LIBRARY SERVICES FOR SCIENCE AND EDUCATION SUPPORT

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Improving the Inclusive Information Space: Introducing Chatbots into the Work of Academic Libraries

Objective. The purpose of the publication is to study the possibilities of using chatbots as one of the tools for developing an inclusive environment in an academic library. **Methods.** The study analyzed international experience and software for creating AI-based chatbots. **Results.** An academic library can use open-source software to create chatbots, but this method will require significant resources. An alternative is commercial services, which are quite easy to use but require monthly funding. **Conclusions.** Chatbot is a very promising direction for building an inclusive direction, and each library can choose how to create and use it according to its needs.

Keywords: chatbot; academic library; artificial intelligence; inclusiveness

Introduction

Different communities always form around libraries. Students, pensioners, and active readers all turn to the library to meet a wide range of needs. Therefore, one of the most important tasks of a library is to support its visitors. To do this, libraries need to develop their space and make it easy, safe, and understandable. This process is called 'inclusion', which literally means "the idea that everyone should be able to use the same facilities, take part in the same activities, and enjoy the same experiences, including people who have a disability or other disadvantage', meaning that the library space becomes more accessible to a wide range of people (Cambridge University Press & Assessment, n.d.). In Ukraine, there is a project called "Barrier-Free Space" (Ministerstvo rozvytku hromad, n.d.) and "Handbook of Barrier-Free Access" (Dovidnyk bezbariernosti, n.d.) implemented by the Ministry of Community, Territorial and Infrastructure Development of Ukraine. These two resources can serve as a basis for libraries to research, implement, and develop inclusion.

A library can be developed in two ways:
1) Developing the physical space: for example, building ramps, adapting workstations for people with disabilities, or providing rest areas, quiet zones, and comfortable furniture for those who are uncomfortable working with large numbers of people, who need to concentrate on their work or who need to rest.
2) Developing the information space: for example, presenting information in a way that can be understood by everyone, making the best use of online resources, and adapting their websites for people with visual, hearing, and other cognitive impairments.

The purpose of the publication is to study the possibilities of using chatbots as one of the tools for developing an inclusive environment in an academic library.

Methods

The methods used to achieve this purpose were analysis and synthesis. We analysed academic library websites and their chatbots, as well as software that can help with their creation

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and use. The main focus was on the capabilities that libraries need. The research was conducted for 5 months while working on the KPI (the Igor Sikorsky Kyiv Polytechnic Institute) Library chatbot.

Results and Discussion

One of the easiest ways to develop an inclusive information space in libraries is to introduce chatbots. Chatbots help libraries to optimise their workspace and make it much more accessible not only for users but also for librarians. For example, chatbots can be the first step on a library's path to creating an inclusive information space.

For example, if a library does not have the ability to remotely process information requests using specialised software (automated library information system), it can use chatbots to do the following: take orders for textbooks, extend the period of use of publications, provide information and advice. This way, all the information is stored in one place, you can set up different access for different people, set up automatic responses, and much more.

The main advantage of chatbots is a simplified communication system, as some users can get confused by the amount of information when using websites. For example, the Library of the National Music Academy of Ukraine was one of the first Ukrainian libraries to implement a chatbot. Experts have compiled the most important information and functions that users might need in one of the popular messengers: the possibility of remotely extending the period of use of literature, access to the electronic catalogue, working hours, rules for using the library, and FAQs (Biblioteka Natsionalnoi muzychnoi akademii, n.d.)

The practice of using chatbots is becoming more popular every year. It is especially useful for strengthening the information sphere of work in academic libraries. Among Ukrainian academic libraries, there is the Scientific and Technical Library named after G.I. Denysenko Scientific and Technical Library of the Igor Sikorsky Kyiv Polytechnic Institute. Users of this library can get answers to any questions about the work of the library, advice on the choice of books and much more (KPI Library, n.d.).

Typically, Ukrainian libraries use instant messenger-based chatbots, but the global practice of using such technologies is much broader. The University of Queensland Library, for example, has integrated a chatbot into its website. The welcome message immediately provides a link to a page describing its capabilities, a brief tutorial on how to use it, and, importantly, information about data and privacy. The first step is to ask for the user's name and email address. A copy of the conversation is sent to the user's email, which helps to keep a history of the dialogue between the library and the user. The chatbot can only search for answers on the library's website, guides, and Open Textbook. The answers are short and include links to more detailed information about the request. The advantage is its multilingualism: in addition to English, it is possible to use, for example, Ukrainian or Polish. The developers have also created a survey to evaluate the work with the chatbot, where, in addition to test questions, there is an opportunity to write a detailed answer (The University of Queensland, n.d.).

Another interesting example is the University of Wollongong Library's 'Chat Buddy', designed to work when librarians are away from their desks. The chatbot is quite simple and starts by offering answers to 4 frequently asked questions and a search for FAQs. If a user is unsure about what to ask, he or she can use the bot to send an enquiry to the library. According to the website, a response should be received within 1 working day (University of Wollongong Library, n.d.).

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The Georgia Tech Library chatbot is very similar to the previous one. This platform has more features and topics, but there are also differences: you can continue the dialogue after receiving an answer, and the widget opens in a separate window (Georgia Tech Library, n.d.).

However, generative artificial intelligence is one of the best assistants in creating an accessible information space. Modern technologies make it possible to create convenient and user-friendly chatbots using artificial intelligence. Zayed University Library's Aisha ChatBot uses this approach. The developers used the OpenAI API (GPT-3.5 turbo model) with the integration of library and third-party information resources. The open-source software with a free plan was used to build the chatbot. In addition, internal testing was performed and only a few real bugs were found. The main errors were related to the generation of non-existent links and the chatbot's confusing sources and responses to current events. Currently, some of the issues have been fixed and public testing is underway. The chatbot supports different languages, for example, it can speak Ukrainian. It can search the library catalogue and provide correct links. Of course, the chatbot is imperfect and has non-critical problems, for example: incorrect definition of 'intent', i.e. searching for articles on the topic 'chatbots' instead of 'chatbots in academic libraries' (Fig. 1) (Zayed University, n.d.; Lappalainen & Narayanan, 2023).

Fig. 1. Library Catalogue Suggested Resources

Sometimes limited resources can complicate the development of chatbots for academic libraries, so it is worth looking at open-source software or low-cost commercial offerings. The former usually includes already developed platforms or frameworks - "software structures with software development tools, such as language translators, debugging tools, libraries" (IGI Global, n.d.).

An example of an off-the-shelf platform is Tock (https://doc.tock.ai/en/). It has several advantages that will be useful for libraries. The first advantage is that no special programming skills are required to set it up, as there is a clear user interface (Fig. 2).

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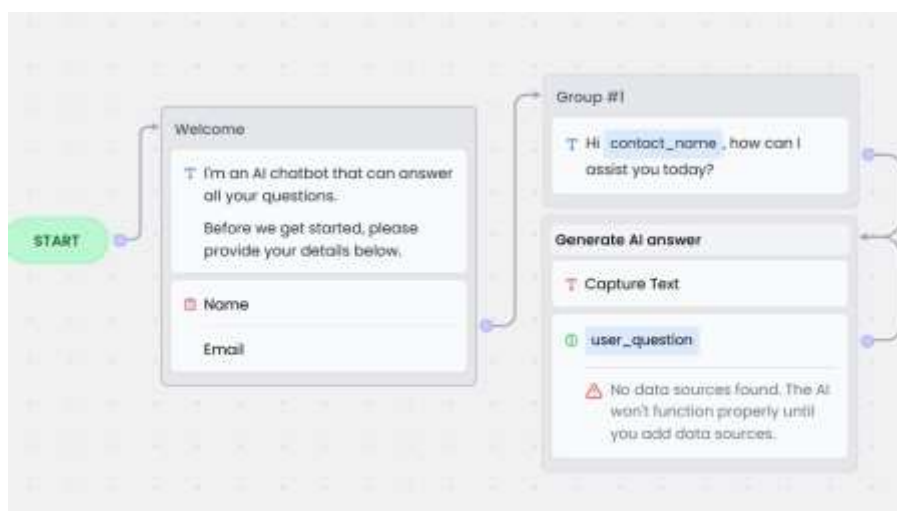LIBRARY SERVICES FOR SCIENCE AND EDUCATION SUPPORT

Fig. 2. Interface for creating stories

This interface allows you to easily create bots and train them using 'stories' consisting of a question and the answer/response. The more sentences entered, the easier it is for the bot to recognise 'intent' and 'entities' using NLU. This can also be seen as a disadvantage, as a significant number of manually entered stories may be required to provide quality answers and maintain a dialogue. At the time of writing, there are 14 different connectors available for the bot to integrate with, for example, a website, Facebook Messenger, Microsoft Teams, etc. Another advantage is the availability of built-in analytics with a wide range of static data. There are quite a few indicators, so we won't list them all, but for library activities, those that describe the time of the call, the date, the type of 'connection' and show the history of the dialogue may be useful.

All these indicators are presented in the form of graphs and diagrams, with interactive elements, making it easier for library staff to understand the information and reducing the workload for them, for example, when preparing reports. If required, it is possible to download them in CSV format. The level of detail in the statistics can potentially be used to analyse user needs, periods of requests, connections, etc. This information can be used to plan the library's work.

Tock mainly uses open-source software, such as OpenNLP, Stanford CoreNLP, or Duckling, which minimises additional financial costs. One of the main commercial services is MongoDB, but there is a free plan.

There are several other features worth mentioning. The first is the availability of a demo platform, which allows you to test the main features of the platform and the learning features. All you need to access it is a GitHub account (https://demo.tock.ai/language-understanding). The second feature is the ability to use large language models and the embedding engine from OpenAi and Azure OpenAi, which will potentially improve the quality of responses. The final feature is deployment using Docker. It's a fairly easy way to get started, with a written manual. It's not the best method for long-term use, but it may be suitable for a library chatbot, as the chatbot will potentially not have a large number of queries. This method also allows for practical testing.

Another way to build chatbots is to use frameworks, which have built-in components to help build, train, and connect bots. They can either include a pre-built user interface or built-in AI models and can also rely on third-party services.

All of these resources have certain advantages and disadvantages in common. The advantages include the possibility of flexible chatbot development, as developers can choose exactly the components they believe are best suited to a particular library and its capabilities. These

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components include both natural language understanding models and third-party service integrations for analytics, messenger connectivity, etc. Disadvantages include the need for development costs and the involvement of IT specialists.

Another issue is the use of various services that are required for the bot to function. Not all of these are free or open source, and access is often provided on a monthly subscription basis, which can make the total cost too high for some libraries. It is also worth noting that any locally deployed software will require appropriate hardware and software to function properly.

Thanks to its wide range of features, Botonic can be described as a promising framework that allows not only the creation of simple conversational text bots but also the addition of graphical elements and the switching between a bot and a live person during the dialogue. The developers have paid particular attention to creating a set of plugins that allow you to connect various services for analysis, translation, NLU, etc. The instructions are quite detailed to help you install, learn, and develop your own plugins. A rather controversial feature is that it is currently intended to be deployed via the Hubtype service. On the one hand, this is intended for deploying chatbots, and the process is relatively straightforward, but on the other hand, there is a limit of 500 active users per month, with no detailed explanation, after which you will need to negotiate the price with the developer (Botonic, n.d.).

An alternative to open-source software is to use commercial services. These can be more cost-effective if you do not need personalised customisation, or do not have IT specialists or the physical and technical resources. There are a large number of them, and each can have its own peculiarities, so for illustrative purposes we have chosen those that include differences in approach to service delivery.

The first is Chatling. Chatling offers 4 subscription levels, which determine the number of AI credits, the duration of conversation history storage, the size of downloadable training files, AI models, etc. It is possible to increase the number of some components by purchasing them 'off plan'. The free version is more suitable for testing, as it only has 100 credits, which correspond to the number of answers to 100 queries (GPT - 3.5). The disadvantage is the lack of easy integration with messengers, as this requires a third-party commercial service (Chatling, n.d.).

The second is Botpress, which has 2 levels: 'Pay-as-you-go' and 'Team'. We will not consider the latter, as even with a discount, it costs 495 USD/month. The former has a free plan whose main feature is the 5 USD AI credit. Using the cheapest model (GPT - 3.5), the price of a response can be on average $0.01-0.05, which corresponds to 500-100 bot responses per month. Therefore, with proper training (in the form of short but informative responses), it is theoretically possible to reduce costs and use this service in libraries that do not have a large number of requests. Another feature is the ease of integration with instant messengers and other services that may be useful, such as AWS S3, Wikipedia, or Google Analytics. Other features such as the number of bots, Always Alive mode, storage size, etc. can be purchased separately if required (Botpress, n.d.).

Commercial services tend to have many common advantages. First and foremost is the lack of need for good programming skills, thanks to a dedicated user interface. It allows you to easily create sequences of bot actions. For example, the first step might be a greeting and collection of contact information, a question from the bot about how it can help, and then the generation of an answer (Fig. 3). However, it is not necessary to create a large number of components, as a chatbot can function with a single component that generates a response to any request.

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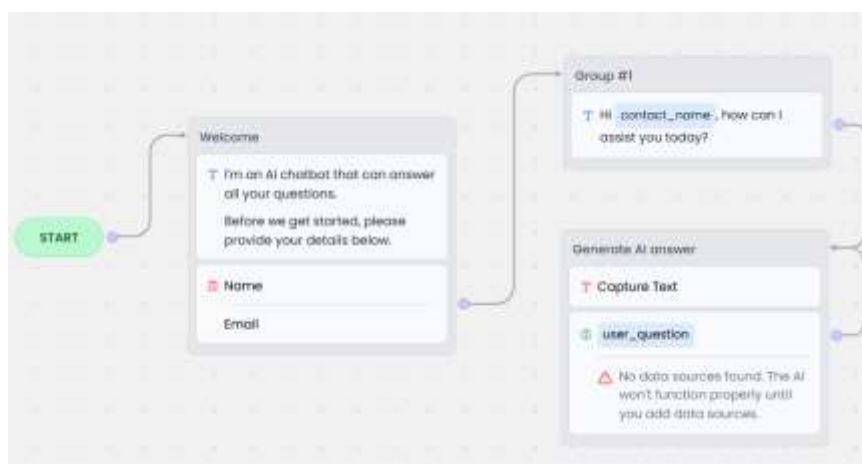LIBRARY SERVICES FOR SCIENCE AND EDUCATION SUPPORT

Fig. 3. Chatling visual constructor

Another advantage is the simplicity of the training. This training is quite diverse and consists of the following components: manual text entry; uploading of text files; training on information from a specific site; and searching on specific sites or the web in general. The whole process is automatic and does not require any additional action. It is also easy to set up a website widget that allows you to choose the colour, size, and language of the interface, upload logos, etc.

It is convenient to place chatbots on the servers of the service itself, as this can partially duplicate the information available on the website or other resources. For example, if the library servers are disabled, it is still possible to communicate via messengers if they have been integrated. This will allow users to receive at least general information about library services.

One of the main disadvantages of commercial services for libraries is their price. A plan that covers a library's basic needs for implementing and using a chatbot can cost around $15 per month. For many libraries in Ukraine, for example, this is quite expensive. Another rather controversial factor is the dependence on a particular service provider: there is the possibility of price changes, work stoppages, various failures, etc. In this case, there will be no easy way to transfer the trained model to another service and you will have to start from scratch. There may also be limitations on the use of statistics and the completeness of the information provided: short storage period, limited access to indicators, etc.

An important condition of using the services listed above is that you read the Data and Privacy section. The services collect and process a certain amount of information, so we need to understand what information we have access to and how that information is used. If the information provided by the developer is not appropriate for the Library, it is better to find an alternative service or consult with lawyers.

Conclusions

Working towards inclusion is an important aspect of any library's work. There are many ways and opportunities to start this work. One of the easiest ways to make your library workspace more inclusive is through the use of chatbots. The development of conversational chatbots is a particularly promising area for academic libraries. They make it easier for users to access information, taking into account all their needs.

The process of creating a chatbot will be different for each library and will depend directly on its capabilities. For example, you can use open source software, which gives you the flexibility to tailor the chatbot to your library's specific needs, but may require more involvement from IT

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specialists and upgrades to the material and technical base. You can also use commercial services. They can be quite expensive but offer several advantages: easy training and setup, deployment, and integration with other services (messengers, social networks, etc.).

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Удосконалення інклюзивного інформаційного простору: впровадження чат-ботів у роботу академічних бібліотек

Мета. Мета публікації – дослідити можливості використання чат-ботів як одного з інструментів розвитку інклюзивного середовища в академічній бібліотеці. **Методика.** Дослідження проводилося шляхом аналізу міжнародного досвіду та програмного забезпечення для створення чат-ботів на основі штучного інтелекту. **Результати**. Наукова бібліотека може використовувати програмне забезпечення з відкритим

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вихідним кодом для створення чат-ботів, але такий спосіб потребує значних ресурсів для створення. Альтернативою є комерційні сервіси, які досить прості у використанні, але потребують щомісячного фінансування. **Висновки.** Чат-бот є дуже перспективним напрямком для розбудови інклюзивного напрямку, і кожна бібліотека може обрати спосіб його створення та використання відповідно до своїх потреб.

Ключові слова: чат-бот; наукова бібліотека; штучний інтелект; інклюзивність