

AI-Powered Chatbots for Enhancing Accessibility in Higher Education – Design and Implementation

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Abstract. The paper explores the application of Artificial Intelligence (AI) in improving communication and accessibility in educational settings through the development of an AI-powered chatbot. The chatbot addresses students common challenges, such as delays and inefficiencies in administrative processes, by providing an instant and reliable access to the college-related information. The presented chatbot developed using a Voiceflow platform leverages the predefined responses and dynamic AI-generated answers to balance the cost-effectiveness and functionality. Paper reviews the related research, it highlights various methodologies and platforms used for the chatbot development and justifies the selection of the Voiceflow for its user-friendly interface and robust integration capabilities. The chatbot functionality includes answering frequently asked questions guiding administrative tasks and supporting diverse user needs, including visually impaired students. By integrating the third-party databases and utilizing the GPT-3.5 Turbo for complex queries, the chatbot demonstrates scalability and adaptability. The testing reveals its potential to significantly reduce administrative workloads while enhancing the user experience and underscores its transformative AI potential in education. Our future work will be towards expanding the language support, emotion recognition, and knowledge base refinement to further optimize the chatbot efficiency and effectiveness in serving students and staff.

Keywords: Artificial Intelligence (AI), Chatbot, education, Natural Language Processing (NLP), Voiceflow

Zasnova in implementacija umetnointeligentnih klepetalnikov za izboljšanje dostopnosti v visokem šolstvu

Prispevek raziskuje uporabo umetne inteligence (UI) za izboljšanje komunikacije in dostopnosti v izobraževalnem okolju z razvojem klepetalnika, podprtega z UI. Klepetalnik se osredotoča na pogoste izzive študentov, kot so zamude in neučinkovitosti v administrativnih postopkih, saj omogoča takojšen in zanesljiv dostop do informacij, povezanih s fakulteto. Predstavljeni klepetalnik, razvit na platformi Voiceflow, združuje vnaprej določene odgovore in dinamične odgovore, ustvarjene z UI, da uravnoteži stroškovno učinkovitost in funkcionalnost.

Prispevek pregleduje sorodne raziskave, izpostavlja različne metodologije in platforme, uporabljene pri razvoju klepetalnikov, ter utemeljuje izbiro platforme Voiceflow zaradi njene uporabniku prijazne zasnove in zmogljivih integracijskih zmožnosti. Funkcionalnosti klepetalnika vključujejo odgovarjanje na pogosta vprašanja, usmerjanje pri administrativnih nalogah in podporo raznolikim potrebam uporabnikov, vključno z osebami z okvarami vida. Z integracijo zunanjih podatkovnih baz in uporabo modela GPT-3.5 Turbo za kompleksnejša vprašanja klepetalnik izkazuje prilagodljivost in razširljivost.

Testiranje je pokazalo njegov potencial za znatno zmanjšanje administrativnega dela ter izboljšanje uporabniške izkušnje, kar poudarja njegov preoblikovalni potencial UI v

izobraževanju. V prihodnje načrtujemo širitev jezikovne podpore, prepoznavanje čustev in izboljšanje baze znanja, da bi še dodatno optimizirali učinkovitost in uspešnost klepetalnika pri podpori študentom in zaposlenim.

1 INTRODUCTION

Artificial Intelligence (AI) has been a topic since antiquity, but its practical applications have surged in the 21st century with advancements in technology. The advent of the tools like ChatGPT, Gemini (formerly Bard) or Copilot has revolutionized industries by offering sophisticated capabilities accessible to the public. AI has already significantly impacted various industries and is going to transform numerous unexplored opportunities. One of the most common applications of AI is in customer service where it minimizes the manpower and broadens the amount of the hours the customer support is available while also lowering the operational cost. A survey of the customer experience with online communication channels shows that 34% of the users find the website navigation non intuitive and 31% of them get no answers to their queries [1]. Notably, 64% of them express the need for a 24-hour service, 55% for instant replies and 55% for resolutions to simple questions [1].

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The paper introduces an AI-powered chatbot designed to optimize the interaction between the college students and administration. It allows the students a 24/7 access to the college-related information thus reducing the administrative workload. The current communication methods, such as in-person visits or emails, often result in delayed responses and miscommunication. In contrast, an AI solution offers instant and reliable answers with possibilities of integration to widely used platforms like SMS, WhatsApp, and Messenger. It is beneficial for parents, visually impaired individuals and new students by providing an accessible and personal support.

Section 2 reviews the research on the AI-powered chatbots in education, focusing on their methodologies, tools, and platforms. It highlights the key studies to establish the technological landscape and explains the choice of the Voiceflow. Section 3 describes the chatbot design and its implementation when integrated with third-party databases and Voiceflow. It affirms the key components such as predefined responses for FAQs, AI-generated answers, and navigation mechanisms like buttons and intents. It also deals with the knowledge base creation and refinement. Section 4 explains the methodology to optimize the chatbot focusing on the GPT-3.5 Turbo for dynamic responses. It highlights the parameters like token limits, temperature and prompt design presents the testing showcasing scalability and adaptability.

2 RELATED RESEARCH

The development of the AI chatbots varies widely in their methodology, reflecting the flexibility of their technology. In [2], Python is used as a preferred computer programming language with its user-friendly interaction with the internet. It is employed in the backend, incorporating machine learning algorithms that enable the chatbot to learn from user interactions and improve over time. In [3], the Azure-based chatbot achieves a 95% accuracy rate, making it highly reliable for students. Transition is proposed from Azure LUIS to the Microsoft Cognitive Language Understanding (CLU) for its offering a greater scalability alongside the customization options. [4] proposes a no-code solution with a platform Land Bot enabling a simple chatbot creation. It is made quickly and integrated to several channels such as SMS, Email, Webpage and Facebook Messenger which is proposed as the best way to connect with students. [5] continues to utilize the advantages of the Rasa and Dialogflow platforms. Rasa is an open-source framework for handling complex and contextual conversations, Dialogflow is a natural language processing (NLP) platform to design and implement to various platforms.

To support the students in their occurring college-related information, [6] tests an idea of a website-based chatbot. Though efficient in solving the issue, answering users queries requires an enormous amount of data. [7] discusses the advantages of a readily available

information provided by a chatbot. Conversing with a chatbot shows that it tremendously helps reducing the workload in the admission process department while helping students with their queries. [8] presents easily-accessible chatbots for college enquiries which are extremely helpful to the students traveling long distances to get the information they need. The implementation is successful, and the issue of a chatbot having no answer is resolved by having an admin update its knowledge base. [9] emphasizes the struggles an admission office may face when overburdened with inquiries. The solution is creating a chatbot. [10] creates a chatbot using Rasa implemented on the Facebook. It answers most of the queries safe when asked "Can I come lately after 8:00 a.m.", the chatbot becomes confused and gives a wrong answer. This shows that the chatbot finds it hard to answer all the students questions, which calls for a thorough assessment of its knowledge base and understanding. [11] provides a solution for getting information about the institute's placement. This is particularly helpful for new students, reducing their stress and anxiety for finding information. [12] provides a more specified information regarding questions, answers, keywords, logs, and feedback messages stored in the backend. The interaction with the chatbot is two-sided, one being the student getting their questions answered and the other one of an admin that can go through the logs and assess some difficulties if needed. [13] uses the powers of an open-source SQL system called phpMyAdmin. It stores the students queries efficiently, the only flaw being the slowness of the system when overloaded. [14] creates an assistant to help students learn how to code. It offers them an in-depth explanation behind the logic of the code they're writing. [15] implements an Artificial Intelligence Markup Language (AIML) for template-based responses to general questions. Latent Semantic Analysis (LSA) handles more complex inquiries. [16] proposes a chatbot that delivers text-to-speech answers alongside regular answers, allowing students to communicate more freely with the assistant.

In [17] the new chatbot helps the new students to apply at the newly enrolled college, guiding them through the application deadlines and requirements, information about fees, scholarships, and many more. [18] improves information sharing with a chatbot that utilizes webhooks to immediately handle multiple requests with zero latency. Telegram is used as an interface for communication, allowing a free access to everyone. Another example of utilizing Telegram's free messaging feature is the chatbot [19], which is designed for parents to monitor their children academic record easily from anywhere at any time. [20] proposes a chatbot solution for career counseling and enrollment support, addressing challenges like availability, consistency, response time, and efficiency. [21] goes beyond the academia and focuses on the mental well-being of its students, creating an intelligent chatbot that provides mental relief and support. It detects emotions from interactions and assesses the mental state accordingly. To help students

with their campus life [22] creates a chatbot with a helpful information and services. It studies which information and services are mostly accessed via communication with a chatbot and how its personality and level of intelligence impact the exchange. In [23], a class of students is given an opportunity to converse with a chatbot about a topic they are learning about in their class. After a period of four weeks of its usage, the students began using it as part of their learning experience. [24] helps visually impaired students to the necessary information through a voice communication.

3 CHATBOTS

Chatbots are agents enabling human-like communication with computers, ranging from simple button-based systems to advanced AI models. For a chatbot to be able to converse like a human, it needs two components in its backend: Natural Language Understanding (NLU) for understanding the questions and Natural Language Generation (NLG) to generate appropriate answers [25]. Tools like ChatGPT, Gemini, and many others exemplify the latter, drawing on extensive datasets to provide contextual and dynamic responses.

With the growing popularity of the AI technology, many companies are looking for ways to allow people to seamlessly integrate it in their everyday life. The chatbots don't require coding to be completely functional as they are being made by dragging and dropping elements. Each element has its own function with an integrated code that works with other elements seamlessly. Different

elements are being connected to create an assistant. Despite their accessibility, creating effective AI-powered chatbots requires a meticulous design and prompting skills. For instance, developers must define precise instructions to mitigate issues like hallucination, where the chatbot generates incorrect or fabricated responses. However, a robust knowledge base is essential, as it's the "brain" that stores all information. In papers [26], [27], [28] and [29] the difficulties of creating the knowledge base and the AI system are expressed as the chatbot needs to know any sort of a college-related question for it to be useful and shouldn't make any mistakes because it cannot be a trusted source if it fails to respond. [29] recommends also a team of programmers, teachers, students and staff to all participate in a chatbot creation. Everyone's perspective is necessary, and some things that might seem logical to a programmer would be a terrible experience for a student using the assistant. Students and staff can cooperate in building the knowledge base since they have an insight in frequently asked questions.

While numerous platforms offer chatbot development tools, each has unique strengths and limitations. In our research we use Voiceflow due to its user-friendly interface, seamless API integrations, and an active community that provides extensive resources. Compared to platforms like Rasa, which requires a more technical expertise, or Land Bot, which may lack advanced customization options, Voiceflow strikes an ideal balance between accessibility and functionality.

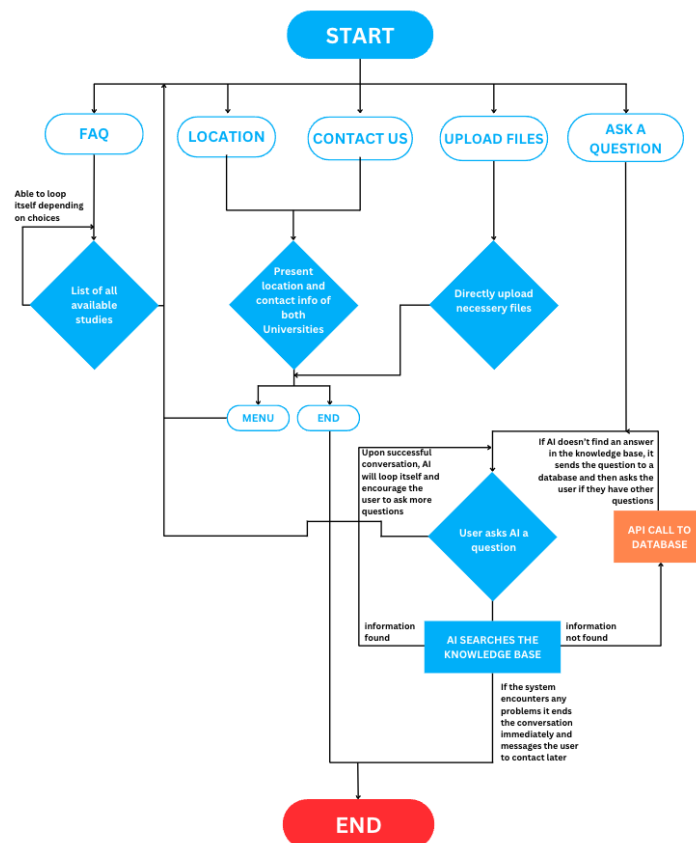


Figure 1. Chatbot scheme.

3.1. Designing the chatbot

Our research is a response to the challenges students face in obtaining college-related information. Many students report delays and inefficiencies in current administrative processes. Our chatbot alleviates these challenges by optimizing communication and minimizing administrative tasks.

Our chatbot is designed with a structured scheme to ensure a seamless connection between the elements. It introduces itself and shows the student conversational options which includes predetermined answers and conversation with an AI. The predetermined answers are made for frequently asked questions and are separated from the AI conversation path. They include the location of the college, contact information, a list of studies, etc. The answers are straightforward and don't require AI to generate them which would increase the monthly cost of the assistant. The chatbot is designed to answer the questions related to payments, deadlines, paperwork, and other queries that would require either emailing the administration or coming physically. Since the administration is familiar with what type of questions they are facing on a regular basis, the first version of the knowledge base is based on them. A third party database is necessary to assess the unanswered questions. An admin would look over the database and see what questions are asked often (and are college-related), and then they would add answers to them to the knowledge base. In that way it is constantly built upon allowing the assistant to help students on a broader range of topics.

The Voiceflow is chosen for its intuitive design interface enabling an efficient development requiring no advanced programming knowledge. The chatbot offers predefined responses which AI paraphrases for the conversation to be more human-like. Predefined responses address frequently asked questions, such as campus location, contact information, and academic programs, ensuring cost efficiency by limiting the AI usage. Dynamic responses leverage the GPT-3.5 Turbo for more complex queries, with carefully written prompts guiding the model behavior.

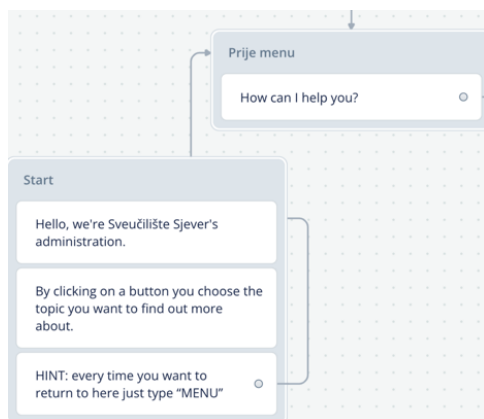


Figure 2. Example of the text.

Images and their carousels are also commonly used to convey a message to the user. As to the navigation through the conversation, this assistant mostly uses buttons that lead to different topics. They are the easiest way of communicating to the user where their decision will take them next as they show the name of the topic that they can choose.

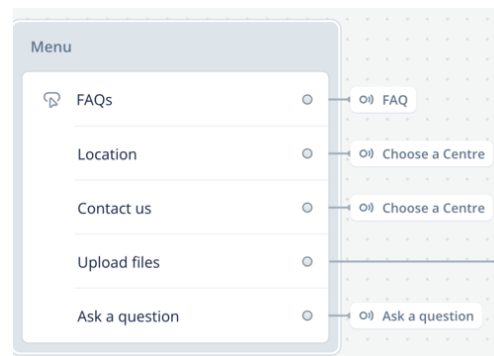


Figure 3. Example of buttons, each of the options on the left are clickable buttons while on the right are locations where each button leads to.

A seamless transition through a conversation using the buttons can be done with intents, i. e. a set of words or phrases that the assistant will detect and then lead the user to a different path. They are great for pure conversation-based assistants that don't want to overwhelm users with buttons, or they can be used as a fallback option. Here, the intent that has been added takes the user back to the beginning of the conversation. The intent is presented at the introduction and can be detected anywhere during the conversation. The idea is that if a user gets lost in the topics or the user accidentally clicks on a wrong option, the user simply types "menu" and it will take the user back to the beginning. It also detects variants of the phrase, for example "Menu", "Take me to the menu", "Menu please", and other.

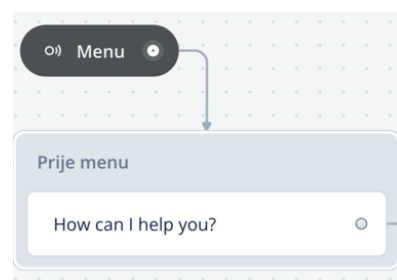


Figure 4. Example of an intent, the dark gray "Menu" area is the intent that leads to the topic.

The Voiceflow allows the developers to connect to third-party applications using APIs. In this case it is used to connect it to the Supabase which serves as a database. The backend of the API functionality is taken care of by a platform. The only thing for the developer to add are the API key, headers, parameters, body and responses it should capture. Then it communicates with a desired

application expanding the assistant's possibilities. Since it needs to send the information to the application, a POST request is used which automatically updates the data in the database.

Figure 5. API setup.

In this specific case the assistant uses the GPT-3.5 Turbo to formulate its answers. The Voiceflow also allows for integration of other GPTs and Claude versions. To formulate an answer, the AI model needs a good prompt that will give it an overview on how it should behave and what to focus on. The prompt focuses on its role as an assistant for the college administration, the tasks it should follow, certain specifics it should be mindful of, and a set of examples of what is expected from it. The temperature of the model is set at a value between 0.00 and 1, with a lower number focusing on determinism and giving a straightforward answer as it is written in the knowledge base, and a higher value allowing the chatbot to a bit of randomness to its answers. “Max tokens” offer the developer to choose which number of tokens can an assistant use to formulate its answers, the lowest being ten and maximum 2000. The higher the amount the bigger the responses can be, but it adds up to the cost of running the assistant as every token costs. A lower number reduces the cost, but also doesn't allow extended answers to queries. The last component is the “chunk limit”, a value from one to ten which decides how many pieces of the information will the assistant use to formulate its answer. It will search through the knowledge base to find every information related to the question, and then will decide which of the sources are the most fitting. From there it will create an answer based on the extracted data.

Figure 6. Example of the AI settings.

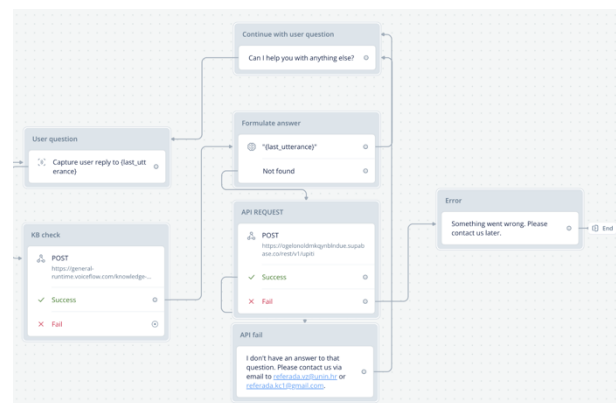


Figure 7. AI conversation and a Knowledge Base setup.

The knowledge base can be built in several ways using URLs, sitemaps, uploading files or writing a plain text in the Voiceflow. It's up to the developers to find the best method in which they will add the information that the assistant will use. In this case a plain text is used as it allows for an easy access and addition of a new information, where the uploaded documents require an update to the whole documentation, removal from the platform and then another upload. With a plain text, everything is being done on the spot in the Voiceflow. The knowledge base is structured as a series of questions and answers which yield the best responses when tested.

All data sources (8)					
Data source	Imported by	Date	Status	Refresh	
unin/krp-content/uploads/BrickStuAue2023_KC_dsp.pdf	You	An hour ago	✓	None	
unin/krp-content/uploads/BrickStuAue2023_K2_dsp.pdf	You	An hour ago	✓	None	
unin/krp-content/uploads/BrickStuAue2023_KC_preadsp.pdf	You	An hour ago	✓	None	
unin/krp-content/uploads/BrickStuAue2023_K2_preadsp.pdf	You	An hour ago	✓	None	
Q: Who is the rector of Szeu? A: Ape Szeu/Dr. Prof. dr. sc. Marin Milosavljevic. e-mail: mator@unin.hr	You	Just now	✓	—	
419-4225-mail: hajduska@unin.hr	You	7 mins ago	✓	—	
419-364—Q: What is contact information of Szeu? A: Hajduska Hajduska	You	7 mins ago	✓	—	
Q: Who is the head of nursing department? A: Dr. sc. Marijana Neuberg. e-mail: marijana.neuberg@unin.hr	You	Just now	✓	—	

Figure 8. Knowledge base sources.

3.2. Example of the chatbot functionality.

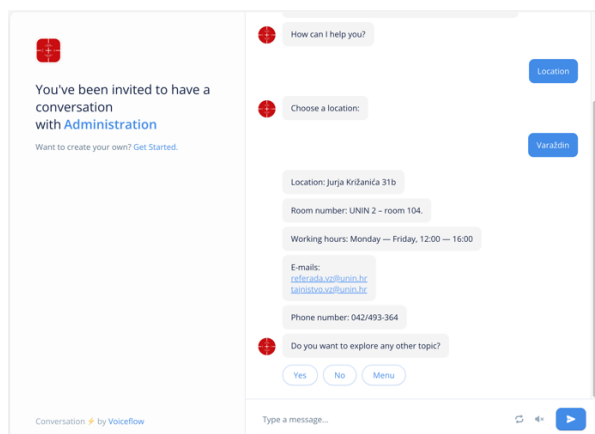


Figure 9. First example of the chatbot functionality.

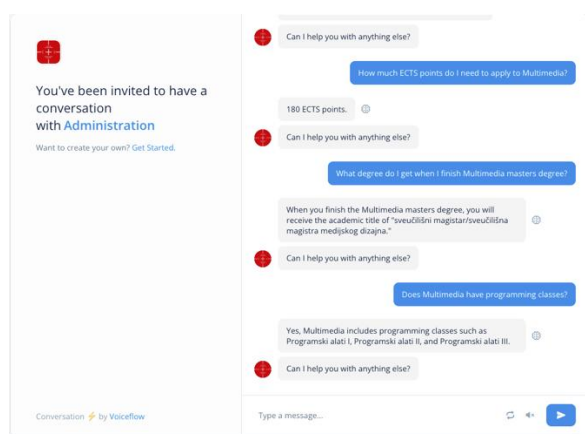


Figure 10. Second example of the chatbot functionality.

The examples show that the chatbot promptly answers any college-related questions if the information is added in the knowledge base. Users are able to access the information by buttons (first example) or by asking questions in a plain text (second example).

4 CONCLUSION

The integration of the AI chatbots in educational settings offers a transformative approach to addressing administrative challenges and improving accessibility for students. The paper presents the design and implementation of a college-specific AI chatbot, leveraging the Voiceflow platform for its balance between the user-friendliness and advanced functionality. By integrating predefined responses for frequently asked questions and dynamic AI-generated answers for complex queries, the chatbot streamlines the communication and reduces the administrative workloads. Its adaptability is further enhanced through third-party databases and GPT-3.5 Turbo, ensuring scalability and personalized interactions.

The findings highlight the chatbot potential to revolutionize how students and staff access an information, offering immediate, reliable, and cost-effective solutions. Besides minimizing the response times and reducing administrative burdens, the chatbot demonstrates inclusivity by catering to diverse user needs, including visually impaired individuals.

However, the system success depends on the comprehensiveness and continuous improvement of its knowledge base. Collaboration among developers, administrators, and end-users is essential to ensure the chatbot relevance and usability. A future enhancement can include a multi-language support, emotion detection for a better user engagement, and features supporting the mental health and well-being, expanding its role in education.

To sum up, the AI chatbots represent a significant advancement in digital transformation for educational institutions. By addressing immediate and long-term needs, this technology supports administration, aids professors, and provides students with a quicker access to essential information, fostering a more efficient and inclusive academic environment.

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