Integrating videogames into learning object using multiagent approach

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Abstract. How is possible to take the advantages of videogames inside of learning objects?. This work tries to answer this question proposing a model in order to integrate the videogames into learning objects coming from several distributed repositories located in different educative institutions. This could be possible using a multiagent system that is designed and implemented, this system is presented here by a case study.

1 Introduction

A videogame is an interactive computer program proposed for entertainment; it can run on various devices such as personal computer, consoles, cell phones, audio allowing users learn in a ludic manner. The videogame market is constantly growing; new developments occur almost every month, increasingly sophisticated and offer more possibilities to the player. Nowadays the videogames are using in multiple platforms creating a lot of mobile consoles. Then, the user could use the videogames consoles exploring academic resources in those devices. However, in the e-learning area, there are several works that offer few options for access educational resources with videogames. [1,14,15].

***Figure 1** A learning object from morphology domain.*

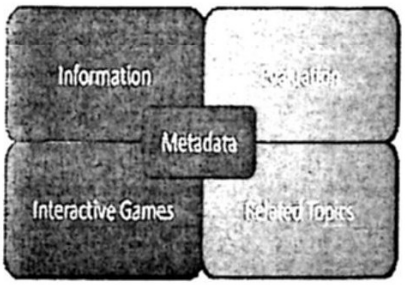

***Figure 2.** Model of Learning object with videogames.*

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The learning objects are considered as educational resources that can be employed in technology support learning. They are a digital pieces of knowledge to put together in order to form online courses; an example is presented by figure 1 of a learning object coming from morphology domain [2]. In figure 2, a model is proposed of learning object (modified from [7]) composed by five components as follow: Information of theory, evaluation, related topic, metadata and the practices in terms of interactive videogames. With this model, the students could learn easier and put in practices the theoretical knowledge playing with the interactive videogames embedded in every learning object. The students can learn and put in practices the theoretical knowledge playing interactive games, or a videogame provided inside of a learning object. The metadata save features of object and the videogames; in addition with the metadata is possible to identify learning objects. The use of learning objects has led several educative institutions to encourage the creation of digital materials for implementation in various devices such as desktop computers, mobile devices, laptops and other devices [8].

Current work is structured in four sections; some common problems using videogames as educational resource are presented in next section. In the contribution section is proposed the use of mobile devices in order to access the educative resources coming from a federation of repositories. Next, a case study presents the feasibility of current proposal. Finally, related work and conclusion sections are described for this work.

2 Problem Outline

The learning objects are generally saved and accessed in repositories which offer a series of services such as display, search, and update. Then a teacher can develop a course in a transparent way searching and selecting learning objects from different repositories. Several institutions use LMS (Learning Management System) to develop course their courses with learning objects on various topics such as: data structure, programming, software engineering, morphology, etc. [7,3]. The creation of heterogeneous learning objects require the compatibility between LMS platforms, OS platforms and content of learning object, but the compatibility isn't a guaranty with portable devices such as mobile devices, handheld, videogame consoles in another. It is possible to identify several difficulties when learning objects are composed with videogame, these difficulties are as follows:

- The learning objects needs to be portable and reusable across multiple platforms, including mobile devices and portable game consoles.
- It is necessary the use of a learning object with videogame.
- It is necessary a better performance searching learning objects.
- The searches of learning objects require to be applying in local and distributed repositories.
- It is important to have a visualization of a learning object as a game.
- It is necessary a high interactivity in the content of learning objects.
- The evaluation methods to measure the quality of learning of object.

3 Contribution

Nowadays, a large number of universities are producing online courses in terms of learning objects and saving these objects in their own repositories, these repositories in general support several local queries with different criteria thanks to the information in the metadata. The universities could connect their repositories in order to reuse the academic contents and offer online course in terms of learning objects. Then, the final user could use videogames accessing different repositories (see figure 3). In addition all the learning objects in the federation should be filter by multiple agents asking and getting learning objects with videogames.

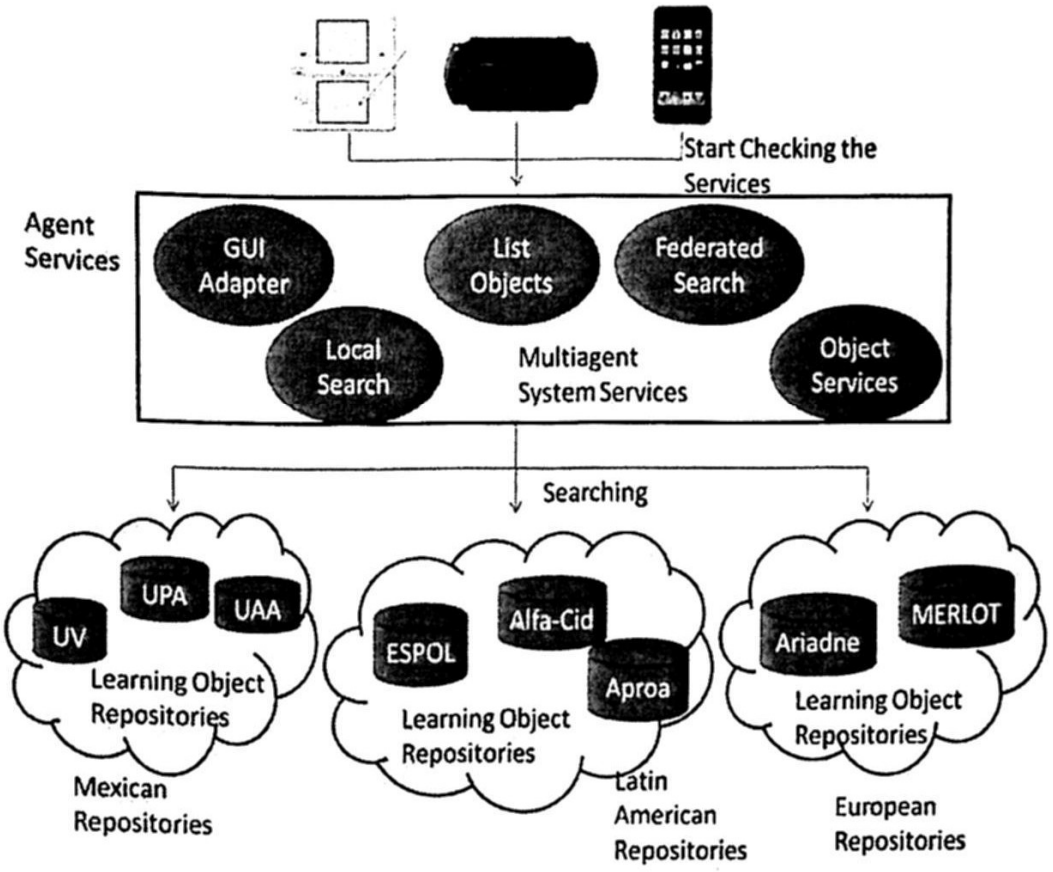

Figure 3.*Access of learning objects with videogames coming from different repositories.*

Figure 3 shows the architectural model where the game console could access and display different learning objects with videogame from different repositories [2,3,5], The user interface of videogame consoles (psp, itouch, pc) allows a direct access of a learning. This multiagent system could access to a large collections of learning objects from different repositories located in different institutions (as an example Mexican repositories, Latin-American repositories and European repositories) which they can share their academic resources. In the multiagent system proposed here each agent is specified in terms of classes with attributes and functions and the interactivity between the agents; these framework give us the opportunity to launch

each agent, with this performance is incremented of a local search and a federated search.

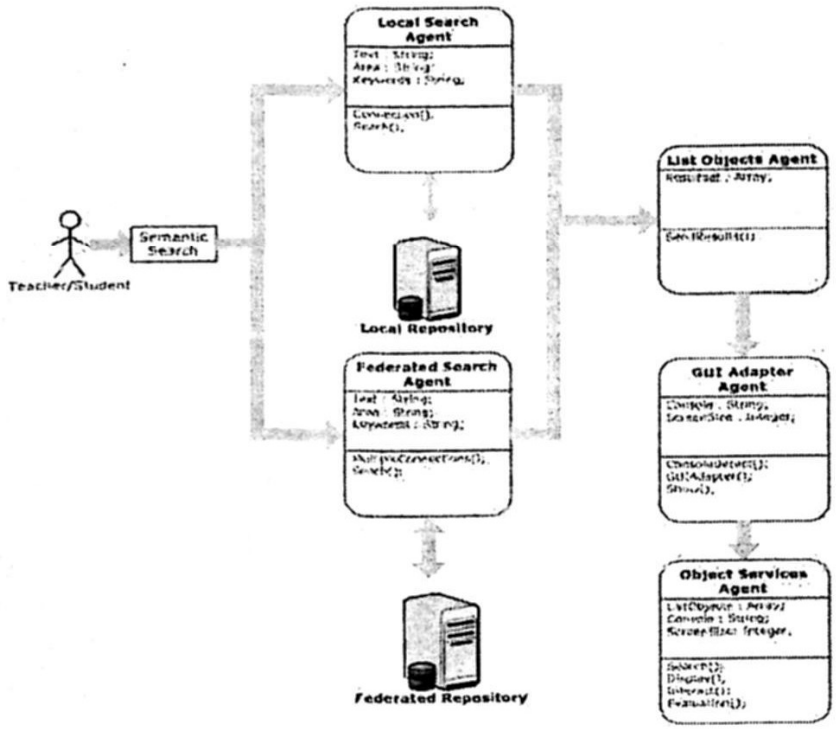

Figure 4. Components of multiagent system.

The figure 4 presents the components of system with multiple agents in each activity. The *Local-Search Agent* work only in the local repository creating queries, the *Federated-Search Agent* this agent work in the federation of learning objects, when this two agents finish their work then the list objects agent get all the results and send to the GUI-Adapter Agent, this agents try to detect the final dispositive to adapt the information generated by the previous agents. Finally, we have the *Object Services Agent*, this agent works with the main functions of a learning object such as the visualization, accessing, interaction (in this space we have the interactivity of a videogame) and evaluation. This community of agents is called "social network games".

```
import jade.core.Agent; import jade.core.behaviours.*;
public class MultiAgent extends Agent{
  protected void setup(){
  addBehaviour(new LocalSearch());
  addBehaviour(new FederatedSearch());
  addBehaviour(new ListAgent()); }
private class FederatedSearch extends Behaviour{
  public void action(){
  try {
        java.sql.Connection conn = null;
        java.sql.Statement s = conn.createStatement();
        java.sql.ResultSet   r   =   s.executeQuery("SELECT   *   FROM
Federated_Learning_Object where description like '+word+'");        }
        catch (Exception e)
      {
```

```
    System.out.println(e);
    System.exit(0);
}}
```

Figure 5. *An excerpt of internal process of multiagent system*

The code of figure 5 shows how the multiagent system works with different classes communicating between them, all the agent functions are launched using the behavior, this event permits launch multiple agents working like threads, but the difference between threads and agents is the performance and stability of the agents. The multiagent system has been implemented with Jade a Framework[10], it use the RMI Interface of Jade in order to create agents, and at the begging start with two agents, one is for the search of local objects and the other for the search into multiple repositories, the result is sent to the *list agent* who receive all the information for send to the GUI adapter agent all these agents communicate with the search and the graphical user interface adapter, finally we have the agent services who offer services like search, display and evaluation.. In the literature of Intelligent Games [9], is commonly the interaction with many community agents to negotiate for reach the best situation to survive, for this reason the principal behavior is the survive of this communities maximize the cooperation with the rest of agents, for example in a FishVille with shoals of fifteen fishes at same time of different species, this one of most popular game in Facebook[9].

4 Case Study

This section presents a case of study using a playstation portable to learn about the human cell in terms of a learning object with videogames (see figure 6). First, the user goes directly to a graphical user interface where he/she could create some quests using words and creating filters to the information. The second step, two agents start the search one is searching in the local repository and another in a federated repository, then an agent take all the results and prepare all the information in an unique list of learning objects. In this step the user doesn't know the platform, then an agent detect the platform where is the client, once is identify send all the aspects to run in this platform to the final agent who gives all the services like search, display, interact and evaluation [13].

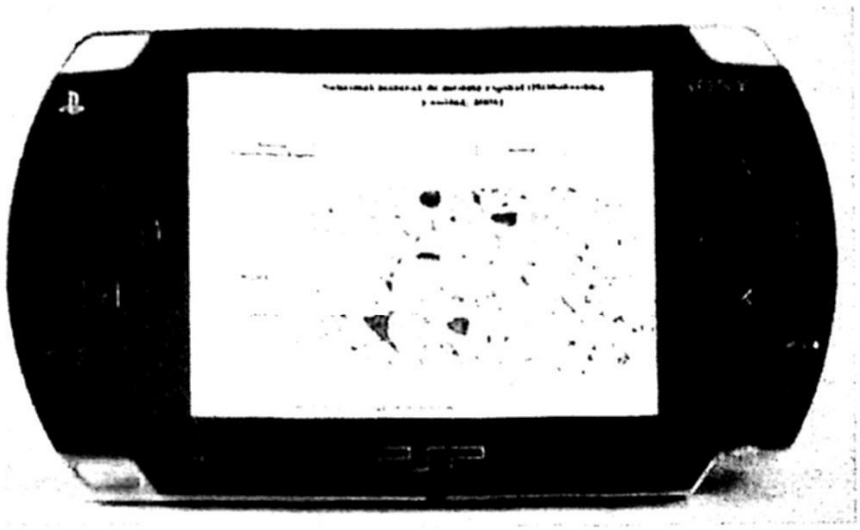

Figure 6. *A human cell as a learning object with videogames.*

The figure 6 shows a human cell as a content of a learning object inside a course of *morphology*. This object is the result of research service notably using two agents, one searching in the local repository and the federated repository, then all identified information by the two process are taken by the agents, creating an uniform list of learning objects, this list of objects are taken by the *GUI adapter Agent*, who detect a play station portable, sending all the display sizes and list of objects at the last object services agent finally we have the game in the form of exercise with a theme of human cell, allowing the user to drag the elements that are relevant to each of the boxes in white, this is done interactively allowing the user to learn based on practices and games.

An example of a metadata of a learning object.

```
<imsmd:general>
 <imsmd:identifier>001 ED</imsmd:identifier>
 <imsmd:title>
 <imsmd:langstring xml:lang="en">Morfologia</imsmd:langstring>
 </imsmd:title>
 <imsmd:catalogentry>
 <imsmd:description>
 <imsmd:langstring    xml:lang="en”>Ejercicio    sobre    ambiente
interactivo en multiples consolas de OA's</imsmd:langstring>
  </imsmd:coverage>
```

The information of metadata used by the agents for the local search and the federate search; all this information is send to only one server in order to have a better performance. This information of the metadata is sent to the web service to form a group of key information related to the learning objects inside the federation. Once created the global index, the multiagent list is used to show the information, and then the graphical user interface agent adapts the interface to the videogame console [10], he searches to federated level inside the federated learning objects repositories are performed; take several searches outline at semantic level.

5 Related Work

In this section our proposal is compared with another related work.

Table 1. Some related works of learning object repositories.

	UAA	Ariadne [11]	ESPOL [13]	APROA [12]
Web Service	X	X	X	X
Multiagent approach	X			
Videgame	X			
Federated Repository	X	X	X	

There are a large variety of repositories in the literature of learning objects. According to the repositories of table 1, they offer basic functions in the searches, carrying out queries of learning objects without taking advantages of any artificial intelligence technique. Current work proposed here presents a major number of characteristic for the use of learning objects with videogames throughout multiagent approach.

6 Conclusions

This paper proposes the use of a multiagent system is composed by learning objects with videogame. In order to assure the portability is proposed a multiagent system to make a portable graphical user Interface and make easy the use of several services, all these service in particular the search of learning objects in several repositories. The proposed model of learning is composed of five components such as: theoretical knowledge, evaluation, related subjects, metadata and practical knowledge in terms of interactive videogames. In this model the students can learn and put in practices the theoretical knowledge playing with the interactive videogames embedded in every learning object.

The proposed multiagent system presents the results with good performance in the connection between different repositories institutions and a good compatibility between different kinds of mobiles devices. As future work, it is necessary a virtual environment of education using all the learning object resources in the different institutions and it is necessary portable devices to communicate all the students, it could be possible to create an online community of videogames to interact between them [15].

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