AI-based Healthcare Chatbot

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Abstract - *Amid the development of artificial intelligence technologies such as deep learning and natural language processing, chatbots are our society's most extensively used services. Chatbot is a combination of the words "chat" and "robot," and it refers to software that either provides appropriate responses to questions or receives commands through communication with humans. Chatbots are used by computers to replace customer response tasks that humans used to do. Chatbots combine the concepts of chatting and robots. Chatbots powered by artificial intelligence make use of conversation systems to enable users to have conversations in natural language with the chatbots through voice, text, or both. Non-face-to-face culture, also known as "untact", which has emerged as both a societal phenomenon and a part of everyday life as a direct result of the rapid spread of COVID-19 is becoming the new standard. Amidst all of these shifting societal climates and changes, there are also active transitions occurring in the provision of healthcare services and the management of health using AI chatbots. This article examines the definition and structure of artificial intelligence chatbots. It also examines many examples of how AI chatbots are used in the healthcare industry. Finally, it identifies the advantages and limitations of AI-based healthcare chatbots and presents the future direction of AI-based healthcare chatbots.*

Key Words: AI, AI-based Chatbot, AI-based Chatbot Architecture, AI-based Healthcare Chatbot, Healthcare Chatbot

1. INTRODUCTION

Amid the development of artificial intelligence technologies such as deep learning and natural language processing, chatbots are our society's most extensively used services in our society. Chatbot is a combination of the words "chat" and "robot," and it refers to software that either provides appropriate responses to questions or receives commands through communication with humans. Chatbots are used by computers to replace customer response tasks that humans used to do. Chatbots powered by artificial intelligence make use of conversation systems to enable users to have conversations in natural language with the chatbots through voice, text, or both [1,3]. AI chatbots that are enabled by natural language processing and computing infrastructure can be implemented in two different ways: one is as a rule-based method that is restricted, and the other is as an artificial neural network method that is unconstrained. The global market for chatbots is anticipated to expand at such a rapid rate that it will more than double its current value of $2.6 billion in 2019 to $9.4 billion in 2024 [2]. According to Gartner, interactive AI through voice bots or chatbots can automate all or a part of customer interactions at the customer center, and by 2026, one in ten customer consultations will be automated using interactive AI. With the advancement of artificial intelligence technology, AI chatbots are being utilized in various disciplines. First, AI chatbots are utilized in online shopping malls, banks, and airlines for customer service. The chatbot can resolve basic customer questions or issues. The second function of chatbots is to provide information on medical care, medicines, and preventative measures in the medical field. For example, inputting a patient's symptoms as data into a chatbot enables it to make predictions about the likelihood of the patient contracting the disease or to make suggestions about how the symptoms can be alleviated. Third. A chatbot is an artificial intelligence secretary that can carry out a variety of duties, including the management of schedules, the writing of memos, and notification functions. Fourth, educational content utilizing chatbots is continuously evolving and expanding. For example, chatbots are used to solve English or math problems and to acquire foreign languages. Non-face-to-face culture, also known as "untact" which has emerged as both a societal phenomenon and a part of everyday life as a direct result of the rapid spread of COVID-19 is becoming the new standard. Amidst all of these shifting societal climates and shifts, there are also active transitions occurring in the provision of healthcare services and the management of health using AI chatbots. This study investigates the definition and structure of artificial intelligence chatbots. It then investigates several examples of AI chatbots being used in the field of healthcare. Finally, it derives the benefits and limitations of AI-based healthcare chatbots and discusses the path that artificial intelligence-based healthcare chatbots will take in the future.

2. DEFINITION AND ARCHITECTURE OF AI-BASED CHATBOT

The term "chatbot" refers to a hybrid of the words "chat" and "robot." A chatbot is a software program that engages in text and voice-type conversations with users to respond appropriately to their inquiries or provide them with the

information that they require. Artificial intelligence chatbots utilize artificial intelligence technologies such as voice recognition, deep learning, and natural language processing to determine the question-asking intent of users and provide appropriate responses. As can be seen in Fig -1[4], AI chatbots are primarily made up of two parts: the Frontend, which is a mobile messenger app or web form that receives messages from users, and the Backend, which is an area that provides answers to inquiries posed by users. The backend identifies and analyzes the question intentions of users using Natural Language Processing (NLP) and Natural Language Understanding (NLU). The backend then generates and delivers appropriate responses to users with a Decision Engine and Natural Language Generation (NLG) utilizing Knowledge Base. Computing technologies for pattern recognition, natural language processing, semantic web, text mining, and context recognition are necessary to put this process into action. The technical components of these AI chatbots are shown in Table -1[5].
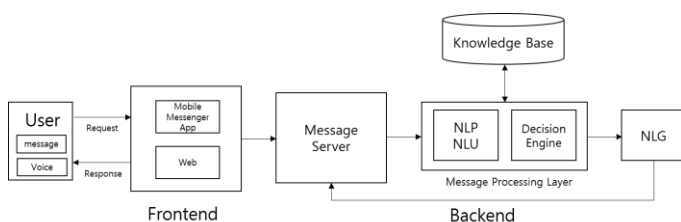

Fig -1: Architecture of AI-based Chatbot

Table -1: AI-based Chatbot Core Technology

Core Technology	Key Features
Pattern Recognition	Machine identification of figures, texts, voices, etc
Natural Language Processing	Includes information search, question response, automatic translation, interpretation through the system, etc
Semantic Web	The intelligent web of the next generation gives computers the ability to comprehend the meaning of data sources and even draw rational conclusions from that meaning
Text Mining	A process or technique for discovering new and useful information in unstructured text data
Context-aware Computing	Providing intelligent, user-centric services by digitizing real-life situations in virtual space

Due to the advancement of artificial intelligence technology, AI Chatbot services are used in a variety of industries. These chatbot services are progressively diversifying their delivery methods and channels as the

industry evolves. At the moment, AI chatbots continue to serve in the roles of simple information delivery and intelligent secretary; however, with the continued advancement of technology, it is anticipated that they will eventually become capable of providing a personalized and professional emotional assistant service as shown in Table -2[5].

Table -2: Service Development Stage of AI-based Chatbot

Division	Level1 Chatbot	Level2 Intelligent Assistant	Level3 Conscious Assistant
Delivery Method	Text, Voice	Text, Voice, and Visual Data	Text, Voice, Visual Data, Behavior Recognition
Input Method	Closed, Partially Open	Partially Closed Open	Combined use of open and closed types
Key Technologies	Pattern matching, keyword, and related word extraction, etc	Deep learning, machine learning, natural language processing, a convergence of other new technologies, etc	Emotion recognition technology, data standardization technology, etc
Service Provided	- Q&A on the learned contents - Simple form of communication with users - Results provided by search	- provides personalized service considering the user's pattern and situation - simple task handing	- Preemptive response to services and various services through emotional exchange

3. CASE STUDY OF AI-BASED HEALTHCARE CHATBOT

The advancement of technology that utilizes artificial intelligence has resulted in the introduction of several novel developments in the field of healthcare. The so-called "non-face-to-face culture" that has emerged as a social phenomenon and an integral part of day-to-day life as a direct result of the rapid spread of COVID-19 is quickly becoming the standard in today's society. In addition, current efforts are being made across the industry to manage health by delivering non-face-to-face medical services using healthcare chatbots that are powered by artificial intelligence. AI-based healthcare chatbots [1, 3] use artificial intelligence technology to autonomously respond to users' questions or requests for information, monitor their health status and provide advice. AI-based healthcare chatbots have the advantage of being able to manage users' health in a manner that is both convenient and efficient, and they are easy to access at any time, from any location. This chapter examines various examples of healthcare chatbots powered by artificial intelligence.

3.1 Youper

Youper [6] is an artificial intelligence-based remote health platform that was developed by a Stanford research team in the United States. It helps decrease symptoms of depression and anxiety. Within this artificial intelligence-powered platform, it is possible to verify the patient's mood status by using a self-diagnosis table that the patient has prepared. In addition, when a patient provides a chatbot with information about his or her emotional state, the chatbot suggests a method or behavior to alter the patient's mood. Youper is integrated with telemedicine, which enables users to speak with medical professionals and receive diagnoses through the use of video conversations. In addition, it offers a service that delivers prescription medicines to patients' residences via consultation with chatbots and medical professionals.
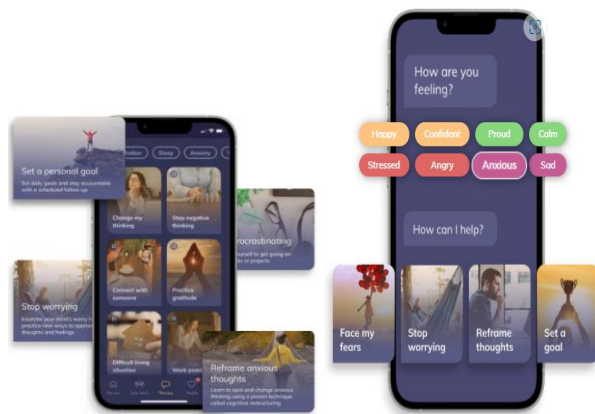

Fig -2: Youper

3.2 Babylon Health

The Babylon Health app [7] was designed for round-the-clock individualized medical consultations. Chatbot Babylon began operations in January 2017 to supplant the UK National Health Service contact number 111 for health-related counseling (NHS). Babylon provides counseling services on behalf of professional counselors, including advice on patient health care, connections to local medical services, and after-hours medical services. When mobile users inquire about symptoms or diseases, artificial intelligence analyzes millions of medical databases for answers, and patients can consult with doctors or specialists via video or text.

Fig -3: Babylon Health

3.3 Woebot

Woebot[8] seeks to improve people's mental health through dialogue regardless of location or time. Chatting with patients allows Woebot, which is equipped with a natural language processing function, to deliver services to patients including psychological monitoring, psychological pattern analysis, psychological status improvement, and cognitive behavioral therapy. Consultation is performed by utilizing expertise and counseling details, and as a result of chatting with patients, it also suggests a method to ask for help from an actual therapist if the condition is serious. A recent study conducted at Stanford University on depressive patients who were separated into groups with and without Woebot demonstrated the efficacy of Woebot by demonstrating a reduction in depressive symptoms in 85 percent of patients who used Woebot. Woebot is accessible via multiple channels and devices, as it is designed not only on social media platforms such as Twitter and Facebook but also on Apple Store and Android. It is possible to share personal stories with Warbot, a cyber therapist, making it possible to receive accurate counseling. Patients are expected to use it frequently because there is no cost for treatment and there are no medical records left.
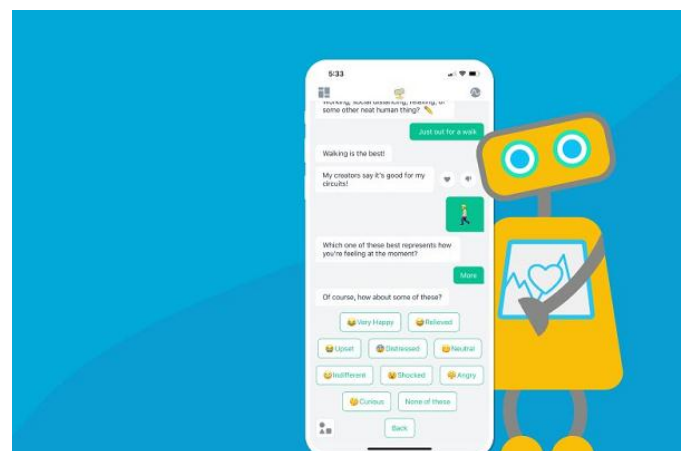

Fig -4: Woebot

3.4 Safedrugbot

The Safedrugbot[9] is a chat service that delivers pertinent information regarding the use of drugs while breastfeeding through the platform of Telegram. Using search terms that are derived from the active ingredients or brand names of the drug, Safedrugbot can explore an extensive database and provide information that is comprehensive regarding the drug guide.

Fig -5: Safedrugbot

3.5 Sensely

Sensley [10] is a service that assists patients who require continuous treatment at home after hospital discharge, and virtual nurse Molly monitors patients' health status. Blood pressure measurement and telemedicine scheduling are Molly's primary responsibilities. Molly says, "It's time to measure blood pressure," when a patient accesses the service through a smartphone while they are at home. After that, the patient or a member of their family wraps the I-health, a home medical device that is supplied to service subscribers, around their arms to begin taking their blood pressure. The measured data is transmitted to the smartphone via Bluetooth, and Molly compares the current measured value to the previously measured value to clarify the current state. The measured data is then sent to the hospital. The measured results are sent directly to the hospital, allowing the physician to respond quickly. In this manner, Molly treats patients similarly to hospital nurses. In addition, Molly can diagnose diseases and provide nursing care to patients using voice communication with patients thanks to her sophisticated voice recognition capabilities, which are based on avatar AI technology.
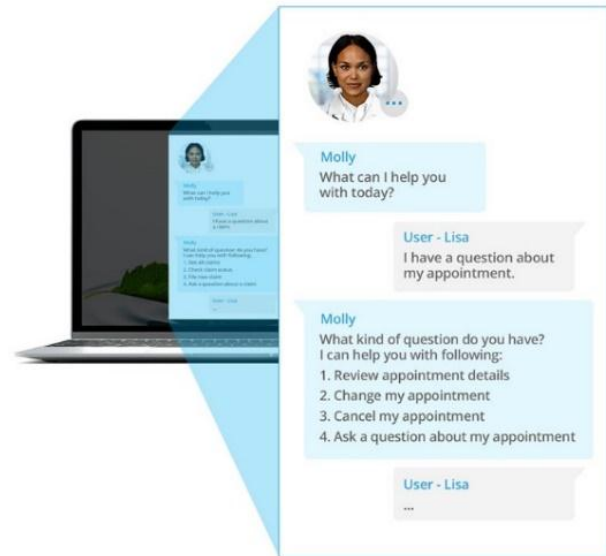

Fig -6: Sensely

4. ADVANTAGES AND LIMITATIONS OF AI-BASED HEALTHCARE CHATBOT

As was just mentioned, healthcare chatbots powered by artificial intelligence have many advantages, including the ability to provide service around the clock, the ability to provide personalized service, cheap costs, and quick responses. The following is an explanation of each of these advantages [11,12] in detail:

- 24-hour service: Since artificial intelligence-based healthcare chatbots are services provided by computers rather than humans, they can offer services round-the-clock regardless of when people are typically available for work. This indicates that patients can receive medical information or advice via chatbots at any time of the day or night.

- Personalized Services: Healthcare chatbots powered by artificial intelligence can collect and evaluate patients' personal health information as well as their symptoms to provide customized advice and treatment options. Patients can receive treatment that is more accurate and efficient because of this.

- Low cost: Healthcare chatbots powered by artificial intelligence can be provided at a lower cost than conventional medical services. This makes it easier for low-income families and areas with limited healthcare care to utilize medical services.

- Quick Response: Chatbots in the healthcare industry that is powered by artificial intelligence can provide prompt responses to the inquiries posed by patients, enabling clinicians to effectively manage urgent situations.

- Large-scale services: Intelligent-based healthcare chatbots can simultaneously serve large numbers of users. This ensures that many people can use it simultaneously, even in areas with limited access to medical care or densely populated cities.

These AI-based healthcare chatbots have introduced a great deal of innovation to the healthcare industry thanks to their many advantages; however, they are subject to the following restrictions [13, 14]:

- Accuracy of question responses: The majority of chatbots with artificial intelligence analyze medical information and respond using natural language processing algorithms. However, the limitations of these algorithms may reduce the accuracy. In addition, because predictions are based on vast quantities of data, poor data quality leads to less accurate predictions.

- Limitations of medical diagnosis: Chatbots in the healthcare industry powered by artificial intelligence can provide patients with answers to their questions, as well as make predictions about the patient's symptoms and the likelihood that they have a disease. However, for doctors to arrive at an accurate diagnosis, they will still need to conduct additional research or ask additional questions.

- Privacy concerns: Chatbots with artificial intelligence collect and analyze health information about patients. It is necessary to have an adequate security system in place to avoid potential invasions of privacy that could result from the collection of such information.

In the future, when designing or implementing healthcare chatbots that are based on artificial intelligence, efforts should be made to overcome the limitations and provide more efficient healthcare services. This can be accomplished by improving the quality of the data, enhancing artificial intelligence algorithms, working together with medical experts, and introducing security systems.

5. CONCLUSIONS

The purpose of this research was to investigate the definition and structure of AI-based chatbots, as well as key technologies for putting AI-based chatbots into practice. In addition to that, the development stage of an AI-based chatbot service was investigated in this research as well. As a result of this research, it was found that artificial intelligence-based healthcare chatbots are a very effective instrument in the delivery of medical services. This was demonstrated through numerous examples of artificial intelligence-based healthcare chatbots, which were accelerated by the non-face-to-face culture that has become the new normal as a result of the rapid spread of COVID-19. In addition, it was discovered that the healthcare chatbot based on artificial intelligence is very effective in improving the effectiveness of medical services and the convenience of patients. On the other hand, it has been established that these healthcare chatbots built on artificial intelligence have several glaringly obvious limitations. Efforts must be made to overcome these limitations and provide more effective healthcare services by addressing them in a variety of ways, such as enhancing the quality of the data collected, refining the algorithms used by artificial intelligence, working in conjunction with qualified medical professionals, and implementing security measures.

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BIOGRAPHIES

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