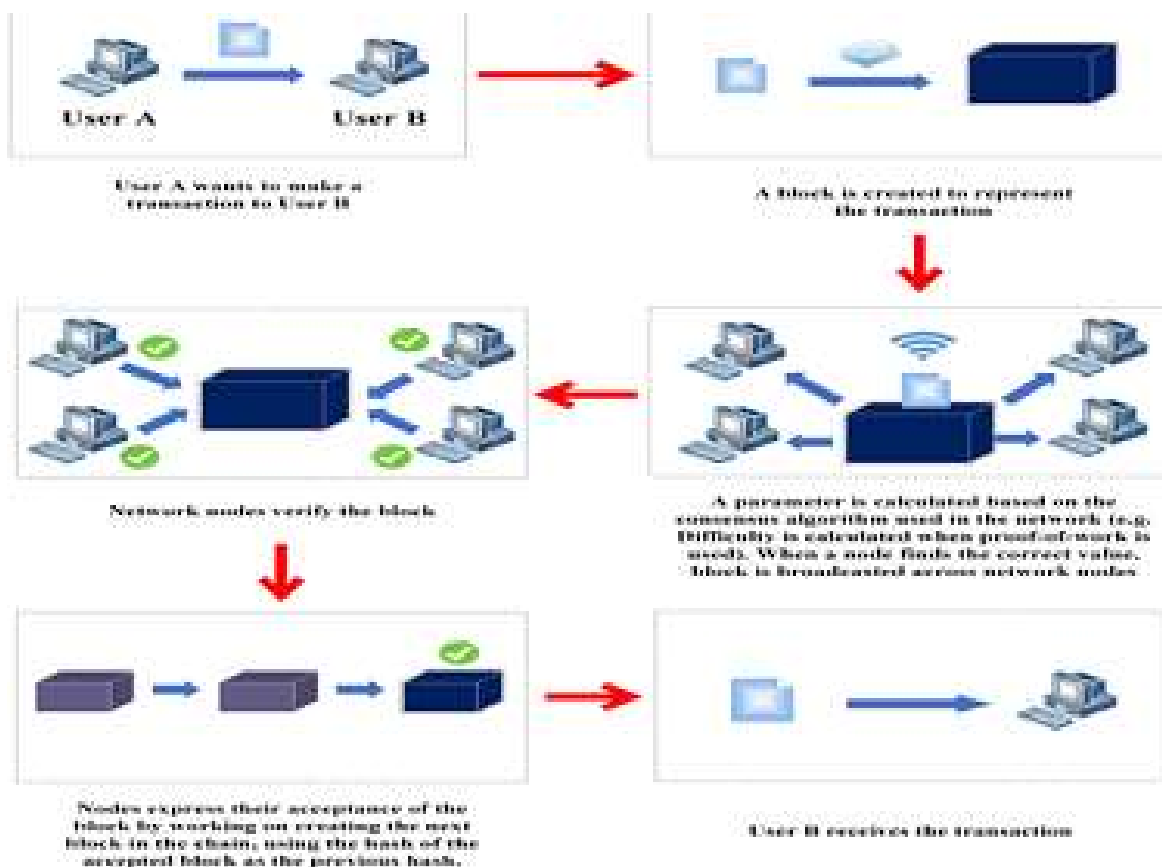


Fig.2 Block Chain Process (Adopted from Zubaydi et al, 2019).⁶

Some benefits and unique features of block chain are the ownership of data, uniqueness, immutability, censorship transparency, cost efficient, guaranteed continuity etc.

3. **Artificial Intelligence:** Artificial Intelligence is the study of science and technology based on various disciplines such as computer science, Biology, Psychology, Linguistics, Mathematics and Engineering. It deals with human intelligence for example reasoning, learning and problem solving. AI can be used in Gaming, Natural language processing, Expert System, Vision System, Speech Recognition, Handwriting Recognition and Intelligence Robots. AI system filters spam, recommended things for people to buy legal advice on everything.

4. **Ontology:** Ontology is a set of concepts and categories in a subject area or domain that shows their properties and the relations between them. It provides semantic relationship between terms and thoughts of knowledge. The purpose of ontology is to organize the information. It discusses on what entities exist or can be said to exist and how entities are grouped or can be grouped, related with hierarchy and divided or subdivided in accordance with similarities or dissimilarities (Bhattacharya, 2016).⁷

5. **Geo Tagging:** Geotagging is a technology that has been applied to archival data in various projects. It allows researcher to archive accurate, automatic, geographical referencing. It ensures a holistic understanding of the digitized data by adding to the pool of distributed resources.

6. **Virtual reference Services:** Virtual reference is an online reference service. It enables library patrons to ask reference questions through a library's web site. Some virtual reference services serve answers to frequently asked



Cover Page



questions (FAQS), selected reference tools, and access to selected databases on the web. Virtual reference service model can be divided into three categories:

- Asynchronous transaction: Ask-a-service, email based, Virtual Reference Desk (VRD) Service, Question Point and Email.
- Synchronous transaction: Chat based services, Video conferencing or Web Cam Services, Digital Reference Robots, Real Time Reference Service etc.
- Collaborative Network: Consortia based Services.

7. Semantic Web: Semantic web means 'study of meaning'. Semantic web is used synonymously as metadata, ontologies or semantics. Its purpose is to convert the entire unstructured document on the web into a web data. It includes the semantics of programming languages, formal logics and semiotics. It acts as an integrator across different application in content publishing, blogging and other system and services. The components of semantic web are in the following:

- HTTP –Hypertext Transfer Protocol for exchanging and transferring hypertext.
- HTML – Hypertext Markup Language for displaying web pages or other information in web browser.
- XML- Extensible Markup Language for the content o the web document.
- XML Schema – It is the content structure of XML.
- Metadata – General framework for machine readable data.
- URI – Uniform Resource Identifier identifies a resource over a network using specific protocols.
- RDF – Resource Description Framework is a standard data format for semantic web.
- Web Ontology Language (WOL) - Web Ontology Language is used to describe the semantic of classes and properties in the domain of internet.
- Turtle – W3C standard alternative used for RDF and XML.
- N-Triples – N-Triples is a liner, plain text format for sorting and transmitting data.
- SPARQL – It is a protocol and RDF query language.
- Notation 3 – Notation3 or N3 is used for assertion or logic language

8. Cloud Computing: Cloud computing is a distributed computing, on-demand, utility based service. It requires remote server and internet to organize and maintain data or applications. It makes the system more dynamic, flexible, usable and replaceable. It provides more reliable, available and updated services to their users in turn. Different cloud provider provides different level of services for example - Amazon EC2 that enables the users to handle very low level details where Google App-Engine provides a development platform for the developers to develop their applications. Different types of cloud services are - Software as a Service, Platform as a Service or Infrastructure as a Service. It resolves the difficulties of large scale data processing.

9. Mobile library Catalogues: Library provides searching, accessing and storing facilities with a particular software management system. Users can get these facilities from their phone. Patrons or users can access library resources from their account. They can check library hours, phone numbers and can also search the catalogue by author, title, subject, accession no, or keyword.

10. Open Technology: Open Technology encompasses the open standards, open source and open software for example open APIs and Protocols, open data formats, Open Source Platforms, Open data etc. API refers to Application Programming Interface. It secures the sites and reduces the inflexibility and legacy problems.

11. Ubiquitous connectivity– Ubiquitous means universal presence of contents at same time. This technology helps to use and reuse the various format of content according to their need. Ubiquitous contents are the personal contents. One can store his/her document in various formats on the web as he/she can access and share the contents over internet. It makes easy with Broad band connection and with mobile devices.



Cover Page



Advantages of Web 3.0 technologies: Web 3.0 technology changes our lives in many ways. Personalized browsing becomes user oriented. Search engine supports depth searching facilities. It is powered by Artificial intelligence to deliver relevant content. Mobile technology provides savvy Apps which serve better functionalities. Access becomes decentralize to make it easy. Real time target develops in personalized marketing techniques. Users can put their quarries information by using natural language. Web 3.0 technology enables us to share data, information and knowledge. It helps machines to convert big data into useful information as early as possible. Prabhu suggests that there are some advantages in Web 3.0 (Prabhu, 2016) ⁸ which are in the followings:

- Web 3.0 improves Data Management system
- Web 3.0 supports Mobile Internet access
- Web 3.0 stimulates Creation and Innovativeness
- Web 3.0 Encourages globalization
- Web 3.0 Enhances users' Satisfaction
- Web 3.0 Helps in Collaboration in Social Web

According to Khanzode and Sarode , Web 3.0 faces several challenging issue like- vastness or double entry or increased workloads, inconsistency, vagueness, deceit, privacy and censorship, etc. (Khanzode, 2016) ⁹ Vastness causes the overlapping and imprecise concepts leads to vagueness. Logical contradictions lead to the ambiguity. These challenges may be meet up with automated reasoning systems.

Web 3.0 for library services: Libraries are now shifting from traditional to virtual. Its services turn local to global and traditional to virtual. There are various web tools which enhance the library services.

- Web OPAC helps users to find and locate their required information by author, title, publisher, accession number and collaborators etc. It also helps in library housekeeping operations especially in acquisition and circulation.
- Blockchain is used for storing information in a distributed, tamper-resistant setting. The blockchain can help librarians to gather, preserve, and share the authoritative information. It is used to create time stamped, verifiable versions of journal articles. It is also used in libraries as a digital rights management (DRM) tool.
- Library can use AI as in Gaming, Natural language processing, Expert System, Vision System, Speech Recognition, Handwriting Recognition and Intelligence Robots.
- Geotagging or Geo Tagging provides specific information at specific location.
- Tagging can be applied to learning management system for editing the subject headings. It enhances the relevancy of the searches that makes the collection more dynamic. It helps in information marketing, user participation.
- Virtual reference service enables library patrons to ask reference questions through a library's web site from anywhere and anytime.
- Semantic web in libraries helps to build tools for discovering and navigating digital resources on the web.
- Cloud computing application is used for integration, accessing electronic journal, tracking of statistical data and also for hosting digital libraries.
- Library websites provide information about library, working hours, holidays, rules and regulations of the library.
- Social networking helps to create a page to reach to new users. It also enables librarians and patrons not only to interact but also to share the resources.
- Social bookmarking promotes interactive participations of users. It simplifies the bibliographic distribution lists. It promotes participation and interaction of the users. It facilitates lateral searching.
- Announcement of the availability of new book, research and other opportunities can be achieved with the application of RSS feeds. It enhances the library instruction.
- Wiki can be used for interaction and discussion between user and librarian. It can be used as virtual reference resources.
- Blog is useful for collection development. It acts as a discussion forum. It can be used for marketing of the information as well as the library.



Cover Page



- Vodcasting helps the users to find materials and to use the library catalogue more effectively.
- Podcasting highlights the upcoming resources of the library. It is used for scholarly communication for interactive learning experience to the users.

Hence, Web 3.0 or library 3.0 tools and technologies have a pivotal role in the significant growth of library services.

Conclusion:

Always new technologies make a room with its innovative features, facilities and functions. Web 2.0 tools and technologies do not lose their importance even in the present era. For example, e-mailing has not disappeared even after smarter communication platforms. They just fight against better technology. Web 2.0 is really user-friendly and people are comfortable using it, but web 3.0 depends on decentralized network that is more users centric than others. Some examples of Web 3.0 sites are iGoogle, NetVives, Dig, Flickr, Delicious etc. It is more transparent and secured. The growth of web technology makes our life relevant, useful, comfortable and enjoyable. From the above study, it is clear that Search technologies, digital inclusion, resource discovery platforms, digital reference services and mobile applications play a pervasive role for enhancing library services.

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