Integration of a Multi-Agent Systems Based on Organization to Validate the Exercises Realized by Learner in an e-Learning Platform

Jamal Berrich, Toumi Bouchentouf, and Abdelhamid Benazzi

***Abstract*—The immediate assessment of learner is a fundamental stage in the training in order to detect advance and the gaps of learner and consequently the teacher will be able to take the necessary measures in order to catch up with the situation.**

In the e-Learning platforms the immediate assessment of learner is limited for traditional exercises in the form of QCM and the other cases oblige the immobilization of the teacher.

Our objective is to integrate a Tester agent responsible for the immediate assessment of the exercises of each teaching domain and respecting a number of rules in an existing platform e-Learning based Multi-agent Systems [1]. For this reason we will adopt the O-MaSE methodology /agentTool III to conceive and model the under system of validation.

***Index Terms*—AgentTool III, e-Learning, Multi-agent Systems, O-MaSE.**

I. Introduction

The electronic learning (e-Learning) [3, 4] is the use of new multimedia technologies of the Internet to improve the quality of the training by facilitating the access to resources and services, moreover it helps also for the exchanges and collaboration.

We are interested in the conception and the realization of e-Learning platform based on the Multi-agent Systems [5, 6].

Several researches were interested in the design and the realization of virtual assistant in an e-Learning platform [1, 2]. The solution suggested has two limits that we propose to solve in this article. The first is the conception methodology which is MaSE [7] which conceives a closed system and does not allow integrating subsystems. The second is the fact that this system has no test tools to check the suggested solution given by learner who answered an exercise other than QCM. In order to exceed these limits, we propose to conceive an agent tester by using the O-MaSE methodology [8].

II. Virtual Assistant Under MaSE

A. Presentation

The adopted teaching model in [1] is described in Fig.1. The assisting companion must give, receive and stimulate the pleasure of learning.

The system is composed of small intelligent entities which act and interact in an intelligent environment.

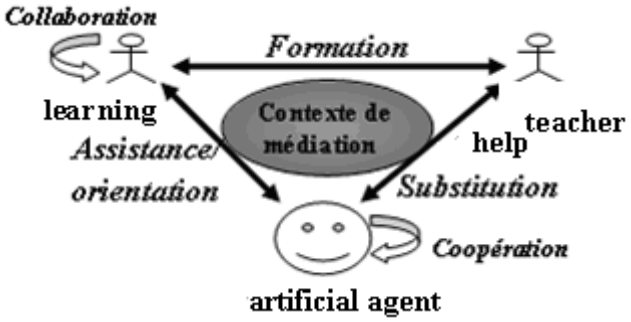

Fig. 1. Teaching model.

The teacher entity; which is a human being; has to deals with tasks of a contents tutor or a stimulating tutor. The learner entity is the principal human actor. The principal operation of the artificial agent entity is to help and collaborate with the teacher entity and to assist the learner entity during a session of resolution of exercises.

B. Limits of the Solution under MaSE

The system proposes an evaluation method for the limited exercises which consists the evaluation of the exercises in the form of QCM. On the other hand if the learner must give an explicit solution to an exercise which is not in the form of QCM, the system must wait the validation by human intervention of the teacher.

Moreover, the conception of the assistant is the same one for any discipline whereas each one rests on a different training plan.

So, the database (knowledge bases and data banks) does not distinguish between the type of the disciplines (all information concerning all the disciplines is stored on the same site), which makes the database inextensible.

In more MaSE methodology used for the system conception has the following weak points [8]:

1) It builds a closed system in which the agents play a number of limited roles and the capacity of change of role is also limited.
2) It does not allow integrating a multi-agent subsystems into the global system, the agents interact on the same level; there is no hierarchy in the protocol model between the agents.

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III. Agent Tester Under O-MASE

A. Statement of the Problem

The objective is to realize an agent tester of validation of exercises which the solution was elaborated by one learner in a distance training using the intelligent agent with the O-MaSE methodology. Our starting point is the goal model elaborated in [1] and described by Fig. 2.

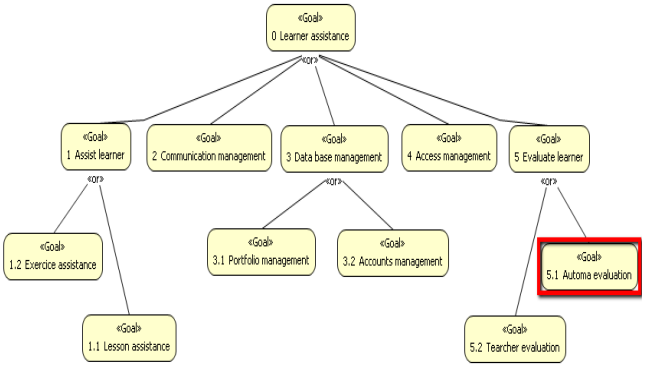

Fig. 2. Goal model.

Our contribution is on the level of the "Automa Evaluation" goal (see Fig. 3) by making the following extension:

1) QCM evaluation: automatic evaluation of the exercises in form QCM like elaborated in [1].
2) Test evaluation: evaluation of the solutions suggested by learner for an exercise which belong to a definite couple (domain, community).

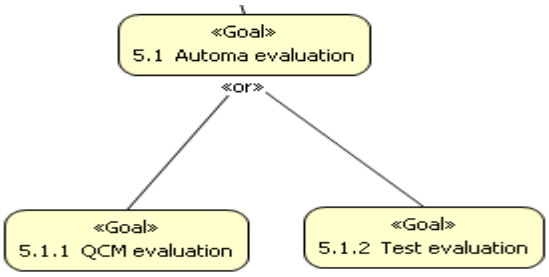

Fig. 3. Extension of the automa evaluation goal

We will present in the following section the O-MaSE methodology and its application to the resolution of our problem.

B. Conception of the Agent tester

The O-MaSE methodology [8] considers the multi-agent systems as an organization of the agents in which those are members. Each agent plays a specific role according to its capacities to obtain its objectives. So, the goal of this methodology is to build an organisational community of the agents basing on the meta-models of the organization:

1) Goal: An objective which the system must obtain or satisfy.
2) Role: Entity able to obtain goals in the organization.
3) Agent: A living component and acting autonomous in the environment.
4) Policy: Describe how an organization may or not may behave in a particular situation.
5) Domain: Describe the real world captured using the Domain Model. It maps the environment objects and the relationships between those objects.

In Fig. 4 we summarize the components of O-MaSE methodology.

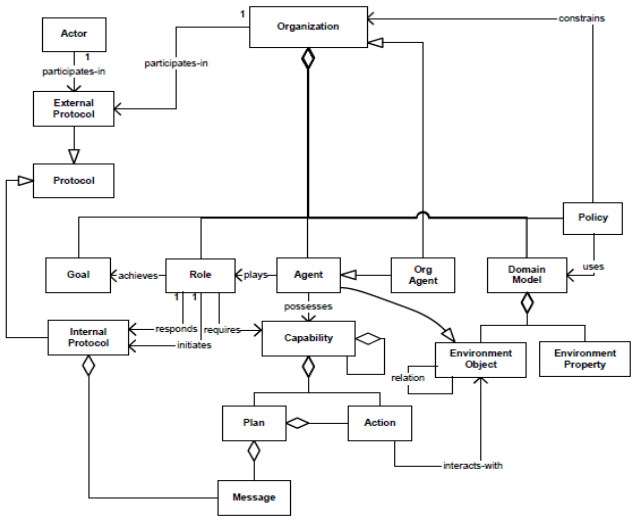

Fig. 4. O-MaSE meta-model

The application of O-MaSE methodology to the conception of the agent tester was made by using the tool agentTools III [9].

Also, we defined the following roles:

1) Tester role: Allows evaluating the solution proposed by learner about an exercise other than QCM. It's based on two other roles which are Domain role and Community role.
2) Domain role: Decide the entity responsible of the validation for the solution.
3) Community role: the validation of the solutions is according to some rules.

In addition to that, we also modified the agent model present in [1] to adapt it to the O-MaSE methodology through the heritage of the agent 'Evaluator' which is responsible for the validation of the exercises in the form of QCM. Thus we added the following agents:

1) Tester controller: dispatch the solution towards the controller of the domain of the exercise. This agent uses the service `Find Domain' to find all the domains of our system.
2) Domain controller: Through the service `Find Community `which is responsible for the search for all the communities in a specific domain. The agent `Domain Controller' send back the request towards the agent controller of the adequate community to evaluate the solution of the exercise suggested by learner.
3) Community controller: Evaluate the solution according to the rules of evaluation of the community and returns the result.

Fig. 5 presents the extension of the agent model presented in [1] taking into account the agent tester.

C. Results Obtained

To illustrate the solution suggested concerning the agent tester, we will apply in the following case:

1) The learner proposes a solution of an exercise of program development in Java language. We added the "Informatique" domain and the "Programmation Java"

community to the organization model (see Fig. 6).

Fig.7 represents the capability-action model which defines the rules of evaluation of a solution of an exercise belonging to the community "Programmation Java".

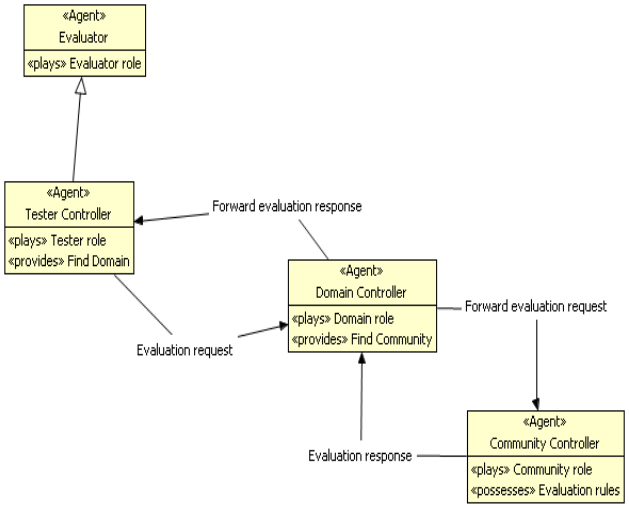

Fig. 5. Extension of the agent model

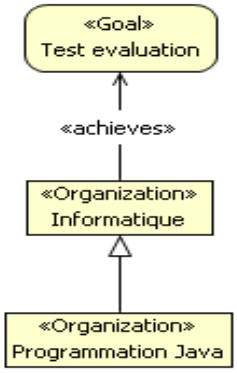

Fig. 6. Part of organization model for 'informatique' domain and 'Programmation Java' community

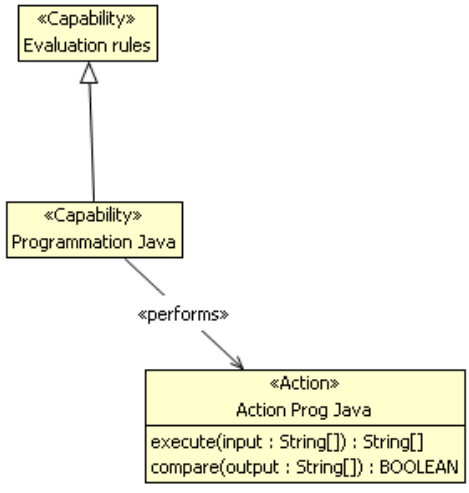

Fig. 7. Capability-action model for java programming community

In the case of a solution for a Java program:

1) Learner will provide the program.
2) The agent `Tester Controller' detects the domain via the service `Find Domain' and forwards the request towards the agent controller of the "Informatique" domain.
3) This last detects the community of the exercise via the service `Find Community' and forwards it towards the agent controller of the community `Programmation Java'.
4) By executing a whole of action `Action Prog Java', the agent will be able to evaluate the solution of the exercise suggested by learner via the return of the 'compare' method.

D. Discussions

The solution that we proposed for the conception of agent tester will be effective only if the rules defined for each community are implemented. Our solution is much applicable for scientific communities that rely on precise theoretical concepts.

In more if we want to represent the maximum of communities it is necessary to adapt the deployment diagram with a distributed system.

IV. Conclusion And FuturWorks

We presented in this article the conception of an agent tester by using O-MaSE methodology, extended to the modeling of a virtual assistant introduced in [1]. This agent allows one learner how to test its solution with an exercise other than a QCM. Using the O-MaSE methodology and the tool agentTools III we could extend the models existing in MaSE methodology and defines in [1] adapting them to the concept of organization introduced into O-MaSE methodology and which enabled us to conceive the agent tester. We then applied this agent tester to the case of the "Informatique" domain and the "Programmation Java" community.

We project to implement the solution suggested by using a BDI agent [10] with the Jadex framework [11]. Another perspective is to model the bank database and the current knowledge database with concept of organization.

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