

# The Role of Chatbots in Supporting Smart Services on Smart Libraries

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## Abstract

*Chatbots* is a digital technology based on artificial intelligence that has been used by various libraries to support the efficiency of information services. The use of the chatbot is considered capable of creating a smart library ecosystem so it is important to continue to develop it so that customers are satisfied with the information services provided. This study aims to provide an overview of the benefits that libraries can obtain from implementing chatbots to achieve the smart library concept. The method used in this study is a literature review from the Google Scholar and Scopus databases. There are 5 articles as the main research data. The results of the study state that there are at least 2 benefits that can be obtained from implementing chatbots in library information services, namely: personalized information services and cyberspace integration with libraries. In personalized information services, customers can obtain information according to their needs without having to be burdened with unnecessary information. As for integrating cyber space with real life, customers are able to access services without having to come to the location. Efficiency is the key word in using technology to support library services. Deeper empirical research on chatbots, especially in Indonesia, needs to be carried out to be able to develop and evaluate the use of this technology. customers can obtain information according to their needs without having to be burdened with information that is not needed. As for integrating cyber space with real life, customers are able to access services without having to come to the location. Efficiency is the key word in using technology to support library services. Deeper empirical research on chatbots, especially in Indonesia, needs to be carried out to be able to develop and evaluate the use of this technology.

*Keywords:* chatbot, smart library, digital technology, information services, digital library.

## PREFACE

Currently various library institutions continue to improve the quality of their services through the use of digital technology. The Chongqing University Library in China has integrated its various services through WeChat social media so that it can be accessed easily via student mobile devices (Wei & Yang, 2017). Alfaresi & Hone (2015) also said that Zayed University in the United Arab Emirates had developed and implemented a library reference service through a mobile application. The roving librarian project at the University of Huddersfield, England, has used mobile devices such as tablets or iPads to reach library users who need reference

services. (Shaman, 2014). Besides that, Taylor & Correll (2007) said that digital technology has integrated library services in one of the British government agencies. The use of digital technology ultimately creates a new idea in the concept and ecosystem of the library.

*Smart library* is a library ecosystem that utilizes digital technology as its fundamental component. Schöpfel (2018) said that a library can be said to be smart and modern if the institution continues to improve its service quality, develop new services, and implement information and communication technology. Aithal (2016) also stated that in the smart library ecosystem, all resources and information will be centralized and converted into digital form so that it can be

accessed by the public as well as educational and research institutions through digital devices. As for Yu, Gong, Sun, & Jiang (2020) said that currently smart libraries must start using RFID technology, the Internet of Things and artificial intelligence to integrate readers and library institutions. The use of this technology certainly provides its own experience that was not previously found in the concept of a traditional library.

*Smart library* is a form of library ecosystem that needs to be continuously developed by library institutions because it is able to provide benefits to library users. Schöpfel (2018) said that services in the smart library focus on its users/user-centered so that the library will continue to develop its services according to the needs of users, one of which is providing personal information/personalized information. Yu et al. (2020) also said that smart library users will get efficient and high-quality service because they can carry out various activities such as borrowing and returning books at any time or making seat reservations in the library online. Meanwhile, library users can obtain the latest information continuously about the latest collections or information resources (Aithal, 2016). Based on these arguments, libraries should continue to build smart libraries from various supporting aspects.

*Smart service* is one of the dimensions that builds the smart library concept where the dimension refers to services that focus on user satisfaction. This dimension refers to the use of digital technology to foster innovation in providing services to library users (Schöpfel, 2018). Not only focusing on developing technically new systems or technologies, smart services must strive to provide services according to user needs. Smart services make it easier to access library facilities in the midst of high user mobility and personalized information services. In this case, the smart nature of smart services must be based on the use of digital technology by library institutions.

*Chatbots* is a digital technology that has been implemented in several libraries. Allison

(2011) analyze the utilization of a chatbot named Pixel in the academic library *University of Nebraska-Lincoln*. As for Bohl (2018) provides an analysis of the use of a chatbot named Plutchik in providing services to the National Library of Medicine. Besides that, Mckie & Narayan (2019) analyze what roles can be presented by a chatbot called Lib-bot at the University of Technology Sydney in delivering library services. The use of chatbot technology indicates that several libraries have started to build library services that are smart/smart services.

Not only in library institutions, the urgency of implementing chatbots has been considered by various sectors so that they are also used to deliver effective and efficient information services. In the health sector, various institutions have developed chatbots which are useful as a medium for conveying official information about Covid-19 in each country (Miner, Laranjo, & Kocaballi, 2020). Chatbots can also be developed during a disaster crisis so that information about evacuation posts can be disseminated quickly to the public (Roman, 2020). As for the banking sector, chatbots have been used to reduce the workload of customer care (Chaitrali, Amruta, Savita, & Prof. Satish, 2017). Apart from that, from the e-commerce sector, chatbots can be developed as a medium to provide product recommendations according to user preferences (Kasiligam & Soundararaj, 2020). The various benefits in these sectors ultimately strengthen the argument that chatbots are a contemporary technology that must be continuously developed to improve user-centered information services, including information services in library institutions or in this case relevant to the dimensions of a smart library.

There are several similar studies that conduct conceptual studies regarding implementing chatbots in a library service. Nawaz & Gomes (2020) examine the system and use of chatbots in general in assisting library reference services. Patil (2018) conceptually examine the use of chatbots

in library institutions through the perspective of artificial intelligence. McNeal & Newyear (2013) provides a brief description of the benefits of various chatbots that have been implemented by several libraries globally. Kane (2016) examines how chatbots can play a role in improving education services, including reference services at universities. This research provides novelty in mapping the benefits of implementing chatbots in library institutions so that a smart library ecosystem can be achieved, in this case the benefits of chatbots will be elaborated on with the smart library concept.

Based on various arguments previously presented, this study aims to map the various benefits that can be provided by chatbots to support the achievement of smart services in smart libraries. The idea that forms the basis of the research objective is that there is an opportunity to utilize chatbots, which are digital technologies, to provide user-centered services. As for basically a smart library is a concept that aims to improve the service quality of the library so that it needs to be continuously developed by every library institution. The research questions that will be answered in this study are as follows: What are the roles of chatbots in supporting the smart service dimension in the smart library?

## LITERATURE REVIEW

### *Smart Libraries*

The smart library concept refers to a library model that uses a new generation of information technology to change the interaction between library users and resources in the library system and realize intelligent service and management. (Zhang,

Lin, & Li, 2018). Information technology and smart services are fundamental things that must exist in building a smart library so that all library activities run in a smart way (Mohapatra & Das, 2013). Information technology is used to comprehensively integrate books and other resources based on real data and information in the library. The use of data through information technology is intended to build smart and personalized management and services so as to improve the user experience of the library. In addition, the smart library does not only focus on providing excellent service but also supports decision-making from management because it is able to provide comprehensive user data.

Figure 1 describes the four dimensions that must exist and continue to be developed to create a complete smart library (Schöpfel, 2018). In the smart service dimension, smart libraries must be able to create user-centered library services and always have a passion for innovating using technology. In the smart people dimension, a smart library must be able to provide access to its users and the librarians in it to participate in producing knowledge. In the smart place dimension, smart libraries must have the awareness to consider environmental sustainability, both from the resources used to the architecture of the building and have a contribution to the development of knowledge in their area. In the smart governance dimension, smart libraries must support the community to participate in the formation of library governance



Image 1. Smart Libraries dimensions (Schöpfel, 2018)

This research will focus on the smart service dimension because basically chatbots are a communication channel for library users that are used to gain access to services effectively and efficiently. Schöpfel (2018) said that smart libraries must continue to adapt to user needs so that service innovation remains user-centered. Relevant matters were also conveyed by Zhang et al. (2018) where smart services must be able to solve the problem of availability and speed of access to resources or information needed by library users. Smart services from the library must be able to support three aspects, namely: resource interconnection, efficiency and convenience / personalization (Mohapatra & Das, 2013). As for Ruan & Wang (2016) said that smart library services must be able to maximize opportunities to meet the cultural needs of the community. In addition, the smart library service must be easily accessible anytime and anywhere by its users (Aithal, 2016). These various arguments ultimately emphasize that in building smart libraries, libraries must continue to find ways and innovate through information technology to

understand the personal needs of each individual.

There are two indicators that support the formation of smart services in smart libraries, namely user-centered services and enthusiasm for innovating library services. In general, user-centred smart library services refer to how users define libraries (Schöpfel, 2018). In this case, it is how libraries are able to utilize technology to adapt to their users in providing library services. Schöpfel (2018) emphasized that the key to innovation in smart libraries is the use of various industrial revolution 4.0 technologies such as artificial intelligence, Internet of Things and others. The innovations in the smart library must make the library support the informational ecosystem where users can be continuously connected to the library. These two indicators will become concepts that will be elaborated on findings regarding the role of chatbots in supporting library services.

### Chatbots

In general, a chatbot is an application that can be accessed via a mobile device

to communicate with each other in obtaining information. The concept of chatbot technology refers to various software applications that are capable of conducting dialogue with humans and using grammar that humans can understand (Maniou & Veglis, 2020). Chatbot will only convey information in a simple form so that users are not burdened with excess information (Miner et al., 2020). Chatbots can be accessed by users in various ways, but various studies emphasize that chatbots are currently being developed to be accessed via mobile devices. (Ali, Naeem, & Bhatti, 2020; Mckie & Narayan, 2019; Shanthi, Keerthana, Nandha Kumar, & Nithya, 2019). In addition, not only in the form of text, the input that is conveyed can also be in the form of voice commands (Ali et al., 2020). Examples of chatbots in everyday life include Google Assistant and Amazon Alexa.

Artificial intelligence is the basis for making chatbots so that these applications can understand human language. Adamopoulou & Moussiades (2020) said that chatbots are artificial intelligence (AI) programs and implementations of interaction models between humans and computers. Through its communicative and interactive nature, chatbots are able to become personal assistants for their users in accessing various kinds of services (Adamopoulou & Moussiades, 2020). The chatbot is able to process language input from its users because it has been equipped with a branch of the Artificial Intelligence program, namely the Natural Language Program (NLP). Through the use of artificial intelligence, interactivity is the main advantage that chatbots can provide (Nawaz & Gomes, 2020). Based on this communication ability, some literature mentions AI with various other names such as digital assistants, virtual agents or smart agents (Ali et al., 2020).

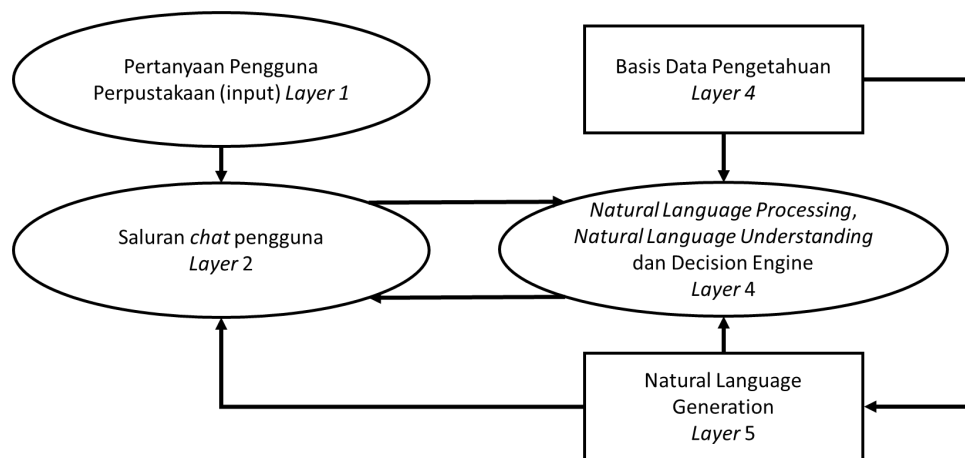


Figure 2. The Basic Process of Library Chatbot Work (Nawaz & Gomes, 2020)

Figure 2 describes the work process of the library chatbot in general (Nawaz & Gomes, 2020). Layer 1 describes the questions that will be submitted on the communication channel at Layer 2. The

communication channel must be installed with the meeting point of the library such as messaging applications or others. Various inputs submitted by Layer 2 will be processed at Layer 3 where the Layer has



been supported by Natural Language Processing (NLP), Natural Language Understanding (NLU) and decision-making machines. These three components are artificial intelligence that can understand, create and send text to users. Layer 4 is the knowledge database as the main unit of the chatbot. The database determines the quality of the information that will be conveyed by the chatbot to users, so it must meet certain technical criteria.

Through its advantages in resembling humans, chatbots are a technology that is considered capable of helping library institutions to provide the best service to their customers. Chatbot in library institutions is basically an information service that can be accessed 24 hours a day as long as the user is connected to the internet (Mckie & Narayan, 2019). As for Nawaz & Gomes (2020) also said that the chatbot provides general questions that are often asked by users and can provide contacts for librarians who work in certain fields. In addition, chatbots are able to make connections in various data in the library so that user questions regarding the collection of resources and their supporters can be answered easily (Patil, 2018). These advantages ultimately support the concept of user-centered services and the convenience aspects of smart library services.

## RESEARCH METHODS

This article is a conceptual study with the aim of synthesizing the theory between chatbots and the smart library concept. Jaakkola (2020) conveyed that theoretical synthesis is the integration of several theories or concepts from various scientific literature that have previously been published. Conceptual studies present a connection between concepts that have not previously been studied so as to broaden knowledge of a particular concept. In general, conceptual studies consist of two aspects, namely summarizing and integrating a concept or phenomenon (Jaakkola, 2020). Summarizing means compiling a knowledge or phenomenon that you want to know from literature while integrating means opening a phenomenon with a new perspective so that newness is obtained in the concept being studied.

The method in this study is a literature review that has been proposed by Nakano & Muniz (2018). Basically a literature review aims to identify, assess and synthesize all of the literature that is included in a particular topic. In conducting a good literature review, a procedure is needed to determine the scope and depth of a topic to be studied. In general, there are three aspects that must be present in a literature review, namely research questions, search and extraction processes and presentation of the results of the review. Table 1 outlines the literature review procedure proposed by Nakano & Muniz (2018) where the procedure will be used in this study

**Table 1.** Literature Review Procedure

No	Stage	Procedure performed
1	Defining the study theme	The theme of this research is the synthesis of the benefits of implementing chatbots in library services from a smart library perspective.  Research questions to be answered: What are the benefits of implementing chatbots in library services so that they can support smart libraries?
2	Browse scientific literature	Keywords used to search: chatbot, library, and digital library. The search was carried out on the Google Scholar and Scopus databases on 1 – 5 May 2021.

3	Read, summarize, synthesize and test the scope and depth of the review	Literature search results will be re-selected using inclusion and exclusion criteria. The following is an explanation of the two criteria:  Inclusion Criteria: Qualitative research that describes or analyzes the role of chatbots in a library.  Exclusion Criteria: Technical research designing or developing chatbot technology.  All literature that meets the inclusion criteria will be analyzed and the abstract will be taken so that a concept synthesis can be carried out.
4	Write a literature review	In this study, the results of the literature review are written in the results and discussion section. The writing of the results will be divided into several major themes

Based on the literature review procedure, this study found 5 articles that focused on the use of chatbots in a qualitative approach. This research does not focus on technical chatbot development so it does not include scientific literature

discussing chatbot development. Table 2 presents a list of the main literature that will be used as data in this study along with an overview of the studies that were conducted.

**Table 2.**Article Study Data

No	Author(year)	Research Brief Description
1	Allison (2011)	This study analyzes how to use a chatbot application called Pixel in the reference service at the University of Nebraska-Lincoln library.
2	Talley (2016)	This study discusses the use of various artificial intelligence technologies in library institutions including chatbot applications. This study discusses the Emma chatbot from the Public Library in Ohio, the Page chatbot from the Nova Southeastern University Law Library and its general use in Canada.
3	Bohl (2018)	This study analyzes Plutchik's chatbot in providing services to the National Library of Medicine. Through artificial intelligence, Plutchick is considered to have a high ability to search literature across databases.
4	Mckie & Narayan (2019)	This research explores the potential of using chatbots to enhance students' academic research experiences developed by the University of Technology Sydney. Based on the results of their research, librarians must collaborate with technology developers in developing chatbots so that chatbots can be created that have value, are easy to use, reliable and can be customized.
5	Ali, Naeem, & Bhatti (2020)	This study analyzes the use of artificial intelligence technology, including chatbot applications, in academic libraries in Pakistan. This research also has implications that librarians must participate in the development of artificial intelligence technology for libraries.

## RESULTS AND DISCUSSION

The synthesis results regarding the use of chatbots in library institutions from the main study

data yielded two major themes, namely: supporting personalized information services, and integrating cyber space and real life. These

various themes will be further elaborated with the smart library concept. The relevance of chatbots in supporting smart libraries has been previously discussed in a literature review. In addition, this study will focus on the smart service dimensions of the smart library concept. The following is an explanation of the use of chatbots in library institutions to support smart services:

### **Support Personalized Information Services**

The theme of personalized information services refers to an information service provided by the library by taking into account the needs and preferences of each library user. Allison (2011) said that there are at least two major characteristics of chatbots, namely providing personalized search results based on specific user activity and collaboration with users to confirm and adjust information search results. Both of these will be the basis of analysis for the system that works to provide information recommendations to its users. Even with a single sign-on system, a university library can provide users with information at a personalized level (Mckie & Narayan, 2019). Chatbot is a smart machine so that this technology will continue to learn from interactions between its users to increase the relevance of the information provided (Allison, 2011). This raises the efficiency and effectiveness of library services because users are not given the burden of an abundance of information and has implications for customer satisfaction (Schöpfel, 2018).

*Chatbots* known as a technology capable of supporting the creation of a two-way interaction experience so that library users are able to ask various kinds of questions according to their needs. Allison (2011) said that the Pixel chatbot can provide information services like humans because it is able to process human language and answer it quickly according to the questions given. As for this, the Pixel chatbot seems to be a communicator in conveying information on the library's website. Talley (2016) also said

that the librarian at the Ohio Public Library continues to improve the ability of the Emma chatbot to answer questions from library users so that it has high accuracy in providing answers according to the resources in the field. The Plutchik chatbot is able to interact with healthcare providers not only with text but with voice and gestures (Bohle, 2018). The interactive nature supported by chatbots ultimately provides easy and fast access for users to obtain information.

Chatbot services can be accessed on digital devices that are owned by each user so that the service can be said to be personal. Several chatbots are already connected to Facebook messenger so that library services can be accessed via cell phones, laptops and other mobile devices (Allison, 2011). Chatbot Plutchik also utilizes applications on mobile devices as a medium to support interactivity with its users (Bohle, 2018). The smartphone is considered capable of being a medium to become a conversational agent capable of providing information from a library's website (Talley, 2016). These various conveniences ultimately make the development of chatbots a library effort to support user-oriented services so that the library services provided can be accessed anytime and anywhere in person. (Aithal, 2016).

The use of chatbots also encourages the culture and characteristics of the library users themselves so that users are more comfortable using library services. The Lib-Bot chatbot developed by the University of Technology Sydney academic library has been designed to fight library anxiety in undergraduate students (Mckie & Narayan, 2019). Chatbot services also support community culture, especially the younger age group, which uses digital media as their personal assistant. Bohl (2018) said that the use of AI technology, especially chatbots, is increasingly relevant to young researchers who are used to using commercial chatbots such as Siri, Google Assistant and Alexa. This is in accordance with the opinion Ruan &



Wang (2016) conveyed that smart libraries must maximize opportunities to meet the needs of digital culture from every level of society. The fact of opening access to services to all levels of society supports the concept of user-centered services.

Various facts that have been presented state that personalized information services are also library user-centered services or in this case chatbots can support smart services in smart libraries. Starting from its support for providing specific information, interactivity with library users to supporting the culture of library users, making chatbots a medium for providing customer-oriented services. In accordance with the Schöpfel (2018) that the smart library must continue to adapt to the needs of its users. As for Zhang et al. (2018) said that a smart library must be able to provide fast access to information and good resources to its customers. In the end, everyone's needs will be met intelligently or in this case assisted by digital technology that is able to process information independently.

The theme of personalized information services can also be elaborated on with indicators of the spirit of innovation in the library. Chatbot is basically an AI technology that can continuously learn about the interaction patterns of its users through NLP programs (Nawaz & Gomes, 2020). Talley (2016) said that until 2011, *Chatbots* Emma, which was developed by the Ohio Public Library, continues to study the interaction patterns between its users so that the accuracy of giving answers can reach 90%. The use of technology such as machine learning and pattern recognition supports how chatbots can continue to study user behavior patterns (Ali et al., 2020). This makes chatbot a technology that can continue to provide novelty to the services provided by libraries because this technology is continuously learning to provide excellent service.

## Integrating Cyberspace with Libraries

The theme of cyberspace integration with libraries refers to how libraries are able to provide online services to their users. Talley (2016) said that chatbots can be used as a medium that facilitates librarians to assist students in distance learning through their reference services. Meanwhile, through interactive chatbots, users can obtain real-time information about the circulation of resources in the library and extend the loan period (Talley, 2016). Nawaz & Gomes (2020) said that chatbots can provide responses or answers to frequently asked questions and connect users to the right librarians so as to support effective and efficient services. Sorna Shanthi, Keerthana, Nandha Kumar, & Nithya (2019) stated that the use of chatbots in university library institutions could make it easier to access information about book availability so students could not have to go to the library directly. These various conveniences ultimately open up user access to library services only through their personal devices.

Connecting libraries and users through digital technology allows users to access library services whenever and wherever they are. Mckie & Narayan (2019) said that the Libbot chatbot developed by the University of Technology Sydney can be used through a mobile device so that university library services can be accessed 24 hours and only with an internet connection. Allison (2011) also said that the Pixel chatbot can provide services for 24 hours and there is only 1% of that amount of time where the chatbot experiences a decrease in performance. Talley (2016) said that chatbots have been able to provide knowledge to library users such as identifying databases, limiting the number of searches and tricks for stringing search keywords at any time. This condition makes library services not limited by the dimensions of space and time and provides efficiency because it helps librarians to provide information services.

The use of chatbots can indirectly assist the librarian's role in answering various questions with high intensity and complexity. Allison (2011) said that not only overcoming repetitive questions, the Pixel chatbot can handle multi-step searches through a series of questions with complex algorithms. Chatbot Emma developed by the Ohio public library has answered 7116 questions during 2011 (Talley, 2016). This of course can support the work of librarians so that they can carry out other duties and functions in library institutions. Not only making connections between library institutions, chatbots in the end also connect library users with librarians as part of the library.

Based on the facts that have been presented, the aspect of integrating cyberspace and libraries is an example of the form of innovation carried out by libraries. The development of library services in the digital realm, including through chatbots, to provide 24-hour services is considered to be a novelty that provides value or benefits to its users through the use of digital technology (Mckie & Narayan, 2019). The use of chatbots in conveying knowledge about libraries is an innovation in itself because it has utilized digital technology as a medium for learning. Library agencies, in this case, must continue to explore the use of other industrial revolution 4.0 technologies to create a wider smart library ecosystem and increase the attractiveness of the library itself. (Schöpfel, 2018).

Integration between cyberspace and libraries is also part of user-centered services. Through access to library services provided 24 hours a day, the library understands the busyness and mobility of its users. In this case the use of chatbots will make the library able to adapt to the needs of its users. According to the statement from Schöpfel (2018) where easy access to information in the library is one of the components that build a smart library. In the end, libraries must be

able to adapt various digital technologies to be able to maintain their existence in a society that has mobility or a high level of activity

## **CONCLUSION**

This research found that there are at least two roles of implementing chatbots in supporting the formation of smart libraries, namely supporting personalized information services and integrating cyber space with real life. The results of the analysis also show that these two roles can support user-centered services and bring innovation to library services. Meanwhile, work efficiency is the keyword for implementing chatbots to create smart services. In terms of innovation, chatbots are considered capable of providing services that are continuously updated because they implement machines that can learn patterns of interaction with their users. In addition, chatbots help libraries to always be connected with their users anytime and anywhere. Eventually,

The implication of this research states that libraries must begin to see opportunities in developing and utilizing technologies that were present in the industrial revolution 4.0, especially chatbot technology. This needs to be done to open the widest possible access and provide the best service to the community at large. The chatbot is a technology that supports the provision of the best service for library users so this needs to be a focus for libraries that want to continue to improve the performance and quality of their services. Future research can empirically examine various libraries in Indonesia that have utilized chatbots in delivering services to their users, especially in creating smart libraries

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