# Jooka: A Bilingual Chatbot for University Admission

**Chapter** · March 2021

DOI: 10.1007/978-3-030-72660-7_64



**4 authors**, including:

Walid El Hefny
University of Tuebingen
**5** PUBLICATIONS **46** CITATIONS
SEE PROFILE

Yasmin Mansy
The German University in Cairo
**4** PUBLICATIONS **19** CITATIONS
SEE PROFILE

Slim Abdennadher
German International University
**286** PUBLICATIONS **2,654** CITATIONS
SEE PROFILE

# Jooka: A Bilingual Chatbot for University Admission

Walid El Hefny, Yasmin Mansy, Mina Abdallah, and Slim Abdennadher

German University in Cairo, Cairo, Egypt
{walid.elhifny,mina.abd-allah,slim.abdennadher}@guc.edu.eg
yasmin.mansy@student.guc.edu.eg

**Abstract.** High school students start to apply to universities during their senior year. This marks the beginning of a frustrating and stressful period for the students as well as the admission staff. Students have countless queries and issues that need to be repeatedly answered and solved by the admission staff. However, with the rise of modern technologies such as conversational agents, the admission process can be automated to decrease the load of the admission staff. Therefore, we investigated the usefulness of a chatbot for university admission that is designed for a specific target demographic. A chatbot was developed named "Jooka" for a university to improve their admission process. Since our target audience is predominately bilingual, we added bilingualism support to Jooka. Jooka understands queries written in English and Arabic, and responds according to the query language. A survey was conducted to evaluate the performance of Jooka with parents and high school participants. Overall, the results showed great acceptance and willingness from users to adopt the new technology.

**Keywords:** Conversational Agents · Chatbots · Educational Systems · Higher Education · Bilingualism

## 1 Introduction

Conversational agents are software applications that engage in human-like dialogues using natural language [11]. They started in the 1960s to deceive users into believing that they are humans in an attempt to pass the Turing Test [15]. It was realized that by giving users the ability to express their interests and questions in a natural way through speaking, typing, or pointing, it will enhance and improve the overall user experience and satisfaction level.

There are multiple reasons why people are interested in chatbots. A study found that getting assistance and retrieving information were the most popular reasons for users to use chatbots [2]. Meanwhile, another study showed that the majority of chatbot users used them for their constant availability [6]. Actually, 72% of users globally expect to receive a response from a customer support service within an hour. However, due to the unavailability of human agents, they receive a response on an average of 6.5 hours, compared to chatbots which respond instantly [16].

Chatbots used in customer support save time and resources when it comes to answering client queries that are frequently asked and repetitively answered. Such practice is very common in higher educational environments where students have various organizational and administration questions that must be repeatedly answered by the staff [14]. Additionally, this is heavily seen during the stressful and annual admission season where the admission staff are expected to respond to questions from an innumerable amount of knowledge seeking high school students [9].

As a result, countless studies about chatbots developed to serve as advisors for universities and higher institutions applicants have been conducted. However, the expectations and needs of the specific target group of chatbot users have not been explored enough. It is important to do so since chatbots will only sustain their relevance provided that they generate good user experience and motivate users in repeated interactions [6]. Addressing the client needs of the targeted consumers will be beneficial in understanding the effect of designing user-specific chatbots.

This paper investigates the effectiveness of a university admission chatbot, and the role of demographics in adopting chatbot technology, as well as, the effects of designing a chatbot according to the needs of a specific target audience. Therefore, a bilingual university admission chatbot was developed called "Jooka" for the German University in Cairo (GUC) to enhance their admission process. Jooka understands English and Arabic queries and responds according to the query language. In addition, the work presented in this paper studies the effect of adding human-like behavior to a university chatbot, and how will it influence user satisfaction. A study in the Human-Computer Interaction field showed that users apply witlessly social expectations while interacting with chatbots [7]. Although admission chatbots exist in the literature, they do not offer bilingualism support nor apply social cues.

The structure of this paper is as follows: Section 2 presents the related work. Section 3 describes the chatbot features and functionalities. Moreover, Section 4 discusses the approach taken for implementing the chatbot. Furthermore, Section 5 discusses our evaluation, results, and discussion. Finally, Section 6 concludes the paper and presents future work.

## 2 Related Work

A chatbot was developed for a university in Asia to benefit the students and university staff. Its purpose was to help in the university admission, and advising students support. Multiple advantages for using a university chatbot were highlighted, including the university admission season hassle. A huge number of applicants is served every year which makes it a stressful time for the admission staff. Answering the queries of all applicants needs a lot of time and manpower resulting in communication errors. Therefore, the presence of a university admission chatbot to answer recurrently asked questions correctly regardless of the applicants numbers will enhance the process [9].

Further research showed that chatbots are even more advantageous to students when deployed on mobile platforms. A chatbot was developed to provide administrative examination data to students. Moreover, a design was proposed to save students time and resources when looking for administrative data, as well as, to automate the repetitive question-answering process of the examination office employees. It was stated that future chatbots must be hosted on mobile platforms since it is the easiest and most fit platform for the students use [14].

Currently, most of the academic assistant chatbots are rule-based and use pattern matching to generate the output. For instance, the proposition of a university related frequently asked questions chatbot involved pattern matching. It uses the Artificial Intelligence Markup Language (AIML) for template-based and general questions such as welcoming and greetings, and uses Latent Semantic Analysis for other service-based questions [13].

Moreover, a study discussed the development of an automated translation open-domain chatbot that was tested on students. The chatbot aim was to allow the students to type in German and have the responses in English compared to copying and pasting text into a translation website. The results showed that the automated translation was minimally 30 times faster than manual text translation. Additionally, students were significantly satisfied with the automated translation. The authors encouraged researchers to use automated translation in future research with language combinations other than English and German [12].

Therefore, it was necessary to support the Arabic language along side the English language in our proposed chatbot due to our targeted users being predominately bilingual, speaking both Arabic as a first language, and English as a second language. However, a study showed that there is a scarcity of research done in the field of Arabic chatbots due to its development difficulty [1]. It provided a review of the published Arabic chatbots to identify the gap of knowledge and to highlight the areas that need further research. After evaluating those chatbots, it was found that linguistic complexities are hindering Arabic language processing. These include morphological ambiguities which means that the word has many meanings, and syntactic ambiguities which means that the sentence has more than one structure.

## 3 Chatbot Design

We designed a bilingual chatbot named “Jooka” to answer questions related to the admission process of the GUC asked by high school students and their parents. Jooka can respond to enquiries written in English and Arabic. Previously, applicants had to access the university website and contact the admission office to receive answers related to their enquiries. Therefore, Jooka has been equipped with a sufficient pool of information to be able to fully aid students through the admission process.

### 3.1 Off-Campus Support

Off-campus support contains the features and functionalities that can be performed while the applicant is at home. It mainly focuses on providing answers to the most frequently asked questions during the admission process. Additionally, applicants can ask about the different majors and facilities available. Enquiries raised by applicants when they are at the admission office such as questions related to the documents needed, fees, scholarships, and financial aid can be answered by Jooka seamlessly. In addition, Jooka keeps track of the applicant information such as their name, high school type, chosen major, and nationality. Hence, it can provide customized and personalized responses that are tailored to the applicant's needs instead of having the applicant visit the university website looking for answers.

Moreover, applicants can ask Jooka about the admission tests that must be taken before enrolling at the university. Jooka can provide the applicants with sample questions as well as the purpose and fees of the test. Finally, Jooka can respond to questions related to the facilities available and the extracurricular activities which are available on the website, however, the admission staff may not be up-to-date with it. Not only can Jooka respond to the admission process questions, it also acts as an academic advisor for the new applicants. It provides help to the new applicants by informing them about the different faculties and majors offered at the university, the courses taken in each major per semester, and the different career opportunities and paths.

### 3.2 On-Campus Support

Applicants visiting the university to submit their documents or take the admission test tend to feel lost and confused. They end up asking other students for directions or waiting for the university admission tours. However, applicants can ask Jooka about the directions to more than 60 unique locations on campus. Jooka will reply with an animated image (GIF) containing the directions to the desired location. Additionally, a Google Maps link will be sent to help the applicant navigate in real-time. Finally, applicants can ask Jooka for the overall campus map to show them the campus structure from the top-view approach.

### 3.3 Social Cues

Social cues are signals depicted by humans when interacting with each other [5]. A chatbot humanness is determined by various social cues which are verbal, visual, and invisible. Verbal social cues are conversational qualities portrayed by a chatbot such as small talk [3]. Small talk allows the chatbot to answer questions in a personal manner creating human-like conversations that serve the user's emotional needs. It responds to user inputs such as "I'm angry" and "You are awesome!". These comments are frequently sent by users, and responding to them increases the user's interest in technology and motivates them to interact

more with the chatbot. Therefore, Jooka supports responding to social messages that are not related to the admission process.

Moreover, visual social cues are viewable features that are graphic and infer human conduct. They include avatars, names, and emojis. Involving visual social cues can yield positive reactions from the users. Therefore, our chatbot was given a name, avatar, and uses emojis when responding to user enquiries. In addition, animated images (GIFs) were used in the responses. Finally, invisible social cues are those that cannot be seen but their effect is felt. An example is the response time. Chatbots respond to user queries instantaneously. However, a study reported that chatbots which use delayed responses resulted in more user satisfaction compared to chatbots that respond immediately [5]. Normally, a human takes some time to read and respond to a message which increases the user's perception of humanness and social presence, as well as, fulfilling the user's social expectations. Therefore, a response delay was added to Jooka to enhance the perceived humanness. Moreover, the delay size was set according to the complexity of the response in terms of the length and data value.

In addition, we used quick replies which are suggestions that appear to the users that can be used when responding to chatbot messages instead of typing. The quick replies appearing to the user differ according to the chatbot message. They are used to assist the applicants when they feel lost while interacting with Jooka. Furthermore, a persistent menu was added which allows the applicants to access the most frequent features at any time. It is present next to the input text field to provide quick access to the main features.

## 4 Chatbot Implementation

Jooka was built using a modified version of the framework presented in [4]. Our chatbot consists of four main components which are the messaging application, web server, chatbot agent, and database. Originally, the messaging application should interact with the chatbot agent and not the web server. However, in our implementation, we swapped the web server with the chatbot agent. Therefore, the user input will be transferred from the messaging application to the web server, and then the web server will send it to the chatbot agent. Afterwards, the chatbot agent will perform the intent matching process, and will notify the web server with the matched intent. Finally, the web server will access the database to formulate a response.

This modification was made to integrate the translation module that translates the Arabic user input into English. The used natural language processing module present in the chatbot engine framework does not understand Arabic text, therefore the translation must be done before reaching the chatbot engine. Hence, putting the web server as the centralized module.

### 4.1 Architecture

An overview of the user journey is shown in Figure 1. At the beginning, the messaging application acts as the conversational user interface where it takes

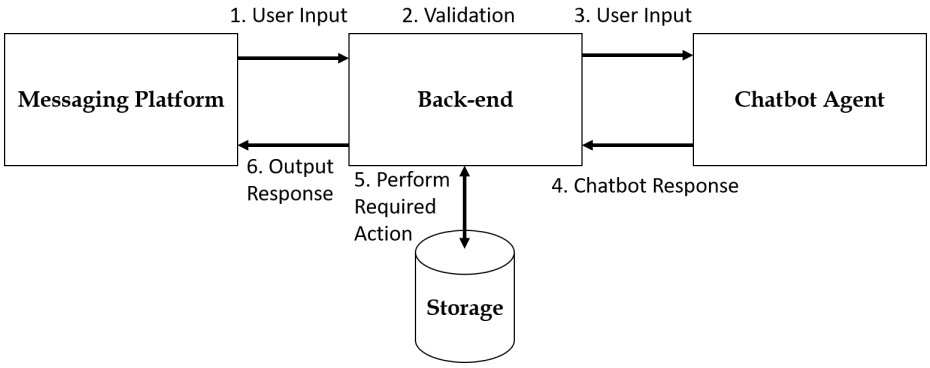


**Fig. 1.** Overview of the chatbot architecture

the user message as an input and sends it to the back-end represented as the web server. Facebook Messenger is used as the messaging application since it is one of the leading platforms in adopting chatbot technology. It was one of the early platforms that allowed developers to host and deploy chatbots on. Moreover, students use Facebook to communicate with each other by sharing announcements and questions on their groups. Additionally, Jooka passed the Facebook review process, making it accessible to all Facebook users at any time.

The web server is based on the Platform as a Service (PaaS) paradigm which is a type of cloud computing that offers a platform to clients, allowing them to build, run, and manage applications without the need to maintain the infrastructure. Heroku, which is based on Amazon Web Services (AWS), is used to host the JavaScript back-end code. In addition, the web server interacts with the chatbot agent and the storage (database) to provide a customized response to the user. Firebase Real-Time Database is used as the storage module since it is an online non-relational database that stores the user information and customized responses.

Finally, the chatbot agent is used for entities extraction and intent matching as described in [4]. Dialogflow Essentials (Dialogflow ES) was used to build the chatbot engine. It is made of up of two components which are intents and contexts. Possible user questions have to be identified first in order to create intents. Therefore, commonly asked university admission questions were collected from the university Facebook page, university website FAQs section, and a collection of other popular universities FAQs. Afterwards, questions in many possible formats were mapped into intents with a specified action that will be sent later to the web server for processing. In addition, the chatbot agent uses contexts to maintain the flow of the conversation. This is done by predicting the user's upcoming questions so the context of the conversation is maintained. Dialogflow ES offers a way to do so through the addition of follow-up intents or upcoming questions whenever needed. Moreover, in order to predict the possible direction of a conversation, flow charts were used. Dialogflow ES is a non-programming

chatbot development tool with a web interface that is used to create entities, add intents, and adjust machine learning settings. In our implementation, Dialogflow ES communicates with a web server to perform the input processing and output generation. Furthermore, our implementation follows the retrieval-based approach described in [4].

### 4.2 Input Processing

As we mentioned earlier, user messages sent through Facebook Messenger are processed first at the back-end. The input is processed for two different purposes which are translation and validation. The translation process aims at inspecting the user message for any Arabic constituents. This is performed by checking the Unicode representation of each character in the user message. If an Arabic character is detected, the user message is flagged to notify the chatbot with the language it should respond with. Afterwards, the user message is translated from Arabic to English using Google Cloud Translation API.

Moreover, the translated text will pass through a validation process to check whether the user input meets the validation criteria for the question asked by the chatbot or not. If the validation was handled through the chatbot agent, it will repeat the same question until the user inputs the required information. However, in our approach, the validation is handled by the back-end, providing a customized message to notify the user about the issue with their message so that they can send the required information. Finally, the validated user message will be sent to the chatbot engine for the output generation phase.

### 4.3 Output Generation

The output generation process is handled by the chatbot agent and web server collectively. The translated and validated user input is sent to the chatbot agent from the web server to perform the intent matching process. The intent identification is performed by using training phrases and parameters for each intent to determine the most suitable reaction to the user input. An intent is defined as the intention of a user for one conversation turn. Therefore, Jooka has a list of intents that can handle a complete conversation with the user. The user message is analyzed and matched to the most suitable intent which contains training phrases that are similar to the user message. Additionally, entities were created to enhance the intent matching process. They are used to identify keywords and parameters in a user message. Custom entities can be created to match custom data which can be used in the training phrases of an intent.

After matching the user message to an intent, an action will be sent to the web server to be performed. Since we are following the framework proposed in [4], a retrieval-based approach was implemented. A suitable response will be retrieved from the database according to the matched intent. Afterwards, according to the language flag value from the input processing phase, a translation may be required to output an Arabic response to the user. Finally, before sending the response to Facebook Messenger to be displayed to the user, the web server

performs some minor operations to make sure that the response is readable in a user friendly manner. The operations include splitting the response into chunks, where each chunk is sent as a separate message, as well as inserting spaces and line breaks. Figure 2 shows a validation scenario, where Jooka sends personalized messages to the wrong user input. Meanwhile, a translation scenario is also shown of messages sent in Arabic and English, where Jooka responds according to the message language.


**Fig. 2.** Jooka's responses to various user messages in English and Arabic

## 5 Evaluation

The System Usability Scale (SUS) and Chatbot Usability Questionnaire (CUQ) were used to evaluate Jooka's performance in terms of usability.

### 5.1 System Usability Scale (SUS)

The SUS is a 10-item scale developed by John Brooke in 1986 [10]. A study showed that the SUS is still applicable and tests for usability and learnability. The SUS is composed of 10 items with five response options for respondents from strongly agree to strongly disagree. The items are divided into oddly-numbered positive comments and evenly-numbered negative comments about the surveyed entity. The SUS score is calculated out of 100.

### 5.2 Chatbot Usability Questionnaire (CUQ)

According to the study in [8], the SUS is not enough to evaluate all aspects of a chatbot interface. Therefore, it is necessary to use an additional survey, which is

the CUQ. The CUQ survey assesses seven different parameters, which are personality, onboarding, navigation, understanding, responses, error handling and intelligence of a chatbot. It also contains positive and negative comments being ordered alternately and a rating of five points from strongly disagree to strongly agree. However, it consists of 16 items to evaluate the overall performance of chatbots. The CUQ score is also calculated out of 100.

### 5.3 Results

We gathered 27 participants to evaluate our chatbot. Out of the 27 participants, 4 participants were parents to high school students (14.8%), while 23 participants were high school students between the age of 15 and 17 (85.2%). Moreover, 85.2% of the participants were females, while 14.8% of the participants were males. There were 18 participants (66.6%) who interacted with Jooka using English only. However, 7 participants (26%) used both English and Arabic, while 2 participants (7.4%) used Arabic only. In addition, the participants came from three different schooling systems which were the National High School System (29.6%), IGCSE "British System" (51.9%), and American Diploma (18.5%). The minimum SUS score recorded is 52.5, the maximum is 100, and the median is 90. Meanwhile, the CUQ minimum score recorded is 59, the maximum is 100, and the median is 92. Finally, the mean SUS score is 88.5, while the mean CUQ score is 87.3. According to the literature, the minimum acceptance value is "Score>71.1", while the not acceptable value is "Score<62.6".

### 5.4 Discussion

Our goal was to examine the effectiveness of a university admission chatbot. Moreover, we wanted to identify whether demographic variables such as age, gender, and lingual preferences affect the adoption of chatbots as an advisor for the applicants or not. In general, the results suggest that the chatbot was considered useful by the participants. This can be seen by the mean SUS (88.5) and CUQ (87.3) scores which are larger than than acceptance value (71.1). Furthermore, analysis of individual questions confirm that the chatbot is adoptable, since it was perceived as a useful tool by the participants. Moreover, the participants found that the chatbot responses were informative and helpful. In addition, participants who used Arabic were satisfied because they can express their questions using their native language instead of English. Finally, the chatbot scored best when asked if it was easy to use, and if it was friendly and welcoming.

However, according to the results, the chatbot did not perform well in a couple of categories. Firstly, it did not score well when asked whether they needed a technical person's help to use the chatbot. This contradicts the results from both SUS and CUQ indicating the ease-of-use of the chatbot. However, some participants stated that the chatbot functionalities were not well integrated. We believe this may be one of the reasons why some participants felt that they needed external support to be able to use the chatbot. Additionally, some participants felt that the chatbot was too robotic and could not cope well with errors. However,

these participants attempted to ask the chatbot irrelevant questions outside of its domain. Therefore, it was normal for the chatbot to fail in answering those questions. Overall, the results build on the existing evidence of the usefulness and adoption of university admission chatbots. Moreover, it adds a clearer understanding of the importance of designing user specific and motivated chatbots which are easy to access and use. Finally, we believe one of the main limitations is the small sample size which can be improved in future work.

## 6 Conclusion and Future Work

We wanted to identify the efficacy and adoption of university admission chatbots which are particularly designed to serve a specific target demographic. According to qualitative analysis, it was found that chatbots are highly helpful and effective for university admission purposes saving time and resources for both students and admission staff. Moreover, it was shown that building a user motivated chatbot has a positive effect on the user satisfaction and adoption of the technology. Therefore, we built a university admission chatbot named "Jooka" to help university applicants with their enquiries. Additionally, we added bilingualism support so the applicants can ask questions in English or Arabic, and the chatbot will respond according to the input language. Social cues were added to provide a human-like interaction with the applicants instead of a monotonic and robotic feeling.

We gathered 27 participants to test the chatbot. The SUS and CUQ surveys were used to evaluate the usability of the system. Jooka scored an average of 88.5 in the SUS, and 87.3 in the CUQ, which are higher than the acceptance level (71.1). The participants found that the chatbot responses were informative and helpful, and they perceived Jooka as a useful tool. They were satisfied with the bilingualism support. However, some limitations were faced since some participants did not spend a sufficient amount of time questioning the chatbot before requesting the surveys to fill. This proves the concept of graphical user interfaces providing a finite amount of options for users to test, compared to conversational user interfaces which give users an infinite amount of time. This causes users to spend less time testing chatbots compared to applications with more complex interfaces since they do not know what to ask the chatbot.

Finally, future research should focus on exploring methods of balancing the humanness and effectiveness of chatbots. This is important as shown in our results, where users viewed the chatbot as a useful tool, while others viewed it as robotic. Moreover, more work should be done in the field of bilingual chatbots. In this paper, the chatbot was given bilingual abilities, however, all processing was done on one language which was English. Therefore, researchers should explore more language combinations, perhaps more than two languages. Finally, adding Arabizi support to bilingual English-Arabic chatbots will be interesting to explore. Arabizi is the concept of writing Arabic words using Latin characters and numbers. Current translation APIs detect Arabizi text, however, the translation process is still lacking.

## References


1. AlHumoud, S., Al Wazrah, A., Aldamegh, W.: Arabic chatbots: A survey. International Journal Of Advanced Computer Science And Applications **9**(8), 535–541 (2018)
2. Brandtzaeg, P.B., Følstad, A.: Why people use chatbots. In: International Conference on Internet Science. pp. 377–392. Springer (2017)
3. Dutta, D.: Developing an intelligent chat-bot tool to assist high school students for learning general knowledge subjects. Tech. rep., Georgia Institute of Technology (2017)
4. El Hefny, W., El Bolock, A., Herbert, C., Abdennadher, S.: Towards a generic framework for character-based chatbots. In: International Conference on Practical Applications of Agents and Multi-Agent Systems. pp. 95–107. Springer (2020). https://doi.org/10.1007/978-3-030-51999-5$_8$
5. Feine, J., Morana, S., Maedche, A.: Designing a chatbot social cue configuration system (2019)
6. Følstad, A., Skjuve, M.: Chatbots for customer service: user experience and motivation. In: Proceedings of the 1st International Conference on Conversational User Interfaces. pp. 1–9 (2019)
7. Gnewuch, U., Morana, S., Adam, M., Maedche, A.: Faster is not always better: understanding the effect of dynamic response delays in human-chatbot interaction (2018)
8. Holmes, S., Moorhead, A., Bond, R., Zheng, H., Coates, V., McTear, M.: Usability testing of a healthcare chatbot: Can we use conventional methods to assess conversational user interfaces? In: Proceedings of the 31st European Conference on Cognitive Ergonomics. pp. 207–214 (2019)
9. Issa, A.A., Jaffal, G.R.: Development of the e-learning communication system: chatbots' impact on the student communication. In: International Journal of Multidisciplinary Research and Development. vol. 6 (2019)
10. Lewis, J.R., Sauro, J.: The factor structure of the system usability scale. In: International conference on human centered design. pp. 94–103. Springer (2009)
11. Nimavat, K., Champaneria, T.: Chatbots: An overview types, architecture, tools and future possibilities. IJSRD-International Journal for Scientific Research and Development (2017)
12. Park, M., Aiken, M.: Automated translation preference with a bilingual chatbot. International Journal Of Computers & Technology **19**, 7502–7509
13. Ranoliya, B.R., Raghuwanshi, N., Singh, S.: Chatbot for university related faqs. In: 2017 International Conference on Advances in Computing, Communications and Informatics (ICACCI). pp. 1525–1530. IEEE (2017)
14. Rasheed, H.A., Zenkert, J., Weber, C., Fathi, M.: Conversational chatbot system for student support in administrative exam information
15. Shawar, B.A., Atwell, E.: Chatbots: are they really useful? In: Ldv Forum. vol. 22, pp. 29–49 (2007)
16. Xu, A., Liu, Z., Guo, Y., Sinha, V., Akkiraju, R.: A new chatbot for customer service on social media. In: Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems. pp. 3506–3510 (2017)