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Development of Circulating Support Environment of Multilingual Medical Communication using Parallel Texts for Foreign Patients

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Abstract—The need for multilingual communication in Japan has increased due to an increase in the number of foreigners in the country. When people communicate in their nonnative language, the differences in language prevent mutual understanding among the communicating individuals. In the medical field, communication between the hospital staff and patients is a serious problem. Currently, medical translators accompany patients to medical care facilities, and the demand for medical translators is increasing. However, medical translators cannot necessarily provide support, especially in cases in which round-the-clock support is required or in case of emergencies. The medical field has high expectations from information technology. Hence, a system that supports accurate multilingual communication is required. Despite recent advances in machine translation technology, it is very difficult to obtain highly accurate translations. We have developed a support system called M^3 for multilingual medical reception. M^3 provides support functions that aid foreign patients in the following respects: conversation, questionnaires, reception procedures, and hospital navigation; it also has a Q&A function. Users can operate M^3 using a touch screen and receive text-based support. In addition, M^3 uses accurate translation tools called parallel texts to facilitate reliable communication through conversations between the hospital staff and the patients. However, if there is no parallel text that expresses what users want to communicate, the users cannot communicate. In this study, we have developed a circulating support environment for multilingual medical communication using parallel texts. The proposed environment can circulate necessary parallel texts through the following procedure: (1) a user provides feedback about the necessary parallel texts, following which (2) these parallel texts are created and evaluated.

Keywords—multilingual medical communication, parallel texts.

I. Introduction

The opportunities for multilingual communication in Japan have increased due to an increase in the number of foreigners in Japan. When people communicate in their nonnative language, the differences in languages prevent mutual understanding among communicating individuals[1], [2]. Differences in languages have to be overcome for multilingual communication to occur. In this study, we focus on multilingual communication support in the medical field. Currently, a medical translator accompanies a patient to medical care facilities, and the demand for medical translators to accompany patients is increasing. However, medical translators cannot necessarily provide support in cases in which round-the-clock support is required or in case of emergencies. Thus, a system that supports accurate multilingual communication is required. In the medical field, in particular, accurate translations are very important. Medical care directly impacts both human life and health. To overcome the language barrier in communication, machine translation is used for communication using native languages[3], [4]. Despite recent advances in machine translation technology, it is still very difficult to obtain highly accurate translations. Inaccurate translations adversely affect communication, and an incorrect machine translation can cause serious problems. Thus, in the medical field, it is difficult to use machine translation support, and we need an accurate translation system.

We have developed a support system for multilingual medical reception termed M^3[5]. Users can operate M^3 using a touch screen and receive text-based support. M^3 provides reliable communication between a hospital staff member and a patient using accurate translations called parallel texts. In this system, the staff and the patient can communicate with each other using pairs of questions and answers, where each pair of question and answer is called an "adjacency pair." This system uses adjacency pairs that are created in advance. Therefore, if parallel texts or adjacency pairs that express what the patients want to say do not exist, they cannot use this system to communicate with the hospital staff.

In this study, we have developed a circulating support environment of multilingual medical communication using parallel texts to support foreign patients. We describe the problem with the use of parallel texts, the proposed environment, and the constituent systems of this environment.

II. Problem with the Use of Parallel Texts

Parallel texts are lines of text in one language that are paired with translations of the same text in other languages. In other words, parallel texts are accurate translations, prepared in advance, that are meant to improve the efficiency and accuracy of medical treatment[6]. Face-to-face communication systems using parallel texts are now in use. One of them is a support system using speech-to-speech translation for foreign travelers[7]. Another topic of research is a tool that supports communication between speakers of different languages; these systems use parallel texts for speech recognition[8]. In these

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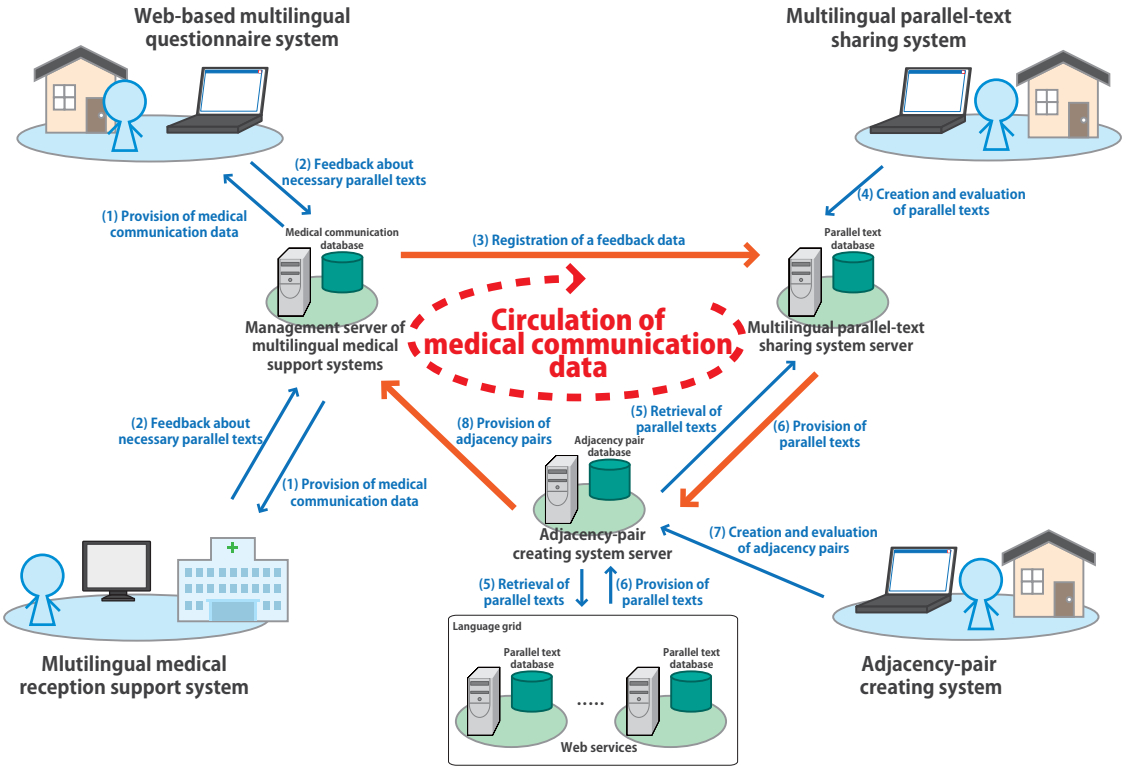

Fig. 1. Configuration of a circulating support environment for multilingual medical communication

systems, the user inputs speech, and the system outputs a translated sentence. However, such systems cannot output sentences that have not been previously registered. Speech translation systems using phrase translation for communication in the medical field have also been proposed[9], [10]. However, even these systems provide insufficient support for the medical field. We need a system that can register, share, and use parallel texts among several hospitals.

We have developed a support system for multilingual medical reception. This system uses Web services via the Internet. If a new parallel text is registered, the system can use it. However, the providers of Web services need to create and register parallel texts. If a creator of parallel texts cannot think of parallel texts that are required in the practical medical field, the Web services cannot provide adequate support. Therefore, we need to consider a system that communicates information about parallel texts that is required in the practical medical field to medical interpreters who create parallel texts.

In this study, we propose a circulating support environment for multilingual medical communication using parallel texts. This environment increases the possibility of communication using parallel texts with feedback about necessary parallel texts from the multilingual medical reception support system.

III. Circulating Support Environment for Multilingual Medical Communication

In order to increase the possibility of communication using parallel texts, we have developed a circulating support environment for multilingual medical communication. In this environment, parallel texts are used for facilitating accurate multilingual communication. This environment is composed of four systems. A multilingual medical reception support system and a Web-based multilingual questionnaire system are used together to aid foreign patients in the medical field. Hereafter, we refer to these two systems as “multilingual medical support systems.” A multilingual parallel-text sharing system[11] and an adjacency-pair creating system[12] are used to support communication using parallel texts.

Figure 1 shows the configuration of a circulating support environment for multilingual medical communication. In this study, we refer to parallel texts and adjacency pairs as “medical communication data.” Medical communication data require satisfactory accuracy. Therefore, we cannot generate them in real time, and we need to prepare the necessary medical communication data in advance. However, a lack of necessary medical communication data may occur when using multilingual medical support systems. The proposed environment can circulate necessary medical communication data by the following procedure: (1) a user can provide feedback about the necessary medical communication data, following which (b) these medical communication data can be created and evaluated. The procedure for circulating medical communication data is as follows:

1) Multilingual medical support systems receive medical communication data from a management server of the multilingual medical support systems.

2) When users face a lack of parallel texts, they register feedback data and the system transmits this data to the management server.
3) The management server transmits the feedback data to a multilingual parallel-text sharing system.
4) Users of the multilingual parallel-text sharing system create parallel texts on the basis of the feedback data and evaluate them.
5) Users of an adjacency-pair creating system create adjacency pairs and evaluate them.
6) Evaluated parallel texts and adjacency pairs are provided to the management server, and they are used in the multilingual medical support systems.

IV. Constituent Systems of a Circulating Support Environment for Multilingual Medical Communication

The proposed circulating support environment for multilingual medical communication consists of the following constituent systems: a multilingual medical reception support system, a Web-based multilingual questionnaire system, a multilingual parallel-text sharing system, and an adjacency-pair creating system.

In this section, we describe each constituent system in detail.

A. Multilingual medical reception support system

We have developed a multilingual medical reception support system termed M^3[5]. M^3 supports face-to-face communication and the procedure followed at hospital receptions. Users can operate M^3 using a touch screen. M^3 provides the following six support functions:

1) Conversation function
   In this function, a hospital staff member and a patient can communicate using parallel texts.
2) Questionnaire function
   In this function, the candidate symptoms are displayed in the list of symptoms when the patient clicks on the region exhibiting a symptom in the chart of the human body. When the patient selects a symptom, the selected region and the symptom is translated into Japanese.
3) Support function for the selection of department
   This function enables patients to select the department that a patient wants to consult.
4) Hospital navigation function
   In this function, when a patient selects the destination, the system displays the route map in the patient's language.
5) Q&A function
   This function provides FAQs about a hospital.
6) Assistance with reception procedures function
   By using this function, a patient can view a series of Q&A on "assistance with reception procedures."

In order to avoid problems related to translational accuracy, M^3 uses parallel texts that have previously been translated accurately by medical interpreters. M^3 can obtain and share parallel texts via Language Grid using Web services[13]. However, if there is no parallel text that expresses what the users want to tell their conversation partners, users cannot communicate.

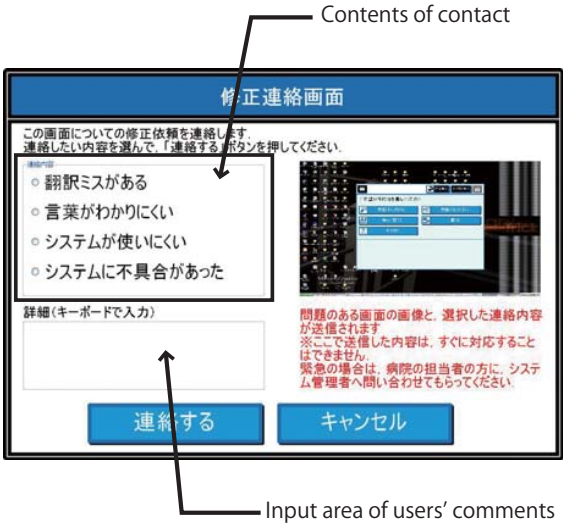

Fig. 2. Screenshot of feedback function in M^3

In order to address this problem, we have developed a structure for providing feedback about the parallel texts required in the multilingual medical reception support system. Figure 2 shows a screenshot of the feedback function in M^3. When users face issues such as the lack of parallel texts and errors in parallel texts, they can contact system administrators by using this function. This system uses voice data as feedback data. Users can register feedback data by speaking. The registered data are transmitted to the management server of the multilingual medical support systems. Then, a multilingual parallel-text sharing system, which collects and shares parallel texts, receives the feedback via the management server. The feedback from a multilingual medical reception support system facilitates the creation of parallel texts that are required in the practical medical field. This feedback function may increase the possibility of communication using parallel texts.

B. Web-based multilingual questionnaire system

A multilingual medical reception support system is operated using a touch screen placed at a medical reception desk. Therefore, if the system is not placed at a hospital, foreign patients cannot receive support.

We have developed a Web-based multilingual questionnaire system as one of the constituent systems of the proposed environment. Figure 3 shows a screenshot of the developed Web-based multilingual questionnaire system. This system aids foreign patients in hospitals that do not have the multilingual medical reception support system. This system is provided as a Web service. Foreign patients can create multilingual information about their symptoms by using the system on a Web browser. They can print the created multilingual information. Figure 4 shows a screenshot of the screen to be printed. Symptom data are described in two languages: the patients' native language and the language the data has

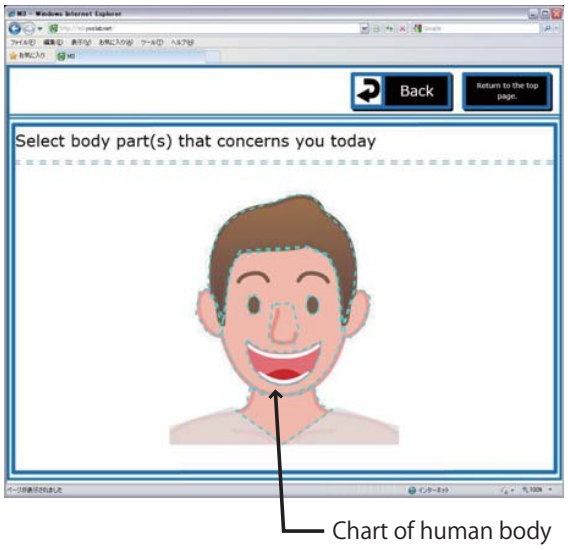

Fig. 3. Screenshot of a Web-based multilingual questionnaire system

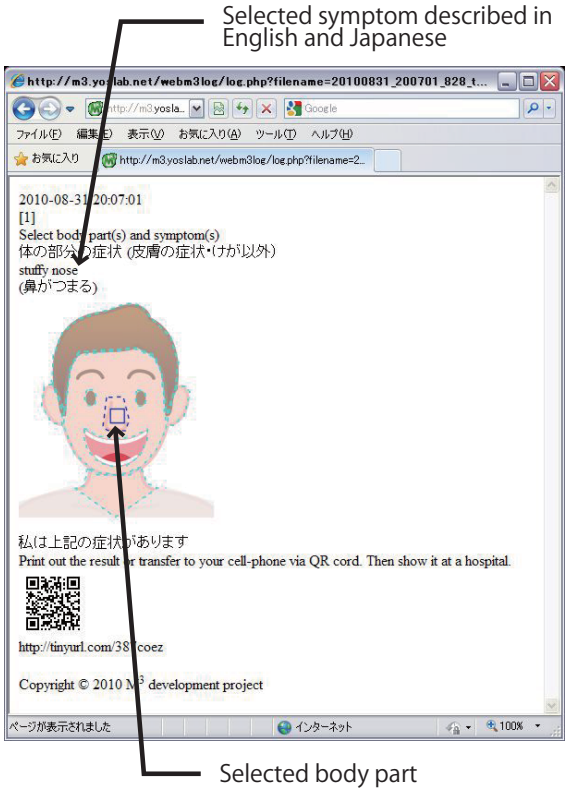

Fig. 4. Screenshot of the screen to be printed

to be translated in. Foreign patients can communicate their symptoms to hospital staff in hospitals by presenting the printed symptom data.

Using this system, users can register their comments. The registered comments are transmitted to the management server

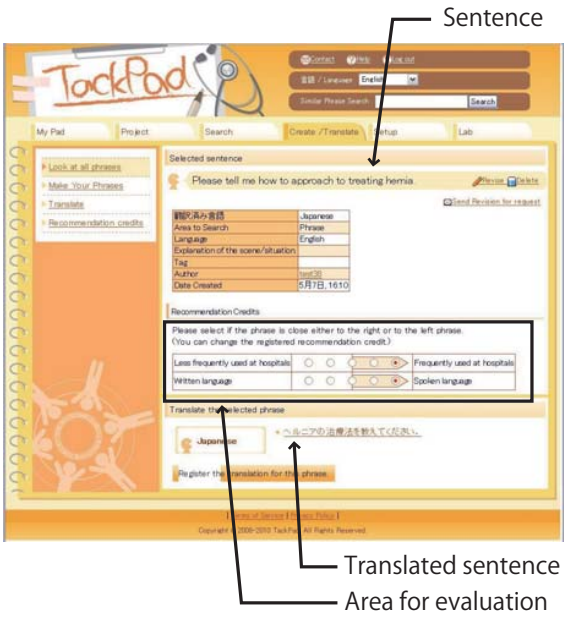

Fig. 5. Screenshot of a multilingual parallel-text sharing system

of the multilingual medical support systems.

C. Multilingual parallel-text sharing system

A multilingual parallel-text sharing system called TackPad[11] collects and shares parallel texts. Figure 5 shows a screenshot of a multilingual parallel-text sharing system. This system collects parallel texts in the following nine languages: Japanese, English, Chinese, Korean, Portuguese, Spanish, Vietnamese, Thai, and Indonesian.

This system collects accurate parallel texts through the following procedure:

1) Hospital staff and patients propose data that are required in the medical field.
2) Translators and medical interpreters translate sentences from the proposed data.
3) Users of the system evaluate the accuracy of parallel texts.

D. Adjacency-pair creating system

An adjacency-pair creating system creates adjacency pairs by combining parallel texts. This system uses a multilingual parallel-text sharing system and Web services on Language Grid[13]. Figure 6 shows a screenshot of an adjacency-pair creating system.

In this system, users create adjacency pairs through the following procedure:

1) The system obtains parallel texts from a multilingual parallel-text sharing system and Web services.
2) Users create adjacency pairs using the obtained parallel texts.
3) Users evaluate the accuracy of the created adjacency pairs in each language.

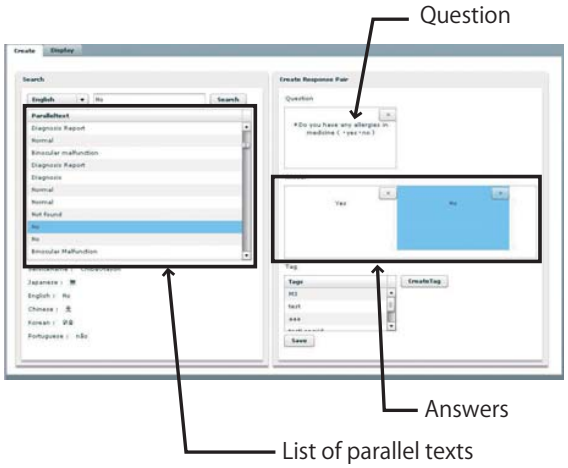

Fig. 6. Screenshot of an adjacency-pair creating system

V. Conclusion

In this paper, we proposed a circulating support environment for multilingual medical communication using parallel texts. In order to increase the possibility of communication using parallel texts, we have developed a system that provides feedback about medical communication data required in multilingual communication systems.

In the future, we need to apply the proposed environment to the practical medical field, and verify the effect of the proposed environment.

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