Applying Interactive Mechanism to Virtual Experiment Environment on WWW with Experiment Action Language

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Abstract

To build an interactive mechanism for distance learning environment such as a scientific experiment, the architecture of learning environment and assisted agents should be taken into consideration first. Another issue for constructing interactive mechanism is protocols between the environment and agents. An Experiment Action Language is designed for this purpose. Besides, the way for agent inferring rules is also presented in this paper.

1. Experiment Environment in WWW

A disadvantage of distance learning on Web, the lack of interaction between user and computer, makes the teaching procedure inefficient. Hence, a learning environment, like Virtual Experiment Environment (V.E.E.), with interactive mechanism supported for scientific experiment on WWW is needed.[6][7]

Some distance learning systems now propose agents for managing system files [10], notifying grades in on-line quiz system [8], diagnosing problems in problem solving system [1][2][5], a recorder of the system [3][4], and so on. This paper will support an interactive mechanism for agents to let agents own the ability to guide and assist students by getting information from V.E.E.. Besides, the protocol used to communicate with both V.E.E. and agents will also be discussed.

2. Architecture of Interactive V.E.E

To build a proper environment for student experiment on web, there are four components in V.E.E. as shown in Figure 1. Accompany with an Interactive V.E.E., an agent called Experiment Agent is used to assist learner during experimenting. Figure 2 illustrates that there are three sorts of interactions among V.E.E., Experiment Agent, and User.

In order to have the assistant ability, the Experiment Agent should be able to infer. There are five components make the architecture of experiment agents completely presented in Figure 3. To make an Experiment Agent intelligent, Knowledge Base is a necessary component and makes the Inference Engine get facts more properly. The results reasoned by Inference Engine will be transmitted to the Knowledge Translator, and then will be translated to appropriate Experiment Action Language before sent out to V.E.E. through using Communication Device.

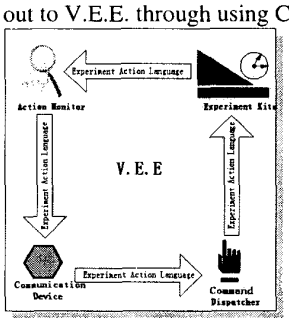

Figure 1. Architecture of I.V.E.E.

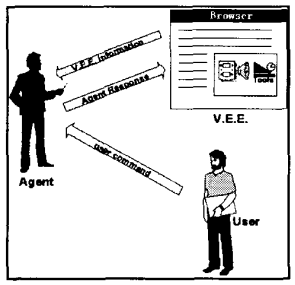

Figure 2. Interactions

Similarly, the Experiment Action Language transferred from V.E.E. will also be received by the Communication Device and then be sent to Knowledge Translator. Information Filter deletes the garbage information translated by the translator and store useful parts into Knowledge Base.

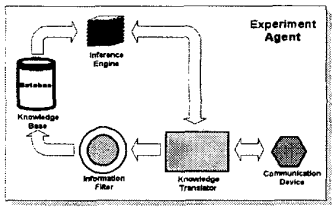

Figure 3. The Architecture of Experiment Agent

3. Interactive Protocol Develop

Experiment Action Language is a language for agent to control V.E.E. and record each step proceeded from learners. To let most of learners realize what command they call easier, scripting language is selected to be the language type.[9] The Experiment Action Language format lists as below:

```
command [object] [-option] [parameter]
```


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Inference Engine will divide the knowledge translated and pass from the Knowledge Translator into three conditions, including correct, inexactitude and error listed in Table 1.

Command / Condition	Command	Object	option	parameter
Correct	Correct	Correct	Correct	Correct
Inexactitude	Correct	Correct	Error	-
	Correct	Correct	-	Error
Error	Correct	Error	-	-
	Error	-	-	-

Table 1. The relationship between determined conditions and EAL (symbol, '-', means "don't care.")

To implement the interactive mechanism of V.E.E., Visual Lab is chosen for the experiment environment in this paper.[11] Taking a real action in Visual Lab for example, a learner moves the vertical ruler to the new position (x1, y1) could be written as `move Ver_Ruler -u x1 y1` in EAL. This command asks agent to "move" the object "`Ver_Ruler`" (Vertical Ruler) to the new position "`x1, y1,`" and the option "`-u`" let agent know that (x1, y1) is the position of the upper-left corner of Vertical Ruler.

By using the interactive mechanism analyzed and designed above, an Experiment Agent can either cheer students or provide suggestion when they doing correct or inexactitude experimental procedure as Figure 6 and Figure 7 shown.

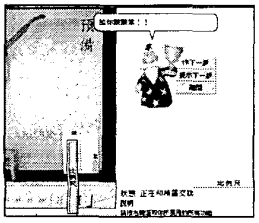

Figure 6.
correct step in V.E.E.

Figure 7.
inexactly step in V.E.E.

4. Conclusion

This paper proposes an interactive Virtual Experiment Environment and the architecture of Experiment Agent. Besides, an intercommunication protocol, Experiment Action Language, is also designed to realize the communication issue between V.E.E. and agents. However, since the interactions will also happen between agents, Knowledge Query Manipulate Language (KQML), is necessarily taken into consideration future. Beside the formation of rules and the intercommunicate protocol, the relations between Inference Engine and Information Filter might need further analysis for the automatic learning issue.

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