



A CONCEPTUAL FRAMEWORK FOR DIGITAL LIBRARY AND THAT APPLY TO THE ENGINEERING EDUCATION AT HIGHER LEARNING INSTITUTION

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Abstract

This study aims to take a theoretical look at the arena of digital libraries. To that end, it is necessary to investigate the requirements of a digital library to establish in the departments of higher learning institutions in Bangladesh. Similarly, this study looks at the level of necessity, especially in engineering programs such as Civil Engineering, from an economic perspective. This is a precautionary measure during an emergency period (state of affairs in-country) and contributes to the Sustainable Teaching and Learning (STL) in higher learning institutions for effectiveness and efficiency in developing human skill resources. For this study, a digital library for Civil Engineering is proposed to develop at the higher learning institution. The outcome of this study may apply to the discipline of Civil Engineering at International Islamic University Chittagong (IIUC) as a pilot program and then focus on diversified areas such as structure, materials, and construction; transportation; geotechnical; environment; and water resources. There are several exceptional features of the digital library. This library will address specific learning and content needs for several different beneficiary groups; the collections will exploit contemporary multimedia techniques to encourage active online STL library collections, which will focus on learning outcomes for lifelong groups. As an integral part of the digital library, a hosting portal is needed to develop to provide easy access to the collections in highlighted diversified areas.

Keywords: Digital library; digital objects; digital storage; electronic media; traditional or conventional library

Introduction

Digital Library (DL) is a unique, online or internet library. It is based on a wide range of extensibility and is characterized as a digital repository or digital collection system (DCS). DCS is focused on the collection of digital objects that includes text, still images, visual material, audio material, video material, print or photograph, originally produced digital content like word processor files or social media posts, digital documents, or other digital media formats. Accessibility of this library through the internet (either locally or

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remotely) is stored as electronic media formats (as opposed to print, microform, or other media), along with organizing, storing data, etc. In addition, DL varies with size, scope, and maintenance.

Civil engineering deals with the physical and natural built environment, including public and private entities in rural and urban regions, emphasizing the following elements.

- Surveying: reconnaissance, feasibility, and planning;
- Planning, architectural design, structural analysis, and design;
- Materials-1: all types ecological and conventional;
- Materials-2 (Major): concrete and asphalt technology;
- Construction Operation: technology and construction management;
- Geotechnical and Geological: soil mechanics, foundations, and treatment (e.g., piling);
- Water resources: fluid mechanics, hydraulics, and environmental hydraulics;
- Transportation: roads and highways, pavements, railways, tunnels, port air, and waterways);
- Environmental: protect to supply safe water, sustainable sanitation, waste disposal, air pollution; and
- Maintenance management: services post construction and lifelong services.

It is evident that the scope of civil engineering is extensive and requires a wide variety of rich information where it requires an extension to the traditional library premises. The concept of DL is not exclusive just to civil engineering. It can apply to the other fields of Computer Science and Engineering, Environmental Science and Technology, Fire Engineering, Mathematics, basic science, etc. DL establishes effective, efficient, and sustainable services for the present and future generations to come. In addition, it promotes accessibility of knowledge from any part of the globe. In addition, it develops a strong network among stakeholders engaged in improving the quality of life (QoL). A similar concept of DL is present in Australia, known as the Australasian Virtual Engineering Library (AVEL), an open-source platform for engineering and technology (Álvarez, 2021).

Digital Library and Traditional Library

‘The terms, which have been in trend at different times, include a paperless library, virtual library, electronic library, online library, desktop library, multilingual library, library without boundaries and more recently, digital libraries.’

In a broad sense, the term DL is a computerized system that allows users to access information through an electronically stored repository of information and data. Traditional libraries emphasize archiving documentation and preserving physical items, especially; information, books, periodicals, manuscripts, and monographs that are the curators of the librarian in a higher learning institution.

Our investigation identified the reasons for the importance of digital libraries, such as comprehensive search, known items, facts finding, introduction/ overview, and related information. Compared to a physical or conventional library, a digital library has more accessibility. It is a matter of concern to the author and publisher to sell their copies of the work (Hossain, 2021). To protect the right of ownership of any intangible intellectual property, the respective authorities/organizations like "World Intellectual Property Organization (WIPO)" enforce several copyright laws. The Digital Rights Management (DRM) act safeguards and legalizes e-books and other digital content sharing, publishing, preservation, etc., from the threats of piracy. With other law enforcement agencies, Bangladesh Copyright Act 2000 was endorsed and amended in 2005 (Hossain, 2021).

The main objective of this study is to develop the concept for establishing DL and then create scope to apply to the engineering education/ program with maximum elastic ranges in higher learning institutions irrespective of any administrative or financial constraints.

Table 1. Depicts factors affecting the digital library with conventional ones

No	Factorial Elements	Digital Library	Conventional Library
1	Accessibility	Users can effortlessly access their information through various electronic formats.	Library staff performs their duties and responsibilities through various sections such as acquisition, cataloging, sorting, periodical, etc.
2	Procurement	Affordable financial alternative as users has the option to procure the softcopy of the resources from any digital platform.	The opportunity to develop methods to obtain books economically and qualitatively.
3	Contents	Opportunity for the users to secure e-books, e-journals as well digitized versions of publications as desired by the user.	Books and publications are acquired through the help of library management.
4	Utilization	Subscribing to online databases to gain knowledge.	Books are advertised via catalogs among departments based on the needs of the user.
5	Curriculum update	Using library operating system to access databases to users. Therefore, allowing faster access to the users.	Curriculum revised through the recommendation of the academics. Most of the time, the department must communicate with academics for the recommendation.
6	Resource sharing	Allow access to the database through a multi-disciplinary department. Providing an opportunity for resource sharing.	The need to prepare funds for different resources and equipment in libraries.
7	Record-keeping	Hyperlinks direct users online to access information from various sources.	Archiving the resources, either physical or electronic, categorically.
8	Organization	Using software to access the digital contents subscribed and analyzed by the concerned department of higher learning institutions.	Using catalogs and preparing index terms, and categorizing collections for practical use.
9	Services	Various users can access information acquired through the Local Area Network (LAN).	Users must acquire information through indexing, abstracting, and services.
10	Technology and skill	Allows users to acquire new technical skills in addition to technological paradigms. Based solely on logical extension.	Information is gathered from traditional sources as well as access to digital resources.
11	Knowledge* Management	Staffs and users understand both hardware and software to acquire digital collections.	Users must be aware of the services and where information is archived.

*Knowledge Management involves the process of sorting, locating, and managing information from various sources.

Table 2. A brief expression of the digital library concept

No.	Reference	Expression
1	(Lynch, 1995)	“System providing a community of users with coherent access to a large, organized repository of information and knowledge. The digital library is not just one entity, but multiple sources are seamlessly integrated.”
2	(Fox, 2014)	“New way of carrying out the function of libraries encompassing new types of information resources, new approaches to acquisition, new methods of storage and preservations, new approaches to classification and cataloging intensive use of electronic system and networks and dramatic shifts in intellectual organizational and electronic practices.”

Methodology

For the establishment of DL, these points are considered:

- 1) Scope and purpose of setting up a digital library: Identify the flexibility, services, size, and user growth rate with technical skills and knowledge.
- 2) Resource collection and allocation system: emphasized on projected users’ requirements and materials selection.
- 3) Infrastructural and software requirements (Tramboo, 2012): Availability of computers and smart devices for library professionals and supporters based on the users’ size.
- 4) Human resources: Competent workforce is the most crucial factor in establishing and running a project (Rathee, 2019).
- 5) Access management: To what extent users are permitted to access the collections.
- 6) Budget allocation: Considering all expected cost components for setting up and operating to maintain the online library/ repository is a prerequisite for establishing the project (Rathee, 2019).

Challenges to Set Up a Digital Library

- Professional’s perspective: Lack of computers and technological knowledge among professionals (Ademodi, 2009; Adomi, 2006). In this era of digitalization, professionals should have a broad vision of ICT applications (Trushina, 2004; Hashim, 2009).
- Local perspective- In Bangladesh, the majority of the institutions don’t have adequate facilities (computer and computer labs) for the students and other supporters. Insufficient collection and access restrictions to digital contents like e-books and e-journals (Rahman, 2008).
- Management perspectives: There are limited governmental support and unstructured training facilities for library professionals to enrich their technical skills to cope with the changing nature of library practices towards digitalization and lack of financial support (Siwakoti, 2009). Nevertheless, the programs are not well structured to meet the growing demand for ICT skills in e-library practice in this digital era.
- Intellectual property perspectives: protecting the legal right of the intellectual property owner is also a challenge. The Library of Congress (LC) summaries the Intellectual Property Act: “Efforts to formulate digital libraries will be delayed or frustrated in the absence of a common, responsible framework of rights, permissions, and restrictions that acknowledges the mutual needs of rights-holders and users of materials in digital libraries” (LC, 1999).
- Digital repository/ library establishment: a collection of digital content is also a big challenge. Collection methods are – (i) digitizing existing physical contents; (ii) acquisition of digital content through

collaboration and negotiation with the authors and publishers; and (iii) access to external sources like websites, e-journals, other e-library collections, e-book publishers' server, etc. (Cleveland, 1998).

- Preservation/ storage of digital content: The complexity and cost involvement impedes preserving a digital repository to establish a digital library. Digital preservation involves “the planning, resource allocation, and application of preservation methods and technologies to ensure that digital information of continuing value remains accessible and usable” (Hedstrom, 1997). The online repository is more susceptible to corruption accidentally or deliberately.
- Limited infrastructure (access to the internet): The International Telecommunication Union (ITU) statistics show till June 2021 that the total internet users in Bangladesh were 117,310,000, 70.5% of the total population (ITU, 2021).

The Features of Digital Library

The features of DL are investigated as follows (Sandusky, 2002):

Table 3. Features and classification of DL

No	Features		Classifications
	Name	Description	
1	User	Are the ones who are accessing the DL for specific information	<ul style="list-style-type: none"> ▪ Scope: use with free and open internet. ▪ Consistency: to support researchers. ▪ Acceptability: to the actual users.
2	Institution	Sponsor of the DL, the higher learning institution and engineering education	<ul style="list-style-type: none"> ▪ Authority and control: Reduce plans and patented work of users from leaking out to the competition ▪ Type: public and private. ▪ Economic model: supported by grants and then generation of revenue. ▪ Resolution: introduce new techniques to provide information to community users.
3	Access	Provides support access to content	<ul style="list-style-type: none"> ▪ Payment model: Free for higher learning institutions, and nominal fees may include during admission. ▪ Visibility: carefully controlled internet. ▪ Persistence: contents preserve forever. ▪ Consistency: provide multiple search access and multiple complex topics.
4	Content	The informative documents uploaded	<ul style="list-style-type: none"> ▪ Scope: Information concerning any branch of human knowledge ▪ Appropriateness to users: based on science. ▪ Perseverance: Allowing a range of initial and specific information ▪ Organization: support different types of search access and intricate topic structures. ▪ Specialization: wide-ranging in nature. ▪ Digitization: digitized versions of content initially produced in another medium. ▪ Source: multiple sources would present content created by many entities. ▪ Restriction: either publicly or restricted.

No	Features		Classifications
	Name	Description	
5	Services	Human and technology-based capabilities	<ul style="list-style-type: none"> ▪ Nature of Interaction: provide support for active work. ▪ Analytic: Tools that allow data analysis and store user-generated data. ▪ Collaborative: Message board systems, defined interest groups, and peer-to-peer facilities. ▪ Collection: clear collection development and indexing policies. ▪ References
6	Design and Development	The process of building and maintaining	<ul style="list-style-type: none"> ▪ Design approach: socially grounded approaches. ▪ Design cycle: accept continuous feedback. ▪ Consulted users: Alternative users are to be consulted by designers and developers.

Conclusion

During the last few decades, physical library collection and service have undergone several transformations, exacerbated due to the boom in technology. Covid-19 has increased the usage of online-based technology, primarily in the education sector. From observation, it can be said that it was performed effectively and efficiently. It is known as the Emergency Remote Teaching and Learning System (ERTL). ERTL is also part of DL. The ERTL learners are often far from the institution, making the work schedule easier than going to the traditional library for assignments. DL acts as a transformation for the engineering program, which invariably acts as a reference desk where users can interact easily.

Besides, due to the flexibilities and size of DL, its concept may widely be applied to the development of engineering theory courses instead of sessional. To study DL's effectiveness, the researcher can focus on easy access to engineering programs like; enhancing the quality of instruction, the productivity of the institution, response to new technology, and across obstacles to lifelong learning. ERTL systems also provide cost-benefit and cost-effectiveness through the adaptability of learning styles, real-time interaction with students, efficient use of multimedia, and small classes. Ultimately, a digital library can generate revenue on the initial investment cost.

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