Proposal of a Model for Smart Library Services to Achieve SDG: A Public University Library Perspective

Md. Mozammel Bhuyan[1] and Nusrat Jannat Bipasha[2]

[1]Lecturer, Institute of Information Sciences, Noakhali Science and Technology University, Bangladesh
[2]Student, Department of Information Science and Library Management, University of Dhaka, Bangladesh
E-mail: mozammel.iis@nstu.edu.bd

Abstract - The main purpose of the study is to explore user's basic concept about smart library at Dhaka University Library (DUL). The more specific aims of the study are to: investigate e-services those are provided by DUL to its users, observe the effectiveness of smart library, propose a smart library model for DUL, identify the problems of smart library at DUL and determine parameters for converting DUL to the smart library. The authors designed a well-structured questionnaire as well as used both online and offline survey method to collect data and retrieved responses were 353. SPSS and MS Excel have been used to analysis data. The study reveals that smart library can meet the user needs and provide necessary information to users according to their demands. The paper also presents a review of DUL services where traditional services are converted into smart library services by using advanced technologies, but the concept of smart library is still unknown to maximum library users. The study also suggests that DUL has to improve service quality, ensure user cultivation and LIS professionals training in order to transfer DUL into smart library.
Keywords: Smart Library Model, Dhaka University Library, SDGs, Developing Country

I. INTRODUCTION

For the blessing of internet proliferation, Information can be distributed through a multiplicity of media besides hardcopy books or journals. At present, the concept of library has been extended to a new format called e-format. We know Library is an essential learning source for an organization. Libraries can take advantages of different technology to offer its users. Some specialists thought that the future Library is tied to the technological enlargement of Web 4.0 which is considered by the terms of Convergence. Many academic libraries have fought over the past ten years to change the perception of the worth and usability of acquired data (Buckland, 2017). Academic libraries no longer have the monopoly on the distribution of scientific information because library patrons have shifted to online scholarly sources (Chambers, 2013). The ramifications of varied resources and the abundance of available data make librarians collecting more difficult (Showers, 2014). Nowadays, the increasing volume of data from various sources relational and non-relational has given rise to the problem of providing an efficient library service to the users. In this challenging conditions make a smart library

with the development of information technology has been a vital part in colleges and university libraries. A smart library is a mobile, location-aware library service that is unrestricted by physical space and aids users in finding books and relevant information (Aittola *et al.,* 2003).

A smart library realizes the associations between books and people anywhere at any time. Digitization, networking and intelligence are the information and technical basis of the smart library (Zhou, 2005). The smart library is essentially user-focused. It seeks to address readers' growing informational needs with a focus on sustainable development and user convenience (Wang, 2011). A smart library is more advanced development often hybrid library and digital library. Within the environment of the IoT, the smart library relies on cloud computing technology and intelligent equipment. By utilizing a new generation of information technology and to enhance the clarity, readability, and responsiveness of the interaction, smart services ae well as management, the smart library is a model of a smarter method to modify the interaction of users and library systems (Yan, 2010).

In the present era, information can be provided through different medias besides traditional or hardcopy. To meet the needs of every person, librarians can start creating an electronic library system termed "smart library". Smart environment, smart librarians, smart and skilled library users are very important to make a smart library.

II. REVIEW OF LITERATURE

Smart library services are becoming in-demand. It creates new knowledge. Smart library is characterized that can be fulfilled by using existed software and hardware systems those are to be maintained by library staff. Asif and Singh (2020) have examined during the Covid-19 epidemic, the trends, opportunities, and scope of libraries has greatly changed because of the technological improvements. In terms of resource sharing and digitalization, virtual libraries have improved. Users are looking for quick and accurate digital information which necessitates the knowledgeable library staff. To meet user demands current trends and preventative steps should be prepared so that libraries can

act pro-actively both now and after the pandemic. Baryshev, *et.al.,* (2015) said that smart library is a set of different electronic resources, complemented by specialized library services, which are delivered by the usage of information and communication technologies, and it is a new quality of a library. Baryshev and Babina (2016) described that smart library offers users with the chance to get knowledge on the basis of the system multidimensional visualization of knowledge.

A. Concept of Smart Library

Simovic (2018) described that a smart library is an inevitable part of a present library system, which itself is an essential part of learning methods and the educational organization. He also said data is collected into the smart library from numerous data sources and two choices are to replacement the recommended books and to purchase the suggested books from the university online bookstore.
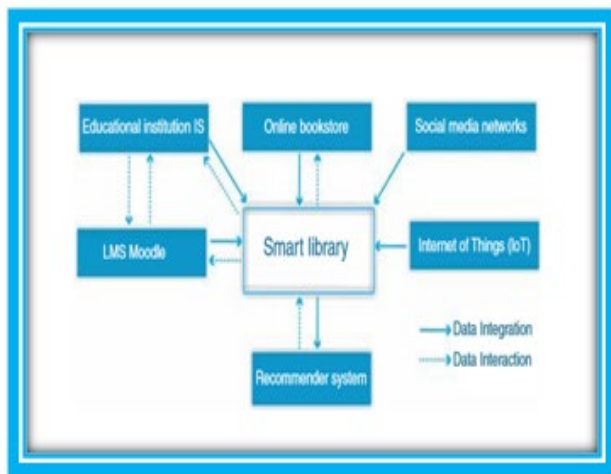

Fig. 1 Smart Data Block Diagram (Simović, 2018)

This is exactly the issue because current data library systems should offer perceptions by utilizing various techniques, such as Big Data. Moon *et al.,* (2014) observed that library is converted into the community center for knowledge concert from the outdated repository of knowledge resources. He also said that for the smart library systems, a new advanced library system allowing for the desires of library services as well as the eco-systems of information technology and smart Library Systems technology such as cloud computing, ubiquitous computing, mobile computing, linked data and Big Data. He mentioned the referential architecture of Smart Library Systems entails of 4 layers: delivery layer, resource layer, service layer and core layer.

Baryshev, Verkhovets and Babina (2018) said with the information development the physical practice of user service is moving to remote services. Smart library has the library's flexibility in rapidly adapting to changing needs and new technologies. He used the term smart library as a synonym for the concept of an intellectual library, digital library or virtual library. Johnson (2012) said that the fundamental principles of enlargement of the smart library include an augmented stress on client-centered and Web-based models of library and information service provision to users and the belief of activity in the design of the smart library allows the library to overwhelmed the resource approach and attain a new level of collaboration with the user. Min (2012) mentioned the theory of smart libraries contains rising, converting and repositioning libraries to originate and attempt for development. Smart libraries play a key role in the construction of networked and more supportable communities. The upcoming library information provision must be a smart library which combines the present library system utilities with the knowledge-based e-learning system to develop inventive human resources. He also offered three layers based on a smart library information service system development environment.

B. IoT Technology

Cao, Liang and Li (2018) revealed along with the growth of smart IoT technology, many libraries have found out "smart" ways to discourse the encounters of unique data evolution and technological change. Ruan, and Wang (2016) stated that advanced technology is the basis and principle of the smart library and can contain wearable technology, cloud computing, mobile internet, intelligent processing technology, and virtual technology. Freyberg (2018) discussed that the crucial goal of smart library is to full fill the changing desires of users so that they can be smart or smarter. Du andLiu (2014) observed that smart library is a mixture of intellectual building and vastly computerized digital library. Smart library is collective with the library, IOT, cloud computing etc. The Internet of things (IoT) was the foundation of numerous schemes for a smart library. Smart library is a kind of digital or virtual library, which makes complete use of information and communication technology to understand the remote reading books from the service viewpoint of digital library etc.

Kulkarni and Dhanamjaya (2017) explored that effective libraries aren't just constructions. They are centers of knowledge where inhabitants have the capability to access those streams and construct skills required in a globalized world but to build smart libraries require smart environment also.

Jerkov, Sofronijevic and Stanisic (2015) stated that to enlarge the access of information and knowledge, smart library is an important pillar in the United Nation's 2030 Agenda for sustainable development goals. Internationally, libraries are perceived as a means to achieve these goals.

C. Smart Library Management Application

Pandey *et al.,* (2017) designed a smart library management application for the libraries in Oman by using the concepts

of Radio Frequency Identification (RFID) and Mobile (IoT). The system will manage and solve all the existing problems as well as provide numerous benefits for the users. Luo, Cao and Qian (2013) thought library is one of the most important parts in any educational organization. In his study, he found about 80% of library users think that the library needs to replace the existing system with a new application. From above discussions, it seems that a smart library must be user based and adjustable to user prerequisites. Smartness means capable of spontaneously understanding the demands of users and offering sources and amenities to fulfill their needs. Thus, a smart library builds a smart relationship between users and resources with the presence of digitization and networking to achieve sustainable development goals.

III. OBJECTIVES OF THE STUDY

The aim of the study is to explore user's basic concept about smart library at DUL. The more specific objectives are to:

1. Investigate new e-services that are provided by DUL to its users.
2. Observe the effectiveness of smart library at DUL.
3. Propose a smart library model for DUL.
4. Identify the problems of smart library and determine.
5. Parameters for converting DUL to smart library.

IV. RESEARCH METHODOLOGY

This study was conducted by the users of Dhaka University Library. The authors designed an online well-structured questionnaire including both open and close-ended questions to collect data. A total of 500 questionnaires were distributed through Google forms and email of which 353 were returned and used for the analysis. In the study authors also used seven points Likert scale. SPSS and MS Excel have been used to analysis data.

V. E-SERVICES AT DHAKA UNIVERSITY LIBRARY

The University of Dhaka was established in 1921 by an Act XVIII of 1920 which is properly known as Dacca University Act. The activities of Dhaka University Library (DUL) are run from three separate buildings. DUL has been providing remote access facility to its subscribed online resources through Ez-proxy server to its users by providing user Id and password.

A. DUL Software: To cope with the modern world and to meet the demand of time, the DUL has decided to automate its operations and services. The gradual developments of DUL software Installation activities are shown below in step by step-

TABLE I BACKGROUND OF DUL SOFTWARE

Software & Year	Background of DUL Automation Project (1998-2020)
DULAP (1998)	DUL started its automation program named DULAP, funded by UNDP and UGC. This system provided bibliographic databases, controlling acquisition, cataloguing effecting bar-coded circulation, CAS, SDI services etc.
DULIB (2008)	Then in 2008, DULIB (Dhaka University Library) software was initialized by the help of Computer Science Department of Dhaka University.
DULIS (2013)	"DULIS" was developed by computer science department of Dhaka University. This new customized software DULIS (Dhaka University Library Integrated System) has been working in the library.

B. Library Collection and Facilities: The Dhaka University Library collection is the largest university collection in Bangladesh. In 2020-2021 academic session.The total number of books and bound volume of journals was about 6, 81,035. (Dhaka University Annual Report, 2020-2021). Beside these,

1. DUL received 2,358 books as gift.
2. An amount of Tk. about 14, 93,875.00 was paid as a subscription fee to Bangladesh Academy of Sciences (BAS) to access online journals.
3. Periodical section of DUL is now subscribing online journals through two types of online journal consortium, named as follows-(1) Bangladesh INASP-PERI Consortium (BIPC) and (2) University Grant Commission (UGC).

DUL also provides different Online services like Catalogue Search, Digital Borrower's ID card, and Resource Center for sight savers etc. In 2013 a new website came into existence. DUL also has been providing remote access facility to its subscribed online resources for off campus use since March 2013. As per licensing arrangements sign up with publishers, only legal users of Dhaka University can right of entry these e-resources. To avoid unauthorized users from retrieving the online resources, specific username and password are required.

TABLE II ALLOTTED BUDGETS FOR SUBSCRIPTION

List of Online Resources	Allotted budget	
	Taka	US $
Subscription of ACS e-books	3, 83,915	
SciFinder	2,84,900	
Remote access subscription	47,100	US $ 550
Subscription of Manupatra	92,400	US $18500
BIPC subscription fees	1,51,7000	
Emerald back file	16,12,000	
Turn it in & world E-book library	4,85,749	US $5130

Fig. 2 DUL remote access log in process

TABLE III ADVANCED TECHNOLOGY AND WEB-BASED INFORMATION SERVICES AT DUL

Advanced technology	Yes/No	Web-based Information Services	Yes/No
OPAC	✓	Online Public Access Catalogue	✓
Scanner	✓	Selective Dissemination of Information	✓
Barcode	✓	Remote access	✓
RFID	x	E-mail delivery	✓
Cloud Computing	x	ILL and document delivery services	✓
Google voice	x	Access to Database	✓
Library bookmark	x	Bibliographic and cataloguing services	✓
Library guide	x	Current Awareness Services	✓

VI. FINDINGS AND DISCUSSION

Data analysis has been constructed on the basis of the surveyed questionnaires from the sample users at Dhaka University Library. The questionnaire was made up of close-ended questions with responses ranging from Yes/No and Seven points Likert scale (Extremely Satisfied, Very Satisfied, Somewhat Satisfied, Marginally Satisfied, Not very Satisfied, Not at all Satisfied, and No comments) were used to know users' satisfaction level about DUL existing smart library services.

Fig. 3 User's concept of Smart Library

Fig. 3 shows that among 353 respondents of DUL users about 77.1% do not have any concept of the smart library. Only 22.9% of respondents know about smart library system.
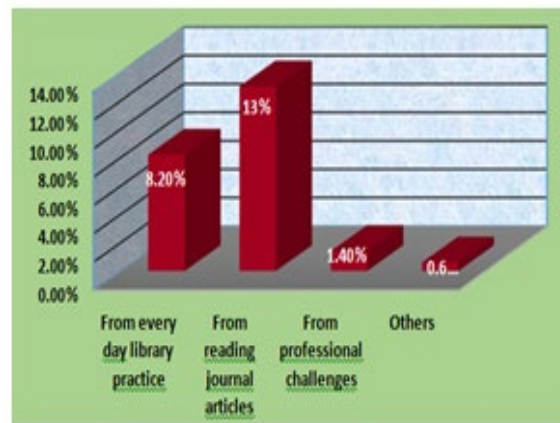

Fig. 4 User's knowing about Smart Library

Fig. 4 indicates that 13.0% respondents know about Smart Library systems by reading journal articles, 8.2% respondents know about Smart Library systems from their everyday library practice.

TABLE IV IMPORTANCE OF SMART LIBRARY

Indicators	Frequency	Percentage
Yes	306	86.69%
No	47	13.31%

Table IV reveals that about 86.69% respondents think that Smart library system is important.

Indicators	Frequency	Percentage
Yes	245	69.41%
No	108	30.59%

Table V discloses that 69.41% respondents believe that DUL has all the capabilities to build a smart library.
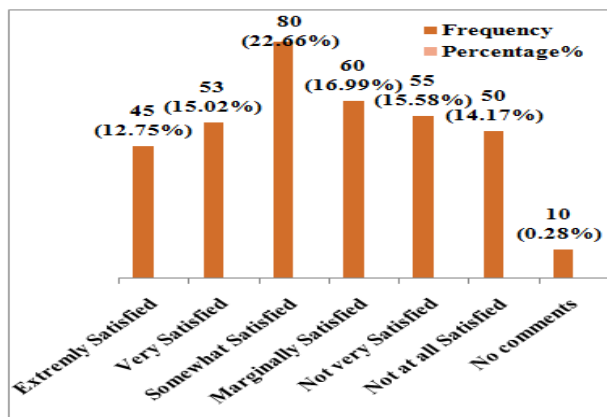

Fig. 5 Users' satisfaction about DUL existing services

Fig. 5 reveals the self-assessment of the respondents of their satisfaction level by using DUL existing services. It is noticed that among all the respondents 12.75% rated their satisfaction level as 'Extremely Satisfied', 15.02% respondents rated their satisfaction level as 'Very Satisfied', 22.66% respondents rated their satisfaction level as 'Somewhat Satisfied', 16.99% respondents rated their satisfaction level as 'Marginally satisfied', 15.58% respondents rated their satisfaction level as 'not very satisfied' and 14.17% rated their satisfaction level respectively as 'not at all satisfied'. On the other hand, the lowest number of respondents 0.28% made no comments.

VII. EFFECTIVENESS OF SMART LIBRARY

The concept of smart library was first put forward by Finnish scholar Aittola (Aittola, Ryhänen and Ojala 2016). Smart library is a mobile library without space limitation that can be perceived by the readers and is composed of intelligent technology and intelligent equipment. The smart library = library + IoT + cloud computing + intelligent equipment, which realizes intelligent services and management through IoT. Researchers thought that to gain SDGs goal smart library can play a smart role by providing access to information and skills in a welcoming environment. It is also able to provide access to ICT with high speed internet and to support life-long learning. Bhuyan & Bipasha (2022) described 20.9% of students who have no knowledge about information literacy among the students of business faculty students at University of Dhaka. For this reason, the term of smart library is still now unknown to maximum students at DU. That's why, to cope up with other countries, DUL should take necessary steps to spread the importance of new term smart library among its users. Smart library offers information resources to improve users' lifestyle. It also provides reliable access and removes cost barriers to gain new knowledge. Through smart library, users can get information from anywhere at any place.

VIII. PROBLEMS OF BUILDING A SMART LIBRARY

A. Lack of Fund: To build a smart library, Funding is a major issue for a library. The highest number of respondents 80.73% are rated funding problems at DUL as 'agree', the lowest number of respondents 7.08% stated their problem as 'disagree'.

B. Resources Unavailable: The highest number of respondents 57.51% are rated their facing problems about resources unavailable at DUL as agree', the lowest number of respondents 9.92% stated their problem as 'strongly disagree'.

C. Lack of Content Management: The highest number of respondents 54.67% are rated their facing problems about lack of content management at DUL as 'somewhat agree', the lowest number of respondents 4.24% stated their problem as' strongly disagree'.

D. Low Downloading: The highest number of respondents 58.92% are rated their facing problems about low downloading at DUL as 'agree', the lowest number of respondents 11.61% stated their problem as 'disagree'.

E. Server is Out of Service: The highest number of respondents 49.58% are rated their facing problems about Server is out of service at DUL as 'agree', the lowest number of respondents 1.42% stated their problem' disagree'.

F. Lack of User's Interest: The highest number of respondents 55.24% are rated their facing problems about Lack of users interest at DUL as 'agree', the lowest number of respondents 4.24% stated their problem as' strongly disagree'.

G. Lacking Computer Knowledge: The highest number of respondents 32.58% are rated their facing problems about Lacking computer knowledge at DUL as 'somewhat disagree', the lowest number of respondents 5.19% stated their problem as' disagree'.

H. Lack of Adequate Staff: The highest number of respondents 43.91% are rated their facing problems about lack of adequate staff at DUL as 'somewhat disagree', the lowest number of respondents 7.65% stated their problem as' strongly disagree'.

I. Not Habituated: The highest number of respondents 29.75% are rated their facing problems about not habituated at DUL as 'somewhat disagree', the lowest number of respondents 8.45% stated their problem as' disagree'.

J. Negligence of Authority: The highest number of respondents 66.57% are rated their facing problems about negligence of authority at DUL as 'agree', the lowest number of respondents 6.52% stated their problem as' strongly disagree'.

IX. RECOMMENDATIONS FOR BUILDING A SMART LIBRARY AT DUL

A. Improve Service Quality: Majority of the respondents i.e., 88.4% suggested to improve DUL service quality.

B. Qualified and Adequate Staffs: 75% respondents thought qualified and adequate staffs are needed to make the DUL as a smart library.

C. Ensure User Cultivation: It is noticed that among all the respondents most of the respondents i.e., 87.1% recommended to ensure user cultivation for smart library.

D. LIS Professional Trainings: Majority of respondents i.e., 73.5% recommended LIS professional trainings to convert DUL into a smart library.

E. Provide Web-Based Library: At present, users are habituated to the dynamic and collaborating nature of the web as well as social networking tools[24]. About 56% of respondents thought DUL should provide web-based library services.

F. Purchased More E-Resources: About 77% participants suggested DUL to purchase more e-resources, to provide user friendly interfaces for gateway system and to update library website regularly.

Beside these, Respondents of DUL also suggested to:

1. Offer easy access facilities for library resources.
2. Ensure powerful server for gateway system.
3. Provide uninterrupted electricity supply with uninterrupted internet supply.
4. Spread of awareness of students as well as faculties about smart library.
5. Give right ICT training to the library professionals of the library to develop the ICT skill of the professionals.
6. Bring a revolution change by spreading the concept of smart library.
7. Make a big budget for the development of library including both infrastructure and resources.

X. PROPOSAL OF A SMART LIBRARY MODEL FOR DUL

We live in the age of science and technology. The technological intension is to construct an intelligent library (Cao, 2018). Now it is the demand of time to make smart library for smart services. In spite of different difficulties, it's urgent to convert DUL into smart library (including both infrastructure development and resources availability).

Based on 'Smart Library Model for Future Generations (Aithal, S. 2016)', earlier discussion, previous theoretical literature review and analysis of survey result authors tried to make a smart library model for DUL. The conceptual model of constructing DUL as a smart library is proposed below:
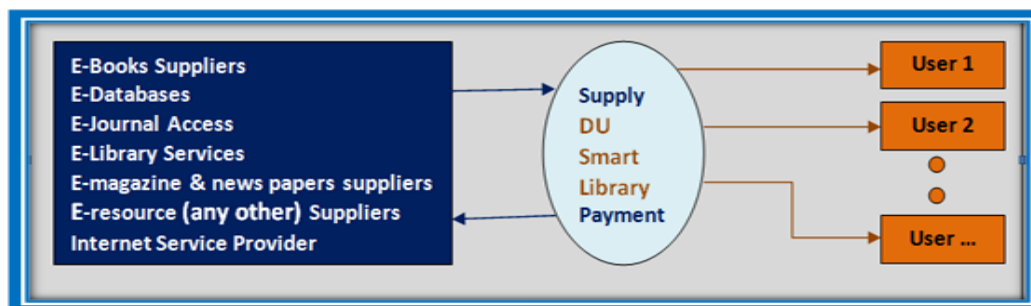

Fig. 6 Proposal of a Smart Library Model for DUL

The proposed model has three dimensions where suppliers supply e-resources to DUL and DUL has received these in lieu of payment. From these e resources DUL users will be able to get their expected information by using gateway server and internet. For this, the user must be logged in by inputting the user ID with password and the user defined remote connection command.

XI. CONCLUSION

Libraries are converted from traditional format to online version day by day. Digital information storage and information communication technologies can completely transform the idea of the library system and turn it into a digital library. The applications of smart library are increasing all over the world. Users now can feel the importance of smart library as well as they think this smart evolution can strengthen their learning capacity. Recently, some university libraries in Bangladesh have started to convert their traditional library into smart library. As one of the largest academic libraries in Bangladesh and in an effort to keep up with other nations, DUL is also making efforts to transform its library into a smart library.

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