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Design and Development of InfoRef using Dialogflow: A 24/7 Online Reference Service Platform

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Abstract

The present study proposes an AI-based conversational agent named InfoRef to provide reference services by creating an interactive interface between library services and users. The application works on the AAA (Anytime, Anywhere, Anyone) model and routes the users to the available information. It provides access to 24/7 information to users. The free version of Dialogflow (a natural language understanding engine by Google) was used for building the InfoRef application. After its development, the InfoRef was integrated with different online platforms like the website, Koha ILS, and Telegram. The integration worked well and generated a similar response on all platforms.

Keywords: AI, Chatbot, InfoRef, Reference Service, Virtual Reference Service

1. Introduction

In the 21st century, it has become essential for libraries to harness new technology; otherwise, they become obsolete (Tella and Ajani, 2022). Libraries can develop and use innovative, cutting-edge applications for user engagement. The chatbot, also known as a virtual assistant, digital assistant, or conversational agent, is one such technology with which a library can facilitate users' search for information in an interactive way. Chatbot is "a computer program designed to simulate conversation with human users, especially over the Internet" (Cambridge University Press, n.d.). Chatbots establish online communication and conversation between humans and computers (Madhuravani *et al.*, 2022). It processes the query input in natural language and draws the most relevant answer. The questions can be asked in either voice or text format. The main selling feature (USP) of Chabot is that it provides bidirectional communication and immediate responses and satisfies the needs of the information seeker.

The evolution of Chabot technology has a long and fascinating history. The first chatbot, Eliza, was developed in 1966, followed by Parry Chatbot in 1972. The emergence of AI-based technology led to the creation of a chatbot named Jabberwacky in 1988 (Adamopoulou and Moussiades, 2020). In 2001, the Smarterchild appeared, which can be integrated into messengers like America Online (AOL) and Microsoft (MSN). It was the first chatbot that assisted people in their day-to-day tasks like movie times, stock prices, news, weather, etc. Many organizations have integrated the AI-based assistant system into their website, messenger, Telegram, WhatsApp, etc., to provide the best experience while navigating the content. Some of the chatbot examples include Ask DISHA 2.0 (IRCTC), Ask GemMy (Government e-Marketplace, India), Ask Umang (Govt. of India), Ask Help (Pune Municipal Corporation), Amazon's chat helper, etc. Soon after the popularity of text-based chatbots, voice-based assistants became popular. Some of the key developments are Siri by Apple in 2010, IBM Watson in 2011, Google Now developed in 2012 and later upgraded to Google Assistant

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in 2016, Microsoft Cortana, and Alexa by Amazon in 2014.

The review of published literature found that the authors have widely discussed the applications of chatbots as support systems in various disciplines and domains like libraries, education (Mondal *et al.*, 2018; Colace *et al.*, 2018), classroom teaching (Topal *et al.*, 2021), banking (Singh *et al.*, 2018), healthcare (Brixey *et al.*, 2017; Chung and Park, 2019; Athota *et al.*, 2020; Gupta *et al.*, 2021; Suebsombut *et al.*, 2022), tourism (Kasinathan *et al.*, 2020; Chaves *et al.*, 2022), etc.

2. Chatbot and its Use in Libraries

The chatbot application has enormous potential in library services. The integration of chatbot applications in libraries fulfills five laws of library science. Five laws provide scientific basis and general principles, which serve as guidelines to librarians in organizing and managing information products and services. The first law, "Books are for use", emphasizes that books and other documents in libraries should be accessible to users so that they can make use of it. The chatbot application facilitates the library users to access information anytime from anywhere. The second law, "every reader his or her book," focuses on the fact library users are a diverse group and that each one of them should be satisfied. The chatbot applications support navigation by users who speak different languages or want to access information in different formats, e.g., text or audio. The third law "every book its reader" is to find users for different kinds of resources available in the library. The marketing and auto recommendation of library resources can be done in the chatbot. The fourth law "save the time of the reader" suggests that user's time is valuable. The chatbot provides an easy interface for navigating the different resources available in the library. The fifth law "library is a growing organism" suggests that library should grow in all aspects; collection, staff, services etc. The chatbot application helps in building the collection of the library based on the log analysis of queries.

One potential use of chatbots is to offer reference services to library users. This is an effective method for converting users in to habitual users. It connects people with the information they want and acts as a personal assistant. The advancement in Internet and web technologies has provided the power to libraries to offer powerful virtual reference services. It is considered the only available and effective method to convert potential users to habitual users (Abdullahi and Mamza, 2014). In recent times, several such popular Text messaging and chat-based services have been introduced in libraries like, Email, feedback forms, chat services, ask the librarian, etc. (Allison, 2012). However, these applications need the involvement of humans to a major extent, where one has to respond to the query. Though, AI-based technologies like Chatbot or Conversational Agents are always available with limited human involvement (i.e., in developing the application). The key advantage of using such a system is that it provides a uniform response to the user whenever the session is triggered. In today's digital age, there is a growing demand for services that allow users to access information without having to physically visit a library. These services are known as digital reference services, and they have become increasingly popular with the emergence of the internet and the World Wide Web. Librarians have implemented both asynchronous and synchronous digital reference services to meet this demand. Examples of such services include email, "Ask A" services, online pathfinders, chat-based reference (instant messaging, WhatsApp, WeChat), video-based referencing services, real-time live web reference FAQs, social networking sites, and mobile-based services (QR codes). Early platforms for intelligent reference services include REFSEARCH, POINTER, Online Reference Assistance (ORA), AMSWERMAN, and PLEXUS (Mogali, 2014; Singh *et al.*, 2019).

Libraries have also embraced AI-based technology as a means of connecting and interacting with users. There have been several examples of chatbot applications implemented in libraries. In 2009, the Mentor Public Library in Ohio developed a chatbot named "Emma the MPL Chatbot" and found a success rate of 90% in answering users' questions (Mentor Public Library and Pandorabots, 2017). The University of Nebraska-Lincoln began developing the chatbot "Pixel" (http://pixel.unl.edu) in 2010, using an SQL database and an open-source PHP interpreter for Program-O written in AIML (Allison, 2012).

The University of California, Irvine (UCI) initiated the chatbot project entitled "ANTswers" in 2013 (Kane, 2019 as cited in Ehrenpreis and DeLooper, 2022). It was developed with an aim to provide online reference services on frequently asked questions like library hours, policies,

printing, and restrooms without requiring the physical presence of the staff. (Kane, 2017 as cited in Ehrenpreis and DeLooper, 2022). In 2020, San Jose State University developed a chatbot named as Kingbot that can process the basic circulation and introductory reference queries of the users (Rodriguez and Mune, 2021). The chatbot was implemented using Dialogflow and Kommunicate. Panda and Chakravarty, 2022 explored the development of chatbot application using engati platform (https://app.engati.com/admin/login).

The literature suggests that the implementation of chatbot applications in libraries has received considerable attention. It has also been noted that chatbot applications can be developed in two ways: either from scratch using programming languages such as Artificial Intelligence Mark-up Language (AIML), Python, Java, etc., or by using chatbot frameworks. Some popular frameworks and platforms for building chatbot applications include DialogFlow, Microsoft Bot Framework, Rasa, OpenDialog, Botanic, and more.

This study outlines the development of InfoRef, a 24/7 reference platform for library users that uses Dialogflow. Implementing chatbots in libraries has been found to help librarians in avoiding repetitive queries (Rubin *et al.*, 2010) and focus on answering more complex queries from users. One of the key advantages of using chatbot applications in reference services is their availability 24/7, as well as their ability to provide quick, consistent, and courteous human-like responses in processing queries (Cox *et al.*, 2019).

3. DialogFlow

Dialogflow is a cloud-based natural language understanding platform developed by Google. The implementation of chatbot applications is straightforward and can be integrated with existing websites and with various applications like Facebook Messenger, Twitter, Telegram, Slack, Viber, etc. The advantage of Dialogflow is that it can be deployed anywhere to create a conversational interface after the development of a complete application (Yossy and Budiharto, 2021). So, there is no need to develop different applications for different platforms. It is available in two versions, i.e., E.S. and CX. Dialogflow ES is the standard version applicable for applications that handle simple to moderately complex queries. However, DialogFLow CX is an advanced version for handling complex queries (Google, n.d.). The key benefit of using the Dialogflow application is that it can be implemented at a low cost with minimum technical knowledge and programming coding skill (Rodriguez and Mune, 2021).

4. Design and Development of InfoRef

The following steps were taken to develop the chatbot application (InfoRef) using DialogFlow:

1. Registration of Account on Google Platform (i.e., Gmail Account)
2. Creation of Agent Name (Name of the application, in this case, InfoRef)
3. Creation of Intents (Presently 04 in this pilot case, Algebra, Arithmetic, MyLibrarian, End. 02 intents are default: Default FallBack Intent and Default Welcome Intent)
4. Enabling Small Talk (Who are you, what is your age, etc.)
5. Training of each Intent with Phrases the user can respond to and responses that the application is supposed to answer
6. Creation of entities (The present application use system entities only, @sys.any)
7. Sample Testing
8. Integration with other applications (Telegram, Website, and Koha)

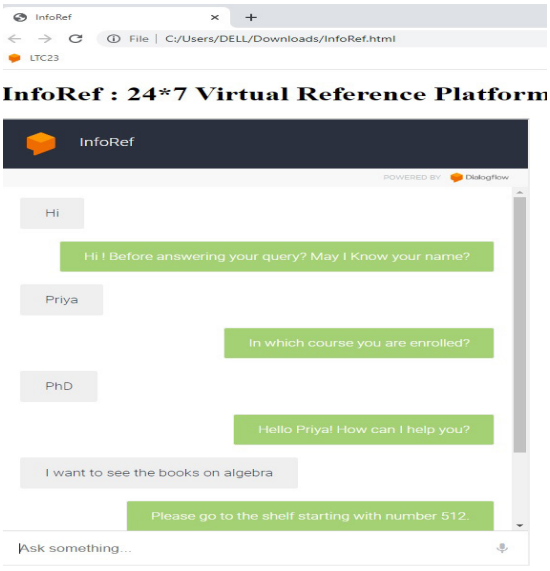


Figure 1. Web page integration of InfoRef.

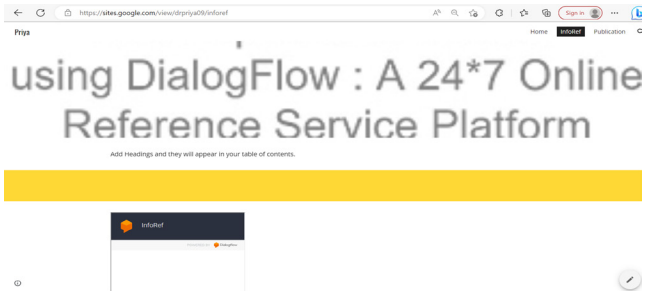


Figure 2. InfoRef integration on Google sites.

After the development of InfoRef, it was embedded as HTML in a webpage on a local machine, as shown in Figure 1.

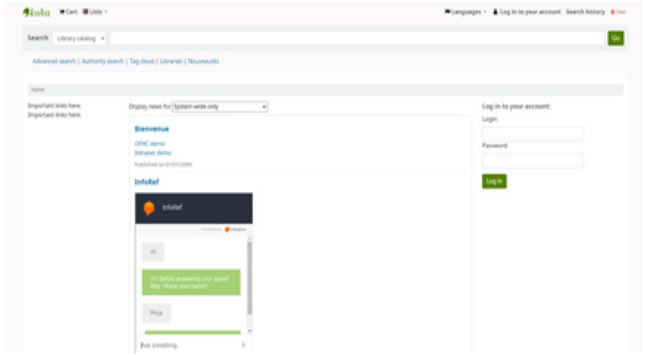
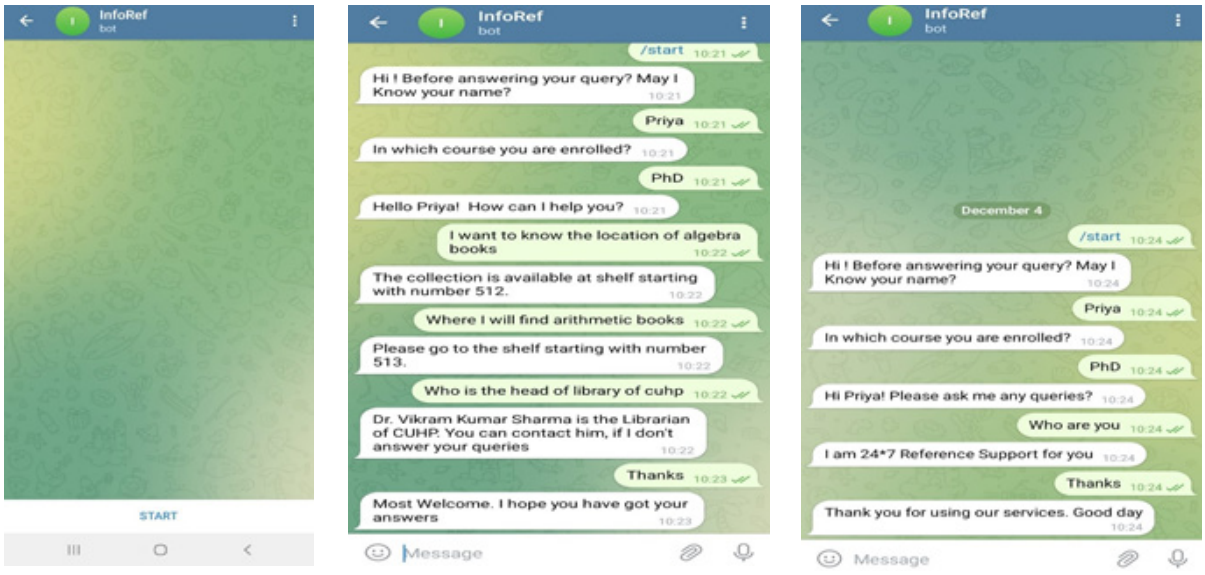


Figure 3. Koha integration InfoRef.

Figure 4. InfoRef integration on Google sites.

Further, the InfoRef application was also linked to the website developed using Google sites. The link to the website is https://sites.google.com/view/drpriya09/inforef. Figure 2 shows the screenshot of the InfoRef application on the Google site.

After integrating InfoRef with the library's website, testing was done to integrate it with the Library Management System (LMS). Koha LMS was chosen for this experiment as it is a popular and widely used LMS in Indian libraries (Thomas, 2017). To test the integration, the demo site of Koha OPAC (http://demo.biblibre.com/) and staff interface (http://intranet-demo.biblibre.com/)



(a) (b) (c)

Figure 5. **(a)** Starting App. **(b)** Chat response with the user. **(c)** Small talk with the user.

provided by biblibre were used. The platform provides cloud-based free testing and uses the latest version of Koha 21.11. InfoRef was integrated by embedding the code in the News setting under Home > Tools > News. Figure 3 shows a small conversation on the OPAC interface. This can be customized for other locations in OPAC with color beautification as per the library's requirements. Lastly, InfoRef was integrated with the Telegram app, as shown in Figures 5 (a)-(c). The same can be accessed from the URL http://t.me/InfoRefBot or by scanning the QR code shown in Figure 4.

Figure 5 (a) shows the starting interface of the InfoRef in the Telegram app. Figure 5(b) shows the conversation between the user and InfoRef in the Telegram app, and Figure 5(c) shows the small talk interactions.

5. Conclusion

This study presents the development and integration of the InfoRef chatbot with various online platforms. Libraries are facing budget cuts, which has made it challenging for them to maintain their traditional services and programs. As a result, libraries are exploring new ways to minimize the impact of these budget shortfalls; and technology provides a solution. By investing in innovative technologies, libraries can automate routine tasks, streamline their operations, and provide new and improved services to their users. This not only helps them make up for lost funding but also enables them to adapt to the changing needs and expectations of their communities. The development of InfoRef demonstrated that libraries can adopt technology to provide 24/7 virtual reference services with minimal programming skills, limited financial resources, and ICT infrastructure. However, to cater to a wider range of user queries, future work should focus on incorporating more intents and building a robust and diverse chatbot application. InfoRef can be an innovative and efficient tool for libraries to enhance their services and engage with users effectively.

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