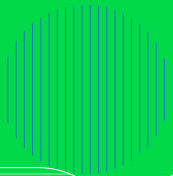
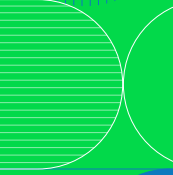
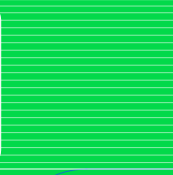
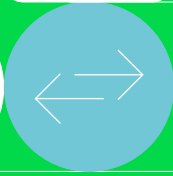
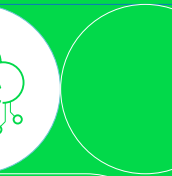
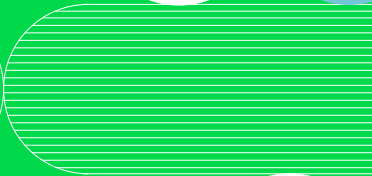
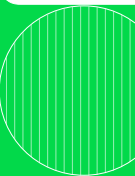
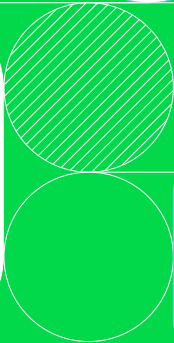
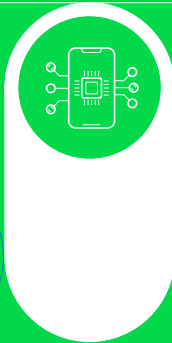
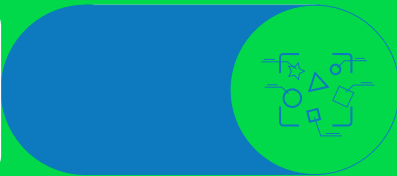
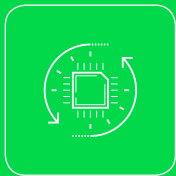
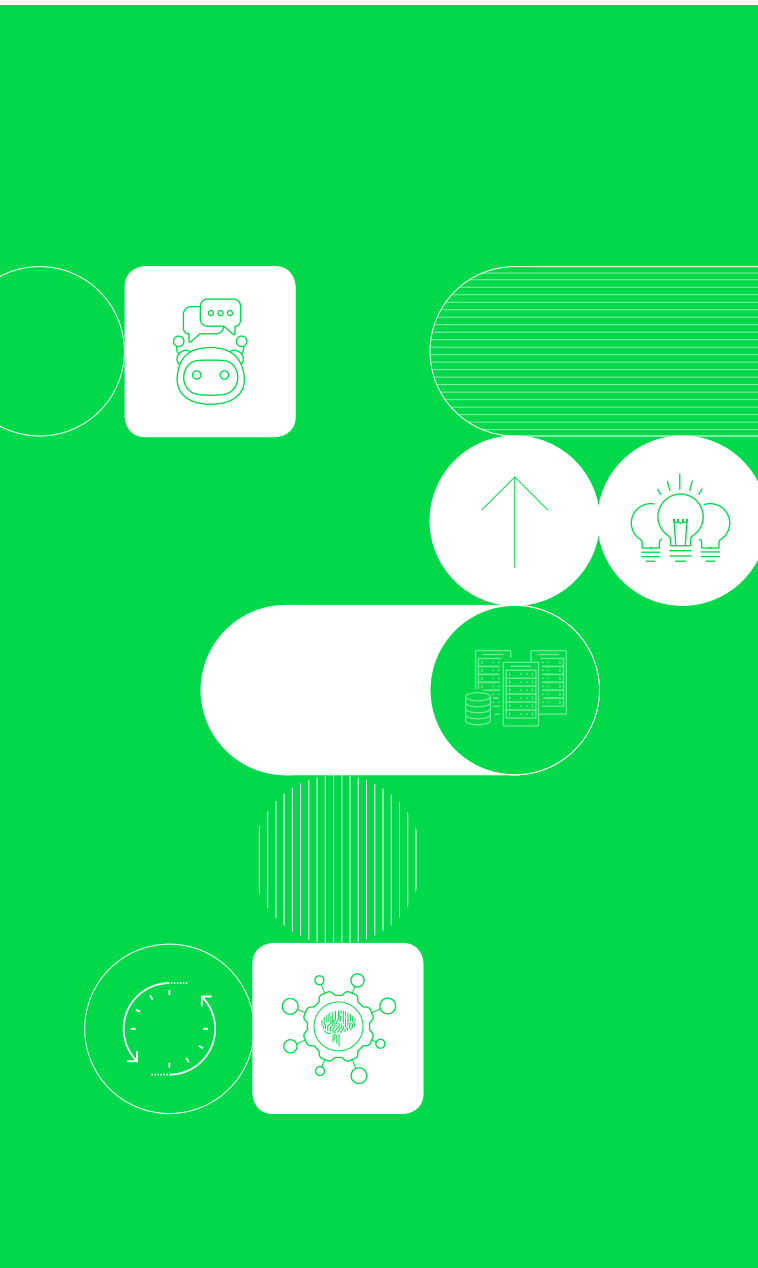


# NAVER-SAPI AI REPORT

## : 2022 Case Study

KNOWLEDGE INTERACTIVE,  
CLOVA CARECALL





The PDF file of this report is available for download at our website  
<https://www.navercorp.com/en/value/research>



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# Practices of AI Ethics Principles

1

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Together with the Seoul National University AI Policy Initiative (SAPI), NAVER introduced the “NAVER AI Ethics Principles” at a joint webinar in February 2021. Since then, NAVER has been striving to establish these AI ethics principles as part of its corporate culture that all members practice within their daily work routine.

NAVER aims to share the thoughts and experiences on AI with everyone in our society and industry. This is because NAVER believes that the thoughts and experiences it has regarding AI should not be confined as its own assets but should become an asset shared by everyone in our society. The <NAVER-SAPI AI REPORT : 2022 Case Study - Knowledge Interactive, CLOVA CareCall>, jointly published with SAPI, is one of the result of these efforts.

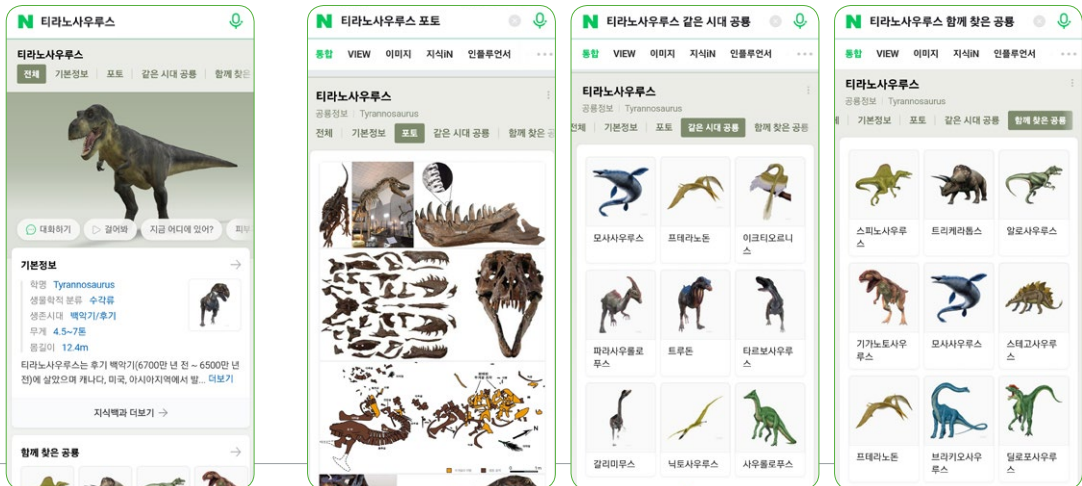
This report examines the design and development of AI services from the perspective of NAVER AI Ethics Principles focusing on the following cases: Knowledge Interactive, a conversational search service; CLOVA CareCall service for supporting COVID-19 control measures; and CLOVA CareCall service for supporting middle-aged and older adults living alone. This report will provide a detailed introduction to the features of each service, along with an examination of the societal and ethical concerns that were taken into account within the context of AI technologies.

## 2.1. Service Features

"Knowledge Interactive" launched by NAVER in March 2022 is a conversational search service that enables users to find information they want by asking questions as if they are engaging in a natural conversation. By using everyday language, users can pose their queries, and the Knowledge Interactive service intelligently interprets the meaning behind the questions and provides appropriate and accurate answers. Specifically, Knowledge Interactive not only presents search results in the form of a daily conversation but also offers the unique capability of displaying 3D models of the searched subject—such as dinosaurs in this case—creating a realistic and engaging search experience for users. Furthermore, through Knowledge Interactive, users can not only access basic information about dinosaurs, such as their length, weight, diet, and the period and era of their existence, but also view photos of dinosaurs, discover other dinosaurs that coexisted in the same era, and explore related information that they might have needed to search for separately on NAVER Encyclopedia, Blog, and Knowledge iN. This comprehensive approach makes Knowledge Interactive a user-friendly search service that considers various factors to enhance user convenience.

### Layout where various information can be seen at a glance

Through Knowledge Interactive, users can not only access basic information about dinosaurs, such as their length, weight, diet, and the period and era of their existence but also view photos of the dinosaurs. Additionally, users can discover other dinosaurs that lived in the same era and relevant information without the need for additional searches.



Source: NAVER Mobile integrated search [https://m.search.naver.com/search.naver?sm=mtp\\_hytop&where=m&query=티라노사우루스](https://m.search.naver.com/search.naver?sm=mtp_hytop&where=m&query=티라노사우루스)

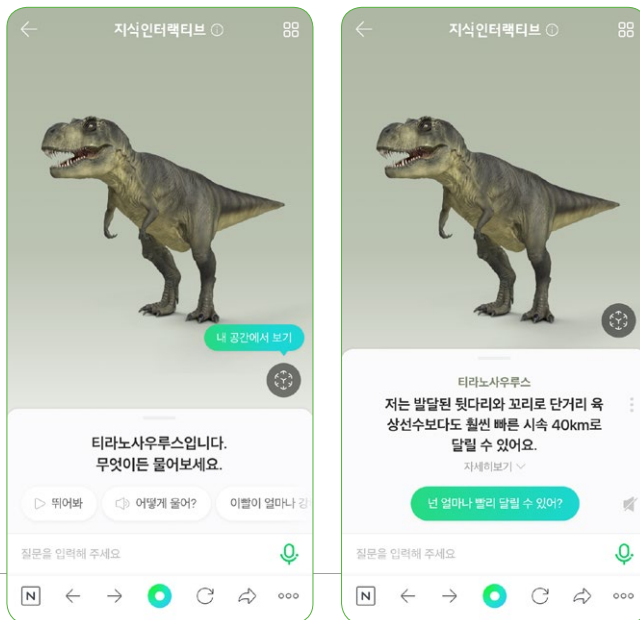
In general, a search service operates when users input a search query, and based on this query, the service provides relevant information that matches the entered query. To achieve the desired results, users must enter their search queries clearly and align them with the purpose of their search. The clarity of the query is crucial for obtaining accurate information, as the search service relies on the expressed intention within the brief search query to present the most relevant results accordingly.

With Knowledge Interactive, users are relieved from the effort of crafting precise search queries because the service is designed to understand the intention behind their questions, even in everyday language. For instance, while a traditional search service might require the query "tyrannosaurus diet" to obtain specific information, Knowledge Interactive provides more natural questions like "Tyrannosaurus, what is your favorite food?" The service then presents the answer in a conversational format, alongside relevant information, such as "I usually eat herbivorous dinosaurs. You can find my teeth marks on many of their bones."

Similarly, if a user asks "How well can you see?" the service interprets it as a question about eyesight and provides the answer: "I have a 55-degree binocular vision, which is superior to modern hawks, and 13 times sharper vision than humans." As a result, Knowledge Interactive streamlines the search process by offering informative responses based on the user's intent, making it a user-friendly and intuitive search service.

### Generates answers to users' questions

Knowledge Interactive presents appropriate search results that answer users' questions. If a user asks "How fast can you run?" to the tyrannosaurus on Knowledge Interactive, it answers, "I can run at 40 km/h, much faster than a sprinter with my advanced hind legs and tail."



Source: Knowledge Interactive <https://m.search.naver.com/p/n.search/csearch/content/eprendernhn?q=티라노사우루스&where=m&pkid=698&key=DINO>

An advantage of a conversational search is that users do not have to search separately for the information they are looking for within the search results. Unlike traditional search services where users enter a query and then have to browse through the results to find the desired information, Knowledge Interactive immediately provides the necessary information based on the user's questions. This eliminates the need for users to search through results separately. Moreover, the Knowledge Interactive service allows users to ask follow-up questions during the process, enabling an uninterrupted flow of search. Users can obtain instant information by asking a series of related follow-up questions. An example of a search flow enabled by the Knowledge Interactive service is as follows: "What is the nickname of a tyrannosaurus?" → "Why do you call it that?" → "How big is it?" → "How much does it weigh?" This convenience enables users to quickly access the information they want without the need to pause and refine their queries continuously, and thus increases efficiency.

Knowledge Interactive is similar to a chatbot in that it is a conversational service that uses natural language processing. However, while chatbots mostly give standardized responses after being trained with a predefined set of answers, Knowledge Interactive does not learn fixed answers, enabling it to give responses to a wider variety of inquiries. Therefore, even though users ask questions in various ways about a diverse range of content, Knowledge Interactive can provide answers fitting for different topics and formats.

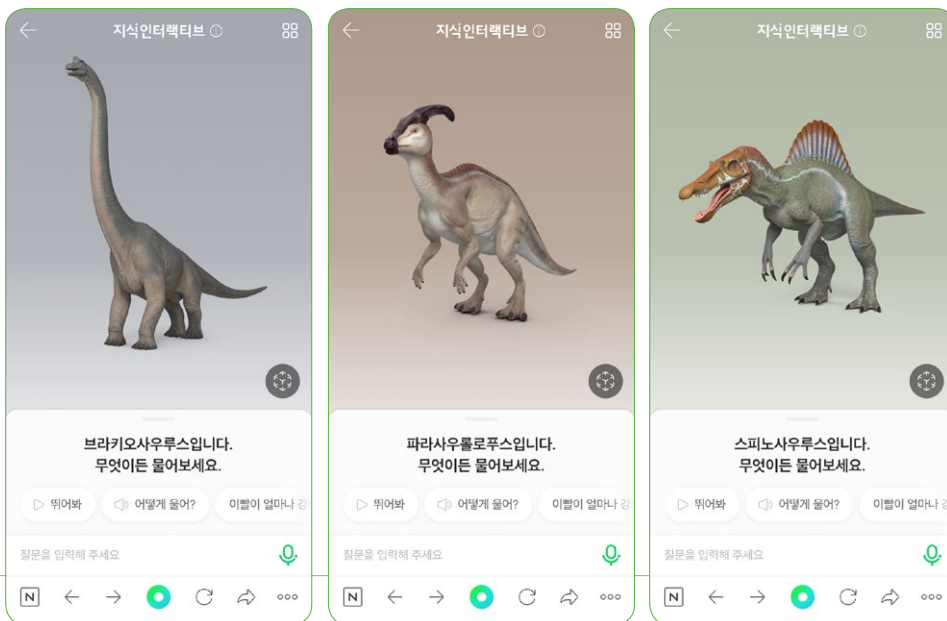
Furthermore, Knowledge Interactive enhances its credibility by presenting the sources of its answers, ensuring users receive diverse and accurate information. When a question is posed, Knowledge Interactive searches for relevant information from verified sources, such as NAVER Encyclopedia. It then extracts relevant documents and phrases that substantiate the information provided, giving users confidence in the accuracy and reliability of the responses they receive. Knowledge Interactive provides an answer after fact-checking to see if the potential response is related to the question, and then cites the verified content at the bottom of the answer for reference. The documents of NAVER Encyclopedia, which Knowledge Interactive finds information from, include more than 5 million entries. This is a much larger database compared to approximately 600,000 entries found in the Korean Wikipedia. Users can check the source of the answer through the provided reference and also explore additional information based on it.

Knowledge Interactive presents the search subject dinosaurs in the form of 3D characters, making it as if the users' questions are answered by the dinosaurs themselves. The idea behind this approach was to engage users by having the 3D character share its own information from a first-person perspective. Additionally, the decision to focus on dinosaurs was driven by the belief that providing visual information in a 3D format for subjects that are not easily accessible or experienced in the user's surroundings would be effective.

3D models are able to present visual information intuitively and realistically, allowing users to have a more immersive search experience through exchanging questions and answers. In addition to posing search-related queries, users can also request specific actions from the 3D dinosaur characters. In fact, users have expressed excitement by asking the dinosaur 3D characters to jump, swing their tails, or even dance. Moreover, Knowledge Interactive is also available in augmented reality (AR), offering users an even more immersive search experience. As of now (December 2022), there are ten species of 3D dinosaur characters: tyrannosaurus, brachiosaurus, triceratops, spinosaurus, stegosaurus, ankylosaurus, parasaurolophus, pteranodon, mosasaurs, and allosaurus.

### Various 3D dinosaur characters

Through 3D dinosaur characters, users can have a more immersive and realistic search experience. Above are the 3D images of brachiosaurus, parasaurolophus, and spinosaurus among the ten dinosaur species offered in 3D.



Source: Knowledge Interactive

<https://m.search.naver.com/p/n.search/csearch/content/eprender.nhn?q=브라키오사우루스&where=m&pkid=698&key=DINO> (Brachiosaurus),

<https://m.search.naver.com/p/n.search/csearch/content/eprender.nhn?q=파라사우롤로푸스&where=m&pkid=698&key=DINO> (Parasaurolophus),

<https://m.search.naver.com/p/n.search/csearch/content/eprender.nhn?q=스피노사우루스&where=m&pkid=698&key=DINO> (Spinosaurus)



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## 2.2. AI Technology

### **AiRSearch**

Knowledge Interactive is a part of NAVER's new search brand "AiRSearch," that was launched in October 2021 to meet the segmenting and diversifying needs of users. NAVER has been establishing an environment where users can search more conveniently with the help of AI through AiRSearch that incorporates NAVER's search technologies, including Knowledge Base, Knowledge Snippet, and multimodal AI, on top of the company's various AI recommendation technologies, such as AiRS, AiTEMS, and AiRSPACE. Knowledge Interactive will be developed as a smart block of various forms going forward. When a search query is entered in the traditional integrated search, a categorized collection according to the nature of information is automatically exposed, such as Knowledge iN, VIEW, Influencer, image, video, news, and shopping. On the other hand, the "smart block" of AiRSearch is different in that it provides search results in a block unit consisting of optimized topics for users, not in a predefined collection unit. In this way, users can get to learn various information that meets their interests, not the standardized results.

### **HyperCLOVA, a Hyperscale AI**

HyperCLOVA, a hyperscale AI, played an important role in Knowledge Interactive becoming a search service based on an advanced conversational AI model. Knowledge Interactive has expanded the way of search using HyperCLOVA, going beyond the traditional search model where texts are matched based on search queries. The ability of Knowledge Interactive to provide accurate information in the form of answers, even when users pose questions in everyday language, is made possible through the application of HyperCLOVA. Unlike text searches, where queries are relatively refined, a separate process for identifying users' search intent is required for a conversational search service like Knowledge Interactive. This is because even though the user intent is identical, questions can be inputted in numerous ways by the users. It is necessary to apply advanced AI technology to decipher the intention of user questions when the forms and content of the questions are different. HyperCLOVA is pre-trained with a massive amount of Korean data, amounting to 560 billion tokens (generally a token means a single word, and specifically, it is a morpheme, the smallest unit of speech that has a meaning), which enabled Knowledge Interactive to generate answers that understand the intention of user questions. Knowledge Interactive continues to learn from the questions users input through HyperCLOVA. This ongoing learning process will form the foundation for providing users with even more advanced search experiences in the future, enhancing the overall development of Knowledge Interactive.

## Fact-Checking Technology

In Knowledge Interactive, a technology has been implemented to reconfirm the accuracy of the answers. While HyperCLOVA generates responses by referencing validated sources such as Knowledge Encyclopedia, an additional fact-checking process occurs before delivering these answers to users. When a user poses a question, Knowledge Interactive first analyzes the intent behind the query and searches for appropriate answers within validated source documents like Knowledge Encyclopedia. Subsequently, it extracts relevant documents and phrases serving as the basis for the response and undergoes a fact-checking verification process to ensure the content is indeed related to the user's question. By presenting these verified reference materials, users have the opportunity to assess the accuracy of Knowledge Interactive's answers and enjoy a positive search experience.

### Presenting references

According to a user's question, Knowledge Interactive finds an appropriate answer from verified sources, such as NAVER Encyclopedia, and fact-checks whether it is related to the intention of the user's question before presenting the source as the reference.



Source: Knowledge Interactive (<https://m.search.naver.com/p/n.search/csearch/content/eprendernhn?q=티라노사우루스&where=m&pkid=698&key=DINO>)

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## 2.3. AI Ethics

NAVER sees AI as “a daily tool for humanity,” and prioritize human-centered values in developing and using AI. From this perspective, Knowledge Interactive is also designed and developed to become a daily tool for people to use conveniently. The motivation behind breaking away from the existing search method focused on search queries and texts, and creating a conversational search service also stems from the goal of providing users with a convenient tool. In order to make the search experience more convenient, the difficulties for users when trying to formulate additional search queries to obtain accurate search results or choosing the appropriate information from search results should be minimized, which led to the concept of “conversational search.” To accomplish this, a search service should be capable of providing accurate information for non-standardized questions, and AI technology is used for this purpose. In this regard, Knowledge Interactive has enhanced convenience as a user-customized search service, offering standardized answers to various questions in everyday language and providing appropriate responses according to different contexts. Furthermore, such conversational and user-customized search is diversifying traditional search methods as well.

In addition, Knowledge Interactive delivers information in the form of conversational “answers,” and provides a verified source that is used to answer the question to help users trust the search result. The service employs a process of sourcing appropriate information for the question from verified sources like NAVER Encyclopedia and fact-checking to ensure the answer is related to the question in order for users to obtain the exact information they are looking for by enhancing the accuracy of the answer. In particular, Knowledge Interactive provides the documents that served as the basis of the answers as a reference to users, allowing them to assess the accuracy of the search results and see various information at a glance. By providing references, the service logically explains what evidence was used to generate the answer that satisfies the user’s search intent, and at the same time, reduces the difficulties of a search process and allows users to obtain a wide range of information conveniently.

Additionally, considering that the search subject is dinosaurs and the target audience likely includes children, Knowledge Interactive generates answers using plain language whenever possible. For instance, the initial response generated by Knowledge Interactive to the question, “Why does the tyrannosaurus have short front arms?” was rather detailed: “It was a desperate measure that my front arms became short because I had to reduce the weight that is focused on my upper body as my jaw and teeth got heavier.” However, to ensure better understanding for users, the answer was subsequently refined into a more straightforward and simplified language: “It was to reduce my weight.” This approach aims to make the information accessible and easily comprehensible to the users, enhancing their overall search experience.

To ensure Knowledge Interactive provides accurate and appropriate answers, several measures have been implemented. Firstly, the learning scope is limited to verified sources like NAVER Encyclopedia, allowing only relevant answers about dinosaurs that serve the purpose of the service. Furthermore, technical measures are in place to filter out inappropriate expressions, including swear words, from the responses. Moreover, a feedback system is incorporated, where answers receiving positive feedback are added to the database for further learning. An ongoing procedure promptly addresses any issues that may arise. Additionally, Knowledge Interactive is equipped with voice capabilities. The service selects the pitch of the voice based on the unique characteristics of each dinosaur, enhancing the realism of the search experience. These efforts demonstrate the dedication to improve user convenience and ensure that Knowledge Interactive fulfills its intended purpose as a reliable and informative service.

Knowledge Interactive presents a novel approach to searching that differs from traditional methods. It offers relevant information in the form of questions and answers, enabling users to experience a seamless search process, even when additional inquiries arise. As a result, Knowledge Interactive remains a valuable and indispensable tool for users in their daily searches and will continue to serve as such in the future.

# CLOVA CareCall to Support COVID-19 Control Measures

# 3

## 3.1. Service Features

CLOVA CareCall is an AI service that automatically calls individuals who require periodic check-ins for COVID-19 symptoms to check if they are experiencing a fever or any respiratory symptoms. Since March 2020, for a period of over two years, NAVER has been dedicated to contributing to the safety of our society and supporting frontline workers. To achieve this, NAVER provided CLOVA CareCall free of charge to local public health centers. The decision to offer this service without cost was made after consulting with numerous local governments across the country, including those in Seongnam, Busan, Suwon, Seoul, and Incheon. Telephone counseling related to COVID-19 used to be conducted by each public health center. However, as the number of individuals requiring symptom checks grew, the public health centers encountered limitations in providing efficient services. In response to this challenge posed by the unprecedented infectious disease, NAVER developed and launched CLOVA CareCall. This service was built upon the foundation of the AiCall service, which small business owners use to manage phone inquiries and reservations.

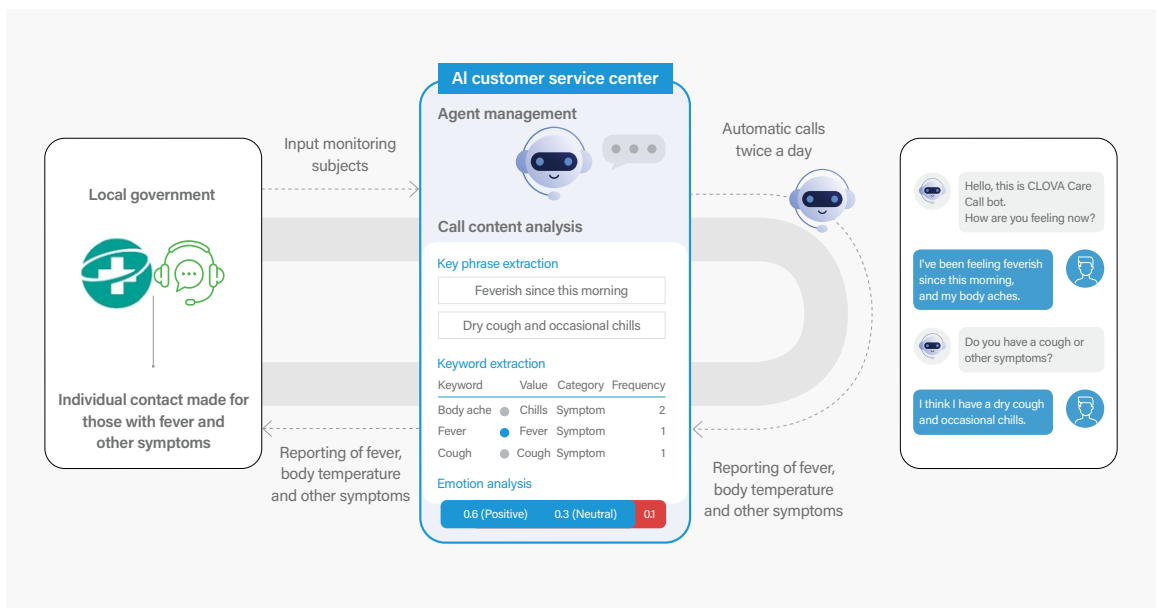
CLOVA CareCall would automatically call people subject to COVID-19 check-ins twice a day, and check their symptoms, including body temperature and cough. Subsequently, it would notify the results to both the local governments and the responsible staff at the public health center. In the event of unanswered calls, CLOVA CareCall made two additional attempts at 10-minute intervals. If the person failed to answer all three calls, an email notification was sent to the designated employee. This system also included advanced call analysis, extracting important keywords like temperature and symptoms, and automating the creation of telephone counseling records that used to be manually handled. Consequently, local governments and public health center employees were able to efficiently access CLOVA CareCall records, allowing them to focus on core tasks such as conducting screening tests and contact tracing to contain the spread of the virus. A local government official said, "CLOVA CareCall contributed to enhancing the efficiency of our public health center and enabling prompt responses to COVID-19-related issues."

CLOVA CareCall underwent continuous improvements to ensure its convenience and effectiveness. One of the distinguishing features of CLOVA CareCall was that it had to conduct an active conversation to assess the symptoms of patients through direct phone calls. To achieve this, extensive datasets covering a wide range of possible answers that might arise during the calls were created, enhancing the accuracy of the service. For example, to a simple question like "Is it okay to talk to you now?" there can be various responses other than "Yes" or "No," such as "It's okay," "Can you call me back later?" and "Who's speaking?" Therefore, the datasets of possible answers for each question were established to understand users' responses more accurately. In addition, the accuracy of dialect recognition was enhanced for the service to be used throughout the country without difficulties by developing and using a separate dialect dataset for CLOVA CareCall.

CLOVA CareCall for supporting COVID-19 control measures came to a natural end in response to the change in COVID-19 policy responses in March 2022, which required individuals to personally call public health care centers if there were any changes in their symptoms. Over the course of two years, CLOVA CareCall conducted a total of 1.3 million telephone counseling sessions across 18 local governments in Korea. With an average of 1,857 calls per day, this service significantly contributed to the safety of our society during this critical period by supporting disease control measures related to COVID-19.

### Process of CLOVA CareCall to Support COVID-19 Control Measures

CLOVA CareCall automatically calls individuals subject to periodic check-ins for COVID-19 symptoms to check if they are experiencing any severe symptoms. CLOVA CareCall conducted telephone counseling across 18 local governments for the past two years, contributing to the pandemic response efforts and the safety of people's lives.



Source: NAVER Cloud (<https://www.ncloud.com/product/aiService/CCAI>)

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## 3.2. AI Technology

### Speech Synthesis

For CLOVA CareCall to interact with users through calls, it requires a voice and the ability to comprehend spoken language. The voice of CLOVA CareCall is produced using speech synthesis technology, commonly known as Text-to-Speech (TTS), which converts texts into speech. The existing speech synthesis technology that is not applied with AI technology generates speech signals by breaking texts into a phoneme, the smallest unit of a meaningful sound, followed by connecting them to the right sound and adding appropriate rhythms. This technology is known as unit selection synthesis which generates speech by saving each sound of 19 consonants and 21 vowels that make up Hangeul (Korean alphabet) and combining them according to the letters entered. However, this is different from how humans actually speak because the same letter can have different pronunciations. For example, although the same letter "seung" appears in the word "eumseung hapseung(음성합성)," which means speech synthesis in Korean, the first and second "seung" sound differently as the "s" in the latter one should be pronounced as a tense consonant. To address these issues and produce more natural-sounding speech, it is essential to acquire speech data that includes the various combinations of unique consonant and vowel sounds. This is where parameter synthesis comes into play. Parameter synthesis uses characteristics of the sound data through additional analysis instead of simply using sounds that have already been stored.

For the past several years, NAVER has been researching and developing CLOVA Voice, its own speech synthesis system. As a result, both unit selection synthesis and parametric synthesis methods are used and deep learning models have been applied to develop the Natural End-to-end Speech synthesis system (NES) technology and High-quality DNN Text-to-Speech (HDTS) technology. NES can create human-like voices for any domain and topic even with short 40-minute recordings, while HDTS offers the best-quality synthetic voices optimized for specific domains such as customer service. These technologies were applied to CLOVA CareCall to generate voices suitable for customer service.

### Speech Recognition

To better understand the user's voice, CLOVA CareCall is powered by NAVER's speech recognition technology which possesses the world's best Korean recognition and processing capabilities. This technology, also known as Speech-To-Text (STT), converts spoken words into written texts by processing audio input and determining the most suitable word through probability calculation. The speech recognition process involves training the input on two essential models: the acoustic model, which focuses on pronunciation information, and the language model, which handles word transformations and their relationships. Both models are necessary since the technology aims to find the word that best fits the context, rather than simply dictating what has been heard.

CLOVA CareCall uses CLOVA Speech, NAVER's speech recognition technology, to convert human speech signals into texts. It then understands the user's inquiry using natural language processing technology. The Neural End-to-end Speech Transcriber (NEST) engine that converts speech into texts learns both audio and language information simultaneously, which is unlike existing modeling methods that learn them separately. This integrative modeling method requires only 10% of the data and time of the conventional method while accurately recognizing a wider variety of new expressions. In other words, this engine is the secret behind the service's high accuracy in speech recognition without having to pre-train large amounts of refined data. Furthermore, CLOVA CareCall has a high recognition rate even for low-quality phone calls thanks to its speech command recognition technology, which performs post-processing, such as refining and correcting the speech output to remove any background noise and reduce misrecognition.

### Chatbot Technology

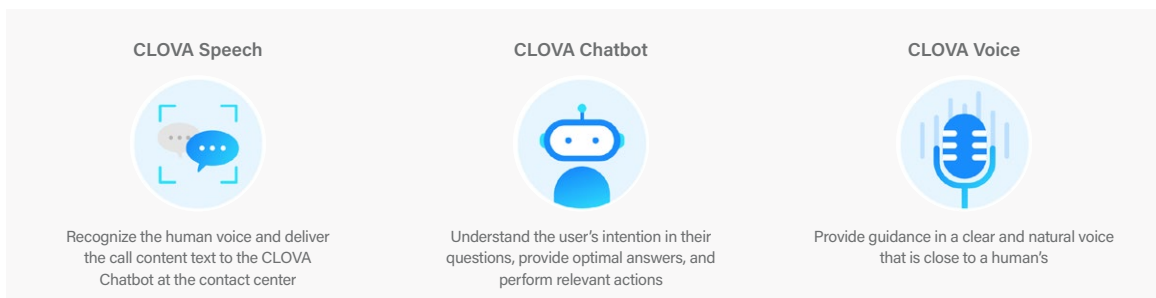
Natural language processing technology plays a crucial role in comprehending the meaning behind a given input through speech recognition. Natural language refers to the language used in everyday conversations among people. When a computer utilizes natural language processing, it signifies the computer's ability to partially understand the language used by humans to perform various tasks, including text classification, data visualization, and data extraction. For example, if CLOVA CareCall asks a person's body temperature and the person answers, "I just checked and it's 37 degrees," the service must be capable of separately recording the temperature, which in this case would be '37 degrees.' On the other hand, if the person says, "Wait a minute," it must be capable of replying, "Let me know once you've checked your temperature," and wait for an answer. This kind of service is known as a chatbot, which uses machine learning technology based on understanding natural language to analyze the morpheme, named entity, and structure of a given sentence. It then figures out the meaning of the sentence and has conversations with humans to perform specific tasks.

NAVER's chatbot performs excellently in Korean language processing, as it is trained with high-quality Korean data. It is also equipped with Automated Machine Learning (AutoML) chatbot builder technology, which generates an optimized chatbot even with a relatively small amount of data. CLOVA CareCall used this technology to introduce a chatbot with high performance in natural language processing by adding datasets related to COVID-19 symptoms.

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### The solutions that make up CLOVA CareCall

CLOVA CareCall uses speech recognition technology to recognize the speaker's voice, and chatbot technology to understand the speaker's intent and find the best answer. It then communicates in a natural, human-like voice generated with speech synthesis technology.



Source: NAVER Cloud (<https://www.ncloud.com/product/aiService/CCAI>)



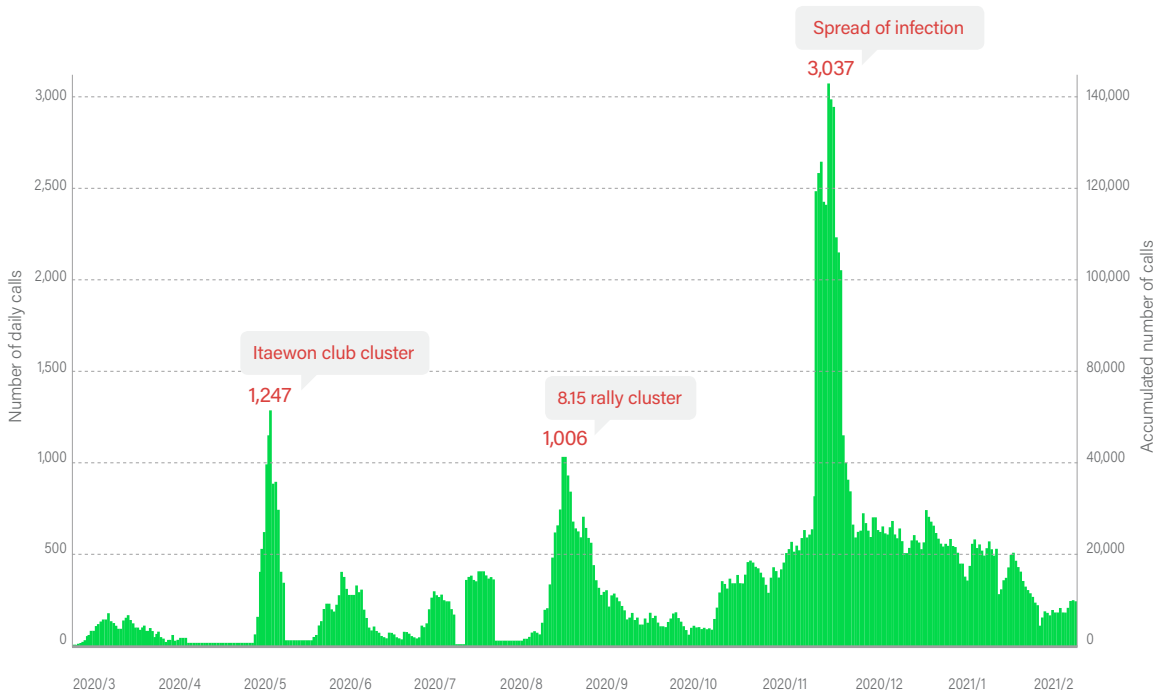
### 3.3. AI Ethics

NAVER's AI is a "daily tool for humanity." During the pandemic, CLOVA CareCall served as a convenient tool connecting local government officers with people who needed to check their symptoms. Thanks to the service, those working in local governments and public health centers could focus more on core disease control measures such as screening tests and contact tracing. As such, CLOVA CareCall reduced the workload of those striving to overcome the COVID-19 pandemic and helped take quick action, contributing to the effective operation of infectious disease control and prevention systems amidst the unprecedented pandemic.

In particular, CLOVA CareCall played a pivotal role during times of high uncertainty when local transmissions continued to rise. When telephone counseling skyrocketed due to spikes in daily confirmed cases, CLOVA CareCall took these calls on behalf of frontline healthcare workers, allowing them to fully dedicate themselves to disease prevention. A local government at Gyeonggi-do that adopted CLOVA CareCall found that its new service handled up to approximately 3,000 calls a day and a total of 27,000 calls in November 2020, when local outbreaks ensued in metropolitan areas. These impressive figures demonstrate the significant potential of AI as a valuable daily tool, especially in times of labor shortages, providing essential support and efficiency in critical situations.

#### Number of COVID-19-related calls received by CLOVA CareCall at a local government in Gyeonggi-do

When phone inquiries poured in due to soaring daily confirmed cases, CLOVA CareCall took these calls on behalf of frontline workers, allowing them to focus on fighting against COVID-19.



Furthermore, NAVER is implementing technology and services to foster greater significance through diversity and connection. High-risk groups, including seniors, may have difficulty using smartphones or apps. CLOVA CareCall has enhanced accessibility by enabling symptom confirmation through simple phone calls without requiring any prior knowledge of the technology. Additionally, by employing voice recognition technology capable of understanding various voices, including inaccurate pronunciation and regional accents, the service has facilitated ease and convenience for a broader range of users.

As a daily tool for humanity, CLOVA CareCall was designed not to cause harm to people. The conversation scenarios and utterances were rigorously controlled in collaboration with public health centers to ensure that there are no omissions when assessing users with COVID-19 symptoms and to minimize voice prediction errors. Furthermore, from the initial planning stages, Clova CareCall applied "Privacy by Design" (PbD) principles, ensuring that user data is deleted after the mandatory retention period of two weeks for symptom confirmation. Additionally, the conversation logs are provided solely to the responsible personnel at the public health centers, ensuring that users can utilize the service without concerns about privacy and information security, thereby enhancing convenience in their daily lives.

Clova CareCall has contributed to COVID-19 prevention efforts as a valuable tool for local governments, individuals requiring symptom assessments, and the overall safety of our society. While its role in COVID-19 symptom confirmation has come to an end, the service will continue to evolve as a user-centric tool, opening up diverse opportunities and possibilities for the benefit of people in the future.

# CLOVA CareCall for the Middle-Aged and Elderly and those Living Alone

## 4

### 4.1. Service Features

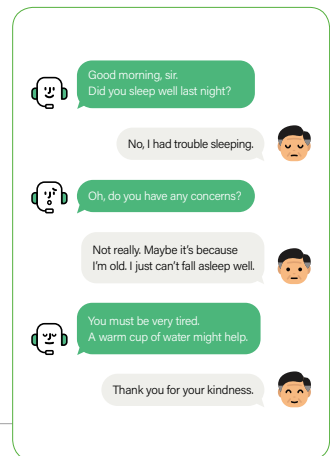
After the discontinuation of COVID-19 prevention efforts, the CLOVA CareCall service has shifted its focus and is now dedicated to providing emotional care and well-being support to middle-aged and elderly individuals and single-person households. CLOVA CareCall is employed to check on their well-being, engage in free-flowing conversations, and provide emotional support. The service makes well-being calls to assess the status of the elderly on topics such as meals, sleep, and outings. Based on their responses, natural conversations are sustained. For example, if the question, "What kind of food do you enjoy eating regularly?" is asked, and the response is "I eat kimchi," the service would follow up with the question, "Do you make kimchi yourself?" and continue the conversation accordingly. CLOVA CareCall was initially beta-tested in Busan's Haeundae-gu on November 29, 2021, to assist local government functions and was subsequently pilot-launched nationwide. The service was officially launched on May 30, 2022.

CLOVA CareCall calls individuals under care once or twice a week to check up on their diet, sleep, and outdoor activities. If the person does not answer the call or something unusual is found, the public officer in charge double-checks on the person. From the initial planning stage, CLOVA CareCall was designed with a focus on active listening and expressing empathy. As a result, the service inquires about well-being in a manner that reflects the conversational partner's responses, utilizing conversational techniques such as rephrasing their stories, building on previous answers to ask follow-up questions, and incorporating responsive interjections to ensure a smooth and natural flow of dialogue. The service also has a 'Remember' function to both raise user satisfaction with personalized expressions, and to take continuous care of the elderly. CLOVA CareCall summarizes and records information related to crucial aspects such as meals and sleep from previous conversations with the user, enabling the natural incorporation of remembered information into ongoing dialogues. In addition to this, the service employs interjections and expressions of empathy, such as using appropriate exclamations like "Oh my" or "Oh no," and expressing empathy by saying "That must have been hard," or "What a relief." Moreover, it also offers suggestions like "You must go see a doctor." The results from the beta testing of this new function showed that participants who used the function found the conversation more interesting, felt more intimate with the service, and were more willing to continue using the function than the comparison group. They also gave positive feedback, for instance, "Older people frequently get sick here and there, and I appreciate how CLOVA CareCall remembers and asks if I'm feeling well."

As of October 2022, 38 local governments across South Korea including Busan, Daegu, Incheon, Seoul, Gyeonggi-do, and Gyeongsangbuk-do were using CLOVA CareCall for middle-aged people and seniors living alone in their respective regions. CLOVA CareCall regularly makes check-in calls, ranging from one to three times a week, to users who have consented to the service. Local government officials can easily monitor the overall call status, as well as any discomfort or issues related to health, sleep, meals, and exercise, through call management tools. Specifically, if there are two consecutive unanswered calls or if unusual or emergency situations are suspected based on the responses, these instances are marked separately. In such cases, officials can promptly verify the individual's condition and take immediate actions, including coordinating with public support services in relevant areas. A survey conducted with elderly individuals in Busan's Haeundae-gu revealed that 94.9% of respondents expressed their desire to continue using the CLOVA CareCall service in the future. Additionally, 95% of the respondents believed that CLOVA CareCall would be helpful in case of safety issues, and 89.9% felt comforted after using the service. Furthermore, local governments utilizing the CareCall service also expressed positive evaluations, stating that CLOVA CareCall is expected to effectively contribute to minimizing the gap caused by the lack of on-site personnel for the increasing number of single-person households.

### An example of a conversation with CLOVA CareCall

CLOVA CareCall calls seniors living alone once or twice a week to check up on their diet, sleep, and outside activities. If the answer includes something unusual, the local government officer double-checks on the elderly. Focused on lending an ear to the user and embedded with the 'Remember' function, this service is well-received by older people for its ability to have a natural conversation on a wide range of topics. CLOVA CareCall is also contributing to alleviating the lack of workforce in the face of the rise of single-person households.



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## 4.2. AI Technology

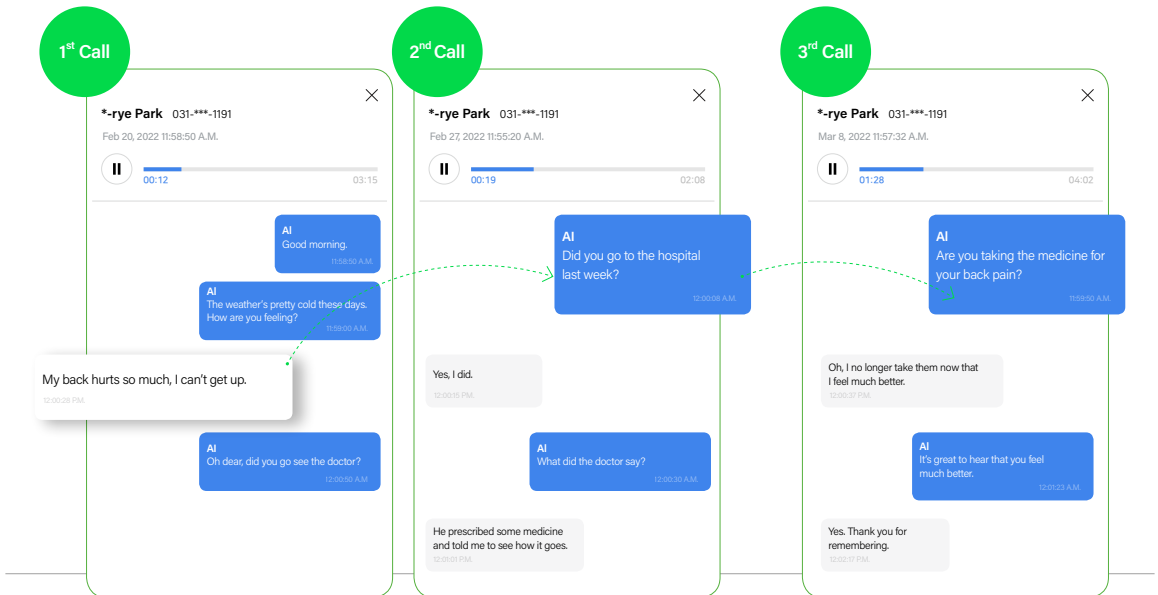
### HyperCLOVA, a Hyperscale AI

The ability of CLOVA CareCall to engage in natural conversations with elderly individuals on various topics is attributed to the integration of Korea's first hyperscale AI, 'HyperCLOVA,' within the AiCall service. A prerequisite for AI to have a human-like conversation is large-scale conversational data that performs a given role under a certain situation. This is where HyperCLOVA comes in, generating a massive amount of training data that satisfies such conditions. This hyperscale language model was used for making conversational datasets because even with a few example texts, it can generate large amounts of similar texts through in-context learning. Initially, the team manually created around 300 sample conversations involving regular calls to seniors living alone, aiming to check up on their well-being and engage in friendly chats. Then, the team applied HyperCLOVA to this sample data to generate about 30,000 conversations. During the pre-evaluation phase, inappropriate conversations were identified and categorized as negative examples. To ensure a diverse range of conversation patterns, the dataset was further enriched by incorporating authentic human conversation data. Consequently, the process of data generation and evaluation was conducted concurrently, enabling continuous enhancements to the model. When the service begins a conversation, it quickly searches 20 answers out of approximately 150,000 candidates and evaluates each of their appropriateness to select the final answer. If the answers are considered inappropriate, the model generates new answers and re-evaluates them before using it as the final response. Employing HyperCLOVA to generate the dataset not only makes the conversational data less vulnerable to privacy invasion than actual data but also speeds up the data generation by about 13 times compared to using manually-generated data.

The 'Remember' function may seem like a simple feature, but it requires advanced natural language processing technology to comprehend the context of conversations and generate natural expressions by utilizing the remembered information at appropriate moments through AI. The new function goes beyond merely asking users for repeated information and instead captures evolving states over time, enabling the delivery of diverse conversations tailored to specific situations. This is unlike existing technologies and studies related to this function, which did not take into account that information is subject to change; because information in real life changes as time passes by, the technology that tracks and updates memory information needs to be developed to harness such information in conversations. For instance, if an elderly person mentioned last week that he plans to go to the hospital, in this week's conversation, CLOVA CareCall must be able to ask if he did go see the doctor. When it calls him next week, it should ask if he has been taking the prescribed cold medicine, and in the following week, check if the user is feeling better. As such, the AI service should continue having conversations to keep an eye on changes in the senior's health status. This is why NAVER developed its technology that tracks and updates information, becoming the industry's first to realize memory-based conversation among the conversational AI services in the market.

### CLOVA CareCall's 'Remember' Function

CLOVA CareCall has applied the 'Remember' function to remember certain key information of the subject and track changes in health status, which is used later to have a natural conversation.



Source: NAVER CLOVA blog ([https://blog.naver.com/clova\\_ai/222752005324](https://blog.naver.com/clova_ai/222752005324))

### Speech Synthesis and Speech Recognition

When CLOVA CareCall calls the user to check how the person is doing, its tone and voice must fit the situation and mood of each conversation. This is why its voice was created to reflect various emotions, including happiness and sadness, by adjusting the rhythm. It was first trained with existing large-scale conversation data of customer service representatives, then minor adjustments were made to the speed and intonation of the speech, allowing seniors to better understand what it says. And speech synthesis technology was applied to create a bright, cheerful, and comfortable tone of voice.

In addition, the Neural End-to-end Speech Transcriber (NEST) engine, a HyperCLOVA-based speech recognition technology, was incorporated to provide accurate speech recognition even for long and complex sentences. This engine demonstrates a high recognition rate even for untrained data, such as colloquial or ungrammatical sentences, and also recognizes inarticulate pronunciations and dialects. Continuous improvements are being made to the technology to enable CLOVA CareCall to answer within approximately one second after seniors finish their sentences.

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### 4.3. AI Ethics

AI that NAVER develops and uses is a “daily tool for humanity.” NAVER prioritized human-centered values in developing CLOVA CareCall as a daily tool to support local governments in expanding their welfare work and provide the elderly living alone emotional satisfaction. Because CareCall is able to make phone calls to check users’ health, it is used as a tool for social workers in local governments, addressing the lack of workforce due to the rising number of single-person households. Local government officials expect that through the call management tool, they will be able to easily monitor and manage the well-being of elderly individuals, including identifying any changes or unusual signs. Particularly, the system flags any unusual responses, enabling officials to promptly check the status of the individual and take swift action accordingly. The employee responsible at the local government can promptly assess the user’s responses and take appropriate actions as any notable points in the user’s answers are specifically highlighted.

Some have raised concerns that communicating with an AI-powered call service might only exacerbate loneliness and isolation of people due to its lack of human nature. However, NAVER’s CLOVA CareCall can relieve loneliness and boost emotional satisfaction with its communication skills that express empathy, support, and encouragement, rather than simply answering “yes” or “no” to a question. The test results of Haeundae-gu, Busan show that while older adults were reluctant to have repetitive, one-sided conversations with rule-based AI, they felt a sense of friendliness and comfort with the HyperCLOVA-powered CLOVA CareCall. The participants commended the service, saying, “The only advice I get from people is to see a doctor whenever I am sick, but I was moved by how CareCall continues to be concerned about how I am feeling.”

Furthermore, with a strong consideration for the value of diversity, NAVER has been providing a wide range of opportunities and possibilities to all individuals, including users, while making diligent efforts to prevent unjust discrimination based on irrational criteria. To achieve this, CLOVA CareCall has been equipped to recognize various forms of speech, such as unclear pronunciation, regional dialects, and colloquial expressions, enabling a more inclusive and convenient service for diverse users. Careful consideration was also given to the selection of conversational voices. Voices that convey kindness, compassion, and the ability to express emotions such as joy and sadness were developed and employed, while simultaneously ensuring that the gender and age of the CLOVA CareCall dialogue agent are not predefined, taking into account multiple factors to ensure inclusivity.

NAVER makes concerted efforts to provide users with AI services in an easily comprehensible manner, considering the diverse ways and levels of rational explanations related to AI. In this regard, CLOVA CareCall, which involves inquiring about one's well-being through direct conversations, caters to users who may not possess a high level of technical understanding. Even those elderly individuals who do not have prior knowledge of the underlying technology can readily utilize the service by simply receiving phone calls after consenting to its usage. NAVER also acknowledged the need to help the elderly recognize that they are in fact talking with an AI agent as they use the service, although the person in charge at the local government does explain about the service when the user initially agrees to use CLOVA CareCall. However, reminding that CLOVA CareCall is an AI service every single time can potentially undermine the user's emotional and psychological satisfaction, making the service less useful. Thus, CLOVA CareCall clarifies that its role is a 'call-based AI chatbot' in its conversation guide and explains that it is an AI while having natural conversations. The AI service also makes sure that users do not misconceive CLOVA CareCall as a human being. For example, it will refrain from making remarks that assume it has a physical shape, and if the user asks its age or gender, it will answer, "I am an AI, so I don't have an age or gender."

CLOVA CareCall serves as a tool for welfare personnel, providing assistance to ensure the safety of the elderly users utilizing the service. Upon the commencement of each call, users undergo identity verification and consent processes, following which information pertaining to their sleep, meals, exercise, and other aspects is shared with responsible personnel. To enhance the safety of the elderly, any peculiar or uncomfortable occurrences, as well as urgent matters, are distinctly marked to enable swift action by the responsible personnel. Additionally, considering that a substantial portion of the conversation pertains to health-related matters, precautions are taken during data generation to adhere to relevant guidelines and prioritize human-generated dialogues to minimize the risk of disseminating erroneous health information or offering inappropriate advice. Moreover, proactive measures are adopted, such as prompt retraining in the event of identifying problematic utterances, to address and mitigate potential issues effectively.

Alongside these efforts, NAVER has taken technical measures on CLOVA CareCall to prevent abusive or inappropriate expressions. Not only was it designed to speak politely and refrain from making harmful statements in accordance with the dialog guideline, but it also avoids mentioning functions that are not provided as well as remarks presupposing any physical presence. The service operators make various endeavors considering all these factors during the data generation process, while making conversations with CLOVA CareCall. For instance, they classify dialogue data that might cause problems as negative examples, while using their modified version as positive examples, and continuously observe the dataset. Moreover, NAVER has established procedures to respond to issues as soon as they are identified.



NAVER applied designs in consideration of data security during all stages of CLOVA CareCall, including its development. Given the sensitive nature of health-related information, especially in the context of well-being checkup calls, specific measures have been implemented to handle such data appropriately. In addition to obtaining explicit consent for the collection of personal information, separate consent is also sought specifically for the processing of sensitive health-related information, thereby reinforcing privacy safeguards. To maintain a balance between maintaining intimacy with elderly users while avoiding any perceived intrusion into their personal information, the level of retained information is carefully regulated. Detailed information is consciously avoided, and only general, non-intrusive data at the level of familiarity appropriate for well-being checkup calls in the context of public duties is retained. Furthermore, to bolster the security of the collected voice data, advanced encryption techniques are employed to ensure its secure storage. Even after the service launch, continuous efforts are made to monitor and address users' privacy and information security concerns, enabling them to freely utilize the service without any apprehensions.

Amidst the rapid increase of single-person households and senior populations, CLOVA CareCall, through its well-being checkup calls, serves as an everyday tool connecting individuals at risk of isolation with society, ultimately promoting their health. In alignment with NAVER's commitment to human-centric values and adherence to NAVER AI Ethics Guidelines, continuous efforts are made to enhance CLOVA CareCall as a practical tool assisting members of our society.

# Harmony Between AI Technology and Society

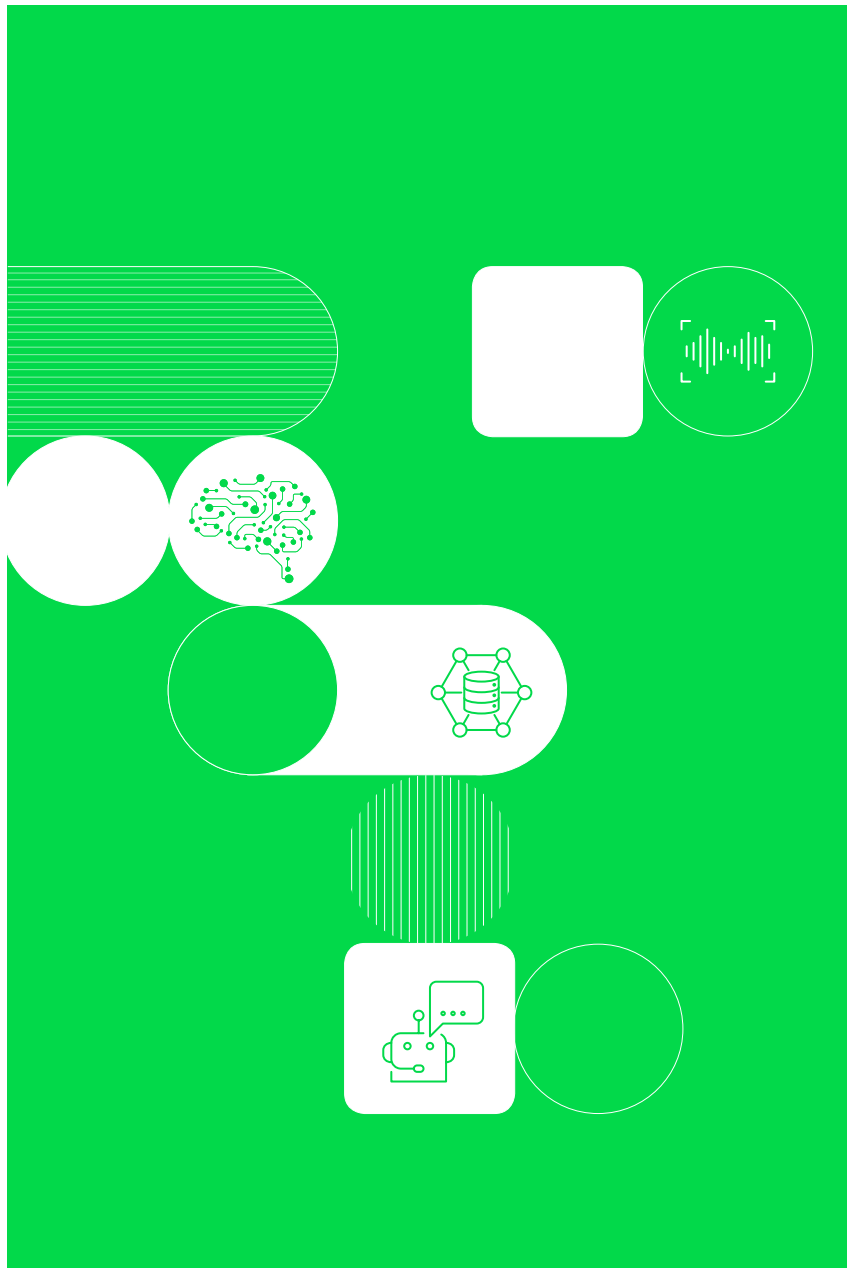
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The NAVER-SAPI AI Report outlines three different AI services—Knowledge Interactive, CLOVA CareCall to support COVID-19 control measures, and CLOVA CareCall for the middle-aged and elderly living alone. Examining specific cases from the perspective of “NAVER AI Ethics Principles” will significantly contribute to concretizing and continuously implementing AI ethics principles. In the future, NAVER plans to practice “NAVER AI Ethics Principles” through various experiments and endeavors, while actively sharing outcomes such as the NAVER-SAPI AI REPORT with society. NAVER remains committed to harmonizing AI technology and society, continuously contemplating human-centric values, and striving for more extensive connections.

NAVER-SAPI AI REPORT  
: 2022 Case Study  
- CLOVA CareCall Release Date

Release Date  
**August 30, 2023**  
Original Korean material published  
December 30, 2022

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