



## Artificial Intelligence Enabled Conversational Agent for Mental Healthcare



Batyrkhan Omarov <sup>a</sup>, Sergazi Narynov <sup>b</sup>, Zhandos Zhumanov <sup>c</sup>, Elmira Alzhanova <sup>d</sup>, Aidana Gumar <sup>e</sup>,  
Mariyam Khassanova <sup>f</sup>

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### Corresponding Author <sup>a</sup>



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### Abstract

Conversational agents are software programs that can converse with users in the manner of a real-world conversation. Artificial intelligence (AI) is not complete without conversation modelling. The most difficult artificial intelligence endeavour since its start has been developing an effective chatbot application. Despite chatbots may do a variety of tasks, their main duty is to accurately understand human speech and respond appropriately. Previously, manual patterns and instructions or simple statistical methods were used to create chatbot architectures. Due to its improved capacity for training, end-to-end AI has replaced these models since 2015. The most popular technique for conversation simulation at the moment is the encoder-decoder recurrent neural network (RNN). The realm of language comprehension served as inspiration for this design. Until recently, some additions and changes dramatically enhanced chatbot conversational abilities. In this paper, we outline our research results into creating an interactive digital chatbot that may provide patients with psychological assistance. To build and train the chatbot, we used resources such as Rasa Natural Language Processing (NLU) technology, which employs natural language processing (NLP) methods. The results of the investigation showed that selecting proper responses while conversing with patients had a more than 70% predictive performance.

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<sup>a</sup> International University of Tourism and Hospitality, Turkistan, Kazakhstan

<sup>b</sup> Alem Research, Almaty, Kazakhstan

<sup>c</sup> Alem Research, Almaty, Kazakhstan

<sup>d</sup> International University of Tourism and Hospitality, Turkistan, Kazakhstan

<sup>e</sup> Alem Research, Almaty, Kazakhstan

<sup>f</sup> Alem Research, Almaty, Kazakhstan

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## 1 Introduction

Globally, mental health issues are becoming more prevalent nowadays. One in every four people, as reported by the World Health Organization (WHO), deals with a mental disease at some point in their lives (Neves & Burgers, 2022). Around the world, mental illness continues to be the main contributor to the financial difficulty associated with health (Lazarus et al., 2022; Vigo et al., 2016; Hwong et al., 2022). The most common causes are anxiety and depression, which are thought to affect 322 million (depression) and 264 million (anxiety) people worldwide, respectively (Waters et al., 2022). Despite the rising prevalence of mental illnesses, it is alarming to note that there are a shockingly low number of mental health experts around the globe (9 per 100,000), particularly in Southeast Asia (2.5 per 100,000) (Maheswari, 2022). Although there are effective and well-established treatments for many illnesses, just around half of those who are affected obtain them (Neves & Burgers, 2022). The primary barriers to effective treatment have been identified as a lack of funding, a dearth of skilled medical personnel, and the stigma associated with mental illnesses (Neves & Burgers, 2022). To provide people who are harmed with accessible, economical, and evidence-based treatment, medical practices are under increasing public pressure worldwide (Juneau et al., 2022).

In this setting, digital tools were welcomed as a solution to problems including social stigma and a mismatch between demand and supplies for mental healthcare. Instead of the traditional mental health treatment paradigm, it was predicted that digital technologies would provide more flexible, accessible, inexpensive, and maybe less stigmatizing alternatives (Norman et al., 2022). Flexible approaches were urgently needed as a consequence of the lack of access to mental healthcare (Myran et al., 2022). There has since been a surge in interest in the creation of mobile apps to supplement traditional mental health treatment (Bertocchi et al., 2022). Despite having clinical effects comparable to that of a medical professional in study results (Grieve et al., 2022; Duffecy et al., 2022), the use and upkeep of such digital psychiatric care products were revealed to be rather low (Zhao et al., 2022). The inability of technology to fully engage patients and the failure of investigational findings to enhance the patient care experience in real-world settings have both been connected to a lack of willingness and acceptability (Thompson et al., 2021; Lundström et al., 2022).

Anxiety disorders including anxieties, panic attacks, obsessive-compulsive psychological conditions, social phobia, and post-traumatic stress disorder are all treated using cognitive-behavioural therapy (CBT). The findings of clinical investigations show that exposure therapy approaches combined with CBT are the most successful for treating particular phobias, but (Mohr et al., 2017). To effectively overcome the phobia, exposure treatments try to build the patient's capacity to resist those stimuli that trigger anxiety or dread by exposing the patient to feared circumstances (Asman et al., 2021). There are three different sorts of expositions: interoceptive (against internal stimuli), natural (against an external setting), and imaginative. The most popular methods for treating phobias are imitation and natural procedures. However, employing virtual reality, digital solutions have started to take on a distinctive function as an alternate version of the exhibition that blends aspects of real-world and fantastical alternatives (Spoorthy et al., 2020).

A reminder of this paper is as follows: Next section views state-of-the-art literature in the area of conversational agents and chatbots for mental health. Section 3 demonstrates materials and methods for

chatbot development. Section 4 demonstrates the results and findings that have been obtained during this research. In the end, we conclude our research paper by indicating obtained results.

## 2 Materials and Methods

The use of computerized or Internet-based (CBT) as a substitute for or addition to in-person treatment has been explored in some studies (Bentley et al., 2021; Romanowska & Dobroczynski, 2021; Hollmann et al., 2021; Kazantzis et al., 2021; Thabrew et al., 2021; Phillips et al., 2022). Online or offline application software used to offer digital treatment explains the psychotherapy paradigm. Along with using active monitoring of behaviour and thinking patterns and encouraging activities between sessions, it is supported by a professional practitioner who typically evaluates progress and outcomes. Including follow-up, treatment often lasts more than 9 to 12 weeks (Eilert et al., 2021). The majority of research on the topic mentions CBPT's utility in treating mild to severe depression, anxiety disorders including panic and generalized anxiety, and post-traumatic stress.

Consumer behavior trends have brought attention to the urgent need to improve our knowledge of chatbots with AI for mental health care. First off, rather than seeing a psychiatrist in person, many people are turning to online psychiatric services like "7cups of Tea," which offers text-based consultations with genuine counsellors (Jain et al., 2022). Additionally, text-based conversational agents like Ruth or Xiaoice have grown in popularity since they allow for private interactions (Shum et al., 2018). Finally, users are starting to recognize and trust virtual assistants on mobile devices and other technology that is AI-enabled. These results suggest that consumers are becoming more open to receiving mental health care through chatbots. These self-service technologies are becoming more and more popular, as seen by the number of people who have downloaded psychological healthcare chatbots.

Despite the growing academic interest in this idea, there is a lack of technical or psychological expertise in many studies on AI-enabled conversational agents. Given the significance of this issue for both fields, as well as for psychologists and AI programmers, it is necessary to integrate prior research into a literature review to get an overview of the state of the field, review applied technologies, identify current challenges and ethical issues, as well as pitfalls, and suggest potential directions for further study.

A renaissance in AI technology is driving the rebirth of online mental health therapies. Conversational agents, often known as chatbots, are AI-enabled software systems that can engage with humans through text or speech using natural language (Sarikaya, 2017). Digital assistants like Apple's Siri, Yandex's Alice, Amazon's Alexa, and other virtual assistants and user interfaces for online banking and shopping presently make use of this rapidly evolving technology (Thiebes et al., 2021). Other uses of the technology include the creation of mental health chatbots, a brand-new category of online mental health services that may have a lasting impact on psychotherapy (Joshua et al., 2022). The automated chatbots may address issues like poor commitment, constrained physician availability, and stigma in mental health care by imitating social dialogue enjoyably and objectively (Darcy et al., 2021).

Does this imply that talking robots will eventually take the role of psychologists? The topic of psychological wellness is also addressed by advances in AI. Reviews show that there are now much more desktop and mobile apps for self-control and psychological health. Virtual assistants are a distinct area of this discipline. Chatbots—software programs that can converse with users and learn on their own—have the potential to replace human conversation partners (Flanagan & Walker, 2021; Omarov et al., 2022). The potential of this study is noted in some areas. For example, (Li et al., 2021) created an empathic chatbot agent for persons with psychiatric illnesses, and further study (Carroll, 2021) investigated the use of a chatbot for patients with Parkinson's disease and an autism spectrum disorder. Another striking example is the Woebot chatbot. The human-robot communication in this chatbot system uses algorithmized cognitive-behavioural therapy (CBT) techniques.

In a study by Fitzpatrick K. K. and colleagues (Schanke et al., 2021), a group of high school kids with potential therapeutic higher rates of psychological distress took part. The patients were given a short explanation of the CBT approach, which is often used in psychiatric therapy. The Woebot program was used for several weeks as part of an experiment, with the caveat that it wouldn't substitute therapy and that users

should seek help in an emergency. The results of the study indicate statistically significant advantages for the study group, including decreased signs of anxiety and despair.

Given the prevalence of mobile devices, several researchers questioned how helpful embedded dialogue agents may be in planning population support (Jain & Khurana, 2022). They looked at the four most popular dialogue agents for cell phones in their research. Simple inquiries on physical health, interpersonal violence, and mental health were made to the dialogue agents by the authors. The study's authors concluded that dialogue agents were inefficient at the time because they often failed to recognize indicators of mental or physical anguish in the addressed queries. However, when questioned about the subject of suicide risk, several of them suggested getting in touch with an expert. The authors claim that advancements in this field will make it possible to utilize conversational agents as a tool for quick aid, particularly psychotherapy.

### 3 Results and Discussions

We developed a chatbot using RASA technology to provide patients with psychological problems with mental healthcare help. This chatbot abides by a certain set of guidelines. To identify entities and get the needed answer, RASA NLU is used. The developed chatbot considers a variety of themes, such as "Greetings," "Confirm," and "Bye," as well as "Diagnosis."

#### *Intent Recognition and Extraction*

Figure 6 shows the initial page of the hypothetical chatbot that would solicit questions from users to assess their psychological health. With the name Shrink bot, we created a chatbot for the Telegram messenger. On Telegram, the suggested chatbot is accessible (Zhumanov et al., 2022). We provide two instances of the hypothetical chatbot representing the questionnaire in Figure 6a. When using a chatbot for the first time, a patient should provide answers. The questionnaire is required to determine a patient's condition. The questionnaire includes several tests, including The Beck Depression Inventory (Jackson-Koku, 2016) and The PHQ-9 (Patient Health Questionnaire-9), which objectively and quickly measure the severity of a patient's depression (Manea, 2015), as well as the Beck Hopelessness Scale (Kliem et al., 2018), CRAFFT Screening Test (Gryczynski et al., 2019), NEO Five-Factor Inventory (The NEO-FFI), GAD-7: Anxiety Test (Sousa et al., 2015), Buss-Perry Aggression Questionnaire BPAK-24, Beck Hopelessness Scale, and Current patient progress is shown in Figure 6b, along with any unanswered questions.

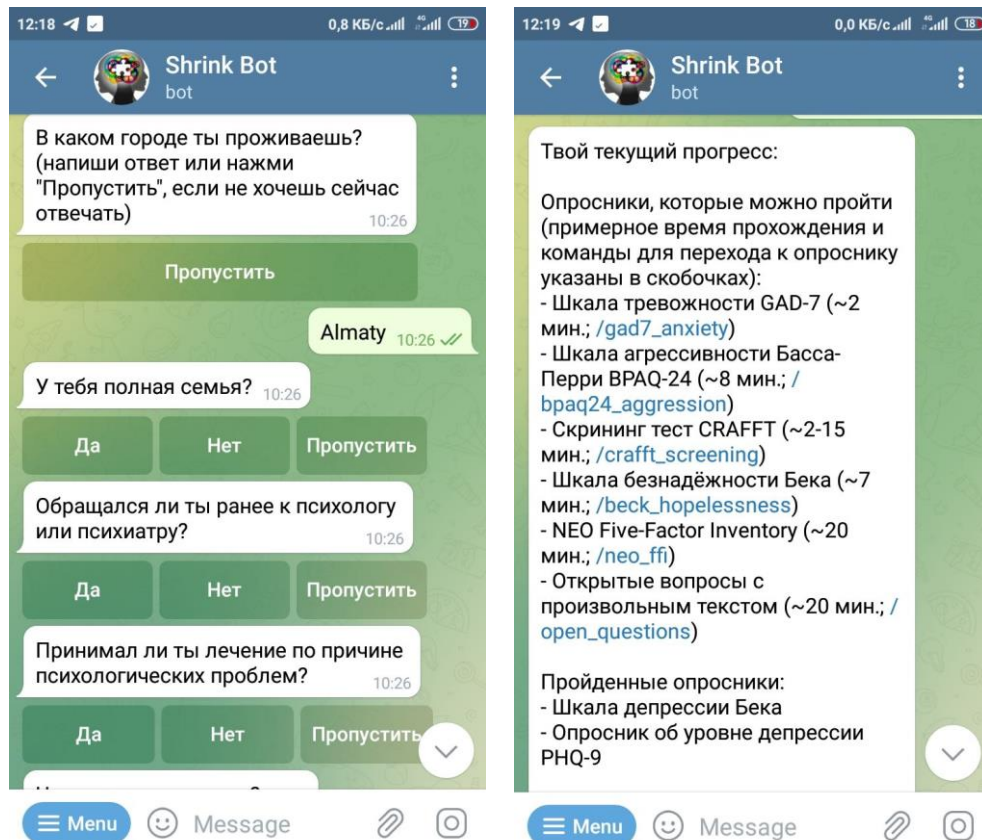


Figure 6. Chatbot architecture

The chatbot psychologist is used in Figure 7. There are some tabs, including /my info, /progress, /reset, and /help, for seeing information about the profile, the patient's current progress, the reset tab for patients who wish to start again, and the help tab for patients who need assistance with using the suggested chatbot's commands.

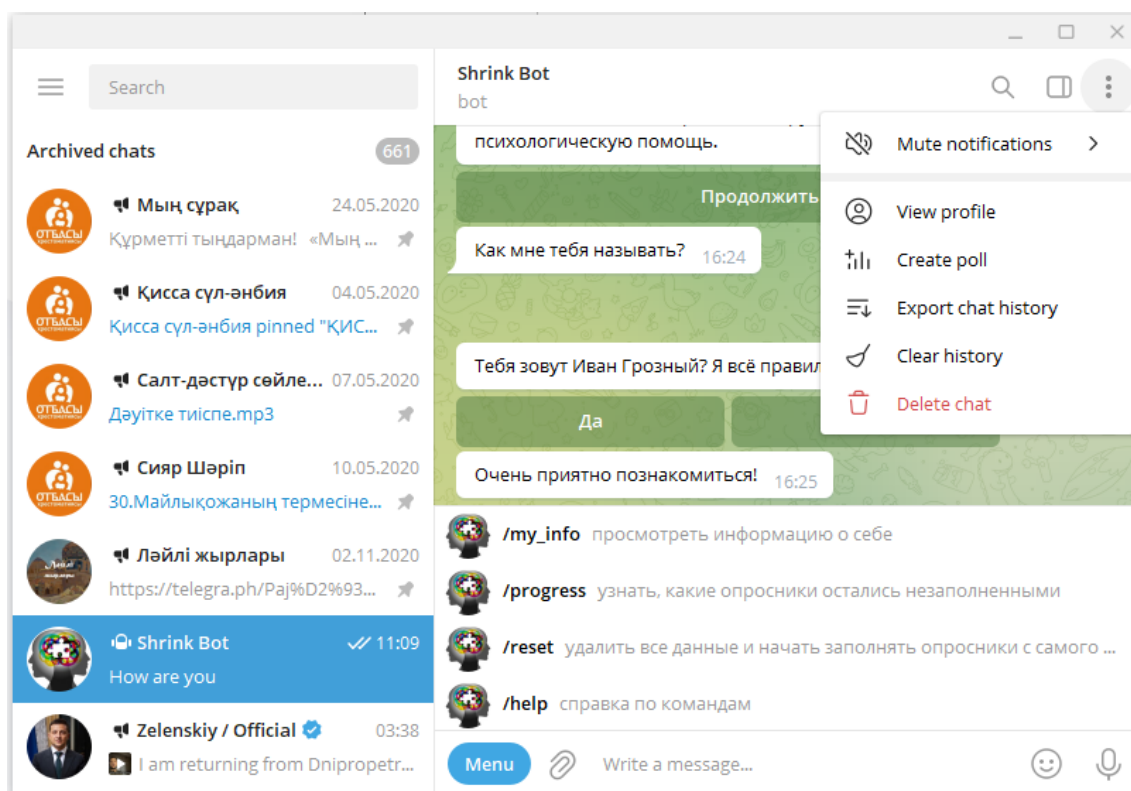


Figure 7. Chatbot in use

### Intent Recognition and Extraction

The results show that the Rasa NLU system is 0.99375 accurate for the purpose for which it was designed. The meaning of "how are you?" is mistakenly detected in the training collection as "diagnostic," as can be seen in Tab 1. Given that the training results do not include any similar phrases, it is quite likely that there is a mistake. The term "time" is a modern machine term that substitutes the words "day" and "day" in the sentence "having a nice day," and the experiment that was run on it yielded no mistakes.

Table 1  
Analysis of the results

	Confirmation	Greetings	Bye	Diagnosis	Total
Confirmation	9	-	-	-	9
Greetings	-	6	-	3	9
Bye	-	-	12	-	12
Diagnosis	-	-	-	450	450
Total	9	6	9	450	450

An examination of the RASA NLU process is what we perform first. This specific training program has an entity integrity score of 0.92 and an accuracy score of one for the entity extract. The chatbot may make mistakes and be unable to comprehend the inquiries or texts coming from the patient's side if the text contains any grammatical problems. Rasa NLU has been used to extract named entities, and it has been shown that this method is quite reliable since there are no errors in entity extraction during the whole phase when

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utilizing the right training and test evidence. In the next phase of our research, we'll apply NLP techniques to examine datasets like (Darcy et al., 2022), to identify signals that are connected to depression.

## 4 Conclusion

We presented the preliminary results of our investigation into the development of a mental healthcare mobile conversational agent for the Kazakh audience in this paper. Additionally, we taught chatbot psychotherapy using a variety of NLU understanding models. The trial's results showed that the identification of patient responses was correct for more than 70%. The data made public show that the Kazakh audiences may find a use for mobile conversational agents. We want to use more artificial intelligence approaches in the forthcoming phases in an attempt to improve the results we have already obtained.

To reduce the stress related to the initial patients who are admitted and the subsequent categorization of such patients, artificial intelligence will become a crucial tool in the activity of mental health professionals. The use of AI in the treatment of mental health issues may help reach more people who need help while also providing a chance for ongoing, individualized control over the problem that is already there. The abovementioned chatbot can only be used for a limited number of subjects in Kazakh. The goal of this study was to look at the viability of developing a mobile chatbot that could be used in the Kazakh language. The results show that a conversational agent can carry on a simple conversation in the Kazakh language. In further, we are going to improve our results by developing a conversational agent that can identify and cure people who are showing indications of depression.

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## Biography of Authors

	<p><b>Batyrkhan S. Omarov</b>  received his bachelor's and master's degrees from Al-Farabi Kazakh National University, Almaty, Kazakhstan in 2008 and 2010, respectively. In 2019, he received his PhD from Tenaga National University, Kuala Lumpur, Malaysia. His research interests include machine learning, natural language processing, and artificial intelligence in medicine.  <i>Email: <a href="mailto:batyahan@gmail.com">batyahan@gmail.com</a></i></p>
	<p><b>Sergazi Narynov</b>  Candidate of Engineering Sciences. General Director of “Alem Research” LLP. Activity: Development and maintenance of IS.  <i>Email: <a href="mailto:sergazinarynov@gmail.com">sergazinarynov@gmail.com</a></i></p>
	<p><b>Zhandos Zhumanov</b>  PhD in Information Systems. Data Scientist in LLP Alem Research.  <i>Email: <a href="mailto:z.zhake@gmail.com">z.zhake@gmail.com</a></i></p>
	<p><b>Elmira Alzhanova</b>  Head of the General education disciplines department at the International University of Tourism and Hospitality, Turkistan, Kazakhstan.  <i>Email: <a href="mailto:elmira.alzhanova@iuth.edu.kz">elmira.alzhanova@iuth.edu.kz</a></i></p>
	<p><b>Aidana Gumar</b>  Residency in S.D. Asfendiyarov Kazakh National Medical University, specialty: Psychiatry, including child psychiatry.  <i>Email: <a href="mailto:aidanagumar5@gmail.com">aidanagumar5@gmail.com</a></i></p>

	<p><b>Mariyam Khassanova</b> Residency in S.D. Asfendiyarov Kazakh National Medical University, specialty: Psychiatry, including child psychiatry. Email: <a href="mailto:mariyamkhassanova01gmail.com">mariyamkhassanova01gmail.com</a></p>
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