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ORIGINAL CONTRIBUTION

A Method for Supporting Medical-Interview Trainings Using Wearable Smart Glasses

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***Abstract*— This article aims to focus on applying ICT to training in medical schools. We propose a method — using wearable smart glasses — for supporting training in giving medical interviews. Applying this method, the trainer monitors the trainees via a network and sends instructions to individual trainees. Accordingly, it supports the trainer in a manner that eases their burden. Moreover, the trainees can check their current statuses on the display of the smart glasses and get efficient feedback immediately from the trainer As part of medical care, the process of asking patients detailed questions about their symptoms — namely, a medical interview to diagnose a medical problem exactly or to determine the kind of examination of symptoms — is very important. Giving a medical interview successfully depends on the experience of the interviewer. A clinician with a lot of experience can extract the necessary information from outpatients. In response to this state of affairs, clinical lectures have lately been focused on. Especially, training in giving medical interviews has become one of the most important items on the curriculum. This training should be repeated by students so that they can master the technical skill of asking medical interview questions. .**

***Index Terms*— Medical Interview, Training, Smart Glasses**

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I. INTRODUCTION

In the case of medical schools in Japan, practical training in how to ask patients detailed questions about their symptoms has been focused on lately. This questioning process is called a "medical interview." In the case of medical care, a medical interview is the first and most-important step in diagnosing exactly or in determining how to examine symptoms in more detail. Practical training in giving medical interviews, which is an important part of clinical lectures, simulates a real medical examination in an outpatients' ward. The number of such practical training sessions has increased year by year from 2010 [1, 2, 3]. It is supposed that required medical-school accreditation for ECFMG certification in the USA has affected the number of practical training sessions in medical interviews [4]. In the case of practical training in medical interviews, the questions that outpatients are asked have been standardization [5, 6]. That status suggests that practical training in medical interviews has been established. Moreover, that training has been adopted as one of the most-important curricula in medical schools.

In the medical school where the authors requested cooperation of students in experiments, practical training in medical interviews was performed in the style of role playing. Three to four trainees played the roles

of clinician and outpatient in turn. A trainer (i.e., a real clinician) checked the process of the practical training while sitting by the side of the trainees. At the end of the practical training, the trainees received advice — based on the trainer's experience — from the trainer about how they gave the medical interviews. Hence, the advice was very useful for the trainees. The practical training in medical interviews should be taken repeatedly to master the technical skill of asking questions. However, the trainer didn't have enough time to give detailed advice to all of trainees. The trainer could only take from five to ten minutes for each trainee. In addition, the trainer couldn't give advice about all of the items asked about during the medical interviews for all trainees. Multiple practical training sessions cannot be given at the same time because the trainer cannot check all of the communications in the medical interviews. In Japan, as a result of this situation, the number of classes for practical trainings in medical interviews is not still enough. The trainer is a real clinician who works at an outpatients' ward, therefore, classes in practical training become a burden on the trainer. In addition, the number of clinicians who can provide teaching is not enough.

In this paper, we propose a method — using wearable smart glasses — for supporting training in giving medical interviews. Applying this method, the trainer monitors the trainees via a network and sends instructions to individual trainees. Accordingly, it supports the trainer in a manner that eases their burden. Moreover, the trainees can check their current statuses on the display of the smart glasses and get efficient feedback immediately from the trainer. Finally, we describe evaluation of our method in a medical school and discussion of usefulness of the method.

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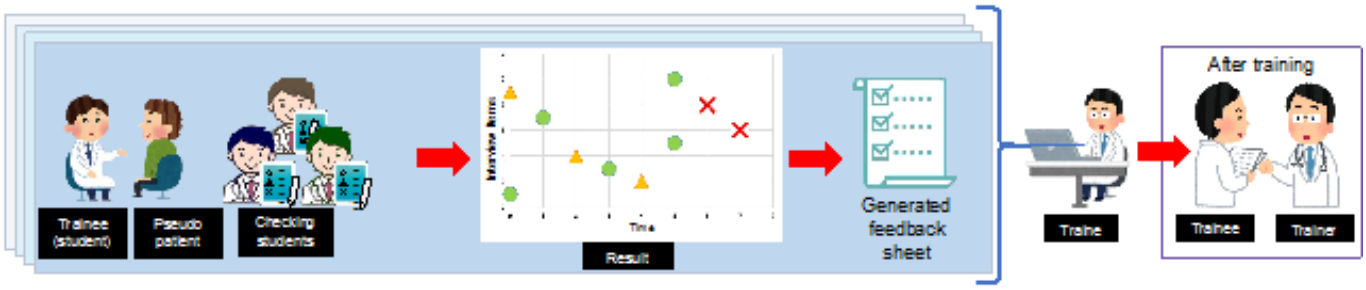

Fig. 1. Overview of our previous method

II. RELATED WORKS

To address the problems in the previous section, we focused on the process of trainees appraising each other at the end of a practical training session in order to support self-learning by trainees. We proposed a method based on the above concept, and implemented a trial practical-training system in a medical school [7]. The proposed system provides the result of mutual appraisals as a synthesis result per trainee at the end of practical training sessions. As a result, trainees could easily understand their mistakes made when asking questions during the practical training in medical interviews. We evaluated the proposed method [7]. According to the results of that evaluation, the probability that the results of the mutual appraisals by the trainees agreed with the evaluation by the trainer was about 74%. That result suggests that self-learning can be helpful for learning medical-interview skills when a real clinician cannot be secured. Taking the style of self-learning, it is easy to increase the number of practical training sessions in giving medical interviews. When the number of clinicians for teaching is not enough, self-learning is one of the substitutes for practical training by a real clinician [8]. The above-described previous research focused on the process at the end of practical training in giving medical interviews. The purpose of this study is more efficiently support that practical training. In this paper, we propose a method that focuses the process involved in practical medical-interview training. As for the proposed method, the trainer gives advice at the precise moment that a trainee has trouble with asking a question during the training. As a result, the training becomes more effective than that based on the previous method. To receive the advice from the trainer, the trainee wears "wearable smart glasses" during the training session. The trainees can steadily perform the training while confirming their progress and checking their mistakes.

A new generation of wearable technology has evolved. Smart glasses are one of the technologies. A systematic evaluation of smart glasses in the healthcare environment has been performed [9]. In this article, the authors say that smart glasses have some clear utility in the clinical setting, and foreseeably a great potential to favorably impact medical and surgical practitioners in their daily activities.

The use of smart glasses in otolaryngology surgery is shown [10]. The device has a beneficial educational effect and allows for remote intraoperative consultation. Improvement in communication using the device would allow improved flow of information between members of the surgical team inside and outside of the operating room.

Fig. 2. Google glass

III. SUPPORTING MEDICAL TRAININGS USING SMART GLASSES

We propose a new method — using smart glasses — for supporting medical-interview trainings of interview with patients.

A. Smart Glasses

A pair of smart glasses is one kind of wearable device. It is a glasses-shaped device composed of a small computer with a display. The person wearing the smart glasses can see a view of the real world with their eyes. They can also see a notification message seemingly floating in front of their eyes when the device displays relevant information. A typical example of smart glasses, "Google Glass [11]" by Google, is shown in Figure 2. The proposed method is shown schematically in Figure 3. The smart glasses have acceleration sensors and a microphone. They can detect whether the trainee is facing the patient and whether the trainee is talking [8]. The trainee sees a warning on the smart glasses when their behavior is deemed unsuitable by the trainer. In particular, the trainer sends a message to advise the trainee when the trainer thinks that it is necessary in the current situation. The server generates current-status information based on the results of checking students [5]. The trainee can see a status view in the display when they want to check their current status.

B. Prototype system

We implemented a prototype system for evaluating the effectiveness of the proposed method. Two models of smart glasses, namely, Moverio BT-200 and BT-300 [12] by EPSON, were used. These models have a stereographic display for each eye. Users can thus see a floating display in the center of their field of view. BT-200 is shown in Figure 4.

When wearing the smart glasses, the trainee operates two button-shaped devices on the desk at which they sit. One button is a "status" button and the other is a "help" button.

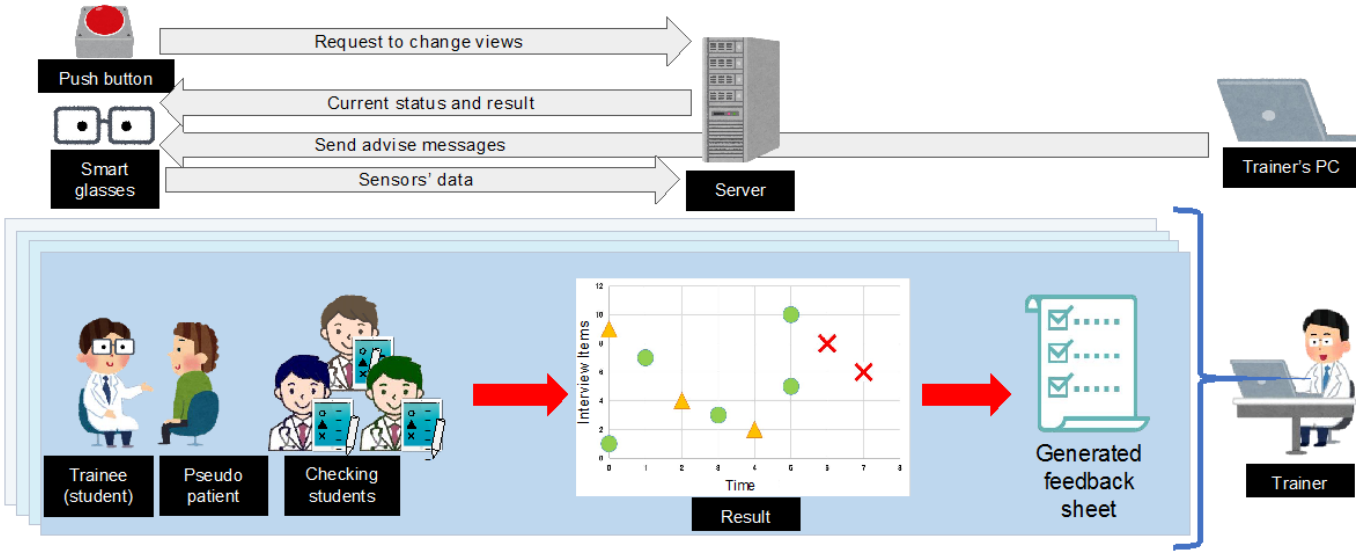

Fig. 3. Overview of proposed method

An example of the view seen in the smart-glasses display by the trainee ("awareness view" hereafter) is shown in Figure 5. Although the background color of the awareness view is black in Figure 5, it is transparent in the smart-glasses display. The trainee can always see the patient through the view. Dark red bars appearing on both sides of the view indicate a warning concerning the facing action of the trainee. That is, the bars become brighter if the trainee stops facing the patient for a certain time or the trainee does not talk to the patient.

Fig. 4. EPSON moverio BT-200

The trainer sends the warning message to the view when the trainer needs to alert the trainee. For example, the message in the center of Figure 5 says (in Japanese) "Reconsider your diagnosis." The message appears over the face of the patient to create strong awareness by the trainee. This feature should only be used in the case of a serious problem. The trainee can ask for the trainer's advice by pushing the "help" button.

The trainee can check their current status-result concerning their training interview on the smart-glasses display when they push the "status" button. An example of a status view is shown in Figure 6. The trainee can constantly check interview items that they have yet to ask. Time spent not facing the patient and time without talking to the patient are shown as colored bars on the right-hand side of the view.

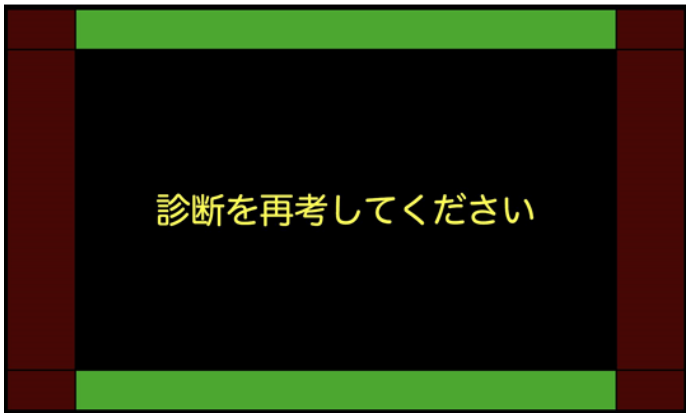

Fig. 5. Screenshot of "awareness view," which is advising reconsideration of diagnosis (Note that the background in the smart-glasses display is transparent)

Fig. 6. Screenshot of status-check view (Note that the background in the smart-glasses display is transparent

IV. EVALUATION

In this section, we describe an experiment in a medical school and its results. To evaluate usefulness of the proposed method, we demonstrated our prototype system for 8 students in a medical school. And we got results of questionnaire after their uses.

Questions and their results are shown in Table I. All of answers are measured by 5-level Likert scale. The answer 3 means neutral value. We discuss about the results in the next section.

TABLE I
RESULTS OF QUESTIONNAIRE

	Question	Average
Q1	Usefulness of notification for no-facing	4.00
Q2	Usefulness of notification for no-talking	4.13
Q3	Usefulness of trainer's advise	4.38
Q4	Obstructiveness for interview (1: obstructed, 5: no-obstruction)	2.88
Q5	Usefulness of status-check view	2.14

V. DISCUSSION

A. Obstructiveness of Notifications

The article[8] describes that smart glasses can provide an opportunity for remote supervision and enhanced surgical education. The object of surgical operation is a human, but they do not talk. Surgeon communicates only with advisor using smart glasses. In our research, the patient in medical interview is also a human. But physician has to talk with the patient. Physician cannot interview smoothly when they think notification is obstruction.

The result of Q4 shows obstructiveness of notification for medical interview is neutral. They seem to be afraid the obstruction although the notification is useful. We have a future plan to improve the views to understand easier.

B. Efficiency of Training Sessions

When a trainee makes an incorrect diagnosis, most of the questions asked become inadequate. That is, the training is not effective for that trainee. In that case, some of trainers would prefer to stop the interview. However, that would waste time. Most trainers therefore wait for the trainee to realize that inadequate-question situation by themselves.

Using the proposed method, the trainer adds a small sign on the display to draw the trainee's attention to the misunderstanding. In this way, the training is not interrupted and the training is made more efficient. The result of Q3 in the questionnaire means the trainees think that the advice on the smart glasses is very useful.

The time taken giving advice to the trainee is short and limited. It is thus not sufficient for providing efficient education. Most trainers cannot point out small mistakes of the trainees. Even so, the proposed system can present some simple mistakes automatically while making training sessions more efficient. The results of Q1 and Q2 in the questionnaire show the trainees think that automatic notifications are also useful.

C. Efforts of Trainers

Medical-interview training is one curriculum that requires a great effort from trainers, and the insufficient number of trainers in Japan is a serious issue. Utilizing the proposed system, however, the trainee can check their results and quickly understand simple mistakes by themselves. The result of Q5 in the questionnaire shows the trainees do not think status-check view is useful. It is not easy to read detailed information on the view during medical interview.

That feature supports trainers' tasks from the viewpoint that trainers can focus on important problems only. Moreover, it might be possible to hold several training sessions in parallel in order to lower the burden on trainers.

D. Chances of Trainings

A medical interview is one of the most-important techniques used by a doctor. Students in current medical schools, however, have few chances of trainings in giving medical interviews.

The number of training sessions could be increased if parallel training was possible. As a result, repeated training sessions would be possible and lead to better medical education.

VI. CONCLUSION AND IMPLICATIONS

In this paper, we proposed a method — utilizing smart glasses — for supporting medical trainings in giving medical interviews. As for this method, the trainees can constantly check the status of their current interview, they can check interview items that they have not yet asked, and the trainers can make them aware of advice easily and quickly.

We confirmed that the usefulness of our proposed method by the experiment for students in the medical school. The proposed method makes medical training more efficient and give trainees more chances of giving medical interviews. It also alleviated to load on trainers. The authors thus suppose that this method will a suitable solution for the current issue facing medical education in Japan.

But some of trainees in the experiment feel notifications as obstructions. As for future work, we will improve the views, which they do not feel obstructiveness by notifications.

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Declaration of Competing Interest

The authors declare that they have no conflict of interest.

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