Learner's Behavior Detection System for Mentoring in e-Learning

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Abstract: In this paper, we describe learner's behavior detecting system for mentoring in e-Learning. It is important for learner to keep her/his motivation in e-Learning. Therefore, existing e-Learning system and LMS (Learning Management System) is to realize mentoring for learner based on learning history. However, past mentoring cannot cover in learner's learning. Then, we focus on the learner's behavior in her/his learning. We propose and develop a learner's behavior detection system for mentoring.

Keywords: Mentoring, Learner's behaviors, Learner's Behavior Detecting System

Introduction

In recent years, WBT(Web Based Training) and other e-Learning has been introduced in enterprises and school training. WBT does not need special devices. Thereby, learner can learn on any occasion on e-Learning. However, learning in WBT is difficults for learner. Learner feels difficult to keeping her/his motivations for learning. There is a problem on WBT, that learner drops out of learning on the way. There is support called mentoring to solve this problem [1]. Mentoring is a kind of learning support method. Person who perform mentoring is called mentor. Mentor communicates with e-mail or chat to her/his supports learner's learning.

In face to face lesson, teacher understands immediately learner's intention. Teacher can guess learner's intention from her/his behavior and facial expression. As a result, teacher can flexibly consider efficient learning. For example, if learner yawned, teacher would guess learner has not concentrate. Teacher can induce learner's consideration by her/his questions. In e-Learning lesson, mentor cannot understand correctly learner's intention. As a result, mentor cannot perform mentoring according to learner's situation. The information that can be recorded for mentoring on existing e-Learning is only learning history and send/receive e-mail history.

Prior studies have been proposed the recording system of learner's intention by mouse click [2]. In that study, learner uses the system on learning in e-Learning. If learner cannot understand learning contents, she/he clicks the link. The system records a timing that learner clicked the link. Mentor can understand learner's status of learning from the recorded information by the system. The studies had been shown two problems of the proposed indication method. One problem is real-time properties of the recorded information is low. If learner has doubt to learning contents during learns, she/he wants to indicate it to mentor. Learner is necessary clarify the reason why that she/he has doubt. As a result, learner discontinues clicking. Even if learner clicks the link, she/he cannot indicate timing of doubt.

Another problem is learner cannot concentrate to learning because her/his consideration is induced to clicking. If learner hesitates to clicking, she/he misses learning contents at that time. These problems has not been solved yet.

1.   Learner's behavior Detecting System

We propose a method of using learner's behavior to solve these problems. We develop a system that detects and records learner's behavior. The system records image of learner's behavior with Web camera and performs easy image processing. The system detects learner's behavior from results of the image processing. Table 1 summarizes the correspondence of the behavior to record and the specific meaning.

Table 1. The frequency of learner's behavior on each system

body part	behavior	specific meaning of behavior
Facial movement	Head nod	agree, consents, understands, sympathize, satisfy
	Lean of head	doesn't understand, Uneasiness, Hesitation, Worry, Distrust
	Head shake	denial, refusal, mistake
Hand movement	Thumbs up	agree, consents, understands, sympathize, satisfy
	Paper	request the stop
	Hand waving	doesn't understand, Uneasiness, Hesitation, Worry, Distrust

If mentor can understand learner's behavior, we improve learning effect of e-Learning. However, an effective method to understand learner's behavior does not exist. We design and implement of such a system which detects learner's behavior and records detection result. We increase opportunities of performing mentoring. The record of learner's behavior improves the interactivity of the mentor and the learner on e-Learning. As a result, mentor can perform more effective mentoring.

In this research, we use only Web camera. Because teacher does not uses special devices in face to face lesson. The purpose of this study is to understand learner's situation from same information as face to face lesson. Therefore, our propose method don't use any special devices.

2. Prototype System

2.1 Overview of Prototype System

Figure 1 indicates that configuration of our system. The system is composed of the learner's behavior detection system and the enhanced Moodle.
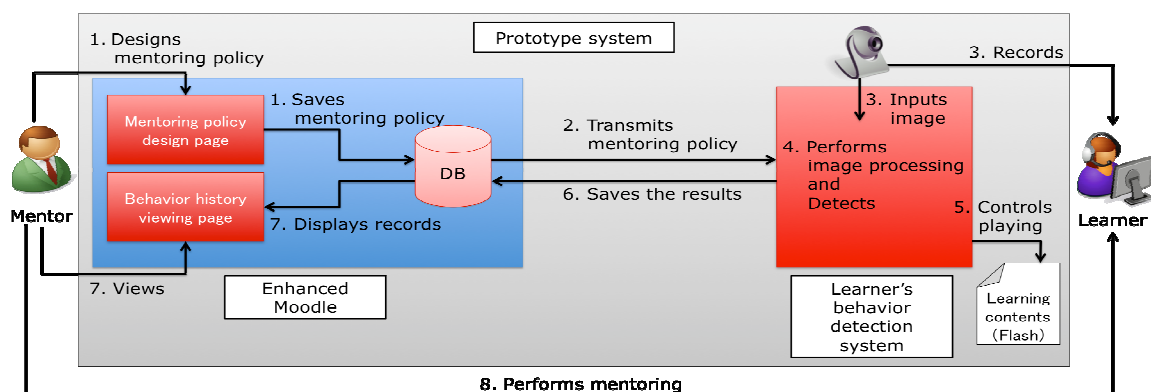

Figure 1. Overview of the prototype system

The learner's behavior detection system is system to detect learner's behavior. The system performs image processing to the image from Web camera. The system detects learner's behavior from the result of image processing using OpenCV [3]. The system saves the result of detected learner's behavior to the database of the enhanced Moodle.

The enhanced Moodle is system that we developed by adding a module to Moodle [4]. We enhanced the mentoring policy design page and the behavior history viewing page to Moodle. The mentoring policy design page is module of Moodle which to design freely mentoring policy. Mentoring policy is timing of mentoring and the method of control playing learning contents. The enhanced Moodle saves mentoring policy to internal database. The behavior history viewing page is module of Moodle which to display learner's behavior history. The enhanced Moodle loads the recorded learner's behavior from internal database. The enhanced Moodle displays learner's behavior history by graph form using pChart [5]. Mentor performs mentoring based on learner's behavior history.

1.1 Overview of the Learner's Behavior Detection System

Figure 2 indicates that learner's active screen with this system. Learner sees two windows with Web browser while her/his learns. Two windows are the learning content window and the mentoring window. The learning content window plays learning contents. The mentoring window gives feedback to learner. We have included a mentoring avatar on the mentoring window. There are three roles of the mentoring avatar.
- tells learner what the system has detected behavior
- shows the message, so as to shift status
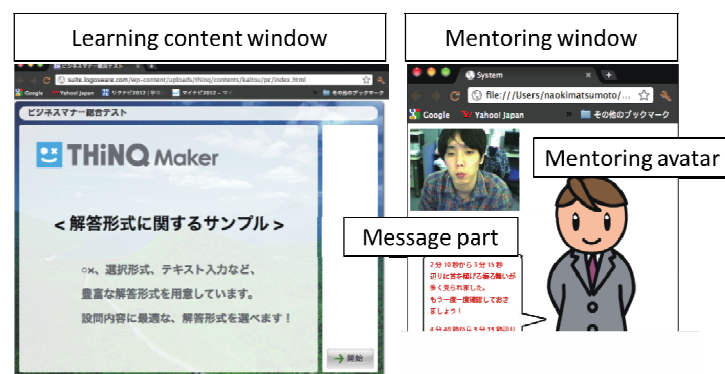- performs mentoring based on mentoring policy

Figure 2. Learner's active screen with this system

If this system records learner's behavior, the motion of mentoring avatar changes simultaneously. Figure 3 indicates the motion of mentoring avatar. A left area of the mentoring window is a message part. In the message part, the mentoring avatar shows mentoring message based on mentoring policy.
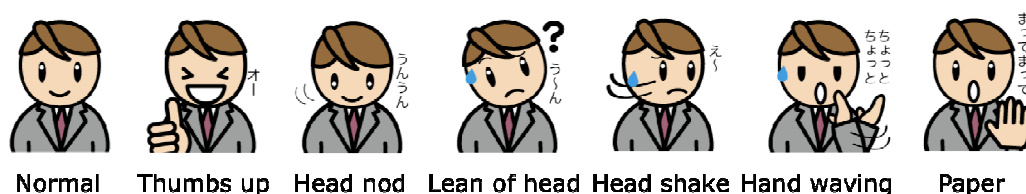

Normal   Thumbs up   Head nod   Lean of head   Head shake   Hand waving   Paper
Figure 3. Motion of the mentoring avatar

2. Preliminary Experiment

2.1 Purpose

The purpose of this experiment is to elucidating the predominance of recording method from behavior. We compare the method of prior research with our method. In this experiment, we confirm two items. Another is frequency of learner's behavior. We confirm it from our system and the image from Web camera. Other is learner's load level that learner feels. We analyze it from questionnaire results.

2.2 Overview

We developed three systems for this experiment. System 1 is system that it record clicking text link. If learner's intentions correspond with text link, she/he clicks it. The system records kinds and timing of clicking text link. System 2 is system that it record clicking image button. If learner's intentions correspond with image button, she/he clicks it. The system records kinds and timing of clicking image button. System 1 and system 2 record learner's intentions from mouse click. System 3 is system that it detects learner's behavior. System 3 detects facial and hand movement as learner's behavior. System 3 records a result of detected learner's behavior and a timing of behavior. Each system respectively can record six kinds of learner's intentions. The recording items on each system corresponds to behavior in table 1. Figure 4 indicates that each screen of system 1 and system 2.

Figure 4. Each screen of system 1 and system 2

We conduct this experiment to two subjects. The subjects uses each above- mentioned three system. We record the subject with video camera during this experiment.
The procedure of this experiment is as follows.
1. Explain the outline of this experiment to subjects
2. Start playing learning contents and recording the subject with video camera
3. Make the subjects fill in questionnaire after learning

2.3 Result

Table 2 summarizes that frequency of learner's behavior on each system. We understood that the learner's behavior detection system be able to record learner's behavior. We confirmed operation of the learner's behavior detection system from this experiment.
All subjects described "System 1 or 2 is better than system 3". However, one of subjects described "I felt satisfaction to indicating intentions by system 3 when the detecting accuracy was good. I felt that system 1 and system 2 better than system 3, because system 1 and system 2 accurate detects intentions". All subjects described "I wanted to freely behave during experiment". We understood that all subjects felt the load to indicating.

Table 2. The frequency of learner's behavior on each system

System 1							
Subject	Total	Interesting	Not interesting	Understand	Don't understand	Mistake it	Too fast
A	10	2	0	2	4	0	2
B	11	0	2	1	7	1	0
System 2							
Subject	Total	Thumbs up	Head shake	Head nod	Lean of head	Hand waving	paper
A	14	1	1	1	9	0	2
B	13	2	2	2	5	1	2
System 3							
Subject	Total	Thumbs up	Head shake	Head nod	Lean of head	Hand waving	paper
A	14	2	0	2	7	0	3
B	10	0	0	3	7	0	0

3. Discussion

We compared the records of system 3 with the image from video camera. As a result, we confirmed misdetection of the system. For example, subject's behavior is "paper", nevertheless, the system detects "thumbs up". One subject described "I felt shyness when the system misdetects". In other words, misdetection involves to subjects. Therefore, we need to consider and improve the detecting accuracy enhancement.

The subjects tended to restricted herself/himself to behavior on system 3. The subjects described "If I freely behave, system 3 detects it as intention". We need consider the recording environment that does not restrict the learner's behavior.

We did not be able to elucidate the effectiveness of our system from result of this experiment. Because the number of subjects is too few. Therefore, we need to conduct the evaluation experiment to confirm the effectiveness of our system.

4. Conclusion

In this paper, we proposed the learner's behavior detecting system for mentoring in e-Learning. At first, we described the learner's behavior in e-Learning and its meaning. Next, we developed the learner's behavior detection system. Furthermore, we conducted evaluation of the system and its evaluation. Finally, we discussed our system based on the result of the evaluation. Thereby, we clearly showed that the problem of our system and the evaluation. In future work, we are going to design the evaluation experiment moreover prove the effectiveness of our system.

References

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