

Using Agents to Create Learning Opportunities in a Collaborative Learning Environment

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Abstract. In order to foster situated learning in a virtual community of practice, we developed a multi-user, real-time, 3D car-driving simulation environment. In such a situation-based learning environment, the availability of enough appropriate learning situations is crucial for success. However, we experienced that often a collaborative usage of the system does not result in a large number of these critical situations. This paper introduces the idea of situation creators, intelligent agents who intentionally create specific situations for learners, into our 3D real-time simulation environment. These created situations challenge a learner much more and force him to react in order to master the driving knowledge.

1. Introduction

In recent years, more and more educational 3D simulation systems have been developed. In a typical training course with such a simulator, an individual trainee interacts with the simulation system through a series of pre-defined scenarios that are usually arranged with respect to growing complexity or level of challenge for the trainee. In contrast to these largely “pre-defined” simulation environments that are limited through the number of built-in scenarios, we adopted an alternative design approach for an educational car-driving simulator [1, 2]. Our simulation system allows multiple (also geographically distributed) learners to virtually drive in a shared driving place in a way close to driving in the real world. Furthermore, the simulation system also enables learners to communicate with peers whose cars are close to their own in the virtual driving place. This way, they can discuss the joint problems they face (e.g., who has the right of way in a certain situation). Therefore, each learner is both a member of community of practice and a component of the learning context. When the learner needs help, an intelligent *coach agent* will detect the current driving situations and analyze the learner’s difficulties and needs, and then can provide situated guidance. Rather than going through a series of pre-defined driving scenarios (as in other environments), a learner will experience potentially rich and

unpredictable driving situations in a way analogous to driving in the real world while learning in our simulation environment.

However, our approach has an obvious disadvantage: if there are not enough drivers in the shared virtual driving place, the number of challenging situations that a learner can experience will decrease correspondingly. This paper proposes an idea to address this problem. We introduce a new type of pedagogical agent, the *situation creator*, into our collaborative simulation environment. Such an agent intentionally creates specific situations in the shared virtual driving place. These situations provide learners with learning opportunities, and thus indirectly affect the learning processes.

2. Situation Creator

Our situation creator comprises three components: a learner model, a pedagogical model, and an expert model. The learner model helps to reason about appropriate situations to be generated for learners. The pedagogical model contains knowledge about driving situations and their prerequisite relationships, but does not contain knowledge about how to teach the learner to handle a specific situation. Finally, the expert model contains specific knowledge about how to create situations, but no explicit representation of domain knowledge to be taught. Normally, a situation creator does not even directly interact with learners (therefore, our architecture does not have the “user interface model” component of the classical ITS model), but just indirectly attempts to create the goal situations and thereby “induces” learning opportunities.

Figure 1 depicts the general architecture of a situation creator and its interactions with its environment. The internal structure of the environment depends on the application domain, which here it is represented as a black box. The situation creator works as a repeated process that starts with capturing the current state of the environment (perception) and ends with acting in the environment. Each cycle contains two phases separated by a dashed line in the diagram. The task in the first phase is seeking or maintaining a goal, and the second phase attempts to reach the goal through making and executing an action plan. As the figure 1 illustrates, the perception module monitors the state of the environment. It updates the information in the memory and the student models. The information about the current state of the environment is needed to evaluate if a goal situation has been reached. If not, the agent will check whether the target situation can be created in the current state or not. If it is impossible to achieve this goal, the agent has to give it up. After giving up a goal or achieving one, the situation creator agent tries to seek a new goal. It refers to information in the learner model and pedagogical model and decides which situation will be aimed at in the new state. For each new goal, the agent builds an action plan to achieve it. If the goal remains unchanged, the agent evaluates whether the current action plan needs revision based on the current system state. The specific knowledge about how to create a situation (in the expert model) is used to make and adjust the action plan. Finally, one or more actions will be performed. These, together with student actions, will certainly have an effect on the environment and cause a new process cycle.

According to this design, we have implemented a situation creator which can create three types of situations. A pilot study showed that the situation creator significantly increased the number of situations that a learner can expect to encounter while using the system. With the help of these created situations, a learner is much more challenged and forced to react in order to master the driving knowledge.

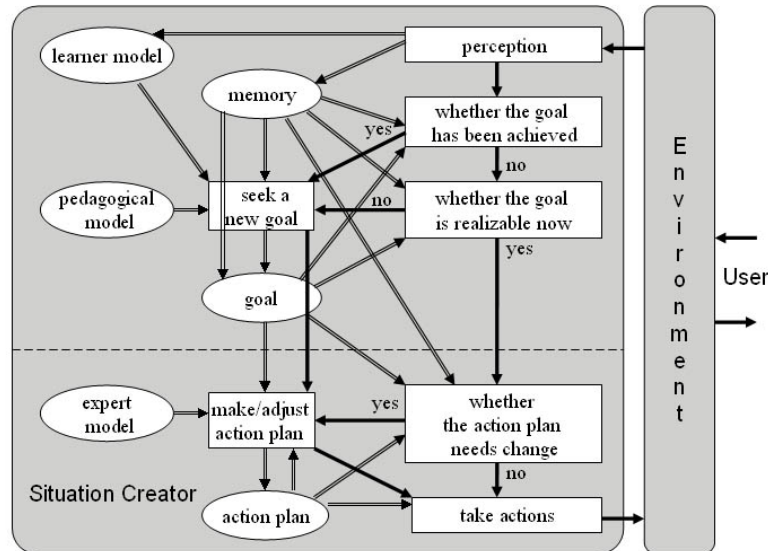


Fig. 1. The abstract system architecture

3. Conclusions

This paper introduced situation creator agents in our 3D collaborative simulation-based learning environment. In order to foster learning in our collaborative simulation environment, these agents create appropriate situations and provide learning opportunities for learners. This paper presented the generic architecture of a situation creator. Based on this design, we have implemented a situation creator that can create simple types of situations. We will extend it to generate more types of situations in the future.

References

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