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Proposed Integration for AICC-based Chatbot Improvement

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Abstract- Artificial intelligence is the foundation of the era of the Fourth Industrial Revolution and has been applied to variou sfields. Among them, there are many fields that use artificial intelligence-based chatbots, such as finance, medical care, etc. C hatbots are also used in call centers, where the turnover rate of call center counselors is traditionally 13 times higher than tha tof other industries. In addition, it is difficult to maintain stable counseling due to realistic difficulties such as time and invest ment costs even when professional counselors are continuously fostered in call centers. Therefore, practical measures are requir ed to stabilize the supply and demand of manpower in the call center industry and support continuous growth. In this study, we present a customized AICC operation service structure that can alleviate the difficulties of call center counselors, receive c ustomer requests, and provide answers in the most similar form to humans instead of counselors. Until now, chatbots functios were based on voice recognition ARS, TTS, and ERMS for a quick response to simple services and connection to counselors. In contrast, the contents presented in this study suggest a service structure that can respond to customers within 1.4 seconds a fter a phone call by combining STT, NLU, and TTS with an AICC-based counseling task automation environment. The establ ished system can secure work efficiency and strengthen expertise, and a plan is presented for a system structure that enables future customer communication in the non-contact era as COVID-19**.**

1. Introduction

Artificial intelligence (AI), one of the important technologies of the Fourth Industrial Revolution, is being developed and used in various fields, and AI applied to autonomous driving, medical image recognition, and chatbots has made remarkable progress. The word chatbot is a combination of chat and robot, and it refers to a system that interacts with humans based on AI as a technology that combines robot AI with an interactive interface. AI-based chatbots are available to customers 24 hours a day and are now developing beyond the level of simple conversation. Therefore, it is thought that the utility of customer management can be improved by providing information faster and more accurately than telephone counseling. These existing services need to be expanded for greater improvement, and the AI currently introduced needs to be further advanced. In other words, a platform for counseling and a system structure suitable for it, as if a person is talking, are required.

In order to realize this, it is necessary to introduce a machine-learning-based chatbot that talks like a human, away from the rule-based chatbot that was conducted sequentially through existing step-by-step counseling. Therefore, this study proposes a system and a structure for a network that can secure work efficiency with the establishment of an automated environment for customer counseling work using AI technology. In particular, a system structure capable of preparing AICC for the non-contact era such as the COVID-19 pandemic was proposed.

2. Related Studies

Chatbots are generally used in call centers. A call center is an industry that receives and processes customer complaints or other requests through telephone media or promotes goods and services [1]. Today, call centers are turning into integrated service centers that provide more services beyond simply resolving customer complaints. Currently various civil service counseling services through call centers have

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increased, and labor intensity has naturally increased [2]. Because of this situation, AI-based chatbot services are being applied more and more actively. In particular, with the development of IT technology, it is becoming more active due to the generalization of smart devices and mobile communication, and the expansion of the influence of messenger apps. In addition, it has the advantage of being a "convenient service" that relieves the stress and technophobia felt while searching, installing, and learning various applications and web services. Table 1 shows the development stages of the chatbot.

Table 1. Analysis of domestic and international trends and prospects for the development of AI chat-bot services [3]

Stage / Section	Level 1 Chatbot Service	Level 2 Intelligent Assistant	Level 3 Conscious Assistant
Offer	Text, Voice	Text, Voice, Visual data	Text, Voice, Visual data, Behavior recognition.
Input	Fully Closed, Partially Opened system	Partially Closed, Fully Opened system	Closed, Opened Dual system
Technology	Pattern matching, Extract keywords and related words, etc.	Deep learning, machine learning, natural language processing, and convergence of other new technologies	Emotional cognitive technology, data standardization technology
Process	- Q&A on what machine learned - Simple forms of communication with users	- Personalized service considering user patterns and situations - Simple task handling	- A preemptive response to services and various services through emotional exchange

Britain's Technavio predicted that the global chatbot market will grow 35% annually to reach $3.17 billio n next year. It also selected banking, financial servic es and insurance, government, retail, and e-commerce as the main areas of growth. Facebook created 100,0 00 chatbots within a year of launching its messenger platform [4], and according to a study by Grand Vie w, the chatbot market is expected to reach about 1.3 6 trillion won by 2020[5].

2.1 Chatbot AI Application Technology

The fields of use and delivery of chatbot services ar e also gradually diversifying. The chatbot services n ot only allow for questions and answers based on sc enarios such as rule setting and pattern matching, bu t also allow active answers through natural language processing-based keyword search and self-learning. F urthermore, chatbots that read users' minds have beg un to appear. Service delivery methods are also dive rsifying beyond messenger apps to the online web, mobile applications, and app in apps, and flexible se rvice delivery methods are being selected and operat ed according to the characteristics of each country a nd service.

2.2 Chatbot AI Application Services in the Financ ial Sector

With the expansion of AI technology, the chatbot m arket has been introduced and grown faster than any other industry. The reason why it was introduced qu ickly in the financial sector is that it is financially more affordable than other industrial groups, but the work in the financial sector is more standardized tha n that of other industrial groups.

Table 2. Chatbot Usage in Korea [7]

	Chatbot	Area of business
Shinhan Bank	Molly	Banking assistance
Kookmin Bank	KBsam	Market analysis and judgment

Table 2 is a domestic use case. In the case of overseas, various solutions have been established and have achieved a kind of popularization by providing chatbot production tools for free. As chatbots become popular, corporate chatbots are working with Legacy for a specific purpose to immediately process customer-desired requests and take on the purpose of the operation.

3. System Structure

3.1 Existing System Configuration

The chatbot system can be classified into a rule-based chatbot, a machine-learning chatbot, a one-time question-and-answer chatbot, a continuous interactive chatbot, and a search model chatbot and a generation model chatbot according to the answer generation method.

Currently, rule-based chatbots, which operate based on predefined rules, are mainly used. The chatbot includes an interpretation rule that interprets a user's input, a response rule that responds to the user's input, or a rule that generates a response [9]. The development of rule-based chatbots does not require large amounts of data and is relatively easy to implement, and although well-defined rules enable high-quality conversation services, defining many rules requires a lot of time and manpower. These are problems with the existing system.

One of the biggest problems with current chatbots is a delay in response time of more than two seconds after a phone call, and the proportion of reconnections to counselors is actually increasing. Figure 2 is an example of analyzing the cause of the response time delay.

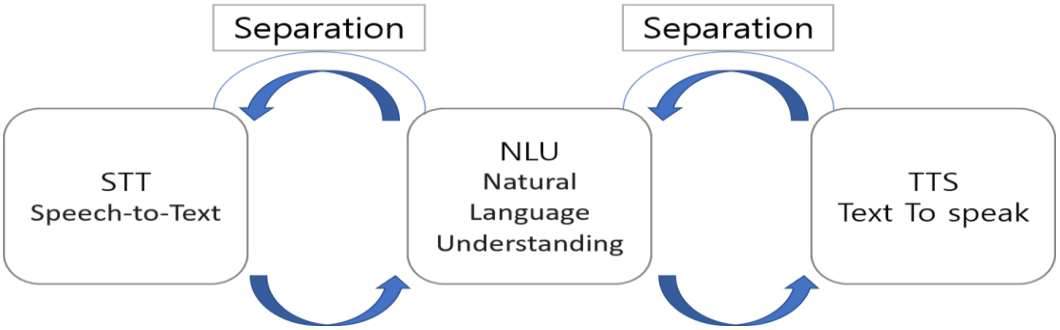

Figure 2- General situation of response speed delay

The delay in the response speed is interpreted as the separation of STT, NLU, and TTS. It is difficult to perform performance optimization tasks because the core modules of the AI engine are separated. According to the paper "Development of AI-based Call Center Real-Time Counseling Helper System-Focusing on the Case of the N Bank Call Center," a study on how to build a corpus to improve the natural language processing performance of the question-answer system was conducted [10]. In this paper, it can be seen that engine changes and multi-engine linkage issues are currently occurring, but the response waiting time is being reduced to less than two seconds to eliminate customer complaints.

3.2 Proposed System Configuration

Rule-based recommended chatbots have various problems, as mentioned above. The AI-based interactive chatbot proposed in this paper enables natural conversation based on natural language processing, and when asked, it gives a correct answer. Machine learning-based chatbots use machine learning algorithms to understand natural languages and generate or select appropriate answers. The natural language process (NLP) module is responsible for decomposing user-entered natural language using various linguistic resources, and the natural language understanding (NLU) module identifies the meaning of the decomposed natural language and passes refined information to the final classification or generation model for generating answers. Furthermore, using the output of the NLU module, the machine learning algorithm selects an existing defined answer or the natural language generation (NLG) module generates a new answer [11].

The target AI voice bot is the most similar service to humans. In fact, it allows customers to receive the level of response from counselors. It should be able to respond within 2 seconds with a voice that is most similar to humans. If the existing method is a separate engine method and the response speed is delayed, the proposed method should guarantee the optimal response speed and performance with an integrated engine. Figure 3 shows how STT, NLU, and TTS can be linked and managed as one.

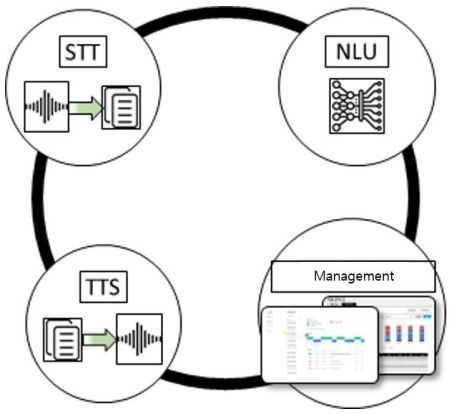

Figure 3- STT, NLU, TTS management

4. System Implementation

AICC is to build an automated environment to enhance the efficiency and expertise of AI-based customer and employee counseling tasks [12]. It provides differentiated customer counseling services and financial services, and employees aim to secure work productivity. In addition, it is

used to strengthen future non-face-to-face customer contact channels in the prolonged COVID-19 pandemic.

4.1 In- Outbound AI consulting bot

AI counseling bots should provide AI solutions necessary for STT/TTS and NLU-based conversations. Natural language processing should provide complex/selective/selective answers, such as NLU, QA, document search, and index documents based on questions and provide highly relevant answers. In STT, recognition rates are important, but false recognition, learning, and statistical analysis functions should also be supported. TTS should be able to change the synthetic sound to a natural and customer-friendly form and tune the speech speed, tone, etc., of the voice. The counseling system should be integrated and linked with the counseling system/AI counseling robot counseling history-integrated management plan and information linkage for one-call processing between counselors and AI counseling robots [13]. Outbound counseling bots should be linked with systems (information systems, operating systems, etc.) by data loading method (real-time/deployment).

4.2 Overall System Structure

An optimized integrated operation management system is required to operate AI counseling robots and chatbot services. The entire chatbot operating system can be divided into system management, service management, monitoring, and statistical services. Integrated operation management provides a single-view type operation management system to improve operation convenience and provides a UI for efficient AI consulting robot chatbot service support. In order to monitor the current status in real time, monitoring of all tasks, including completion rate, outstanding rate, and abandonment rate, should be done by tracking the service process starting with the customer's phone call. It should also be able to provide a variety of statistical data that can give an immediate view of meaningful statistical data.

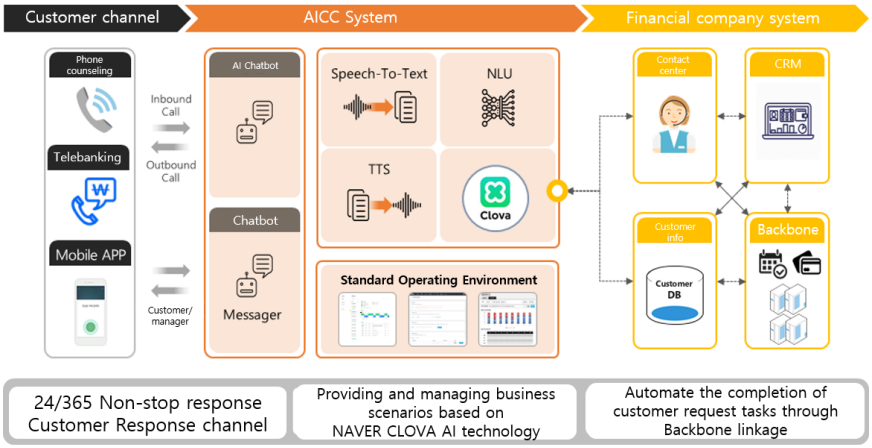

Figure 4- Entire service architecture

Figure 4 shows that the entire service architecture allows end-to-end consultation processing from the customer contact stage to the connection of the term system to increase the efficiency of consultation work and deliver a differentiated customer service experience. This designed service architecture can provide and manage business scenarios based on AI technology, with 24/365 continuous response per customer channel. In addition, it will be possible to automate the customer's request work through the connection of the period.

5. Conclusion

AI is developing into a service that can help people as an important technology of the Fourth Industrial Revolution. As systems and applications advance, users feel quite tired of installing new applications and learning how to use them, while in the case of chatbots, they can receive the services they want by sending messages, increasing interest in the role of chatbots in customer counseling or civil service. In addition, with the development of AI, chatbots have been re-examined, and many IT companies are applying chatbot-related platforms as they have evolved from natural language processing to natural language understanding and natural language generation.

In this study, we proposed a service structure for the advancement of chatbots based on AI with the expansion of the use and scope of chatbots and the development of AI. In order to solve the problem caused by a response delay of 2 seconds or more after utterance, a service structure was proposed in which STT, NLU, and TTS are operated separately as a third party and AICC including an AI-based AI counseling bot is used.

The proposed service structure will be able to solve the problem caused by a response delay of more than 2 seconds after a call, which can increase customized responses to customers and the work efficiency

of counselors. The proposed service structure can efficiently conduct non-face-to-face services due to the prolonged COVID-19 pandemic and can be applied as AI-based future AI counseling for non-face-to-face services in the future.

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