Application of Chatbot at a Higher Education Institution in Republic of Serbia

Rade Matić , Miloš Kabiljo , Nemanja Deretić & Aleksandar Vukomanović

Belgrade Business and Arts Academy of Applied Studies, Republic of Serbia.
E-mail: rade.matic@bpa.edu.rs, milos.kabiljo@bpa.edu.rs, nemanja.deretic@bpa.edu.rs, aleksandrar.vukomanovic@bpa.edu.rs

Abstract A chatbot is an algorithm, a programming script, designed to give users the ability to communicate and interact with it online in order to perform a specific task, without any human factor involvement. In the beginning, chatbots were exclusively programs with which it was possible to correspond by exchanging instant text messages. The main focus of the paper is on the presentation of usage of chatbot ADA (Academic Digital Assistant) based on artificial intelligence. ADA chatbot was developed to provide students with an enhanced study service and the necessary information during their studies. Statistical parameters of the use of chatbot ADA and the analysis of statistics of conversations by channels show growing trend in the use of chatbots in all three surveys of communication channels (Viber, FB Messenger and Website). The conclusions of the analysis of top 10 scenarios and number of conversations are shown that students' interests were in accordance with the school calendar and obligations.

Keywords:: education, digitalization, chatbot, natural language understanding, distance learning.

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1 Introduction

Chatbots are important news for customers, users and clients on the one hand, and for sellers, companies and institutions on the other hand. They allow companies of all sizes and profiles to offer 24-hour support to their customers, clients and stakeholders without additional labour costs, but their essence is not to completely replace the human factor. The primary function of chatbots is to free working time of employees to address the more complex needs of customers, by no longer having to worry about rudimentary issues and simple requirements that customers most often deal with. In that sense, the experience so far unequivocally confirms that customers like the fact that chatbots are always available and easily accessible - which means that they no longer have to be "on hold" while the agent answers the phone or answers the e-mail. A successful chatbot should be accessible, easy to talk to, easy to use and easy to understand. Many chatbots have been developed for industrial solutions, while there is a wide range of lesser-known chatbots relevant to research and their applications. According to the research (Adamopoulou & Moussiades, 2020a), there has been a rapid growth of interest in chatbots, especially after 2016. Viber as a particularly popular application in Eastern Europe started using chatbots at the same time, and the use of this advanced and multi-useful functionality has been growing ever since.

Chatbots can use a variety of message formats to interact with users - text messages, photos, website addresses, videos, galleries, gifs, stickers, contact cards, localized content cards and buttons. In short, brands have a whole arsenal of different types of messages at their disposal to create and maintain a strong connection with their customers - and lead the conversation through more vivid content, which is much more attractive to the customer than a typical customer support channel. This is especially useful for information chatbots specializing in areas such as information content and news. According to the survey (Franzese, 2017), 89% of surveyed users rate their impressions of the conversation with the chat, which provided customer support, as positive or neutral. The results also show that users prefer to communicate with the chatbot about simpler actions and questions. According to the same survey, 52% of users worldwide are dissatisfied with the service if they have to wait more than 2 minutes to talk to customer support.

The Covid crisis has caused long-term and multi-layered effects on the education system, revealing again the fact that the country's level of development significantly determines the ability of educational systems to respond and react. As far as higher education is concerned, the transition to distance learning has been an opportunity to expand flexible learning modalities, laying the groundwork for a sustainable transition to more online learning in this educational sub-sector in the future. (Vidas-Bubanja et al., 2020; Kabiljo, et al., 2020)

The aim of this paper is to show the importance of the existence of chatbots at an educational institution, because chatbots are well on their way to becoming one of the key links in the chain of communication with text messages. Using branches of artificial intelligence such as machine learning (natural language processing), the authors of these applications are finding new ways to make accessing information, servicing and planning easier, by including advanced "smart" machines in conversations.

The paper consists of five chapters. The importance of chatbots in the modern business of companies and institutions of different profiles is presented in the first chapter. The second chapter contains literature review about chatbots from the first mention of this term to the present day. Chatbot ADA (Academic Digital Assistant) of Belgrade Business and Arts Academy of Applied Studies (BAPUSS) in Republic of Serbia is presented in chapter three (BPA, 2020a). Statistical parameters of the use of chatbot ADA and the analysis of statistics of conversations by channels (top 10 scenarios and number of conversations) are shown in chapter four. Concluding remarks are given in the last chapter.

2 Literature Review

The originator of the idea of a chatbot is considered to be Alan Turing, who was among the first to test whether a computer program could talk to a group of people without one realizing that their interlocutor was artificial (Turing, 1950). The first chatbots to mimic a psychotherapist's operation were chatbots named ELIZA (Weizenbaum, 1966) and PARRY (Colby et al., 1972). In the literature, the term Chatterbot first appears in 1991, according to the paper (Mauldin, 1994).

The first online chatbot inspired by ELIZA was ALICE (Artificial Linguistic Internet Computer Entity) according to Wallace (2009). In recent years, many global companies have developed their chats according to the paper of Adamopoulou and Moussiades (2020b), such as Apple Siri (Siri), IBM Watson (Watson Assistant | IBM Cloud, 2020), Google Assistant (Google, 2019), Microsoft Cortana (Microsoft, 2019), and Amazon Alexa (Amazon, 2019). According to the same paper, three of the most common languages for the implementation of chatbots are Artificial Intelligence Markup Language (AIML), Rivescript, and Chatscript. Chatbots, through access to machine learning, extract content from user input using Natural Language Processing (NLP) and have the ability to learn from conversation. Chatbots use Natural Language Understanding (NLU) as a part of NLP to retrieve context from the unstructured user input in human language and respond based on the current user's intention (Jung, 2019).

A chatbot platform must have the following three parts that really add conversational experience (Matic et al., 2021):

- Natural Language Processing (NLP): understanding user input and extracting relevant information.
- Conversation flow: including managing the context of the conversation.
- Action Fulfilments: used to represent simple responses, as well as advanced features such as database querying, Application Programming Interface (API) requests, or a custom logic trigger.

3 CHATBOT ADA - Academic Digital Assistant

In the conditions of the COVID-19 pandemic and due to the closure of the educational system, BAPUSS was obliged to provide online educational content and interaction with its students. In order to improve, modernize and digitize educational services, the Academy developed the ADA chatbot to provide its students with improved service and necessary information during their studies. It is easy to communicate with the ADA chatbot because you have the feeling that you are talking to a friend who can perform complex tasks such as applying for exams.

Chatbot ADA receives messages from various communication channels (Viber, FB Messenger and web chat via the Academy website). As we have noticed, the ADA is not dependent on just one communication platform. Also, the ADA is not dependent on just one NLU service. Namely, during the development of the ADA project, it was established that some NLU services are free, and they work just as well as the services of large companies. The problem of flexibility and independence from only one NLU service (manufacturer) was solved using metamodels. (Matic et al., 2021) ADA uses NLU services such as RASA (RASA, 2016) and Dialogflow (Google Dialogflow, 2020) to understand user intentions. ADA analyses text and, based on machine learning techniques, compares and then generates intent and its entities. The generated result is sent back to the chatbot platform, which uses a certain algorithm for intent, entities, context and sends a response to the user in the appropriate format to display the message. The digital assistant answers all potential questions from students and prospective students regarding basic questions and services, and is available 24 hours a day. The ADA currently covers over 250 scenarios and topics related to issues of most interest to students. ADA chatbot is informative and transactional. The types of scenarios and cases that the ADA knows are:

- Small talk - The main purpose of this type of conversation is to keep users on the channel and contribute to people-like conversations. A short conversation is called an optional conversation. They mainly include: greetings, funny phrases, positive feelings, negative feelings, the latest shows and songs, questions for testing chats.
- Frequent QA (Questions and Answers) - scenarios focused on student needs (teacher, subject, lectures, literature, education, etc.)
- Different types of transactions - exam registration, cancellation of exams, change of examiners, change of elective subject, purchase of a book, reset of password, etc.

Some of Frequent QA scenarios are (BPA, 2020b):

- information on teacher consultations,
- deadlines,
- academy ranking,

- lecture schedule,
- student rating,
- events,
- service availability,
- academic environment,
- date of lectures and exams,
- activities taking place within the Academy and
- other useful academic information.

The ADA also helps prospective students to learn more about the Academy. ADA is trained to provide students with the highest quality educational services with a wide range of information about teachers, classrooms, curriculum, literature, working hours, library, subjects, notices, educational content, lecture schedule, price list, etc. Students ask the ADA for various information such as: the amount of tuition, what documents are needed to enrol in the new school year, the schedule of lectures or the date of consultation with a particular professor. The ADA can also perform some processes such as registering or cancelling an exam, changing a teacher on an exam, resetting a password, or purchasing a book.

Thanks to that, the success is that currently almost 30% of students use ADA as the primary channel of communication with the Academy with a tendency to grow. The ADA project is the first project of its kind in the Balkans in the field of education that provides time savings, easier and better communication, faster and more efficient implementation of educational services. Chatbot technology has the potential to significantly influence the way students experience educational institutions and the way they communicate with them.

The goal of the platform, in addition to being available to a large number of students for all the necessary information about the Academy, is to obtain official information without waiting, as well as to relieve contact centres and teachers to focus on a more creative task. Chat is available for free in Serbian via Viber, FB messenger and the Academy's website. Chat in English is on alpha test. Artificial intelligence enables the ADA to learn, that is, to become "smarter". In this regard, learning is a long process and the team for the implementation of this project constantly monitors the interests of students. The development team with use of NLU is constantly learning

ADA new scenarios and implementing new services, such as change of elective subject, attendance records, easier transfer of knowledge by teachers, etc.

4 Statistical parameters of the use of chatbot ADA

Since its inception (September 2020), the ADA has seen an increase in users and the number of messages and replies received. Statistical parameters indicating the following tendencies are given in Table 1. It can be noticed that the number of verified users via the website is zero, because it is impossible to do a single verification of users via the website. Verified students are those who have undergone two-factor authentication required for some type of payment or other type of sensitive services and business processes.

Table 1: Number of users and received messages

Parameter	Viber	FB Messenger	Website	Total
Number of users	4,251	623	8,574	13,448
Number of verified users	2,336	158	0	2,494
Number of received messages sent by users	180,966	11,544	26,683	219,193

source: ADA database

The analysis of statistics of conversations by channels in the period September 2020 - December 2020/January 2021 - December 2021/January 2022 is shown in Table 2. In the analysed months, the dominant channel through which the message was sent to ADA was Viber (in 2020, 70.43% of total messages). In 2021, Viber used 79.60% of the total number of messages, and in January 2022, 85.96% of the total number of messages that month.

Table 2: Average number of conversations per channel in the period September 2020 - December 2020 / January 2021 - December 2021 / January 2022

Conversation via	September 2020 - December 2020	January 2021 - December 2021	January 2022
FB Messenger	71.25	406.92 (+471.12%)	972 (+138.87%)
Viber	3,970.00	5,899.42 (+48.60%)	14,222 (+141.08%)
Website	1,595.25	1,104.25 (-30.77%)	1,350 (+22.25%)
Total	5,636.50	7,410.59 (+31.475%)	16,544 (+123.25%)

source: ADA database

Chatbot ADA works in Serbian but it should be noted that it is easy to switch and learn to communicate in English.

In the analysed periods from Table 3, students' interests were in accordance with the school calendar and obligations.

Table 3: TOP 10 scenarios and number of conversations (without short conversations)

September 2020 - December 2020		January 2021 - December 2021		January 2022	
Scenario	**Number of conversations**	**Scenario**	**Number of conversations**	**Scenario**	**Number of conversations**
Professor's consultations	1,129	Exam registration	6,610	Informing about the ways of certifying the semester	1,743
Checking the amount from the price list of the Academy	1,109	Student verification	3,994	Checking the amount from the price list of the Academy	1,461

Location, opening hours and which books are offered in the Academy's scriptorium	752	Checking the student loan amount	3,927	Exam registration	1,321
Required documentation for enrolment in a particular school year	719	Checking the amount from the price list of the Academy	2,761	Semester verification	1,064
On which floor is a certain cabinet	550	Checking personalized exam dates	2,655	Checking the student loan amount	984
Which professors teach a particular subject?	523	Informing about the dates of consultations	2,620	Checking personalized exam dates	912
How a student can enrol in studies?	445	How a student can enrol in studies?	2,515	Budget ranking information	984
Work calendar information	354	Location, opening hours and which books are offered in the Academy's scriptorium	2,429	Automatic verification	586
Budget ranking information	351	Informing about exam deadlines	1,869	Student verification	509

source: ADA database

In September, the month of taking the exams, students were most interested when the teacher teaches, examines or holds exercises in a particular subject. In October, the month of enrolment in the new school year, at the top of the list of inquiries was information on the amount of tuition and the type of documents required for enrolment. In November, students inquire about professorial consultations and the office, working hours of the Academy, etc.

5 Conclusion

Timeliness and automation of responses are benefits of chatbots. They do not sleep and have no need for rest. They give feedback to consumers within seconds at any time of the day.

The realization of this project was started by the Academy, guided by the attitude that the chatbot has the potential to significantly influence the way students experience educational institutions and the way they interact with them. Based on the presented statistical analysis, the justification of the introduction of chatbot as an auxiliary tool for providing services and communication with students can be noticed. Statistical parameters of the use of ADA and the analysis of statistics of conversations by channels show growing trend in the use of chatbots in our Academy. From this we can conclude that in addition to the economy, every educational institution should eventually have its own chatbot. As much as the conditions of the pandemic endangered the education system, they changed it so much and opened opportunities for different, more advanced and more efficient methods of learning and transferring knowledge. Digital technologies offer completely new answers to the question of what people learn, how they learn and where and when they learn.

A chatbot may not be the solution to all student problems, but it is a powerful tool that have already increased the efficiency of BAPUSS and supported the realization of the educational process. The direction of further research is to enable the ADA chatbot and learn to be an aid that will enable students to study the material provided by the syllabus of the subject.

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