Information Navigation Technology for Improved Search Efficiency

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Abstract

Search systems are becoming increasingly important to find desired information from a vast pool of information. We developed navigation technology enhancing search systems usability, which allows users to reach desired information. Our technology creates navigation keywords related to situations to narrow down a search efficiently. This paper introduces case examples of the "Information Navigation System" that was developed for the Customer Support Center of NEC Fielding, Ltd.

Keywords

search, navigation, contact center, information usage

1. Introduction

The ability to seek out and use pertinent information from the vast pool of information amassed on the Internet and within enterprises is a critically important issue these days. For instance, the contact centers of various firms are endeavoring to offer speedier customer service by accumulating information on past customer inquiries including how they were resolved, accessible as shared knowledge that any operator can draw upon when faced with a similar inquiry. However, as the amount of stored cases increases, it also becomes increasingly difficult to find the appropriate recorded case to use as reference.

We have researched and developed interactive information navigation technology in which the system suggests keywords as an aid to guiding the user to pertinent information from among the enormous accumulated information pool. We will introduce this technology through the case example of the "Information Navigation System" at NEC Fielding's Customer Support Center.

2. Characteristics of Navigation Function

2.1 Issues Facing Conventional Systems

There are two general shortcomings when it comes to conventional problem example searches. Firstly, there is the difficulty of expressing a problem as a search keyword. If the failure symptom is expressed using a special term or somewhat differently depending on the operator, operators tended to be confused as to how to express the situation as a keyword, thereby complicating the keyword input process. Secondly, since each case record usually includes multiple symptom entries, it can be difficult to find the appropriate example because similar phrases can have totally different meanings.

For example, if you were to input the keywords "power supply" and "abnormal" to find a case record for "power supply is abnormal but printing is normal," there is a good chance that you would find a case with a totally different meaning, such as the opposite "power supply is normal but printing is abnormal."

2.2 Technical Characteristics

In order to solve the problems of difficult keyword expression and inappropriate search results, we developed a search support navigation function that suggests crucial keywords to the user. The navigation function can be characterized by the following two technologies.

1) Narrowing down Using Related Keywords

The system automatically extracts the relationship between keywords (problem item or "subject," and symptom or "what happened to it"), so the operator can focus on this relationship and narrow down the problem. For instance, if the operator selects the keyword "paper" which denotes a problem item, a number of symptom keywords related to "paper," such as "jammed" or "dirty," will be displayed as the navigation keywords. Likewise, if a symptom-related keyword is initially selected, related problem items will be displayed as the navigation keywords. For the example "power supply is abnormal but printing is normal" that was

mentioned earlier, the subject can be narrowed down even if multiple case examples coexist because the problem items and symptoms are indexed in pairs such as “Power supply, Abnormal” and “Printing, Normal.”

2) Dynamic Priority Ranking

Every time a keyword is selected, the next keyword to be displayed is calculated dynamically. Based on situations such as the user’s selected keyword or search results, the priority of candidates for the next keyword is calculated and optimal keyword suggestions are displayed to narrow-in on the problem.

Priority ranking is based on the number of cases associated with each keyword that is included in the search results. Keywords linked to a larger number of cases express significant problems that occur more frequently. So we give them higher priority as navigation keywords. Furthermore, the keyword selection history is also used to evaluate priority. Keywords that are frequently used in keyword searches and through the navigation function are considered to be high-priority navigation keywords.

2.3 Effectiveness

Our system automatically analyses cases and extracts navigation keywords from them. There is no need for human operation in setting the index information definitions, thereby simplifying the implementation and running of the system. Moreover, since the system displays search keywords extracted from stored case histories, even if the phrasing differs somewhat from case to case, the operator will be able to find a keyword that is close to what he is looking for and close-in on a specific case from there.

3. Information Navigation System (Problem Case Navigation System)

3.1 System Overview

Fig. 1 shows a screen image of our system. The right window shows the search results listing problem cases, and the left window shows navigation keywords to narrow down the search. The system structure is shown in **Fig. 2** . Basically the system is comprised of: (1) the Data Generation sector that extracts index keywords for the problem item and the symptom from case data accumulated at the contact center; and (2) the Navigation sector that handles the search and navigation, and generates the screen shown in Fig. 1. The case data and index keywords generated by the Data Generation sector are

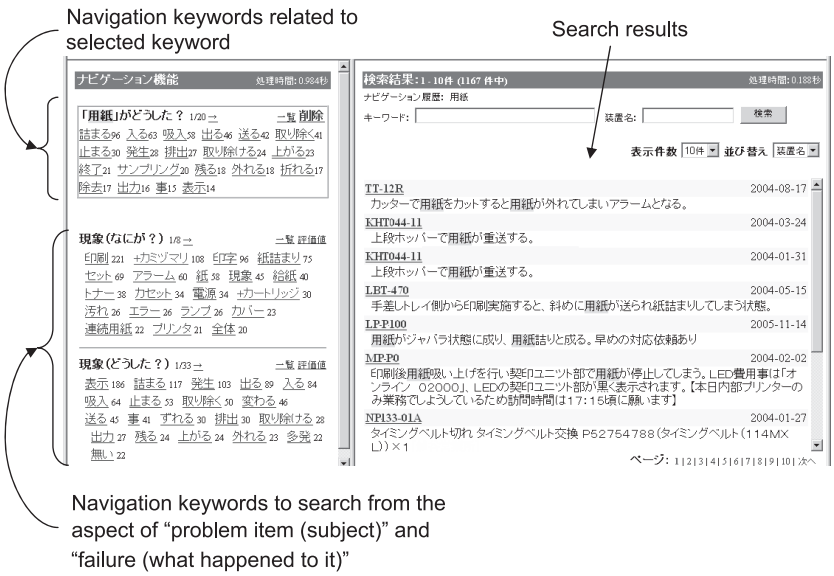

Fig. 1 System screen example.

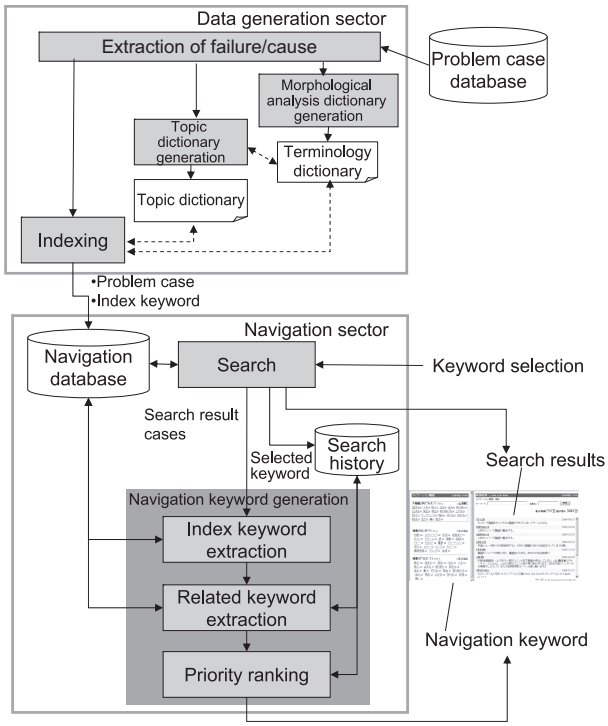

Fig. 2 System structure.

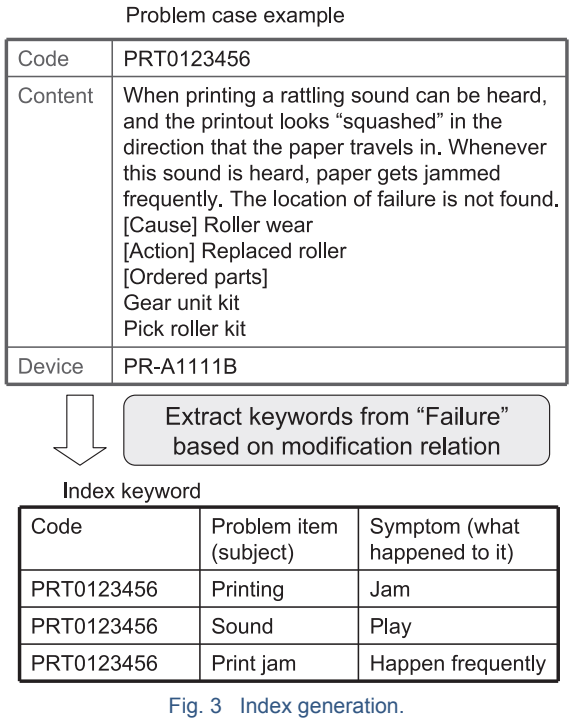

Fig. 3 Index generation.

stored in the database of the Navigation sector for later use. The Data Generation sector is a pre-processing program, while the Navigation sector runs on a Web server and a user operates navigation functions using a Web server.

3.2 Data Generation Sector

As shown in Fig. 2, the Data Generation Sector extracts the description of a failure and its causes, and generates a morphological analysis dictionary, topics dictionary, and indexes. The Failure/Cause extraction block extracts the description of failure, causes, and actions taken from cases.

At the Morphological Analysis Dictionary generation block, to generate the dictionary, special terminology such as error messages and device names are extracted from the case records based on statement formats and frequency of appearance. This dictionary is utilized in the following Topic dictionary and the Japanese language analyses performed to generate indexes.

The Topic Dictionary generation block looks for subjective keywords followed by specific case particles (*wa* , *mo* , *ni-tsuite* , *ni-kanshite* > *ga* > *wo* > other) in Japanese text, and registers the keyword as the problem item.

The Index Generation block extracts related keywords presenting the nexus of “subject” and “what happened to it” by modification analysis from the failure description sections of each case. Referring to the Topic Dictionary, it indexes the keyword group that has the source keyword and the destination keyword, as the group of the problem item (“subject”) and symptom (“what happened to it”). **Fig. 3** shows an example of keyword group extraction. In this example, three pairs of keywords “printing, jamming,” “sound, heard” and “print jam, frequent” are extracted denoting problem item (“subject”) and symptom (“what happened to it”).

3.3 Navigation Sector

As shown in Fig. 2, the Navigation block searches cases based on the keyword selected by the user, and generates appropriate navigation keywords associated with the search results.

After the Search block searches cases based on the keyword selected by the user, the Index Keyword Extraction

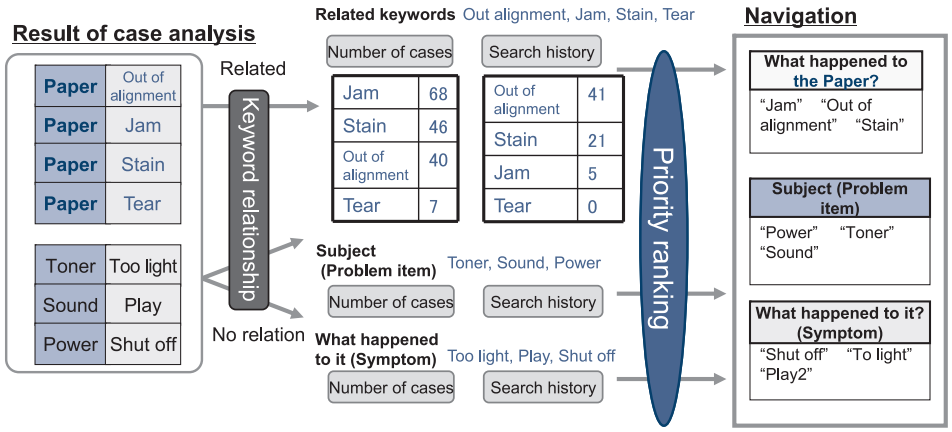

Fig. 4 Flow of navigation keyword generation.

block extracts the index keywords found in the search results from every category "problem item (subject)" and "symptom (what happened to it)." The Relational Keyword Extraction block selects index keywords that have modification relation with the keyword selected by the user. For instance, let's say the user selects "paper" for the "problem item (subject)" and runs a search as is shown in **Fig. 4** . The keywords related to "paper" are extracted as the "symptom (what happed to it)" keyword found in the search results. Then these keywords are ranked based on the number of related cases and the frequency of appearance.

Even keywords that do not have modification relation with the keyword selected by the user are displayed as usable navigation keywords to allow searching from a different perspective by ranking in each category, "problem items" and "symptoms."

Keywords are ranked based on the number of past cases and two types of search histories (how many times it was selected as a navigation keyword, and how many times it was searched as a keyword). A keyword found in a large number of cases denotes a problem that occurs frequently, and a keyword that appears frequently in search histories signifies a high degree of interest. Therefore keywords with high values for both indicators are regarded as ranking high in priority.

4. Evaluation

We had operators at our contact center leverage the system as part of their daily activities and evaluated the function's effectiveness based on the operation logs.

The system is also equipped with conventional keyword search and device name search functions (upper right corner in Fig. 1). By the utilization of conventional search and navigation search functions, we evaluated the effectiveness of the navigation search function. During the approximately 2 months, 166 users leveraged the system, logged into it 939 times, and searched 1,132 times.

From experimental results, we found that 25% used only the navigation function, 54% used a combination of navigation and conventional search functions, and 21% used only conventional search. This showed that the navigation function was used in 79% of the total number of searches, implying that this function was useful for problem case searches.

5. Conclusion

The problem case navigation system will enable case searches that are independent of the skill level of the operator.

By development of navigation technology with easy search operations, we are contributing to the improvement of contact center services.

Moreover, the information navigation technology that we developed is not limited only to contact centers, and can be applied to document search systems within enterprises, as well as product search at portal sites such as videos, etc.

Through research and development of navigation technologies to allow users to easily find the desired information from among a vast pool of information, we intend to make the rela-

tionship between people and information a more fulfilling one.

*As the products introduced in this paper are mainly provided for the domestic market, some figures feature explanations by the Japanese Language.

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