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**Тема работы**

**Чат-боты как технологии искусственного интеллекта в России и США**

***Выполнил:***

*Рудченко Андрей Сергеевич,*  
учащийся 10А класса  
Государственного бюджетного общеобразовательного учреждения  
Московской области  
«Одинцовский «Десятый лицей»

***Руководители:***

*Сухоручкина Ирина Николаевна,*  
педагог дополнительного образования  
высшей квалификационной категории,  
кандидат технических наук,  
*Фирсова Лидия Викторовна,*  
учитель английского языка  
высшей квалификационной категории,  
Почетный работник общего образования;  
Государственное бюджетное общеобразовательное учреждение  
Московской области  
«Одинцовский «Десятый лицей».

# “Chatbot: artificial intelligence technology in Russia and the USA”

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## **Introduction**

### **1. Research relevance**

- 1) In Russia and the USA chatbots are actively used by buyers and sellers of goods and services and those who provide them.
- 2) Chatbots are actively used for surveys, in banking, medical care and healthcare, law, education, entertainments.
- 3) On October 11, 2019, the National strategy for the development of artificial intelligence (AI) in the Russian Federation for the period up to 2030 and the decree of the President of the Russian Federation on the approval of the National strategy were published.
- 4) The Ministry of economic development of the Russian Federation is a controller of the AI in Russia instead of the Ministry of digital development, communications and mass communications of the Russian Federation.
- 5) Russian President Vladimir Putin proposed to introduce AI in public administration.
- 6) 64 % of internet users say 24-hour service is the best feature of chatbots. 37 % of people use a customer service bot to get a quick answer in an emergency. There were over 300,000 chatbots on Facebook in 2018 [1].
- 7) The 4<sup>th</sup> world summit “Artificial Intelligence for Good”, Geneva, 4-8 may 2020, organized by the UN International Telecommunication Union will demonstrate globally how artificial intelligence will accelerate sustainable development [2].
- 8) By 2020 80 % of companies will use chatbots [3].

### **2. Research purpose**

Our research purpose is to study the advantages and applications of chatbots and to present research and development (R&D) plan and algorithm of author's product *AndRay* chatbot as artificial intelligence and decision-making information technology.

### **3. Research objectives**

- 1) Research capabilities and applications of chatbot technology as artificial intelligence and decision-making information technology.

- 2) Compare the use of chatbots in Russia and the United States.
- 3) Research, develop and submit author's *AndRay* chatbot R&D plan and algorithm.
- 4) Analyze problems, needs to develop and use chatbots in industries, different socio-economic areas for information analysis and decision-making.
- 5) Inquiring, carrying out public opinion polling and survey of popularity of chatbots as artificial intelligence technology in Russia and the USA from the State budgetary educational institution "Odintsovo "Tenth Lyceum" students, teachers and students of the Moscow State Institute of Foreign Relations (MGIMO University) of Russian Ministry of Foreign Affairs, Campus in Odintsovo, the National Research University Higher School of Economics, the Federal State Budgetary Institution of Higher Education "MIREA – Russian Technological University", inquiring and poll result analysis.

#### **4. Research object**

Our research object is artificial intelligence technology in communications, information analysis and decision-making.

#### **5. Research subject**

Our research subject is chatbots as artificial intelligence technology in Russia and the USA.

#### **6. Research problems**

- 1) Explore technology, capabilities and applications of modern chatbots as artificial intelligence and decision-making information technology.
- 2) Compare the use of chatbots in Russia and the United States.
- 3) Submit our R&D plan and algorithm for creating our *AndRay* chatbot.
- 4) Analyze problems, R&D needs and chatbot applications in industries, different socio-economic areas for information analysis and decision-making.

#### **7. Research hypothesis**

As a representative of the younger generation I believe that chatbots are necessary for everyone who wants to make their lives, communications, studies, work, information analysis and decision-making easier, more reasonable and better thanks to computer technology.

## **8. Research methods**

When developing our research topic, theoretical methods such as analysis, comparison, generalization, systematization, synthesis, formalization, as well as empirical methods such as modeling, experiment, programming, survey, questionnaire have been used. Internet resources, electronic and printed resources such as scientific journals and books have been analyzed.

## **9. Literature review and sources used**

5,040,000 sites of Internet resources about chatbots in Russian, 250,000,000 sites in English have been analyzed. Russian-language books were not found, but 78 articles in scientific journals on the topic of chatbots in Russian have been studied. 128 books, 9,210,000 articles, 12 scientific journals on the topic of chatbots and virtual assistants in English have been studied. Abstracts of articles in scientific journals and books in pdf format in English have been studied. Consequently there are much more printed and electronic resources such as scientific journals and books about chatbots and virtual assistants in English than in Russian.

In ScienceDirect (Scopus) Data Base we have analyzed 432 articles in English, including 75 articles published in 2018, 205 in 2019, 28 in 2020. By the types of articles there are 25 reviews, 250 research articles, 2 encyclopedias, 39 book chapters. By the publication titles there are 41 articles by new scientists, 30 articles about computers in human behavior, 26 procedia computer science. By access the data types there are 63 articles in open access, 3 articles in open archives.

## **10. Hardware and software**

Hardware: 1) computer; 2) smartphone; 3) camera; 4) interactive whiteboard; 5) printer.

Software: 1) social networks in Russia: Vkontakte, Odnoklassniki, My World; in USA: Facebook, Twitter, LinkedIn, Pinterest, Google Plus+, Tumblr, Instagram, LiveJournal, YouTube; 2) free open-source cross-platform IDE Code::Blocks; 3) Microsoft Power Point.

## 11. In-depth study level of the topic

In 2019 the CODDY school of programming [4] and the Faculty of Computational Mathematics and Cybernetics of Lomonosov Moscow State University organized 2 courses “Chatbots in Python” and “Web applications in Python” for creating chatbots, web applications and games in Python. There are dozens of articles on the Internet about proposals to develop chatbots for business.

## 12. Author's contribution to problem solution

- 1) The author has developed the algorithm for creating *AndRay* chatbot as an artificial intelligence and decision-making technology.
- 2) The author has made the comparison of the use of chatbots in Russia and the USA.
- 3) The author has inquired, carried out public opinion polling and survey of popularity of chatbots as artificial intelligence technology in Russia and the USA from the State budgetary educational institution “Odintsovo “Tenth Lyceum“ students, teachers and students of the Moscow State Institute of Foreign Relations (MGIMO University) of Russian Ministry of Foreign Affairs, Campus in Odintsovo, the National Research University Higher School of Economics, the Federal State Budgetary Institution of Higher Education “MIREA – Russian Technological University”, inquiring and poll result analysis.

## Main Part

### 1. How did it all start?

Chatbots have been developed and used for more than half a century. In 1966 the early natural language processing computer **program ELIZA** was created by J. Weizenbaum at the MIT Artificial Intelligence Laboratory. The program mimicked the therapist's speech paraphrasing the sentences that had been told to it. It used the technique of active listening, highlighting key words in the patient's speech. When it couldn't find an answer, it'd say, “I see” and change the subject.

In 1972 **PARRY** chatbot was created. The program could imitate the speech of a paranoid schizophrenic and often impersonated a patient. It was called “ELIZA with

an opinion". The psychiatrist differs from the schizophrenic in the absence of own opinion. The chatbot was smarter than its predecessor *the Therapist* and could deceive psychiatrists. 48 % of them did not realize that they were communicating with the bot.

16 years after PARRY scientists tried to create a bot with artificial intelligence, and it took 9 years. The **Jabberwacky program** can simulate a human conversation in an entertaining manner. The bot remembers everything that has been said to it and finds the answer using the context::template method. He learns slang, jokes and forms its own character. **Robot George** helps Russian students to learn English in **the LiveEnglish project**.

In 1995 as an important milestone in R&D of smart bots **A.L.I.C.E.** (Artificial Linguistic Internet Computer Entity) **program** was developed. **A.L.I.C.E.** is the first Internet bot with natural language processing. It uses heuristic patterns received from the interlocutor and can conduct a conversation. It is unable to pass the Turing test, but was recognized as the most *human* bot, humanoid, talking robot.

In 2001 the popular **SIRI** (Speech Interpretation and Recognition Interface) program and the **SmarterChild bot** were created. Their popularity showed that users would like to communicate with the smart bot that has its character and can give a useful advice. 30,000 AIM (AOL Instant Messenger) and MSN (Microsoft Network) users have chatted with bots.

With the advent of the era of **Big Data** we need systems that can process, analyze and extract the information we need. In 2006 the IBM company started the **WATSON software** development and systems. Chatbot can process natural language and learn in communication. It can immediately answer any question such as how to open a bank account or what to give my mother for her birthday. IBM's advanced **Watson for Cyber Security software** includes a chatbot, a voice assistant and manages cognitive information security centers.

## **2. The use and capabilities of chatbots**

### **2.1. Trade**

In stores many customers are helped with the purchase of goods by consultants. In online stores there is no consultant, and if the buyer does not understand something there is no one to ask. We will not buy the product we need, and the seller will not receive money from the product that could not sell. Here the chatbots instead of the the consultants come to the aid. They will tell you the date of delivery and the price of the product, its quantity and everything you want to know about it.

### **2.2. Medical care and healthcare**

Chatbots are used in medical care and healthcare. There are many different symptom-checkers, most of them are developed as automated question-and-answer systems such as questionnaires, questions are asked according to prescribed management rules. Chatbots are also used as virtual assistants for doctors and patients. They do not diagnose diseases, but they can remind you to take your medicine, provide information about side effects and make an appointment with a doctor.

Advanced intelligent systems adapted to the responses of users, understand the conversation context and collect information about their health status like doctor consultations. On average the anamnesis collection by a doctor takes 60 % of the consultation time and lasts 15 minutes. The anamnesis collection using the program is several times faster, and percentage of medical errors is lower.

Bots are used to make a preliminary diagnosis based on the marked symptoms. Diagnostic accuracy with such systems is not great, since it is impossible to determine accurately the disease from the patient's complaints, and additional information is needed such as examination data, tests, research and anamnesis. Bots are trained to ask the right questions and collect complete information about the disease compared to the initial complaints of the patient.

### **2.3. Office work**

Chatbots help with work especially in the office. With chatbots users fix printers in the office or send requests to the technical support. They ask where the



meeting room or the right office is located, about salary and bonuses, how to get to workshop when the plane leaves to fly on a business trip.

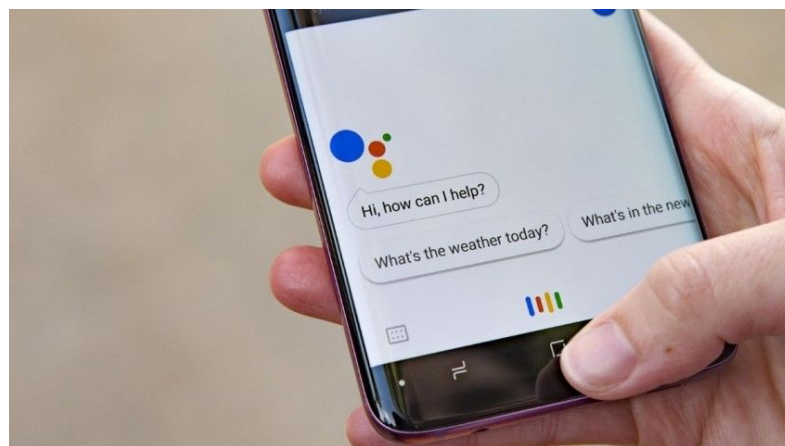
#### **2.4. *Entertainments***

Many chatbots can talk to you, play games with words such as “Cities”, offer popular music. Such chatbots are available in social networks and messengers. Chatbots may be helpful with different tasks.

### **3. Modern chatbots**

#### **3.1. *Google Now***

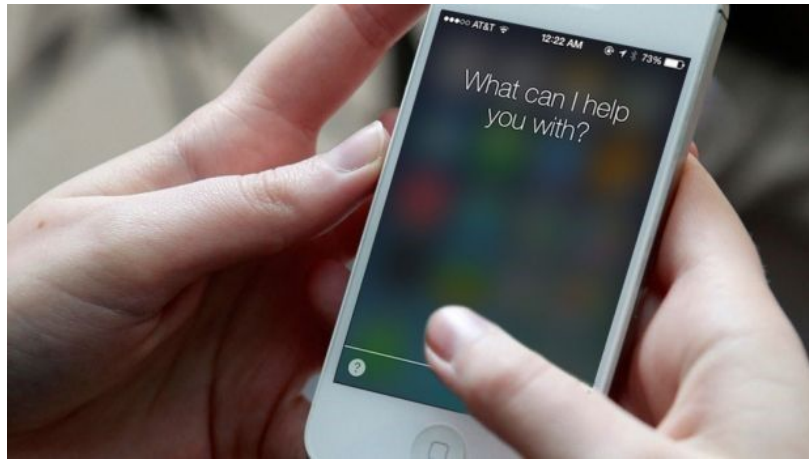
**Google Now** (Figure 1 illustrates) is one of the first Google voice assistants in Russian, works on devices with Android, iOS and Chrome browser. It suggests the best route to your destination taking into account the user location, offers news, analyzes mail and search queries.



**Figure 1. Google Now**

#### **3.2. *Siri***

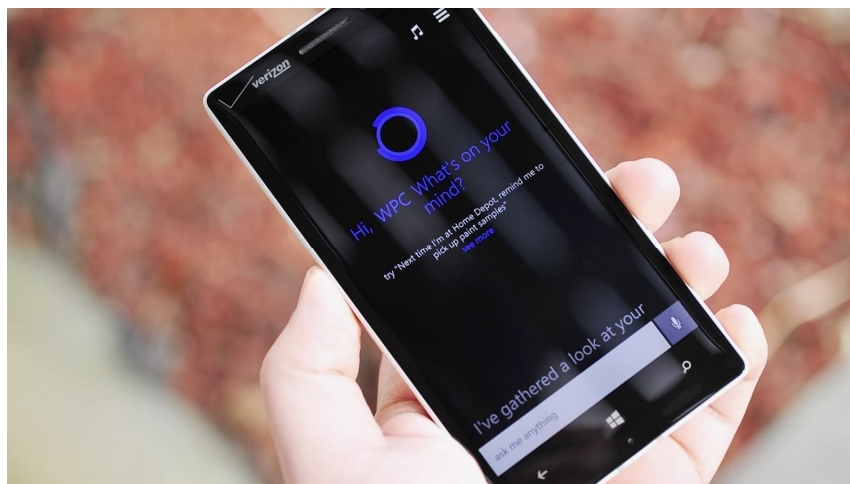
Siri (Figure 2 illustrates) works only on Apple devices; conducts dialogues and gives recommendations such as where to go, what movie to watch; supports many languages. There is a voice assistant in Russian.



**Figure 2. Siri**

### **3.3. *Microsoft Cortana***

Microsoft's Cortana (Figure 3 illustrates) is available on Windows, iOS and Android; manages reminders and calendars, tracks parcels, sets alarms and searches the Bing search engine for news, weather forecast and other information. Russian language is not yet supported.



**Figure 3. Microsoft's Cortana**

### **3.4. *Amazon Alexa***

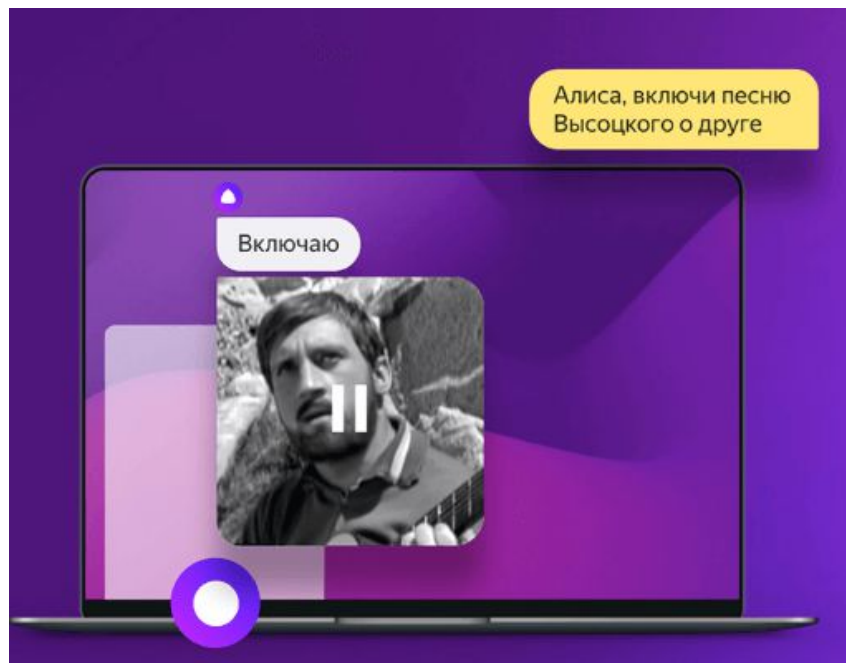
Amazon Alexa (Figure 4 illustrates) is integrated in to Amazon audio devices (Echo, Echo Dot, Tap) and the Fire TV set-top box; plays music, reads the news, offers information about weather forecasts and traffic jams. You can order products on Amazon using your voice. Russian language is not supported.



**Figure 4. Amazon Alexa**

### **3.5. *Yandex Alice***

Yandex Alice (Figure 5 illustrates) is a voice assistant developed by Yandex in Russian; available on Yandex and Yandex Browser on Android and iOS platforms and desktops; integrated with other Yandex services. Yandex voice assistant recognizes music and photos. You can call a taxi, control the Navigator system.



**Figure 5. Yandex Alice**

## **4. Evolution of chatbots in Russia and the USA**

In the USA chatbots have been actively developed since the early 2000s. Chatbots have been developed in Russia since 2016. Popular products at World Market such as Google Now, Siri, Microsoft Cortana, Amazon Alexa have been

developed in the USA, and Yandex Alice has been developed in Russia. 67 % of Americans Millennials born in 1981-1996 are willing to buy goods and services using chatbots, and 40 % of them do so every day. In Russia chatbots allow you to purchase goods and customer services of chain stores, so Russians do not use chatbots as Americans interact with AI chatbots.

## 5. AndRay chatbot development algorithm by the author

### 5.1. *What kind of chatbot do I want?*

To create a chatbot that meets the user's requirements you need to answer the question: "Why do I need a chatbot?". I decided to develop Autoresponder robot *AndRay* chatbot that will repeat my answers and phrases depending on the question asked or the phrase of my interlocutor. It is not easy for the interlocutor to determine if you're dealing with a *human* or an AI/chatbot.

### 5.2. *What should my chatbot be able to do?*

- 1) Our *AndRay* chatbot can memorize the information that we have recorded and information is being fed automatically, and play back the information that we have recorded. *AndRay* chatbot should work as follows.

#### **Before using the bot:**

A: Hi! What's up? ← We memorize the phrase to which we will respond.

B: Hi! Well, how are you? ← We memorize the phrase that we will answer.

#### **After using the bot:**

A: Hi! What's up? ← We compare the phrase with what we remember.

Chat-bot: Hi! Well, how are you? ← We will reproduce the answer.

- 2) *AndRay* chatbot should be able to respond regardless of typos and grammatical errors, install the app on your smartphone and work offline, translate with Yandex Browser.

#### **Before using the bot:**

A: Hi! What's up? ← We memorize the phrase to which we will respond.

B: Hi! Well, how are you? ← We memorize the phrase that we will answer.

#### **After using the bot:**

A: Hi! Wuuuz up? ← We compare the phrase with what we remember.

Chat-bot: Hi! Well, how are you? ← Even with an error we will reproduce the answer. Up to 10-20 % of errors will be allowed.

3) What to do if there is no answer to the question or phrase in our database?

Then there are two options. 1<sup>st</sup> option: send the host a message that the chatbot can not respond, and then the host must respond instead of the chatbot. 2<sup>nd</sup> option: after 1 to 2 minutes the chatbot will write “Busy” and “Will respond after”, and the chatbot will send the host a message “The dialogue is over”.

#### **Before using the bot:**

A: Hi! What's up? ← We memorize the phrase to which we will respond.

B: Hi! Well, how are you? ← We memorize the phrase that we will answer.

#### **After using the bot:**

A: Hi! Wuuuz up? ← We compare the phrase with what we remember.

Chatbot: Sorry, I have to go, let's go after, okay? ← We didn't find the answer.

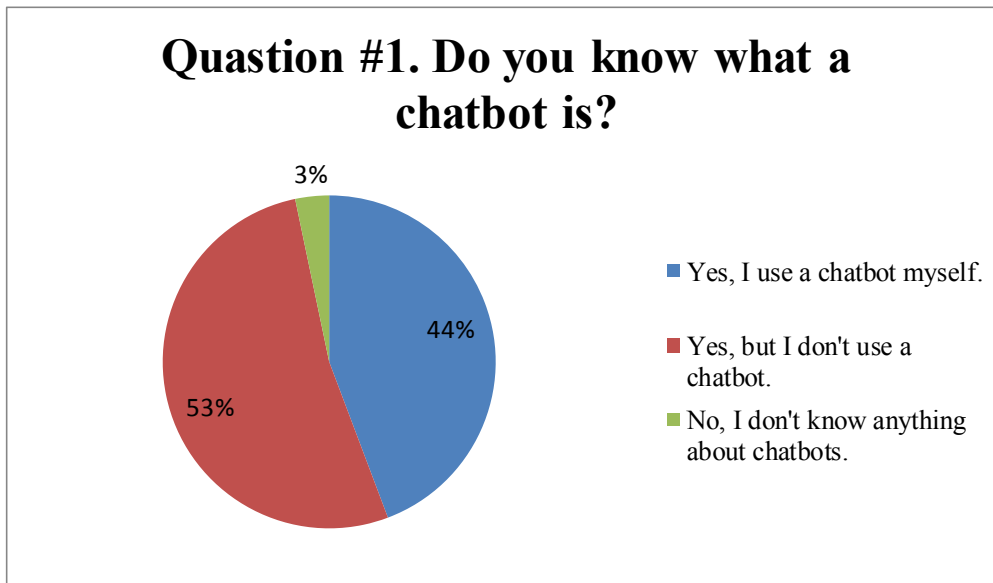
### **5.3. *Where do I use AndRay chatbot?***

You can use the chatbot in any social network or messenger. I will use *AndRay* chatbot in the social networks where I communicate more effectively.

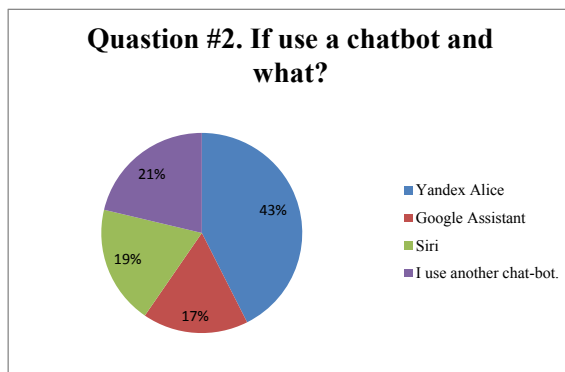
## **6. Inquiring and poll result analysis**

We have inquired, carried out public opinion polling and survey of popularity of chatbots as artificial intelligence technology in Russia and the USA from the State budgetary educational institution “Odintsovo “Tenth Lyceum” students, teachers and students of the Moscow State Institute of Foreign Relations (MGIMO University) of Russian Ministry of Foreign Affairs, Campus in Odintsovo, the National Research University Higher School of Economics, the Federal State Budgetary Institution of Higher Education “MIREA – Russian Technological University”, inquiring and poll result analysis. A survey was conducted on chatbots in a group of specialists, university students (MGIMO MFA, HSE, MIREA) and lyceum students of the “Odintsovo “Tenth Lyceum” from 12 to 30 years old. 263 people participated in this survey. If you want to participate too, follow the link below: <https://docs.google.com/forms/d/e/1FAIpQLSfAqIzTLfbU5WUZFdU1SFZV0ZpNX>

[2CUdnUDsjsaQHwRmzgAaw/viewform?usp=sf\\_link](https://2CUdnUDsjsaQHwRmzgAaw/viewform?usp=sf_link). Figures 6, 7, 8, 9, 10 illustrates the survey results analysis.

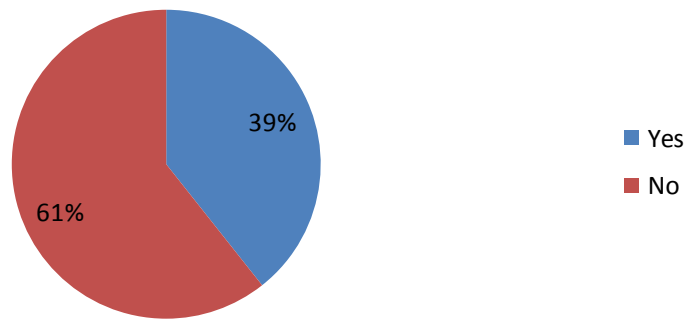


**Figure 6. Question # 1**



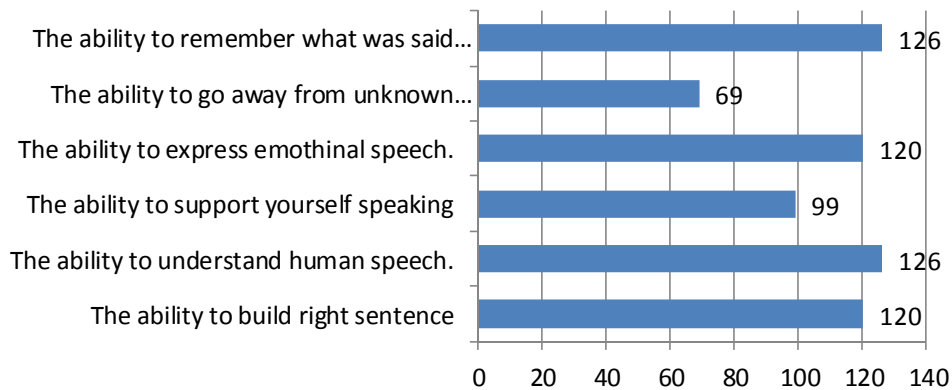
**Figure 7. Question # 2**

**Question #3. Would you like to have your own chat-bot?**



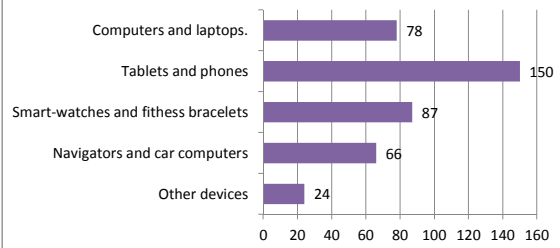
**Figure 8. Question # 3**

**Question #4. What opprtunities would you like to have in this chat-bot?**



**Figure 9. Question # 4**

**Question #5. Which facilities would you like to use a chat-bot?**



**Figure 10. Question # 5**



## Conclusion

### 1. Summary

- 1) Chatbots are necessary for everyone who wants to make his life, communication, study, work, information analysis and decision-making easier, more reasonable, effective and better thanks to computer technology.
- 2) In the USA chatbots have been actively developed since the early 2000s. Chatbots have been developed in Russia since 2016. Popular products at World Market such as Google Now, Siri, Microsoft Cortana, Amazon Alexa have been developed in the USA, and Yandex Alice has been developed in Russia. 67 % of Americans Millennials born in 1981-1996 are willing to buy goods and services with chatbots, and 40 % of them do so every day. In Russia chatbots allow you to purchase goods and services of chain stores, so Russians do not use chatbots as Americans do.

### 2. Results

Our research purpose has been achieved. The advantages and applications of chatbots have been investigated. R&D plan and algorithm of author's product *AndRay* chatbot as artificial intelligence and decision-making information technology have been submitted.

The research objectives have been fulfilled.

- 1) Development of technology, capabilities and applications of modern chatbots as artificial intelligence and decision-making technologies has been investigated.
- 2) The comparison of the use of chatbots in Russia and the USA has been made.
- 3) 5,040,000 sites of Internet resources about chatbots in Russian, 250,000,000 sites in English have been analyzed. Russian-language books were not found, but 78 articles in scientific journals on the topic in Russian were studied. 128 books, 9,210,000 articles, 12 scientific journals on the topic of chatbots and virtual assistants in English have been analyzed. Abstracts of articles in scientific journals and books in pdf format in English were studied. There are much more



printed and electronic resources such as scientific journals and books about chatbots and virtual assistants in English than in Russian.

- 4) In ScienceDirect (Scopus) Data Base we have analyzed 432 articles in English, including 75 articles published in 2018, 205 in 2019, 28 in 2020. By the types of articles there are 25 reviews, 250 research articles, 2 encyclopedias, 39 book chapters. By the publication titles there are 41 articles by new scientists, 30 articles about computers in human behavior, 26 procedia computer science. By access the data types there are 63 articles in open access, 3 articles in open archives.
- 5) Problems, needs for development and functionality of chatbots in industries and different socio-economic areas for information analysis and decision-making have been analyzed.
- 6) The study reveals chatbots, their capabilities and applications in various socio-economic spheres of activity.
- 7) R&D plan and algorithm to develop *AndRay* chatbot have been developed and presented. The author has developed a plan and algorithm for developing an autoresponder chatbot that will repeat the author's answers and phrases depending on the question asked or the interlocutor's phrase. It is not easy for the interlocutor to determine if you're dealing with a *human* or an AI/chatbot.
- 8) Chatbot software makes life easier. You will more trust chatbots and computers.
- 9) Practical significance of the work is to stimulate the creation of chatbots as virtual assistants based on artificial intelligence technology that will solve important problems for each user and contribute to the solution of global problems of mankind.

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