Outline of an Auto Response Solution (AI Chatbot) for Assisting Business Automation and Labor Saving

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Abstract

The auto response solution, with which the AI responds to inquiries, is recently attracting attention as one of the applications of AI technology that can make up for human resource shortages and support diversified ways of working. It is especially notable that the use of chats as a means of inquiry other than the telephone and e-mail is increasing because of the ease of use, and the chatbots are expanding their usage scenarios as a familiar AI technology. This paper introduces an outline of an auto response solution that can give highly accurate answers to inquiries by utilizing the Recognizing Textual Entailment technology. This procedure can recognize the diverse expressions of natural text.

Keywords

auto response, chatbot, natural language analysis, help desk, contact center, work style reform, operation automation

1. Introduction

The recent diversification of inquiries addressed to inquiry operations at help desks and contact centers is increasing burdens on the response staff, making it difficult to ensure the required staff levels due to the human resource shortages. This situation has resulted in increased attention on the auto response solution in which the AI deals with the inquiry operations in place of human staffers. In this paper, the authors will introduce NEC's Recognizing Textual Entailment technology that can recognize diverse expressions of natural text, the methods for its utilization, actual cases of use of the auto response solution and the approaches to be taken in the future.

2. Outline of Auto Response Solution

The auto response solution automates the inquiry responses and the routine operations that have previously been dealt with by human staffers such as travel expenses settlements by text and voice. This solution reduces the burden on the inquiry staff and the labor for

problem solving greatly and improves the convenience of operations. It makes it possible to let the AI respond to simple inquiries and routine operations while letting human staffers respond to more complicated operations and inquiries that need certain expertise.

This solution gives an advantage of inquiries from anywhere and instant solution possibilities to the end users. The businesses running the contact center and the corporate help desk operations department can also improve the efficiency related to the responding human resources by entrusting simple inquiries to the AI (**Fig. 1**).

The auto response solution has the features as described in the following.

(1) Recognition of various expressions using the Recognizing Text Entailment technology

Since the Recognizing Text Entailment system has enabled absorption of fluctuations in expressions, it is now possible to respond to various expressions used in questions with a high accuracy. The details of the said technology will be described in section 3 below. However, in the case of a chatbot making use of machine learning, it is required to prepare variations of many question texts as the learning
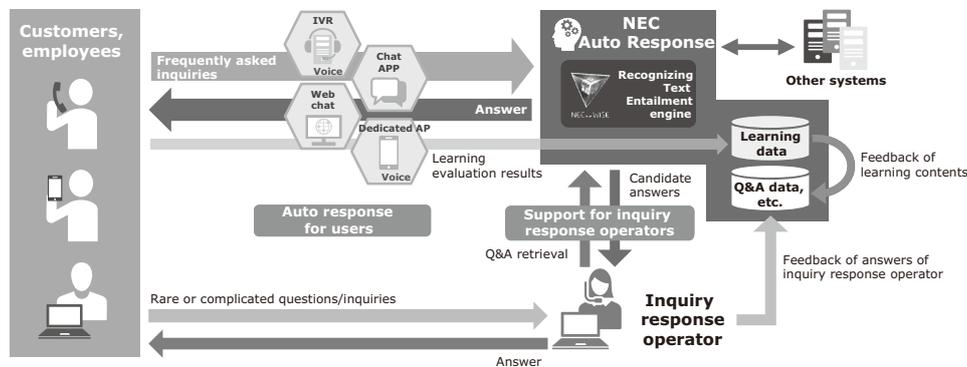
Fig. 1 Auto response solution outlined.

data in order to increase the answer accuracy. The use of this technology can then reduce the large amount of data to be prepared, so it is effective for reducing the operation burden.

(2) High extendibility thanks to externally-linked API

The solution provides the connectors for linkages with LINE and Microsoft Teams as standard. It also prepares interfaces for flexible linkages with external systems such as the Robotic Process Automation (RPA) and web application servers. This results in high extendibility including the possibility of building a mechanism that acts to settle travel expenses based on connection with a travel expenses settlement system or a scheduler.

(3) Compatibility with both the cloud and on-premises systems

Most current chatbot tools provide services from clouds but this solution prepares on-premises compatible products in order to meet the needs from customers under severe security requirements or for those who want to use the private clouds operated by themselves.

3. Recognizing Text Entailment Technology, Its Applications

The present section describes NEC's Recognizing Text Entailment technology, which is one of the special features of the auto response solution, and its use. This technology determines whether two texts have the same meaning at a high accuracy and high speed. Even if the texts use different expressions, it can determine if their meanings are the same by considering the importance of words, semantic correspondence and word classes. For instance, two texts "the engine suddenly stopped" and "the engine stalled" employ different expressions
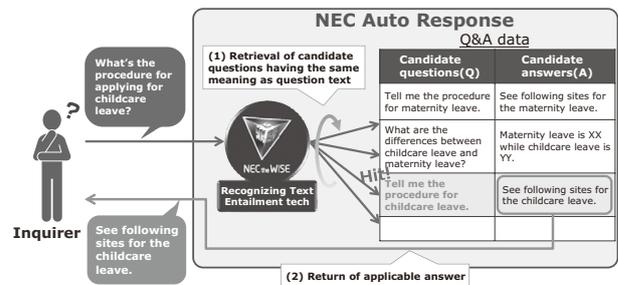
Fig. 2 Application of Recognizing Text Entailment technology.

but the technology determines that they are identical. See **Fig. 2** for a description of the method of its use in the auto response solution. The question text of the inquirer is compared with the candidate questions (Q) in the Q&A data, the candidate question (Q) having the same meaning by retrieval using the Recognizing Text Entailment technology, and the answer (A) corresponding to it is returned to the inquirer.

The use of the Recognizing Text Entailment technology brings about the following effects.

(1) Improved retrieval accuracy

In the operation of chatbot, since the answer to the question is often unused if the accuracy is low, it is required to improve the correct answer rate. See **Table** for the differences between the traditional keyword retrieval and the retrieval using the Recognizing Text Entailment technology. While the retrieval keywords "Product A effective" with the traditional keyword retrieval hit any text containing all the keywords so that a text like "Product A is not effective to influenza" may be retrieved. However, this text has negative meaning therefore it is not the one to be retrieved. "Product A has a disinfection efficacy" comes at a low level in the

Table Differences between keyword retrieval and Recognizing Text Entailment retrieval

Retrieval target database	Keyword retrieval Product A effective	Recognizing Text Entailment retrieval Product A is effective
Product A is effective for Norovirus.	Hit（○）	Hit（○）
Product A is not effective for influenza.	Hit（×）	Not Hit（○）
Product A has a disinfection efficacy.	Not Hit（×）	Hit（○）
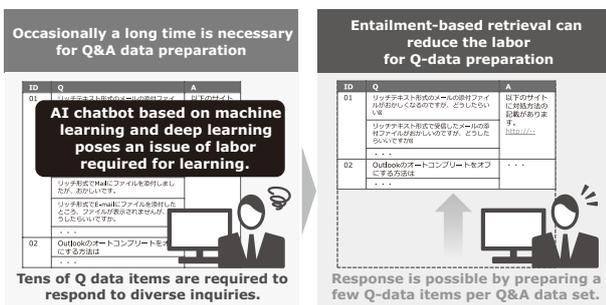
Fig. 3 Differences in the burden of data preparation.

retrieval results because it contains only one of the keyboards. However, since "effective" and "efficacy" have similar meanings, this text needs to be hit. Even when an answer that should be hit is difficult to reach with the transitional keyword retrieval, a retrieval using the Recognizing Text Entailment technology makes it possible to find the answers with close meanings.

(2) Improvement of operation efficiency

To improve and maintain the correct answer rate in the operation of chatbot, it is required to enrich the Q&A data for dealing with new kinds of questions and to perform routine maintenance, but the burden of such operations sometimes makes continuance of operations difficult. Use of the Recognizing Text Entailment technology enables enrichment of Q&A data and improvement of maintenance efficiency as shown in **Fig. 3**. With a chatbot having a mechanism for machine learning of Q&A data, between 10 and 20 items of data are necessary per Q&A data set in order to improve the answer accuracy. The preparation of such a large amount of data poses an important burden. On the other hand, NEC's solution can recognize diverse expressions thanks to the Recognizing Text Entailment technology. So only a few items of Q data per Q&A data set can achieve a similar accuracy, which means that the burdens for the Q&A data enrichment and maintenance can be reduced.

4. Applications of Auto Response Solution

This section introduces two cases of actual use of the auto response solution.

4.1 Case of NEC Group's corporate help desk

NEC Management Partners, Ltd. (hereafter "NMP") provides an auto response service for answering questions related to operation from the personnel and general affairs staffs in the NEC Group since July 26, 2018.

(1) Circumstances of introduction

Previously, inquiries from the domestic staff of the NEC Group have been responded to in the operating hours of working days by operators of the NMP Contact Center referring to the collection of FAQs from the personnel and general affairs departments and to the inquiry history information as shown in **Fig. 4**. This method has been accompanied with issues such as phone is always busy, Inquiry not responded outside working hours, phone is passed around so that more time and labor are necessary, and so on.

(2) System outline

To solve the issues outlined above, provision of an AI chatbot applying the auto response solution was started as shown in **Fig. 5**. The main objectives of
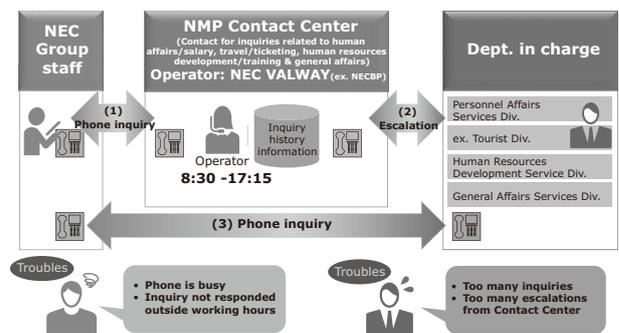
Fig. 4 Issues with regards to NEC Group's corporate help desk.
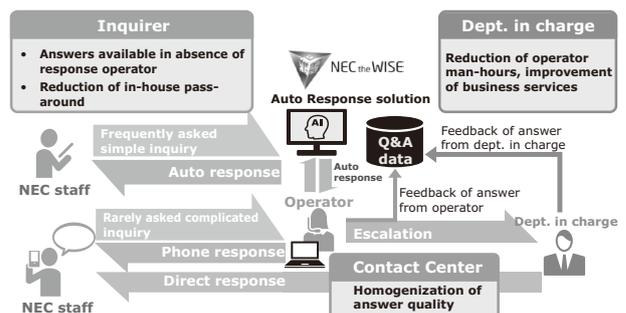
Fig. 5 Objectives of AI chatbot.

the service are as follows:
- Improvement of NEC Group efficiency: Time reduction for both inquirers and responders
- Extension of service hours: Answers by auto response even when the operators in charge are absent
- Improvement of quality of response: Homogenized answer level (fair response/barrier-free)

(3) Effects of introduction

Auto response to about 900 inquiries per day brings the following effects.
- About 28% reduction of Contact Center inquiries thanks to automation of inquiry response by the auto response solution
- Improvement of correct answer rate to questions provides increased instantaneous problem solution so the staffers can reduce the time taken for inquiries and focus on their jobs. According to an in-house questionnaire, 71% of inquiries led to confident solutions and the time taken for solving issues has reduced to 2/3.

(4) Future development

Based on the "chatbot that answers inquiries", NMP will provide the working practices assistance function for each individual staffer by acting for business system-linked operations such as travel expenses settlements and meeting room reservations aiming at implementing a general business work portal for the NEC staff.

4.2 Case of emergency consultations from residents (Saitama Prefecture)

(1) Circumstances of introduction

The Saitama Prefecture runs an emergency phone consultation service with which, in case of an acute disease or injury, nurses respond via phone consultations on the first-aid measures in home and the necessity of visiting medical institutions. To enhance emergency phone consultations aiming at ensuring the safety/security of prefectural residents and to optimize the availability of emergency medication, the local government has introduced the national common dial (#7119) and 24-hour/365-day service. Recently, the government studied the introduction of the Saitama AI Emergency Consultation service in order to improve the convenience of the service further and reduce the burden on the consultation staff and the emergency medical staff by promoting optimum hospital visits.

(2) System outline

In addition to the existing emergency phone con-
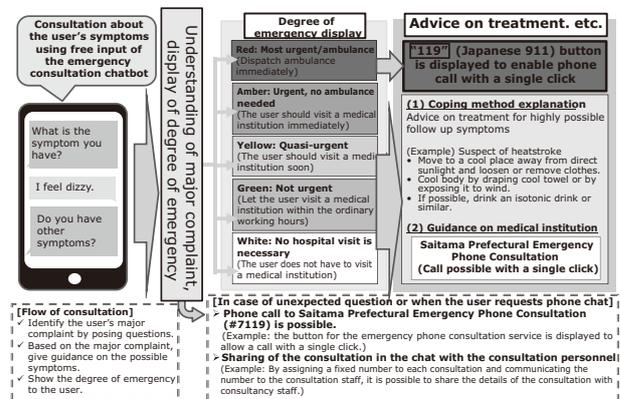
Fig. 6 Outline of Saitama Prefectural AI Emergency Consultations.

sultation service, the Saitama Prefecture started provision of an emergency consultation chatbot, the first one using AI in Japan, on July 19, 2919, aiming at improving the convenience of residents and optimizing visits to medical institutions. As shown in **Fig. 6**, when a user makes an inquiry in one of the various available ways, the service understands the major complaint (main symptom appealed by a patient) from the context. It then uses the Recognizing Text Entailment technology and displays the degree of emergency and advice for treatment according to the relevant scenario in the symptom table (108 patterns) of the Japanese Association for Acute Medicine.

(3) Effects of introduction

The prefectural residents appreciated the system by saying "easier to use than telephone", "very useful", "consultation according to symptoms alleviated the insecurity" and so on.

(4) Future development

Proposals are being made for voice input and foreign language compatibility to enhance the service. Efforts are being made to improve the convenience of prefectural emergency consultation and to reduce the burdens on emergency consultation staff as well as on emergency medicine sites by promoting optimum hospital visits.

5. Conclusion

In the above, the authors outlined the auto response solution and introduced actual cases of its use. It will be a matter of course that AI will provide answers to frequently asked questions and replace humans in routine operations. NEC is capable of auto response based on voice

recognition and multi-language translations in addition to holding text chats, and the usage scenarios are currently expanding. NEC is also developing solutions making use of AI technology for efficiency improvements in automation of the preparation and maintenance of data.

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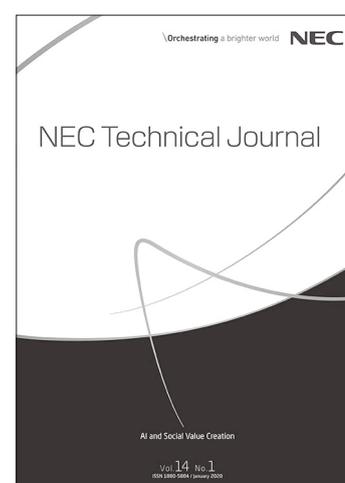
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